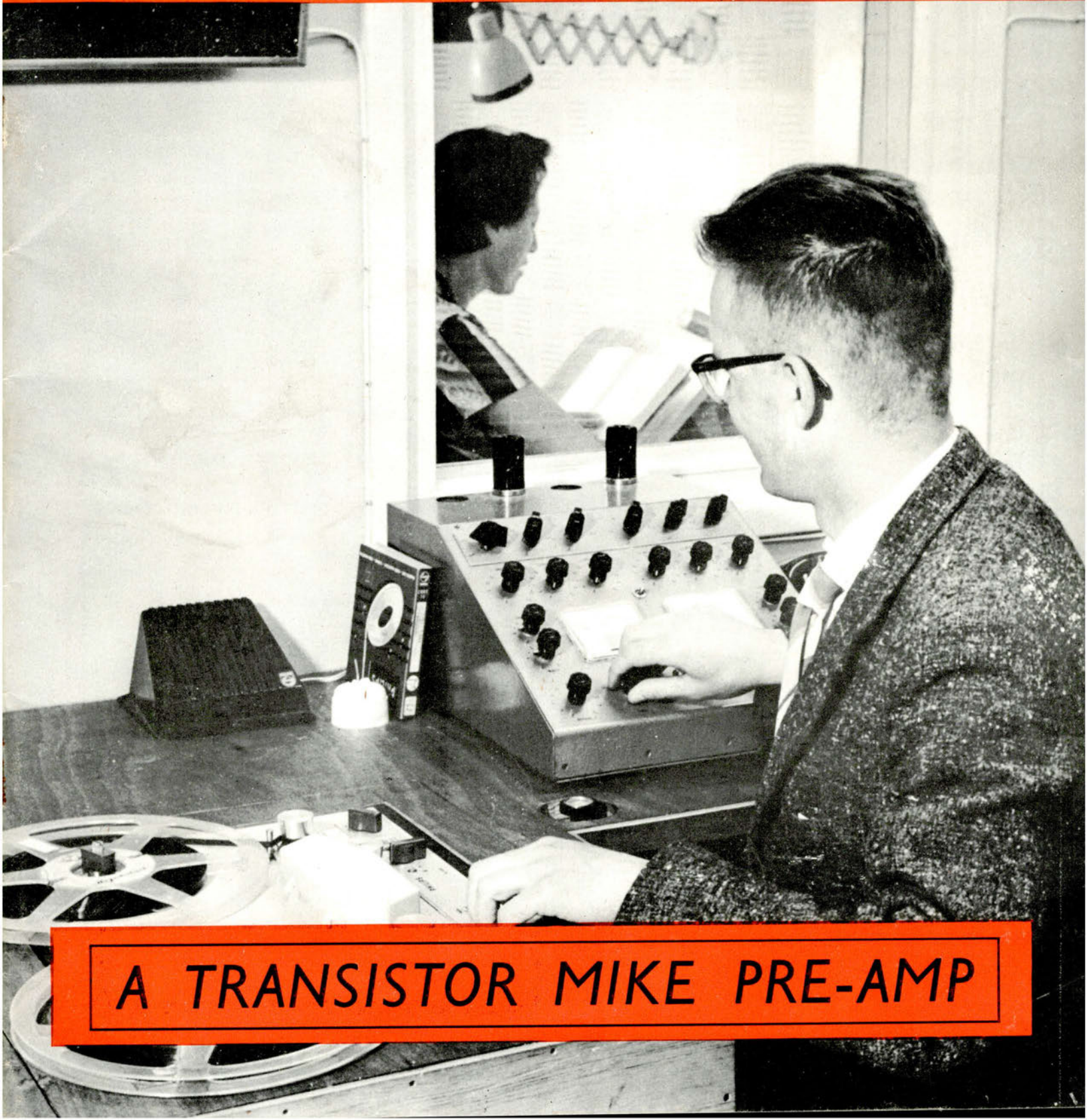


the TAPE *price 2/-* RECORDER

SEPTEMBER 1963
VOL. 5 NO. 8

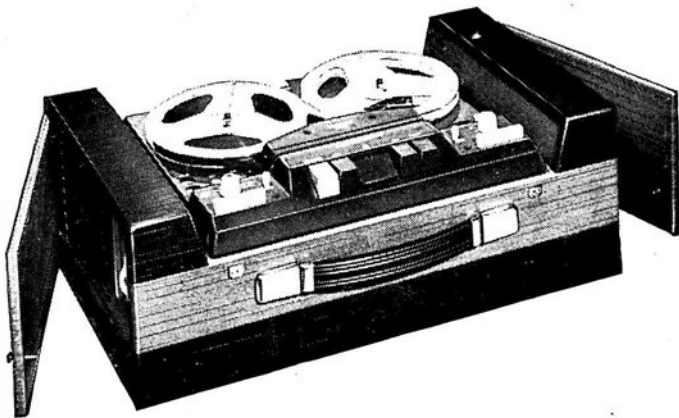
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SIEMENS
TAPE RECORDER
for the connoisseur



SIEMENS NORGE Model 12
4 TRACK STEREO/ALL TRANSISTOR
HIGH FIDELITY TAPE RECORDER

The world's most experienced professionals have made this brilliant newcomer for you. You will immediately appreciate the technical perfection and ingenuity of this incomparable tape recorder. There are 3 Tape Speeds, 3 Heads-Record, Playback and Erase—with Sound-on-Sound trick recording and many other facilities. The Model 12 has two Hi-Fi speakers built in. Rewind time is 2 mins. for 1,200 ft. of tape. Weight 35 lbs. Strongly made and finished. Beautiful to hear and see.

The **SIEMENS** Range comprises
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BUTOBA MT7 & MT7R

Battery operated with Mains performance

If you're looking for a multi-purpose tape recorder buy a "Butoba." This range of battery operated machines is outstanding for purity of reproduction and is ideal for recording music, speech and bird-song. Easily transportable, "Butoba" will help to make your holiday memorable. You can have the music of your choice wherever you go and, together with your camera, you can bring home tapes which have captured forever the sounds and scenes you have selected to record. The "Butoba" is truly economical on batteries and there is a mains converter available for home use. High Fidelity range 6 in. oval speaker. Good output. (1 watt.) The MT7R is available with remote control facilities, ideal for dictation in office or car.

The prices of the range are attractive
Model MT7 44 gns. MT7R 49 gns. MT5 66 gns.

Please send me details of the Butoba/Siemens Tape Recorders.

NAME

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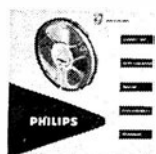


GO
FOR ANY
SOUND
KEEP IT
SAFE
ON



PHILIPS TAPE

GREEN
for standard
RED
for longplay
BLUE
for doubleplay
GREY
for tripleplay



Capture a sound on Philips Tape and it's yours for ever—yours to play back and enjoy whenever you like. Available in all current reel sizes of standard, longplay, doubleplay and tripleplay, Philips Tape gives you all these advantages: great sensitivity, wide frequency range, low noise level, high resistance to stretching or breakage, powerful adhesion of the magnetic coating. And of course, they're colour-packed for easy identification. Whatever tape recorder you own, get the best out of it—with Philips Tape.

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PHILIPS ELECTRICAL LTD., ELECTRO-ACOUSTICS DIVISION, CENTURY HOUSE, SHAFTESBURY AVENUE, LONDON WC2 (PTA4314)

WORLD RECORD CLUB OFFERS YOU THE CHOICE OF ANY 3 PRE-RECORDED TAPES



58 The fabulous dynamic Duke Ellington himself in eight great numbers including Stomping at the Savoy, In the Mood and Honeysuckle Rose.



1 Tchaikovsky Swan Lake. John Hollingsworth conducts the Sinfonia di London in a great performance of this well-loved ballet music. Also in stereo.



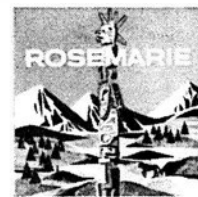
59 The silken voice of Nat King Cole in 'Walkin', 'Because You're Mine', 'You'll Never Grow Old', 'Baby Won't You Say You Love Me' and 8 more. Also in stereo.



30 Ian Carmichael, Joyce Blair, star cast and orchestra. As Long As He Needs Me, Consider Yourself, all the hit numbers from Lionel Bart's great show. Also in stereo.



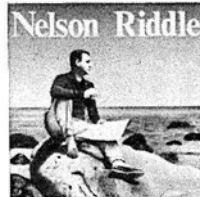
49 Beethoven Fidelio Overture, Brahms St. Anthony variations, Mendelssohn Hebrides Overture, Wagner Siegfried Idyll. Superb interpretations. Also in stereo.



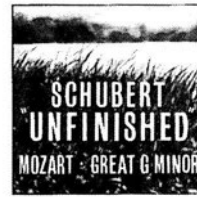
50 David Hughes, Barbara Leigh, Andy Cole and chorus sing Indian Love Call, Rose Marie, and all the other tunes from Friml's well-loved musical. Also in stereo.



61 The world's 3 greatest sonatas — Beethoven's Moonlight, Pathetique and, Appassionata—superbly played by famous TV pianist Joseph Cooper.



71 The smooth sound of the Nelson Riddle Orchestra in Touch of Your Lips, Body and Soul, The Tender Touch, As you Desire Me—11 favourites in all. Also in stereo.



44 Leopold Ludwig and LSO combine brilliantly in an exciting 'double': two of the world's greatest symphonies receive vivid new interpretations. Also in stereo.



63 Cuban Carnival, Yesterdays, Blues in My Heart, and eight more great numbers played by George Shearing with vocals by Dakota Staton.



48 Deep in My Heart, Drinking Song, Serenade all the old favourites fresher than ever with Marion Grimaldi, Linden Singers and Orchestra. Also in stereo.



53 Bizet's thrilling music magnificently performed by Sinfonia di London under Muir Mathieson. Also in stereo.



77 In the Mood, Bugle-Call Rag, Chattanooga Choo-choo, Serenade in Blue—9 original tracks by the immortal Glenn Miller and his band.



14 Tchaikovsky Symphony No. 5. Sir Malcolm Sargent and LSO combine to give this famous symphony a dramatic and colourful rendering. Also in stereo.



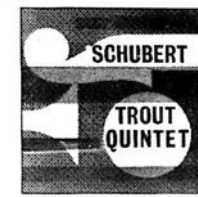
35 Ol' Man River, Bill, Make Believe, many more well-loved numbers from this famous musical memorably sung and played by full star cast. Also in stereo.



11 Dvorak Symphony No. 5—From The New World. Leopold Ludwig conducts the London Symphony Orchestra in a dramatic and moving performance. Also in stereo.



32 Star cast and orchestra stage all the famous songs. Getting to Know You, Hello Young Lovers, I Whistle a Happy Tune, Shall We Dance, etc. Also in stereo.



69 The exquisite playing of the Virtuoso Ensemble matches the beauty of Schubert's celebrated Trout Quintet, which contains some of his most famous melodies.



40 Bruna Rizzoli and Giuseppe Savio with the chorus of the Teatro Nuovo di Milano and orchestra conducted by Napoleone Annovazzi.



52 Gracie Fields sings her favourite songs for you, including In My Little Bottom Drawer, Sally, Song of the Mountain and ten others.



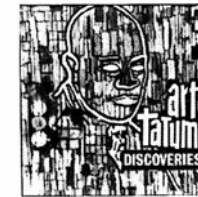
31 Rimsky-Korsakov: Scheherazade. Sir Eugene Goossens conducts the LSO in a breathtaking performance of this rich and exotic masterpiece. Also in stereo.



90 Ebb Tide, Waterfront Blues. When the War breaks out in Mexico, Carolina in the Morning, and many more by Jerry Colonna and his Dixieland Band.



2 Greig Piano Concerto. Alexander Jenner in an electrifying performance with the Bavarian State Radio Orchestra conducted by Odd Gruner-Hege.



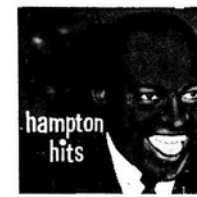
76 Unforgettable Art Tatum in person plays Tenderly, Body and Soul, Without a Song, Begun the Beguine—12 superb numbers from the greatest-ever jazz pianist.



74 Superb Sarah Vaughan in ten great numbers. If I Loved You, Saturday, It's Delovely, You'll find Me There, etc. Every one a hit.



38 Hervey Alan, Ian Wallace, Marion Grimaldi and chorus sing the immortal favourites: Cobler's Song, Robbers' Chorus, Chu Chin Chow, etc. Also in stereo.



34 Stardust. How High the Moon, Nearness of You, 'Round Midnight, King David—eight numbers by the vibraphone genius, Lionel Hampton. Also in stereo.



54 Tchaikovsky's last and greatest symphony, is here given a splendidly moving rendering by the Sinfonia di London conducted by Muir Mathieson. Also in stereo.



65 Our Love is Here to Stay, The Nearness of You, Guilty, and nine more great hits, all with America's top vocal group, the fabulous Four Freshmen.



81 Some of Chopin's loveliest melodies magnificently played by world-famous pianist Fou Ts'ong—The Four Ballades, Nocturne in F Sharp Major, etc.

FOR ONLY 30/-

THE GREATEST BREAKTHROUGH SINCE TAPE RECORDING!

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EVERY ONE OF WORLD RECORD CLUB'S UNRIVALLED RELEASES AS 12" LPs IS NOW AVAILABLE ON 3 3/4 ips TAPE!

Now you have the opportunity to play any WRC release on your tape recorder. Each of these 'tape records' runs at 3 3/4 ips, mono, on 5" spools and can be played on either 2 or 4 track recorders. New electronic techniques of tape-to-tape transfer give these 3 3/4 ips WRC pre-recorded tapes a standard of reproduction unattainable previously at less than 7 1/2 ips.

WORLD RECORD CLUB 7-POINT PLAN MEANS BETTER LISTENING FOR YOU!

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Choose now, any three of the superb 3 3/4 ips pre-recorded tapes shown here, for only 10/- each and number them on the attached coupon. (If you wish, of course, you can choose 12" LPs instead. Introductory discs and tapes are both the same price.) Please send no money until after you have received, played and approved them. We want you to prove to yourself, before paying, that our tapes are equal to the world's best.

2. THE OPPORTUNITY TO BUILD A UNIQUE TAPE COLLECTION.

The WRC plan offers you an exciting and varied annual repertoire of more than 70 selected tape releases, covering classics, jazz, shows, ballet music, light music and 'pops'. Every one is a superlatively recorded 3 3/4 ips mono tape (or 12" LP—mono and stereo). Tapes are offered to you at the

privilege club price of 29/- (plus a small charge for post and packing)—much less than you would pay elsewhere for recordings of anything like this quality.

Your only obligation, as a Club member, is to agree to buy four more tapes (or 12" LPs) during your year of membership. Beyond this, there is no subscription or membership fee.

3. A PLANNED PROGRAMME.

Every World Record Club release is hand-picked by an independent panel of Britain's top musical authorities. 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, Antony Hopkins—and, as special adviser on tape, Miles Henslow.

4. NEW CLUB MAGAZINE.

The new club magazine contains 48 pages, many in colour. Packed with fascinating features, information, competitions and special offers, it comes free to all WRC members.

5. SPECIAL CONCERT PRICE CONCESSIONS.

Many concert halls and theatres throughout the country (including the Royal Festival Hall) allow special concession rates to club members for many performances.

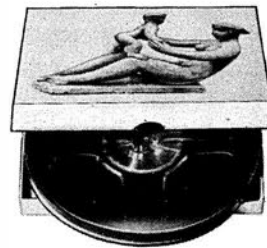
6. FREE BONUS TAPES.

The more you buy, the more you save! After fulfilling the minimum membership obligations, you earn another tape of your own choice free for every extra three you buy!

7. EXCLUSIVE EXTRA RELEASES.

In addition to the regular monthly selections, the club offers members exclusive extra tapes at the standard Club price.

World Record Club is unique—the first and greatest Record and Tape Club in Britain, with the largest show catalogue (on tape and mono/stereo disc) in the world. No other method of tape—or record-buying offers you so many additional benefits, so much freedom and variety of choice, with no 'high-pressure' selling. And, of course, there are no subscriptions or membership fees of any kind.



... AND IF YOU OWN A STEREO TAPE RECORDER hear the fantastic reproduction of **STEREO 21** THE NEWEST, TRUEST SOUND ON TAPE TODAY!

Revolutionary new STEREO 21 pre-recorded tapes (7 1/2 ips twin-track) are issued exclusively by World Record Club. But they are offered without membership commitments of any kind. The first list of all new STEREO 21 releases is now available. It features 30 superb stereophonic tapes ranging from Beethoven's Eroica with Josef Krips conducting the LSO, to a lavish full-cast production of Oklahoma.

As always, WRC prices present unparalleled value—all STEREO 21 releases cost either 50/- or 60/- depending on playing time (up to 50 minutes). STEREO 21 tapes are now obtainable through leading retailers or direct by post from World Record Club. Send for full catalogue now—STEREO 21 must be heard to be believed!

Don't miss this great opportunity. Send off the coupon today, for your 3 introductory selections for only 30/-

7-DAY FREE TRIAL OFFER—POST TODAY!

STEREO 21 FREE BROCHURE

To WORLD RECORD CLUB (Dept. TRR II) Box 11
PARKBRIDGE HOUSE, RICHMOND, SURREY.

SEND NO MONEY NOW

3 3/4 ips pre-recorded tapes	12" LPs
------------------------------------	---------

Tick what you want

Please send me, without obligation, on 7-day free trial, the three selections indicated. (Your 3 selections must be either all tape or all disc.) If satisfied, I will pay you 30/- plus 3/- postage, packing and insurance. Only at that stage may you enrol me as a full member of World Record Club, entitled to all the benefits described. My only obligation as a member would be to agree to purchase 4 more top quality 3 3/4 ips tapes over the next year at the special club price of 29/- each (or 12" LPs at 26/6) plus a small charge for post and packing. If I am not completely satisfied with my 3 selections, I will return them to you within 7 days, in good condition, and owe you nothing.

Signed.....
this offer applies in Gt. Britain and N. Ireland only.

MY 3-SELECTION 'PACKAGE' COMPRISES

Choice No. 1 Choice No. 2 Choice No. 3



(place tape/disc key numbers only in the circles)

Tick here if stereo 12" LPs are required where available

Mr/Mrs/Miss.....
(BLOCK CAPITALS PLEASE)

ADDRESS.....

To WORLD RECORD CLUB (Dept TRR II)
Box 11 PARKBRIDGE HOUSE, RICHMOND, SURREY.

Please send me your free colour brochure, showing the full range of your new STEREO 21 releases.

NAME.....
(BLOCK CAPITALS PLEASE)

ADDRESS.....

Trade Mark
Scotch

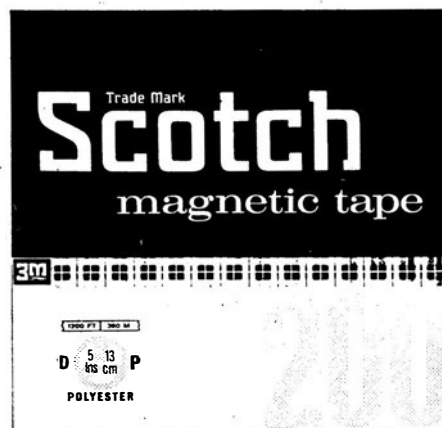
Magnetic Tape

**REDUCES THE COST
OF TOP
QUALITY RECORDING**

Down comes the cost of top-quality tape recordings. The makers of "SCOTCH" Magnetic Tape are pleased to announce price reductions throughout their range. For example, 5" No. 200, double play was 45/- — now down to 41/-. 5¾" No. 150 long play was 35/- now down to 32/6. 7" No. 150 long play was 50/- now down to 44/6.

MORE GOOD NEWS

—A new standard play tape, polyester-backed No. 175 brings down the price of top quality polyester recording. And there's an exciting new pack, colour coded for easy identification. Now more than ever before, insist on "SCOTCH" Magnetic Tape. Get full details of the new prices and alterations in the range from your nearest "SCOTCH" stockist.



3M MINNESOTA MINING AND MANUFACTURING CO. LTD. 3M HOUSE, WIGMORE STREET, LONDON, W.1.

the TAPE RECORDER

Editor - - - - - MILES HENSLow
 News Editor - - - - - Alan Lovell
 Advertisement Editor - - - - - Julian Berrisford
 Editorial Offices - - 99 Mortimer Street, London, W.1
 Telephone - - - - - MUSEum 3967 to 3969



MEMBER OF THE
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EDITORIAL

DURING the 1939-1945 War, the boffins minted an encouraging phrase—"The difficult we can do immediately: the impossible takes a little longer". It is the last half of that which has always appealed to us, for though it is easy to quarrel with it technically, the word "impossible" is far too loosely used whenever a job is difficult; and when it comes to progress—in terms of invention, scientific and mechanical development and applications—a thing is only impossible if its achievement depends upon a breaking of the natural laws—i.e., basing it upon something that won't work. For example, there is little doubt that we shall one day find a way of overcoming the force of gravity, because it is something which results from a set of circumstances which are based upon the natural laws of the universe. On the other hand, we shall not find the answer to the old inventors' dream, "perpetual motion", because it entails getting something for nothing.

The above preamble was inspired by the recent development of *Telcan*. In our 1956 *Year Book* we looked forward to the tape recorder for vision because, despite all the "impossibles", it obviously had to come along; and in fact it came along with such a rush that it was with us before the next edition was printed. Similarly, with a domestic recorder for television programmes, it was merely a matter of time before it appeared. Needless to say, the present models are not perfect; and none knows that better than its inventors: but the important fact is that someone has at last got around to making it work and (in terms of simplicity and cost) work very well indeed. Now there will be no holding back the competition and endeavour, and it cannot be so very long before the domestic recorder makes its real impact. This, too, is only the beginning of what should prove to be a series of most fascinating developments. Limited only by the qualities of the recording material and of the machines that handle it, there is nothing that can be converted into electromagnetic information that cannot be recorded on tape and "replayed" from it. The camera that uses an electromagnetic material, instead of the conventional light-sensitive film, is only as far distant as the abilities of scientists to overcome the problems of making it work.

However, enough of the crystal-gazing. Down to facts. It must not be thought for a minute that *Telcan*, or any quick developments that follow it, are going to kill the modern domestic tape recorder as we are just beginning to know and understand it today. The requirements for the recording of ordinary, everyday sounds are not to be compared with those for the recording of television signals. The two devices have quite different jobs to do; and if there are any who doubt this, and have thoughts of "holding their horses" before buying the portable that they have been coveting for the past six months, let them press on and buy. And if there are still any doubts, consider the professional counterparts. Broadcasting corporations and television studios use vision recorders, but they still need (and buy) many hundreds of sound re-

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coders. We emphasise this point because we well remember how many people decided to delay the purchase of their television set, five or six years ago, when the words "colour television" were mentioned.

The one very important connection between the two—the sound and the vision recorders—is the stimulus that the latter should have on the former, when it comes to engineering. It is not going to be so easy to make a fool-proof, reliable vision recorder for the homes of the millions as it is to make a modest little sound recorder with a running speed of 3¾ inches per second; and as engineers learn how to handle the more difficult jobs, so will they be considerably more at home with the easy items. It is probably true to say that the quality and reliability of ordinary sound radio receivers made an appreciable step forward when the more complicated television receiver put in an appearance. It is certainly true to say that the whole business of servicing radio sets improved beyond measure. It had to. People would not continue to buy something which earned a name for continuous trouble, and which could not be put right quickly and efficiently; so the manufacturers took active steps to see that after-sales-service was developed.

During the years when the tape recorder should have been making its greatest impact in the home, it suffered its most serious setback. It is only quite recently that it has won its way back and is now beginning to enjoy delayed popularity. All this was because of sloppy manufacture and poor servicing facilities. With the new stimulus which we foresee, as a result of *Telcan* and its developments, all tape recorders should gain something—and their owners should gain a lot.

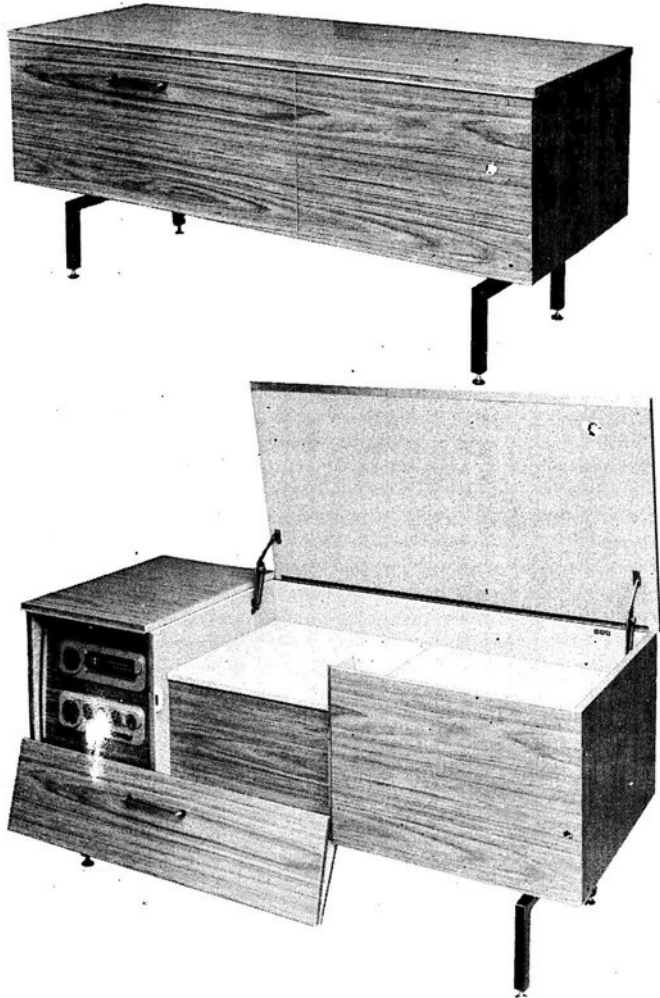
COVER PICTURE

THE Dutch Library for the Blind, an Association established in the Hague, has been very active in welfare work for Blind and partially sighted people for nearly 68 years. This month's front cover picture shows the studio owned by the Association and the machine being used to record the weekly general news bulletin is the Philips professional recorder. After the master tape has been made copies are run off using fifteen Philips E.L. 3542 recorders simultaneously.

SUBSCRIPTION RATES

The subscription rate to *The Tape Recorder* is 27/6 per annum (U.S.A. \$4.00) from The Tape Recorder, 99 Mortimer Street, London, W.1. Subscription + Index, 30/- (U.S.A. \$4.25). The same rates apply to *Hi-Fi News*.

HERE AND THERE AND



High Fidelity Equipment Cabinet

FOR those enthusiasts whose wish to build their tape recording equipment into the same cabinet as the high fidelity equipment, G.K.D. have produced their Anglian cabinet. The removable instrument fascia is cut to receive Quad control units for FM tuner and power amplifiers. If required, an additional tuner for AM can be fitted below the turntable motor board.

The design follows the lines of other G.K.D. products, a single hinged front panel which lowers smoothly in a specially designed track providing access to the control panels. Two hinged lids are fitted, one giving access to the FM tuner and amplifier and the other to the turntable or tape deck.

A choice of finish is available—sapele mahogany, dark Australian walnut or teak. Metal fittings are in satin anodised aluminium. The legs are finished black and provided with height adjusters. The overall dimensions are width: 55¼ in. depth: 21 in. height: 25 in. The prices are £38 17s. for sapele and walnut finishes and £39 18s. for teak. **Manufacturers: G.K.D. Ltd., King Street, Houghton Regis, Bedfordshire.**

* * *

AGFA announce Price Reduction

AGFA Ltd., announce that the retail price of their PE 65 triple play 3,600 ft. tape on a 7 inch spool has been reduced by nearly a pound—from £6 13s. 9d. to £5 15s. 0d.

* * *

Tape at St. Paul's

THE problem of sound re-inforcement in a large and echoing building gives a challenge to public address engineers, which is often met in unexpected and ingenious ways.

Such a problem is presented by St. Paul's Cathedral, where Standard Telephones and Cables Ltd. are installing a new sound system. This is to be a permanent fixture and must be tailored to the building's great size and very long reverberation times. S.T.C.'s chief public address engineer J. L. Goodwin, states that it takes well over ten seconds for sounds to die away to one millionth of their original power, (60db decay).

The new system uses line-source loudspeakers with a special switching arrangement, directing sound to the occupied portions of the church, and cutting out the speakers to unoccupied portions. But this does not completely solve the problem of echo and sound-mixing, for it takes three-tenths of a second for a word spoken at the altar to reach the far end of the nave.

This is solved by imposing a suitable delay on sounds from the altar microphone and the pulpit microphone—using a form of "Tape Recorder". A magnetically loaded neoprene belt is stretched around a metal drum rotating at 80 revolutions per minute. Eight magnetic heads are placed around the drum: two recording heads, from the altar and the pulpit microphone, and five playback heads so spaced as to give the correct phasing of sound from the various banks of loudspeakers. Transistorised amplifiers are used throughout, and a single erase head wipes the tape clean on every revolution.

Two New Emitape Leaflets

TWO further Emitape instructional leaflets have been added to their series by E.M.I. Tape Ltd., Hayes, Middlesex. They are entitled "Adding Sound to Slides with Emitape" and "Two and Four Track Recording with Emitape". Both of these leaflets give concise information on these two aspects of recording.

* * *

T.V. Camera Kit

WITH domestic video-tape recording forecasted in the near future readers may be interested to hear of the transistorised television camera now being marketed in kit form by Beulah Electronics Ltd. The camera, costing £71 (including lens and videon tube) can also be used for closed circuit television when connected to a standard receiver.

* * *

Tape Recording Course

THE Middlesex County Council have organised a short course at the Chiswick Evening Institute on Tape Recorders. The Class will meet on Tuesday evenings for 2 hours commencing at 7 p.m. The course will be for one term only and will start from 24th September and last until the 10th December 1963. It has been designed to assist the man or woman who has, or is contemplating the purchase of a tape recorder and would like to learn how to operate it properly. The problem of keeping the machine in good repair will also be dealt with.

Enrolment week is from 16th September but application for the course may be received at the address given below at any time. The fee for the complete course is 10s. Further details and application forms may be obtained from **Head of Institutes, Education Office, Town Hall, Chiswick, London, W.4.**

* * *

Licences for Microphones

OWNERS of "Lustraphone Radio Mikes" will be pleased to hear that they now need a licence to operate them. The licence, issued by the G.P.O., costs £2 and is effective for five years. No limitations are imposed on the use of radio-mics (the range of which is approximately 300 yds.) although they must not be allowed to cause interference.

* * *

Recording the Rush Hour

TWENTY-SIX tiny Stuzzi Memocord portable recorders were used recently by the L.C.C. to provide information on the type and

EVERYWHERE

amount of traffic using the new roadway at Hyde Park Corner. The registration numbers of the vehicles were recorded by several observers positioned at different junctions. The Memocords, supplied by O.F.F.M.A.C., give an hour's recording time on a special cassette, and are the smallest portable recorders on the domestic market.

* * *

Tape in Court

ALTHOUGH officially frowned upon, for obvious reasons, the tape recorder is being used more and more in British courts of law. The first came into use in South African courts in 1954 and were used in New Zealand in 1958. Mr. R. H. Harbour, Clerk to the Justice at Crewkerne, in Somerset, began using a Grundig T.K.41 back in 1950. He maintained however that its use is limited and would be unsuitable in "committal proceedings for trial on indictment."

More use seems to be made of the tape recorder on the continent however. For example the Burgomaster of Ostend proudly displays the recording equipment in use at the City Hall. Each member of the council has a microphone, no doubt to eliminate interruption from hecklers!

* * *

Hendon College of Technology Course

DETAILS of the course, organised by the Hendon College of Technology, are now complete. Nine, two hour lectures on Wednesdays at 7 p.m. are as follows:—

October 9th	What is High Fidelity?	J. Moir
October 16th	Loudspeakers	R. L. West
October 23rd	Tape Recorders	R. B. Dyer
October 30th	Turntables and Pickups	J. Crabbe
November 6th	Room Acoustics	J. Moir
November 13th	Frequency Modulation	A. W. Wayne
November 20th	Stereo	R. L. West
November 27th	Amplifiers	J. K. Manners
December 4th	Tape Recording techniques	J. Berwick

The fee for the course, is £1 and readers are advised to book early. Application forms can be obtained from the **Bursar, Hendon College of Technology, The Burroughs, Hendon, London, N.W.4.**

* * *

Fidelity Fortnight

IN conjunction with Cliff and Halifax's retail branch and one of the company's wholesalers, Fidelity Radio Ltd., have launched a Fidelity Fortnight in Wolverhampton. Large sections of Cliff and Halifax's display space in six branches in the area have been devoted to Fidelity products and the Fortnight is centred around a talent competition based upon taped entries. The prizes are Fidelity products, submission of winning tapes to recording and drama departments and a day out at the London Hilton during the Fidelity Fair in August/September.

* * *

AMICROPHONE with an unusual property is the new Turner 500. It employs a moving coil structure and has the ability to cancel out background noise. This is of great advantage in outdoor recording. The price has not yet been announced though is quoted as "expensive". It is distributed by **Ad Auriema Ltd., 414 Chiswick High Road, London, W.4.**

* * *

WyndSOR Announcement

WYNDSOR Recording Company Limited, WyndSOR Works, 2, Bellevue Road, Friern Barnet, London, N.11, have announced the appointment of Wilmex Limited, of Wilmex House, 151/153, Clapham High Street, London, S.W.4, as their sole agents throughout the world in connection with the exportation of their tape recorders.

Wilmex Limited are already experienced in the exportation of tape recorders as they are the agents for Ferrograph.



The designer of the Tandberg Model 64 Mr. Asbjørn Ollestad, with the Design Prize for 1962.

Tandberg Tape Recorder Model 64 Wins Prize

THE Tandberg Tape Recorder Model 64 was recently awarded the Norwegian Industrial Organisation & Export Council's prize for the best industrial design of 1962.

The jury had 259 products from which to choose, and we quote an excerpt from the citation, "The product is characterized by an appearance of solid reliability. The visible technical details are subordinate to the whole, and the machine has a discreetness of design which will enable it to blend into the surroundings anywhere".

* * *

Dansette Products Trade Show

AS there is no National Radio Show this year, Dansette Products Ltd., will be holding a trade show at their Stanmore premises between August 26th and September 6th. September 4th will be set aside as a special Press preview day.

* * *

E.M.I. Electronics' New Look

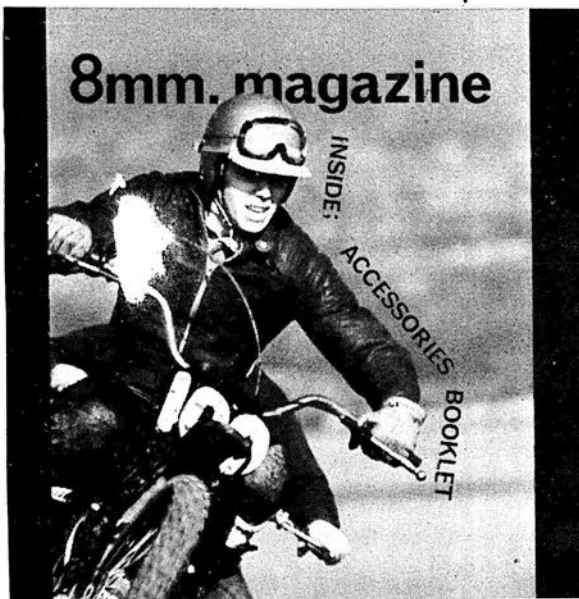
AS a further stage in the streamlining of EMI Electronics Ltd's organisational structure, certain sales activities will be transferred on July 1 to different divisions, to ensure an even higher standard of service to the Company's customers in various branches of industry.

A new division, to be known as the Automation Division, has been formed under Mr. F. G. Helps to take over the systems activities of the Industrial Division and Instrument Division. These will include machine tool control, Robotugs, weighing and mixing control, instrumentation tape deck systems, EMIIac II analogue computers, industrial telemetry and automatic control of industrial processes.

Broadcast and Recording Equipment Division will handle sales of its full range of equipment. Planning, estimating and execution of orders for broadcast and recording equipment will be undertaken by Installation and Maintenance Division, in addition to its other activities.

The Valve Division will continue in its present form.

IT'S NOT THE ONLY HOBBY YOU KNOW— OR DO YOU?



Any 8 mm. enthusiast will tell you, tape recording is highly complimentary to cinematography. Don't say we said so, but 8 mm. cine can also be usefully employed to supplement tape recording. Sound and sight are rarely separable and regular reference to 8 mm. Magazine and the Tape Recorder will keep you up to date in both fields.

Don't take our word for it and rush to spend anything from twelve to two hundred pounds on a camera. Take 8 mm. Magazine home this month and see for yourself.

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copy by ordering now**

8 mm. MAGAZINE

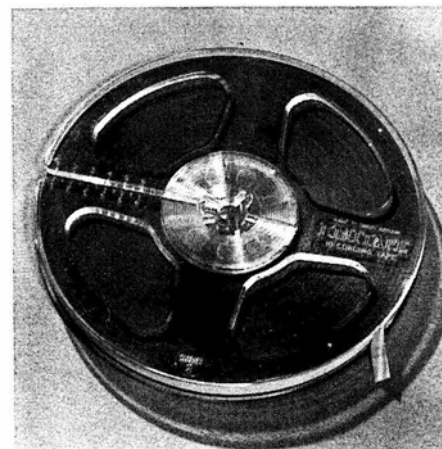
**SEPTEMBER ISSUE ON SALE
THURSDAY, AUGUST 15th**

**G. M. SMITH
PUBLISHING CO. LTD.**

MICRON HOUSE,
GORRINGE PARK AVENUE,
MITCHEM, SURREY

By RAFE SEABROOK

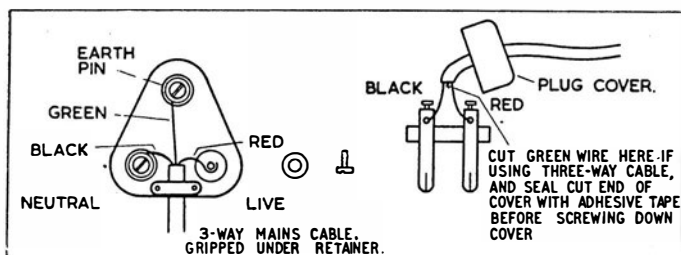
THE FIRST SPOOL



NEARLY everything that I am about to write has been written about, and talked about, many hundreds of times; nevertheless I make no apology for the repetition because this is a page of advice for the beginner—for the person who has just arrived home with his first tape recorder, and who is about to make nearly all the mistakes that nearly everyone else has made before him. This short article will not prevent more than a quarter of the mistakes, but it will probably help to save many readers from making them a second time. I hope so, at any rate.

Read the Instruction Book right through

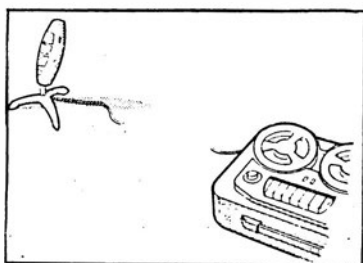
However impatient you may be, do not skip the first step of all. Read the instruction booklet right through, from cover to cover—and then go through it again, item by item, with the new machine in front of you. Check even the most obvious things, and start with the mains plug. If



it is a Continental machine and if the three wires are other than the British standard red black and green, and if they are unmarked (most unlikely, these days) make certain that the right one goes to the Earth pin.

When everything written has been partially digested, and followed, and when the moment comes for the first recording, save yourself one of the most irritating happenings of all. Turn the volume control right down, then start up on "Record" and allow the tape to run for at least thirty seconds—preferably sixty. Then turn up the volume to the desired or recommended level and begin to talk. Do this, and when you go over to *fast rewind* in order to hear what you have said, you will not spend your first frustrating minutes re-threading the tape which whipped off on to the full spool, because you can press the *Stop* button

*
Keep the Microphone
well away from
the Recorder
*



while there is still a margin of unrecorded tape on the take-up spool. This is a most worthwhile habit to get into and to practice on every recording occasion. Many an otherwise good recording has been ruined through missing the first sentences, words, or bars of music—all because of a last minute rewind which ended in an overshoot and a re-threading. There is another good reason for this advice. The end of the tape suffers the greatest wear and tear; therefore let this end have nothing important on it!

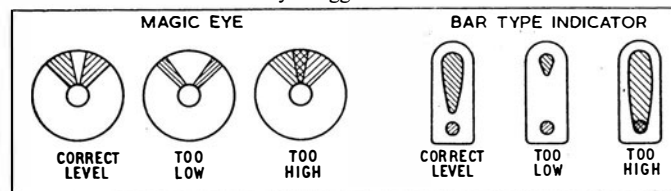
A Stupid Habit

How many "first tapes" have started, I wonder, with a tapping noise of a finger against the microphone, a series of distorted blowings and whistles, followed by a *one-two-three-four-a-b-c-d*? (And, incidentally, the public address announcers on the Belgian cross-Channel boats

can read the first part of this paragraph and commit it to memory!). It is a stupid and unnecessary habit. The blowing tells you nothing, for it only registers as a magic eye or meter overload. We are now dealing with recording levels and elementary microphone techniques. Whenever possible, place the microphone securely, and sufficiently far away from the recorder to avoid picking up the mechanical noise of the motor, etc—and thus, preferably, not on the same table, unless it is standing on something soft and vibration-absorbing.

Exaggerated Consonants

Write something on a sheet of paper, or choose a paragraph in a book. Read aloud, talking towards, *but not at*, the microphone. After a couple of sentences (or before them), say: "I am reading at a distance of so-and-so inches from the mike. The volume control setting is at at so-and-so." Then adjust the volume, read further, and make another announcement. Speak close to the mike, and into it, and say what you are doing. Then replay what you have recorded. Note how the consonants, the tees and esses sound horribly exaggerated. Note also how the different



distances, speaking levels and volume settings compare—and so get a sensible understanding of what you are doing. Then try holding the mike as you talk, and note how irritating are the noises of the cord rubbing against the table edge, the fingers moving on the case, etc.

"Safe" Volume Setting

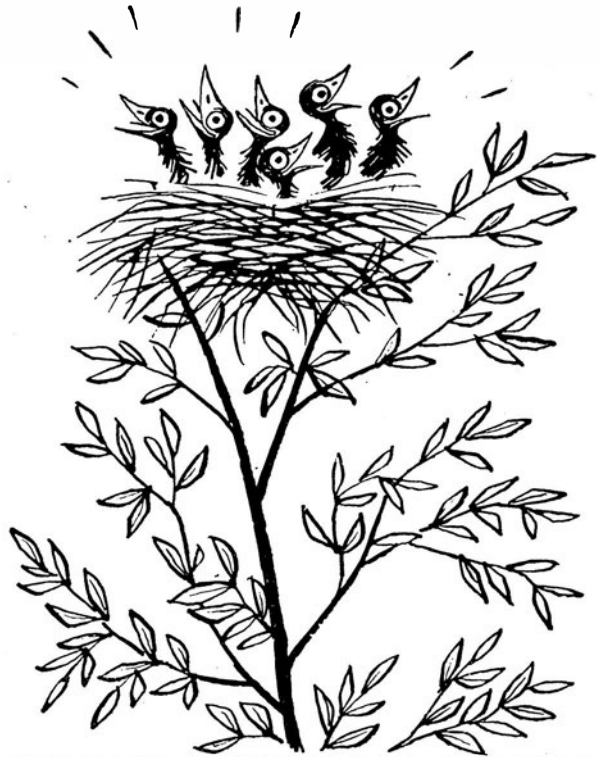
One of the most useful things to get buttoned-up at this stage is the "safe" maximum volume setting when recording music. Very few musical works start off at maximum loudness. Make allowance for this, because the volume level should *never* be changed once the recording has started. You will soon learn how to recognise distortion, but only if you study it. For example, a distorted piano recording gives you occasional notes (mostly the high ones) which sound as though they were being played into a bottle. Over-recording of orchestral music produces a rough, edgy sound on loud passages. Note how the magic eye or meter behaves on these loud passages, or on apparently not over-loud but sharp, high piano notes.

Find the Correct Level

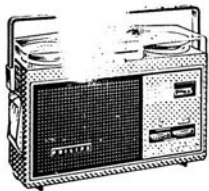
Don't record at too low a level, otherwise you will bring up all the background noise when you replay at a volume level which is loud enough for normal listening. On the other hand, don't record at a level which allows you no margin at all for the unexpected loud bits. This form of experiment may be tedious, but not a minute of it is wasted time. It is one of the most important things to study. Master it, and your recordings will please you when you replay them in the months ahead. Ignore it, and you will realise your mistakes with disgust when your experience has given you a sharper ear.

And now for some simple but very important do's and don'ts—so simple, some of them, that many people who ought to know much better

Top 6!



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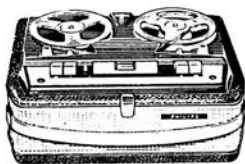
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THE FIRST SPOOL—Continued

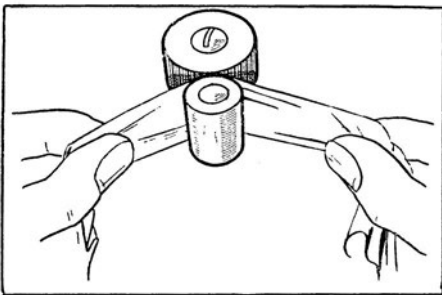
seem to be quite unaware of them. Start all recordings, whenever possible, with the volume right down, and turn it up smoothly and rapidly just before the actual item begins. This cuts out the clicks and plops. Do the same in reverse at the end of a recording. Volume down. Off. It also gives you "tape space" between items, and breathing space of silence. A habit to cultivate from the very beginning. At first this may be difficult, because there is most definitely a temptation (almost akin to the demands of a telephone bell) to rush things. A moving tape seems to demand that you talk at it. Adopt the attitude of being "the boss". Let a few unrecorded turns of the spool mean nothing to you. They will come to mean very much indeed, and you will be grateful for them.

Be Quite Ruthless

Make notes of what you record. Be generous with your tape. Don't fall into the trap of regarding the spool on the machine as part of the machine. Buy a second and a third spool of tape at the time you buy the machine—or the next day. Wipe out anything and everything that gives you doubts on replay. Be quite ruthless about this. Save nothing that is less than the best, unless it is unrepeatable—in which case a bad recording can sometimes (but rarely) be better than no recording at all. Believe me (if you believe nothing else that I have written here) it is far better to rub out and forget something inferior *immediately*, than to keep it and have second thoughts about it later. Second thoughts breed third thoughts, and your own sense of values will go to pot. And then, when you gain experience, you will be torn between what to keep and what to scrub. I repeat, **be quite ruthless**. And you will find, later, that this sound discipline will help you to be even more ruthless when it comes to making decisions later on, when replaying what you originally thought was "good".

Go back to Zero

Don't set your recorder up to record something and then leave it standing. Go back to "zero" with everything, and start afresh for everything new—for few items demand the same treatment. Switch off at the recorder, *before* switching off at the mains. This will help you not to leave the pressure roller in contact with the capstan—which will develop into a "flat spot", which will give you "flutter" on all else that



Keep the pressure roller and Capstan clean

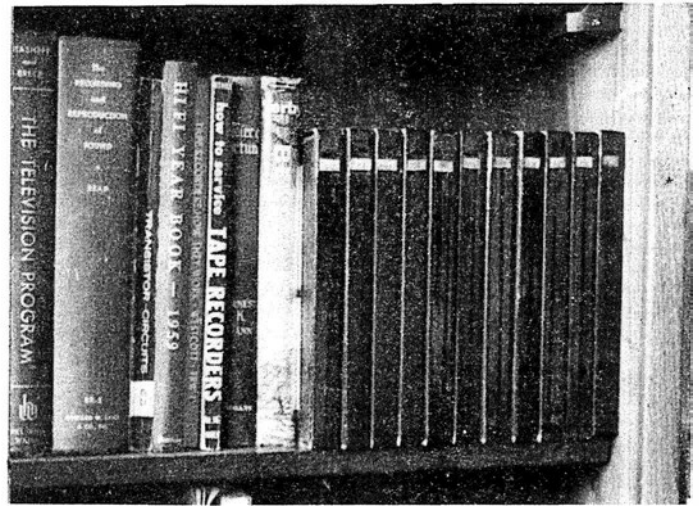
you record and replay. Don't finger your tapes—not even on the shiny side. You will leave greasy fingerprints if you do, and these will collect dirt, and this will not merely affect (although microscopically—and one must think in those terms) the close contact between tape and tape heads, but will help to bung up the important points of contact on the heads.

Keep the Tape Path Clean

Keep the tape path clean. Much unwise and false publicity was given to tape advantages over discs in the early days. The result has been to make people think that discs had to be nursed, while tapes could be roughly handled and would last forever, giving perfect results nonetheless. Don't believe it. True, discs are fragile, despite their "unbreakable" basic material; but tapes have to be cared for, too, and cleanliness pays dividends in terms of recorded quality.

General Hints

Don't leave spools of tape lying in the hot sun—even empty spools; and don't stand heavy objects (books etc) on them. A warped spool brings a dozen hardships to its user. Don't leave a battery recorder for months without removing its batteries—or the leaking cells may well remove much of the value of the instrument. When you pack away your mains lead, or your microphone, treat them gently. Even though it is a

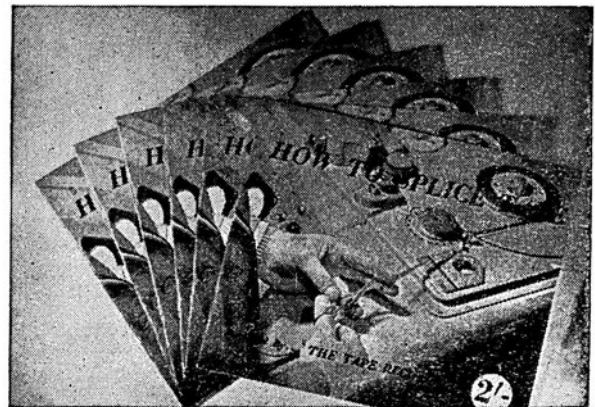


good habit to pack them away tidily, kinks and knots and strains can play havoc with the wire strands. Far better leave the microphone "out" but covered, than to disturb its lead four times a day!

If you want to experience the major disappointment that so many newcomers to tape recording invite, hide the microphone behind a curtain, or vase of flowers, and let it record a party or a mealtime conversation. Your eyes help you to focus your ears on required bits of talk at parties. Your ears are deaf to knife-and-fork clatter at meals. But the microphone is not so selective!

In conclusion, don't expect your new recorder to do the impossible, and do not get bored with it because it doesn't! A pencil mark against the volume control is definite; your memory is not. Your intelligence and skill make the good recordings—however expensive the recorder. And don't become a one-spool user. Who buys a gramophone and lives with one disc? If you have bought a tape recorder, prepare to buy tape. If you are not of that mind, then you have thrown away good money. That is the final and most important observation of them all.

DO YOU SPLICE TAPE?



HOW TO SPLICE TAPE

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THE TAPE RECORDER

99 Mortimer Street, London, W.1



ET 92

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NAME.....
(BLOCK LETTERS PLEASE)

ADDRESS.....

Readers' Problems

★ Readers who encounter snags or who run into trouble with their tape recording equipment, are invited to write to this editorial office for advice, marking the envelopes "Readers' Problems—Tape". Replies will either be sent direct by post, or published in this column if the subject is of general interest. However, we must emphasise that this advisory service cannot include requests for information about manufacturers' products when such information is obviously obtainable from the makers themselves. It is also essential to keep the queries reasonably short and to the point, and to limit them to one specific subject if at all possible. And, please, in no circumstances confuse such letters with references to other matters which have to be dealt with by other departments in our office.

... about CCIR and NARTB standards

Dear Sir: Assuming recordings were made through a control unit having playback facilities for tape, switchable CCIR & NARTB, to a tape recorder complete with electronics, and similarly could record to either system, what would be the resultant sound on playback be like if:—(a) Recorded C.C.I.R.—Playback C.C.I.R., (b) Recorded C.C.I.R.—Playback N.A.R.T.B., (c) Recorded N.A.R.T.B.—Playback C.C.I.R., (d) Recorded N.A.R.T.B.—Playback N.A.R.T.B.

Yours faithfully, A. N. Lisburn.

I do not know what equipment you have in mind, but if this is to professional standards, the equalisation, as well as recording pre-emphasis, will be variable over wide limits, and will differ with speed of tape travel.

I presume you are familiar with the time-constant expression of characteristic descriptions, and will understand when I point out that at the higher speeds, there are considerable differences between CCIR and NARTB characteristics, which become less important at the lower speeds. Indeed, on some mid-price range tape recorders, it is possible to play a tape recorded with one standard through a replay chain equalised to the other standard, and compensate with the ordinary tone controls. But, of course, if professional, or hi-fi, equipment is used, the discrepancy becomes more obvious.

Having thus qualified my answer, here are some details: at 30 and 15 ips, C.C.I.R. standards, 35 microsecs (turnover $f = 3.5$ kc/s) at $7\frac{1}{2}$ ips, 100 microsecs, (1.6 kc/s turnover) at $3\frac{3}{4}$ ips, 200 microsecs, 800 c/s turnover, and at 17 $\frac{1}{2}$ ips, 400 microsecs, 400 c/s turnover.

N.A.R.T.B. standards, 30, 15 and $7\frac{1}{2}$ ips, 50 microsecs, 3 kc/s turnover. At the lower speeds, apart from a bit of extra pre-emphasis (reduced time-constant compared with C.C.I.R.) the N.A.R.T.B. characteristics are much the same. But there has been a B.S.I. recommendation for 70 microsec standard at $7\frac{1}{2}$ and 140 microsecs at $3\frac{3}{4}$, which brings all the standards (including the European, different again) into line, so that a single test tape could be used. In theory that is, for in practice, head losses and tape differences make serious changes in the overall response.

From this you will note that a C.C.I.R. tape recorded with a 100 microsecond time constant, played back on an N.A.R.T.B. machine with 50 microsecond time constant will have a pronounced step 'in the middle', resulting in a predominance of bass and reduction of treble. If the treble is predominant, the time constant is too high. So your four conditions are:

- (a) Rec. C.C.I.R., Play C.C.I.R.—normal.
- (b) Rec. C.C.I.R., Play N.A.R.T.B.—lack of bass, treble 'thin'.
- (c) Rec. N.A.R.T.B., Play C.C.I.R.—lack of bass, treble 'shrill'.
- (d) Rec. N.A.R.T.B., Play N.A.R.T.B.—normal.

... about varying speed

Dear Sir: The speed of my Reflectograph Model 500 (variable speed model) has started to drift. When set to any speed, it will vary first one way and then the other. After half an hour or so, it seems to get slightly better although not much.

Yours faithfully, W. H., London.

Speed drift on the Reflectograph 500 is more than likely the result of either (a) incorrect pinch pressure, or (b) dry bearings of the capstan motor.

The variable speed facility only applies on fast wind or rewind, and is effected by changing the voltage feed to the Garrard spooling motors. Provided there is not a switching fault allowing incorrect take-up and back torque, this should give no trouble. To prove whether this is aggravating your fault, observe the machine during the fault period and make a loose part-loop of tape first between the head system and take-up spool and then between the heads and feed spool, so that the spools

have no effect on transport tension. If the fault continues as described in your letter, check that the capstan is receiving correct pressure by manually relieving it and noting that speed (tone of recorded signal) should drop. I think you will find that the problem resolves to dry bearings.

The capstan motor is a Papst, with the flywheel formed from the outer rotor—direct drive, in fact. Speed changing is effected by switching of the field coils, so there is no mechanical drag that would cause your fault except the rotor spindle and its bearings. Access to the bottom is fairly simple, but to get at the top, you need to remove the whole deck-plate (quite a few screws) and then let a few drops of light machine oil—only a little—ease into the bush while turning the rotor by hand. A good deal of patient work is needed on this job, and it may need several applications over a period of days. But beware of over-lubrication and do not attempt to reset the bearing by the casing screws at the base. Any more ambitious servicing should really be done by the agents—Pamphonic Reproducers, Ltd., Westmorland Road, London, NW9.

Fitting a Different Deck

Dear Sirs: I would be grateful if you could offer me some advice concerning the following problems: (1) I have an Elizabethan de luxe type recorder. I have an opportunity of obtaining the "Wearite" 5 A.N. series deck, and would be obliged if you could inform me if this deck

could be fitted to the existing electronics, and if so what, if any, modifications would be needed. The unit would be used in conjunction with a "Capital" record reproducer, Model 101B, of which I enclose a copy of the technical specification.

(2) What would be the requirements to equip this series 5 A.N. deck to record from radio/player and microphone sources, and replay through the Capitol record player. (3) Can monitoring facilities be added?

Yours faithfully, C. B. A., Peterborough.

The Wearite 5 deck should make a great improvement to your rig, but there are several factors to take into account. When connecting, you will need to note the solenoid feed. The brake solenoid requires between 25 and 90 mA direct current for energising, and is de-energised by short-circuiting when the manual or auto-stop is applied. The normal technique is to insert the 300-odd ohms of the solenoid winding in the amplifier H.T. line, and the correct method of connection is just following the existing smoothing. This will need the addition of an electrolytic, about 16 mfd, 450 V working, connected from the system side of the solenoid return line, i.e., the amplifier H.T. line, to chassis.

The head connections are rather different. Whereas the erase head presents no problem, being a simple two-wire connection, and requiring roughly the same erase power as you have at present, the R/P head is a double-wound type with an auxiliary tapping to the connector plug for separate Record and Playback connections, so that the bias, instead of being coupled to the feed line in the amplifier as at present, is taken via the second octal plug and socket. It is also very important that the earth line of the head connections be returned to the common on the 1st stage, and not to any other earth point. Moreover, to obtain the correct frequency response, the head should be transformer matched to the input stage, and to get the best from this deck, a playback pre-amplifier stage is desirable. For correct matching, the head is fed to this stage via a head lift transformer, type 977.

To replay through the Capitol 101B, you need an equalising circuit following this stage. Indeed, it is advisable to feed the deck through the Elizabethan circuit, taking off the high impedance output to feed the Capitol, if you want to make the best of your equipment. Similarly, recording be via the Elizabethan, to get the correct input, and you can monitor from the second stage of the Elizabethan, through the Capitol, or simply into headphones.

By GRAHAM BALMAIN

PROFILE OF A DROPOUT

Part 2 of an article examining the nature, effects and assessment of tape output fluctuations.

FIRSTLY, my regrets for the delay in continuing this article from the first part in the May issue. To any aggrieved readers—including those three who invaded the *Tape Recorder* office in protest—I can only plead private circumstances beyond my control, and certainly beyond the Editor's. In view of the time lapse a brief recapitulation of Part 1 may be helpful. We have looked in a very general way at how output fluctuations arise and have defined dropouts as those fluctuations which are *audible*. The effects of various operating conditions were discussed and the necessity for having objective methods of assessment pointed out.

I have since been taken to task for implying, by showing only pictures of *tape* faults, that most dropouts are due to them, whereas in fact dirt and dust which appear in use are generally responsible. This was because it is so much easier to photograph something which is fixed to the tape than even to see something which falls off as soon as one tries to find it, let alone survives being painted with colloidal magnetite. But some outside support for that unfashionable view is welcome since, as an interested party, my own motives for suggesting it might be misinterpreted.

Popular Method

One popular method of detecting and assessing dropouts involves recording a steady tone and displaying the tape output on a cathode-ray oscillograph—not individual cycles of the signal waveform, but so many cycles in each horizontal sweep of the spot that they run together into a continuous band across the screen. The height of the band depends on the peak-to-peak amplitude of the tape output, and the top and bottom edges of the band should ideally be quite straight.

Typical records obtained in this way are shown in **fig. 6**. The time base used here is not the repetitive electronic one provided in the c.r.o.

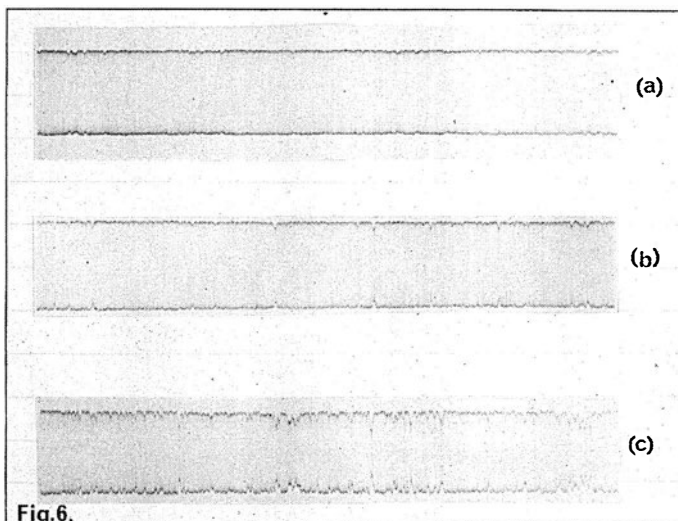


Fig. 6. Typical oscillograms of tape output fluctuations, signal frequency 10 Kc/s, tape speed $7\frac{1}{2}$ in/sec. The same length of tape recorded and reproduced (a) full track (b) half track (c) quarter track. Tape made in 1958.

but the continuous movement of the film in the camera past a vertical line on the screen whose height follows the instantaneous tape output. The general fuzz at the edges of the band represents what we hear as modulation noise, while the more obvious triangular incursions may represent dropouts or not according to their depth and length.

Although this technique is very simple, it has several disadvantages if there is much work to be done. Firstly it is wasteful; one-half of the band only is needed (since the other is a mirror image of it) and then perhaps only part of it depending on what depth of dropout is interesting.

Secondly, it is unselective; every tiny irregularity appears up to a limit far beyond the present range of significance, making examination of the important fluctuations more difficult. Thirdly it is expensive to use and process large amounts of film. Fourthly, it is awkward from the ergo-

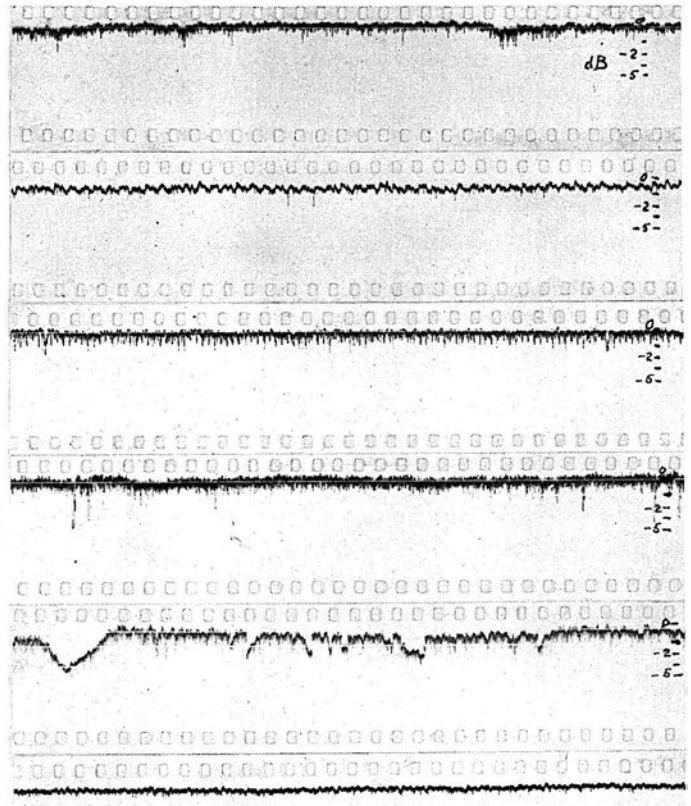


Fig. 7. Oscillograms of demodulated output signals; 10 Kc/s at $7\frac{1}{2}$ in/sec. half track. Demodulator time-constant 10 milliseconds rise and fall, film speed 3 in/min. Samples of six makes of tape. The white lines visible on most of the records are calibration marks produced by opaque lines drawn on the c.r.t. screen.

nomie point of view; the required information is not presented in a convenient way and, of course, the individual fluctuations must still be measured in some more or less tedious fashion.

Demodulation

The first two objections and half of the fourth can be removed by treating the tape output as an amplitude-modulated carrier and demodulating it, much as is done with the signal in an a.m. radio receiver. With suitable circuitry one can produce a fluctuating d.c. which follows the peak value of the tape output as closely as is needed, the circuit time-constants being readily adjustable to pass as much or as little of the more rapid fluctuations as one wants to see. One can also expand the scale of the more interesting upper output range, having suppressed the rest electronically, to fill the same space on the c.r.t. or the film as before.

Some examples of such records are shown in **fig. 7**. You will see that we now have a single definite line representing the peak output level (the "envelope" of the output waveform) with clear positive indications of the fluctuations, as against the rather negative indications given on records of the complete envelope. The shorter fluctuations in the latter may easily be overlooked, or obscured by halation on the c.r.t. screen.

Shapes

However, this is still not really the answer for large-scale testing; the expense and the awkwardness of measurement still remain. Besides, it is too powerful a method to be applied to the mere counting and location of fluctuations, which is all **fig. 7** shows. This can be done just as well,

and more conveniently, by a high-speed chart recorder (fig. 8). The photographic method is better used to examine the shapes of individual fluctuations. For such work one needs to expand the time scale some 50 times, by increasing the relative film/tape speed, although even here an ordinary chart recorder can be used for illustration if the tape speed is low enough and the fluctuation large enough. The latter method gave the "Dropout Profiles" shown in fig. 9. The shapes of fluctuations are certainly important when one comes to design routine testers, as we shall see later, and they may also influence audibility, although there is little data yet on exactly how.

It is as well at this stage to examine shapes in some detail, looking first at what might be expected from the geometry of the process. Fig. 10 shows the geometry and Appendix A contains the very simple basic mathematics.

Dropouts Simplified

To keep the maths. down to my level I have made some rather rash simplifications. We assume the following: 1. That no pressure pad is used. 2. That a foreign particle between the tape and the head causes both a uniform spacing over the track width and a sharp bend in the tape at the point of contact. 3. That the particle is small compared with the front-face curvature radius of the head. 4. That it is non-magnetic. 5. That it moves across the head with the tape. 6. And that the tape wraps round the head enough to always touch it on the side of the gap remote from the particle (as shown in fig. 10) or on both sides if the particle is at the gap. Some of these assumptions are true only sometimes, and some never, but we can examine the errors in a moment.

From expressions (1) and (2) in the appendix, we find the length or duration of a disturbance depends on the square-root of the front-face radius R and the square-root of the particle size h . For example, take a typical head with $R = 1$ inch (= 1000 thou') and a particle with $h = 1$ thou': $2q = 2\sqrt{2} \times 1000 \times 1 = 90$ thou' approximately, or just under one-tenth of an inch. At $7\frac{1}{2}$ in/sec. the disturbance will last about 12 milliseconds, at $1\frac{1}{8}$ in/sec. about 50 ms. (Note that this is not necessarily the length of its audible effect, but there will generally be some relation between one and the other.) Reducing either R or h to one-quarter of these volumes, for instance, will reduce disturbance lengths or times to half the figures given.

Evidently heads with very small front-face radii have some advantage here; but it may be offset by more rapid wear—especially with pressure

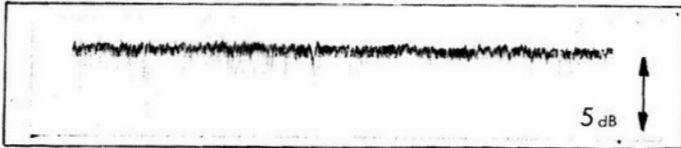


Fig. 8. High speed chart record, 10 Kcls at $7\frac{1}{2}$ in/sec., quarter track. Time-constant 10 milliseconds, chart speed 1 in/min. Modern standard-grade tape; this kind of chart always looks much worse than the tape sounds.

pads—and by difficulties with tape wrap-round and/or with long-wavelength response kinks appearing uncomfortably high in the a.f. range. Data recording systems, unworried by these disadvantages, do often have such heads to reduce dropout lengths, however. Although, as we shall see in a moment, the actual "depth" of a fluctuation may be less than we would expect from this simple analysis, nothing short of reducing the particle height h can reduce that depth under given mechanical conditions except perhaps increasing the a.c. bias (see part 1).

Assumptions examined

The shapes of the ideal fluctuation are plotted on dimensionless axes in fig. 11. The general form is similar to those in fig. 10 although there are obvious differences in detail due to the rash assumptions listed above. Let us first examine (2), which is never true. Tape is elastic, so that under normal playing conditions it will stretch slightly in the area immediately round the particle; but it is also stiff, so that it will usually curve more or less gently over the particle instead of bending sharply at that point. The former tends to reduce the depth of the fluctuation, the more as the track width is increased, the more as the tape is made thinner or more elastic and the more as the tape tension is increased. The latter tends to round off and broaden the bottom of the curve—more as the particle becomes smaller—and will also make disturbances due to very small particles longer than expected. Already the allowances for these effects, sketched in fig. 11b, bring the curve much nearer to some in fig. 9.

Two of the other assumptions can be dismissed briefly. No. 3 is always true in the sense that the whole thing gets out of hand if it is not. No. 5

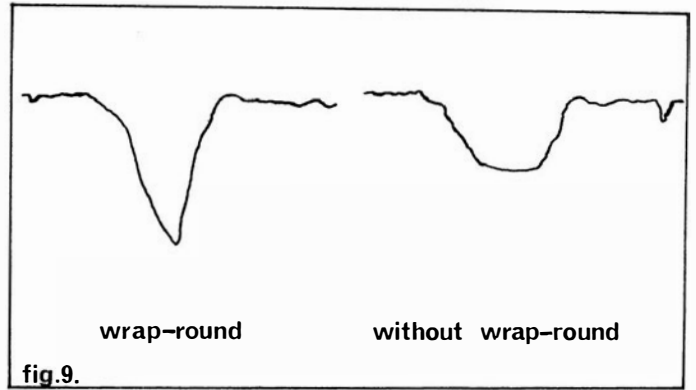


Fig. 9. Dropout Profiles. Medium-speed chart record of 5 Kcls at $1\frac{1}{8}$ in/sec, quarter-track. Chart speed 6 in/min, time-constant 100 milliseconds. Experimental tape with huge fluctuations.

is true if the particle is stuck to the tape or is part of it, but a loose particle may roll or slip between the tape and the head and thus lengthen the disturbance.

Pressure Pads

Assumption (1) is the most questionable, of course, but then the effect of using a pressure device is itself pretty unpredictable, depending entirely on the form of the device and the pressure it applies. It may merely prevent the tape from fluttering against the head, or it may localise any disturbance to the area immediately round the particle. Provided the contact surface is resilient, it will tend to reduce both the lengths and depths of fluctuations and it will probably have more effect where there is no wrap-round than where there is.

No Wrap-Round

Assumption 6 is rarely true these days, especially on cheaper machines. Here, the tape generally runs in a straight line past the heads, perhaps just touching their gaps, with pressure-pads or whatever to preserve head-tape contact. Examining the conditions briefly (fig. 12 and Appendix B), we assume in place of 6 that there is a large free length of tape on either side of the head so that, if the tape is pushed out a small amount at a point a little to one side of the gap, the amount of movement at the gap will be nearly the same. The pressure devices will be ignored for the moment.

The disturbance length and time for given conditions turn out to be the same as for full wrap-round, but the curve is much fuller (fig. 13): the arc of a circle, in fact, since the spacing is determined by the particle following the circular front face of the head. One would intuitively expect the subjective effect of such a fluctuation to be greater than those of fig. 11 with full wrap-round. One would also expect much less modification of the circular form by the mechanical behaviour of the tape since, by assumption, the latter is not flexed or stretched over the particle, although in practice it must be to some small extent.

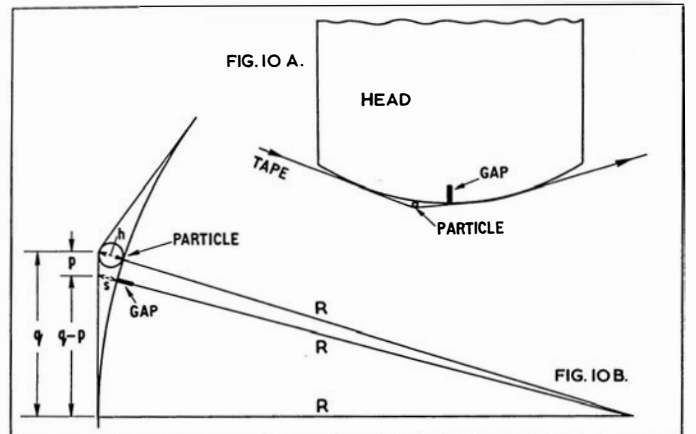


Fig. 10. Dropout Geometry, where the tape wraps round the front face of the head; (a) general plan, slightly exaggerated (b) geometrical diagram, much exaggerated. R =Front-face curvature radius, s =gap-tape spacing, h =particle height, p =distance along tape from particle to gap, q =distance from particle to point of contact with front-face See Appendix 'A'. (Continued on page 315)

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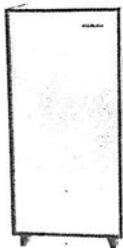
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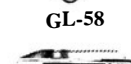
UXR-1



UXR-1



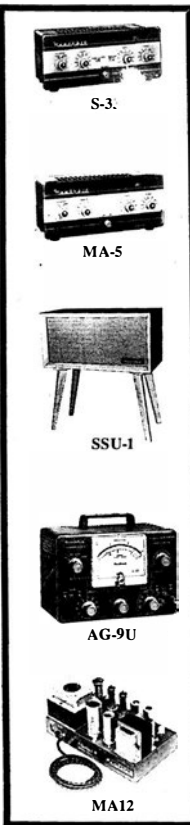
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Profile of a Dropout—cont.

Summing Up

To summarise our conclusions so far, output fluctuations can be reduced in both overall length and depth by:—(a) Increasing tape speed; (b) Increasing track width; (c) Increasing a.c. bias; (d) Using thinner, more flexible, more elastic tape; (e) Increasing tape tension; (f) Using pressure pads or similar devices; And in length only by: (g) Sharpening the front-face curvature of the head. In addition, wrapping the tape round the front face will probably make fluctuations less objectionable while leaving the overall length and depth unaffected (unless a higher tension due to the wrap-round itself decreases them).

All this might seem like treating the symptoms and ignoring the causes. As mentioned before, the majority of dropouts heard in domestic

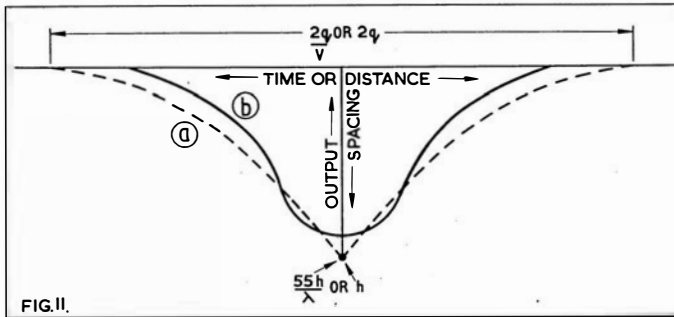


Fig. 11. Shape of fluctuation, with wrap-round: (a) ideal (b) allowing for tape stiffness and elasticity.

use are due to dust and dirt settling on the tape and the recorder. Only the user can prevent these by taking reasonable and obvious precautions—it is surprising how many enthusiasts treat l.p. records with meticulous care and yet cheerfully leave their tapes and machines uncovered during the daily dusting and grate cleaning operations. For their part, the tape manufacturers are thinking ahead to future, even more stringent requirements for tape. The third and last part of this article will describe a production dropout tester and some of the measures taken against the appearance of unwanted irregularities in the tape coating.

APPENDIX—THE IDEAL FLUCTUATION

A.—Full Wrap-Round (fig. 10). We have to find the spacing s between the gap and the tape as the particle moves across the face of the head. It is sufficient for this purpose to take s as an extension of the radius R , although strictly speaking it should be taken as the perpendicular from the gap on to the tape. First, we want to know the length of the disturbance from lift-off to touch-down, so to speak. Invoking Pythagoras in fig. 10b we find the following.

The Maths

$$q = \sqrt{(R+h)^2 - R^2} = \sqrt{h^2 + 2Rh},$$

or, since h^2 is very much smaller than $2Rh$,

$$q = \sqrt{2Rh} \quad (1)$$

The length of the disturbance is evidently $2q$ and its duration $T = 2q/v$, where v is the tape speed, so

$$T = 2\sqrt{2Rh} \quad (2)$$

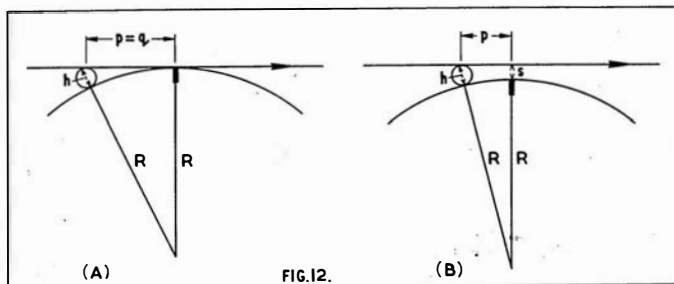


Fig. 12. Dropout Geometry, no wrap-round: (a) particle just touching tape and front face, (b) after lift-off.

Obviously q is the maximum interesting value of p , for beyond this value no separation occurs at the gap. To find s in terms of p , h and R we adopt a technique which my maths. master called "inspired unsimplification": in other words, you worry at the thing until it produces what you want. The first step of such a process generally looks pretty simple, not to say silly: $s = (R+s) - R$.

$$(R+s) = \sqrt{R^2 + (q-p)^2},$$

Using Pythagoras again in fig. 10b,

$$\text{so } s = \sqrt{R^2 + (q-p)^2} - R \quad (3)$$

in which $q = \sqrt{2Rh}$, from (1).

Expression (3) contains all the variables required either explicitly or implicitly. However, it can be simplified by approximation and still be accurate enough for our purposes. Rearranging and squaring both sides:

$$(s+R)^2 = R^2 + (q-p)^2,$$

$$\text{or } s^2 + 2sR + R^2 = R^2 + (q-p)^2.$$

Ignore s^2 , which is very much smaller than $2sR$, and we get

$$2sR = (q-p)^2,$$

$$\text{or } s = \frac{(q-p)^2}{2R}.$$

$$\text{In full, } s = \frac{(\sqrt{2Rh} - p)^2}{2R} \quad (4)$$

Varying p between 0, at the gap, and q , at lift-off or touch-down, will now give the physical shape of the disturbance. The electrical shape, i.e. the loss curve, is found by combining express (4) with that for the spacing loss (mentioned in pt. 1):

Attenuation $A = 55s/\lambda$.

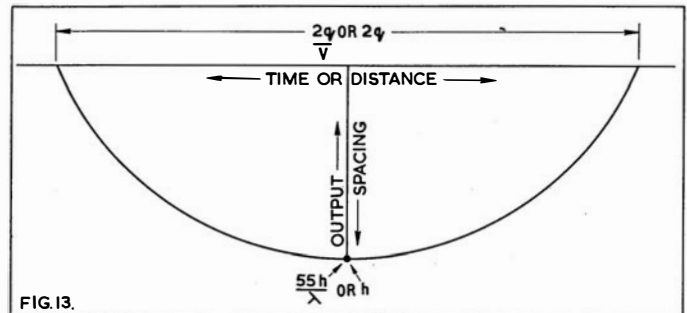
λ being the signal wavelength ($= v/f$ where f is the signal frequency).

$$\text{So } A = 55 \frac{(\sqrt{2Rh} - p)^2}{2R} \text{ dB.} \quad (5)$$

This can be plotted either against distance p or time $t = p/v$ from the gap, the shape of the curve being the same in either case.

B.—No Wrap-Round (fig. 13).

The argument is similar to that above, and indeed the expressions



for the disturbance lengths and times are the same as (1) and (2). For the shape we start as before: $s = (R+s) - R$.

$$\text{This time, } (R+s) = \sqrt{R^2 + (h-p)^2},$$

$$\text{so } s = \sqrt{R^2 + (h-p)^2} - R \quad (6)$$

which looks as awkward as (3) but is in fact much simpler. Examination of fig. 12 suggests that the loss curve might be the arc of a circle. We can check this by rearranging (6), squaring both sides, and bringing variable terms to the left-hand side, giving

$$p^2 + (R+s)^2 = (R+h)^2.$$

This is the equation of a circle of radius $(R+h)$ whose centre is at the centre of curvature of the front-face. Therefore, provided we plot in suitable units on the vertical scale (linear for the physical curve or dB for the electrical) we can simply draw the arc of a circle through three points: $p = q$ in either direction on the horizontal axis and $s = h$ or $A = 55h/\lambda$ on the vertical axis (fig. 13). For those who prefer the long way round, the equivalents to (4) and (5) are:

$$s = h - \frac{p^2}{2R} \quad (7)$$

$$\text{and } A = 55/\lambda (h - \frac{p^2}{2R}) \text{ dB.} \quad (8)$$

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FUNDAMENTAL BUILDING

PART ONE ————— THEORY

IRRESPECTIVE of the quality of sound recording equipment, or of the technique employed, the result of any recording session is influenced for good or bad by the studio acoustic. Whilst the term "studio acoustic" covers a multitude of phenomena, including intrusion of unwanted sound, and problems associated with particular room shape or size, the fundamental factor which affects the "sound quality" of a room in the majority of cases is, however, the reverberation period.

During a sound in any given space, the waves travel outwards from the source at 1,100 feet per second until they meet some physical obstacle in the space, from which they are reflected. All building materials, furnishings and finishings have the power to absorb a proportion of the sound falling on them, as well as to reflect some of it, and thus the reflections of sound waves in a room gradually reduce as their energy is absorbed by the various surfaces, until comparative silence ensues.

The period of time taken for the sound to decay to one thousandth of its original pressure (or by 60 dB, which is the same) is taken as a convenient yardstick for this state of comparative silence, and it is known universally as the reverberation period. Widely varying times are quoted as optimum for various purposes, from one third of a second and even less for small "talks" studios to that of several seconds for the performance of certain types of "romantic/classical" music.

Substantial Variation

The reverberation period is not necessarily constant at all frequencies, quite often a substantial variation occurs in its length at the lower, middle and upper frequency ranges, giving rise to unbalanced effects. I have recorded organ music in a large Chapel with a 5 to 6 second reverberation period in the bass, falling to a second or so in the upper frequencies, the effect given to music being that of enormous bass predominance and a "treble hungry" quality. Generally it may be said that the middle and upper frequency reverberation periods should be equal in length but that a small increase in the bass value for general musical use is of advantage, with however, a reduction of the bass value for rooms where speech is all-important. The upper frequencies are most easily absorbed by average building materials and furnishings and every care should be taken that no unnecessary absorption of them takes place.

An example of the complexity of the rivalling claims to reverberation periods is given in Table 1, where optimum times are shown for various frequencies, volumes and duties. If ever an example was required of the fallacy of the "general purpose" hall or recording studio, here it is! The reverberation period of any space is a function of the volume and the area and quality of absorbents in that space. W. C. Sabine set down a formula about 1900 relating the factors in an acoustically simple space as follows:

$$T = \frac{0.49 V}{A + (A_1 \times a_1) + (A_2 \times a_2) \dots}$$

where: T = Reverberation Period (in seconds); V = Volume (in cubic feet); A = Total area of acoustically similar absorbents (in square feet); a = Absorption co-efficient of the particular absorbents. The term $(A \times a)$ is expressed in "Sabins" and sometimes special absorbents are tabulated directly in Sabins. (People, chairs, etc.)

For reasons outlined earlier, calculations of the reverberation period should always be made in the bass (125 cps), middle (500 cps) and upper (2,000 cps) frequency ranges, and for more detailed work much closer intervals and higher frequency ranges are examined to ensure an evenly balanced result.

Absorption Co-efficient

So far, no enlargement has been made upon the term "absorption coefficient" which appears in Sabine's formula. If one considers an open window in a room, it is fairly obvious that sound falling upon the opening will not be reflected back into the room, thus an "absorption co-efficient" of 1.00 results. Following experiments in laboratories, other

surfaces and materials have been classified in relation to the "open window" condition, so that a material with a co-efficient of 0.6 will absorb 0.6 and reflect 0.4 of the sound falling upon it. Some absorbents are comparatively more efficient at low frequencies, others are so at the middle and high frequencies, and in this general quality lies the secret of acoustic design, to select the right absorbent for the proper duty.

Before proceeding to examine the various families of absorbents I should emphasise that the science is by no means an exact one, particularly for the non-specialist dealing with spaces of 6,000 cubic feet and under. Sabine's formula, although simple, is by no means the ultimate, and it is not unknown even in recent years for rapid amendments to be made to absorbents in new Concert Halls following live tests of the actual (as opposed to the theoretical) acoustic! There is no substitute for clear ears and crisp judgement in assessing acoustics, although a theoretical appreciation of the principles involved is an indispensable foundation from which to work. Time spent in assessing and, as necessary, altering the reverberation period of a studio is never wasted; microphone type and placing, and use of tone controls and filters can in part compensate for a bad acoustic, but such tricks cannot be considered as anything but expedients.

Differing qualities

And now, after this grandfather-like homily, back to absorbents. I have already drawn attention to their differing qualities, and these enable them to be grouped conveniently into four sections of acoustically similar properties, each section of which, surprisingly, comprises similar types of building materials.

Group 1 (Table 2) are hardly absorbents at all due to their very low

Building		125 c/s	500 c/s	2,000 c/s
Halls for speech (under 25,000 cu. ft.)	R	1	$\frac{3}{4}$	$\frac{3}{4}$
Ditto (over 250,000 cu. ft.)	R	$1\frac{1}{2}$	1	1
Multi-purpose Halls School Halls Chamber Music Rooms (under 25,000 cu. ft.)	R	$1\frac{1}{4}$	1	1
Multi-purpose Halls (over 250,000 cu. ft.)	R	$1\frac{3}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$
*Halls for orchestral music (under 25,000 cu. ft.)	R	$1\frac{3}{4}$ to $2\frac{1}{4}$	$1\frac{1}{4}$ to $1\frac{1}{2}$	$1\frac{1}{4}$ to $1\frac{1}{2}$
*Ditto (over 250,000 cu. ft.)	R	$2\frac{1}{2}$ to $3\frac{1}{2}$	$1\frac{3}{4}$ to $2\frac{1}{2}$	$1\frac{3}{4}$ to $2\frac{1}{2}$
St. Paul's Cathedral, London (with congregation)	A	$7\frac{1}{4}$	$6\frac{1}{2}$	$5\frac{1}{4}$
Weingarten Abbey (with congregation)	A	6	6	4
Festival Hall, London—Full	A	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{4}/1\frac{1}{2}$

Table 1. Approximate reverberation periods (in seconds)

*For successful hearing of organ music it is my view that these figures need to be increased by as much as 50% for the shorter times. The short reverberation period of the Festival Hall will be noted; whilst ideal for precise and contrapuntal music, some critics have voiced a wish for a longer reverberation period for the more "romantic" type of music. In the above table the letters R and A in the second column indicate "Recommended" or "Actual".

ACOUSTICS

Material	125 c/s	500 c/s	2,000 c/s
Boarded roof soffit, below tiled or slate roof, boarding $\frac{3}{4}$ in. thick	0.15	0.1	0.1
Brick wall plain or painted	0.02	0.02	0.04
Concrete	0.01	0.02	0.02
Cork, linoleum, rubber flooring, stuck to solid	0.05	0.05	0.1
Floor tiles (hard) or composition	0.03	0.03	0.05
Glass (32 oz. in windows)	0.3	0.1	0.05
Glass ($\frac{1}{4}$ in. plate in windows)	0.1	0.04	0.02
Plaster on solid backing	0.02	0.02	0.04
Plaster on lath or plaster on plasterboard over a small air-space	0.3	0.1	0.04
$\frac{1}{2}$ in. soft fibre board mounted direct on solid backing and painted	0.05	0.10	0.15

Table 2. Absorption co-efficients for common building materials of low absorbercy (Group I) (All per square foot)

absorbercy; they really perform as reflectors. Nevertheless, they should be included in the calculation.

Group II absorbers (Table 3) are commercial products, designed, with office blocks in mind, chiefly to absorb higher frequencies (typewriters and speech). The name "acoustic tiles" generally applied to them should not be taken to imply that they have a universal effect; the average domestic room with its soft furnishings is often treble hungry enough without further indiscriminate blanketing, and they should be used with discretion.

Panel Absorbents

Group III absorbers (Figure 4) are a most valuable group about which not so much is known, however, as with some of the other groups. This group consists of panel absorbers which function by being set into vibration by the middle and lower frequencies, and when the sound source ceases, the cessation of the panel vibrations acts as a damper or absorber. In addition, whilst vibrating, the panel adds to the general "loudness" of the sound level and the hard surface possessed by the majority of them reinforces the upper frequencies. The great musical quality of some of the older music rooms and halls relies much upon the properties of painted plaster on lath and polished hardwood panelling and strip flooring (even reluctant hi-fi wives might react favourably to a sitting room lined with hardwood panelling!).

Group IV (Table 5) are miscellaneous but nevertheless important absorbers, whose characteristics are sometimes assessed directly in Sabine. Note the absorbent effect of air itself, which has quite an effect upon the high frequencies, to the extent of .003 Sabins per cubic foot. In a small Hall $40 \times 12 \times 15$ feet of air will account for $.003 \times 7,200 = 21.6$ Sabins at 2,000 c/s, equivalent to some 36 square feet of typical "acoustic tiles". Below 2,000 c/s the effect is negligible.

Before leaving absorbers, one point should be made: that is, if a permanent position for the sound source is selected in any room, the surfaces surrounding it should be as sound reflecting as possible, but



The photograph shows the Royal Festival Hall, London, one of the finest concert halls in the country

otherwise absorbent surfaces should be as evenly distributed as possible, unless a particular acoustic defect has to be treated. By means of the foregoing, the reverberation period for a room can be calculated (at the three frequency ranges, at least please) and any acoustic deficiency remedied by varying the absorbers. Those lucky enough to be able to borrow equipment for measuring the value will still find Sabine's formula and the tables useful for corrective purposes.

White Noise Tape

A reasonable substitute for proper equipment for measuring the reverberation period, can be made up by playing a "white noise" or "warble tone" tape (in the appropriate octave band) and then stopping it. Another tape recorder with an omni-directional microphone should be used simultaneously to record the sound, its cessation and the resultant "die away". By the use of a tape marking fluid (such as "Indicord") and simple calculation, or by running the tape through at a slower speed and using keen ears and a stop watch, it should be possible to gain an idea of the appropriate value. A homely, but nevertheless efficient method is to clap the hands together and to record and analyse it, or to try to assess (by ear) the time taken for the various frequencies to die away. Sometimes, it is better to get a friend to clap his hands and to stand a

Material	125 c/s	500 c/s	2,000 c/s
Perforated fibre acoustic tiles $\frac{3}{4}$ in. thick	0.15	0.50	0.60
Fissured mineral tiles fixed to plasterboard with $\frac{1}{2}$ in. air space	0.18	0.83	0.82
Vinyl faced perforated tiles with mineral wool backing on solid	0.10	0.57	0.70
"Acoustic Pyramids" (by The Marley Tile Co.) with mineral wool backing)	0.40	0.75	0.80
Perforated plasterboard (12% perforated) on battens backed with 1 in. rock wool plus 1 in. air space	0.18	0.90	0.45
Ditto, but with tissue paper backing, on 2 in. air space	0.18	0.65	0.50

Table 3. Absorption co-efficients for typical commercial absorbers (Group II) (All per square foot)

Note: When selecting commercial absorbers, the co-efficients of the particular products should be used in calculation in preference to those typical ones given above. (Continued on page 319)



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FUNDAMENTAL BUILDING ACOUSTICS — Continued

Material and fixing	125 c/s	500 c/s	2,000 c/s
$\frac{3}{8}$ in. Plywood on studs or battens without porous material in air space	0.30	0.15	0.10
Ditto, but with porous material in air space	0.40	0.15	0.10
$\frac{3}{8}$ in. match boarding over air space on solid wall	0.30	0.10	0.10
(See also perforated plasterboard on battens, etc., and plaster on lath in Table 2.)			
Soft fibre board on battens on solid backing or joists or studs	0.30	0.30	0.30
Ditto, but painted	0.30	0.15	0.15

Table 4. Absorption co-efficients for panel-type absorbers (Group III)
(All per square foot)

Note: When selecting commercial absorbers, the co-efficients of the particular products should be used in calculation in preference to those typical ones given above.

few feet away for any such aural assessment. I have heard a leading organ builder test a Church on the same principle, by emitting a loud roar-screach, much to the horror of an elderly Churchwarden, who searched suspiciously thereafter for evidence of cloven hoof, horns and tail!

The points in this article cover, necessarily rather briefly, the funda-

Item	125 c/s	500 c/s	2,000 c/s
Air (per cubic ft.)	nil	nil	.003
Audience seated in fully upholstered seats (per person)	2.00	5.00	5.50
Upholstered seats (unoccupied) (per seat)	1.30	3.00	3.40
Audience seated in wooden or canvas/metal seats (per person)	1.70	4.30	4.70
Wooden or canvas/metal seats (per seat)	0.80	1.60	1.90

Note: Audience or seating causes shading of the floor in auditoria and this should be allowed for in reverberation times. Suitable adjustments of the floor absorption in consequence of this shading are suggested as follows:

- At 125 c/s reduce tabulated absorption by 20%
- At 500 c/s reduce tabulated absorption by 40%
- At 2,000 c/s reduce tabulated absorption by 60%

Item	125 c/s	500 c/s	2,000 c/s
Theatre Proscenium opening with ordinary stage set (per sq. ft. of opening)	0.20	0.30	0.40
Medium carpet on solid floor (per sq. ft.)	0.10	0.30	0.50
Ditto (on hollow floor)	0.20	0.30	0.50
Curtains (medium fabrics) hung in folds or spaced away from wall (per sq. ft.)	0.10	0.40	0.50

Table 5. Absorption co-efficients for special items (Group IV)

mental principles of the reverberation period and sound absorption; application of them to design of studios for varying duties, music rooms and halls, is a matter of special consideration which I hope to consider in a further article, together with a few notes upon sound insulation and problems associated with room shape.

A Word of Advice

Before ending, I must offer one word of advice about acoustic treatment of rooms, and that is to avoid wherever possible the use of combustible materials. It is so easy to lose one's self in enthusiasm for creating an acoustically perfect room, and to create at the same time a potential bonfire of highly combustible materials through which fire can spread with appalling speed. A good principle is to use non-combustible materials, or materials incorporating little or no combustible content, and to avoid enclosed spaces for fire to spread unseen. The local Fire Brigade is well worth consulting on these matters, I find them always ready to help; it is remarkable how keen they are to do themselves out of business!

Bibliography

It is usual to offer a bibliography for readers anxious to go rather deeper into these matters than an article of this nature allows. There are several books on sound absorption and acoustics generally, and any local library should be able to provide a wealth of information on the subject, but I would recommend the book called "*Acoustics, Noise and Buildings*" by Parkin and Humphreys, published by *Faber and Faber*.

I wish to acknowledge permission given by the Building Research Station to publish extracts from "Building Research Digest", No. 36 (revised), which has been used as the basis for **Table 1**, and wholly for **Tables 2, 4 and 5**, quoted in this article.

A most comprehensive list of sound absorption co-efficients has been set down by Evans and Bazley called "*Sound Absorbing Materials*", and this is published by H.M.S.O. at 3/-d.

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A REVIEW OF TAPE RECORDS



PREVIOUSLY we have recommended selected tape records from time-to-time without giving a full-scale review, but the number of tapes awaiting critical listening has now been growing for some months, so we have decided to devote more space to the subject in future. This review will still be basically a "selection", as pre-recorded tape quality is somewhat variable and it would be pointless to give details of tapes which were then condemned in the following paragraphs.

We would like to remind readers that commercial tape copying is, unfortunately, still not as consistent as disc pressing, so that good copies of those we have rejected may be available and bad copies of those we shall recommend may be around. However, we have judged the tapes *as received*, and to give some idea of how selective we are, the initial batch for this month totalled 15, but we shall mention only nine as having sound quality and performances providing adequate mono reproduction and good entertainment via moderate tape recorders at 3¾ i/s. The one stereo tape in the bunch passed without reservations.

* * *

Our ten tapes cover a wide range of music to suit all tastes, but a selection of waltzes which should delight everyone is included in *Waltzing in Vienna* Vo. 2 on *World Record Club TT 194*. Josef Lanner, Carl Ziehrer and four members of the Strauss family are represented by pieces rich in the gayest Viennese tradition, played by the Vienna Volksoper Orchestra under Josef Leo Gruber. It is true that you can

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start the tape anywhere and hear similar sounds, but the pieces have considerable individuality, and for anyone wishing to give an old fashioned waltzing party in this age of "the twist," this is the tape.

* * *

In a different Viennese spirit is *Beethoven's Symphony No 2 and Sonata No 30 in E Major* on *WRC TT 193*. The symphony is played by the London Symphony Orchestra under Josef Krips and is given a good performance with plenty of drive and tautness, yet with loving attention to the woodwind passages in the best Krips manner. The sonata is played by Ernst von Dohnanyi and receives a slightly tame performance in comparison.

* * *

For music in utterly different vein we turn to Mike Simpson and his Orchestra on *Saga STG 8055*. Called *The Opposite Sides of Mike*, this is "bigband" stuff with very lively performances and recording. Track One is "Big Beat" music in— to quote the box note—"... the strong, hot muscle-busting tradition", while the other track carries "Tempo Nuevo"—more languorous stuff. If you like this sort of music you will like this tape.

* * *

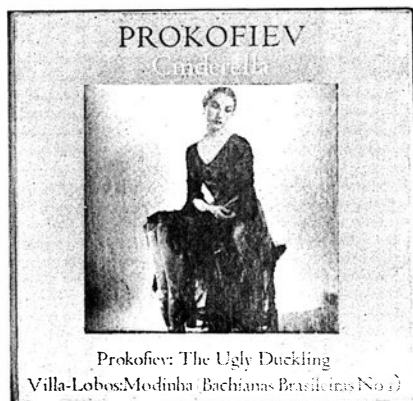
Another abrupt change of mood—but not century—comes with Prokofiev and Villa-Lobos on *WRC TT173*. The Russian composer's *Cinderella Ballet Suite* is colourful music, very much in the tradition of classical ballet, and providing lively listening. Performance is by the Stadium Symphony Orchestra of New York under Leopold Stokowski. *The Ugly Duckling* by the same composer is sung by Reginci Resnik (soprano); this work seems rather to go on-and-on, but as it is sung in English the children may be interested. Villa-Lobos is represented by *Modinha* from *Bachianas Brasileiras*, some rather sad contemplative music for strings.

* * *

The 20th century joins hands with the 18th on our next tape, *WRC TCM33*, in the figures of Hindemith and Mozart. Joseph Fuchs, violin, joins the London Symphony Orchestra under Sir Eugene Goossens in work being *No. 3 in G Major*. The Hindemith work is interesting but may seem a little "spiky" to many readers. The Mozart, on the other hand, sounds absolutely delightful, receives a wonderful performance and is given a very authentic-sounding recording. We were so beguiled by this tape that it was played again when all the others were finished—we think this is really fine Mozart.

* * *

From 18th. century grace to modern foot-tapping rhythms with *The Modernes* on *Saga 8075*, called *Swingin' Easy*. This tape is best summarised by quoting from the box note: "It is merely a fine job of record-





ing and performing some good tunes, tunes that you and thousands like you have enjoyed over the years." There are 16 tunes altogether, and both playing and recording are extremely crisp and lively. The rhythms are very catching indeed, and this tape should be excellent for dancing parties — or even simple foot-tapping!

* * *

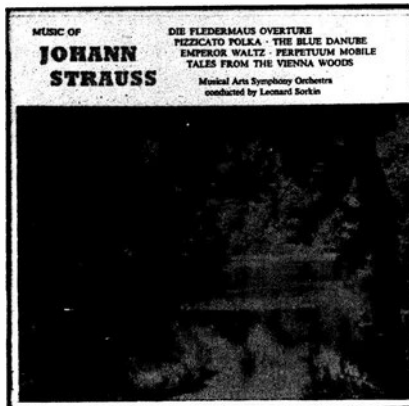
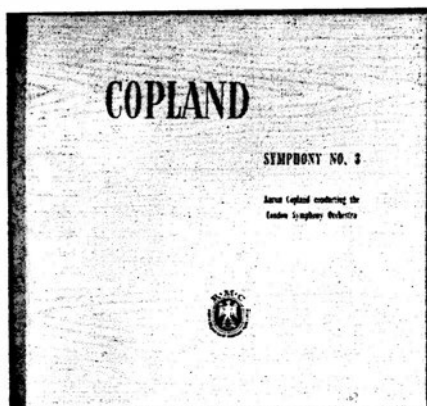
A very different type of popular music is found on *WRC TT 195*. This is Vol. 2 of *Ellington in Concert*, with Duke Ellington and his Orchestra recorded at a public concert given at Cornell University as long ago as 1948. Track One carries five separate items, while the other track has a long medley and the *Tattooed Bride*. As is customary in the world of jazz, all the individual instrumentalists are named—and very good most of them are. The immediate post-war years were an odd time for jazz, as is evidenced by this tape with its rather noisy arrangements of 'pop' songs of the time. At that time jazz had neither the virility of *traditional* or the sophistication of *modern*, but Ellington collectors will no doubt buy this tape and disagree.

* * *

The last 3¾ i/s mono tape brings us full-circle back to *Music of Johann Strauss* on *Saga STG 8081*. Performance is by the Musical Arts Symphony Orchestra conducted by Leonard Sorkin. Items included are: Overture to *Die Fledermaus*; *Pizzicato Polka*; *Blue Danube*; *Emperor Waltz*; *Perpetuum Mobile*; and *Tales from the Vienna Woods*. These are pleasant and clearly recorded performances of famous and well-loved pieces, and a particular plum is the *Pizzicato Polka*, which sounds delightful and realistic when played via wide-range equipment.

* * *

We remain across the Atlantic for the composer Aaron Copland, but cross back for him to conduct the London Symphony Orchestra in a performance of *Symphony No. 3* on *WRC TCM 34*. As with much of Copland, this is essentially music of the desert, with many suggestions of the wide open spaces of the prairie. Lonely woodwind passages contrast with full orchestral climaxes in a manner suggestive of Shostakovich—such are ideological boundaries in music! This is a remarkably rewarding modern symphony which suggests that the names of Copland and a few other serious American composers will join a handful of jazz-men in outlasting 10,000 "pop" vendors.



Talk of better quality reproducers brings us to the three 7½ i/s stereo tapes in this month's batch. *Beat Tropicale* on *Saga STE 3023* features José Bethancourt and his Orchestra, with Harry Coon and Richard Campbell on drums. Bethancourt is a Latin-American musician of some repute who plays a famous marimba and is accompanied here by the flute, guitar, piano, bass, timba, bongos, gourd, maracas, sencerro, claves and timpani which make up his orchestra.

The first part of the tape carries five Latin pieces using various of the above instruments to produce some very enjoyable sounds, followed by *Savage Drum Fantasy*, an interesting and occasionally eerie medley for percussion featuring the two named drummers. This last section makes use of complex sound-on-sound recording techniques to produce effects which are new and worthwhile in their own right. One item, *Tombs of Cameroon*, is described as "spirit ululations echoing gauntly through the reaches of vaulted sepulchres". The whole thing is very effectively done, and the relief arising from the spaciousness and clarity of stereo is very noticeable after several hours of 3¾ i/s mono. This tape admittedly uses stereo in a gimmicky fashion, but somehow one senses a pleasing restraint and the sounds produced are certainly colourful and interesting.

* * *

It is some time now since the *World Record Club* issued its Stereo 21 tapes, and we have two of these not previously mentioned. *STT 52* carries sharply constricted music in the form of the Bliss Checkmate ballet suite and Handel's *Water Music*, followed by a set of *Act Tunes and Dances* by Purcell. The *Sinfonia* of London is conducted by Sir Arthur Bliss. Checkmate has plenty of colour and bite and is given a clear vivid recording, while the Handel sounds extremely natural and real, with just the right sort of weight in the bass to give one the 'feel' of the concert hall. One of the sections includes a very striking episode for treble recorders which warms one's heart to these delightful instruments.

Tchaikovsky fans will like the coupling of *Francesca de Rimini* and the *Hamlet Fantasy* found on *STT 98*. The Stadium Symphony Orchestra of New York is conducted by Stokowski and produces a rich full-bodied sound ideally suited to this type of music.



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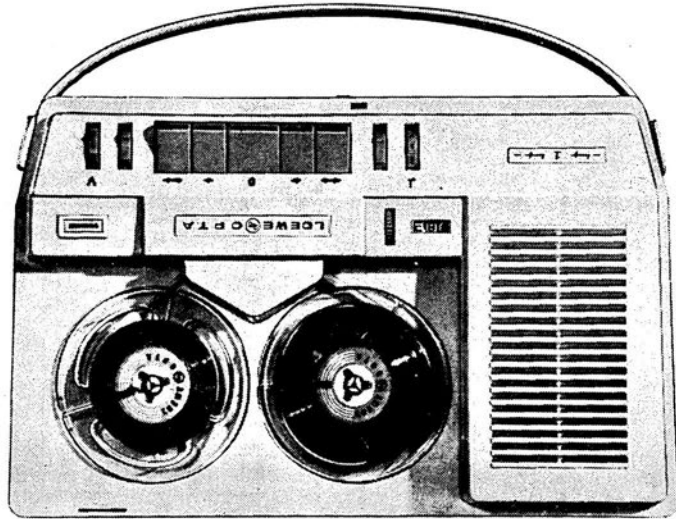
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MODERN BATTERIES

UNTIL recently, if you wanted a dry battery for a torch, pocket radio or portable tape recorder, it was merely a question of obtaining one (or more) the right *size* for the job. All comparably sized batteries gave virtually the same performance, since they used the same basic chemical system. Now, however, two striking new cell systems have been developed, both giving an improved performance. Batteries using these new systems are beginning to find their way into the shops in increasing numbers—so that now you can choose a *type* of battery as well as size. For portable tape recorder enthusiasts this is exciting news indeed: the improved performance of the new systems means more running hours per battery change, with less distortion, wow and flutter as the batteries age.

Performance and Cost

What are these new batteries? How do they compare—in performance and cost—with the “old faithfuls”? Which one should you choose? These are some of the questions that will be asked over and over again during the next few months. In this article we shall attempt to define some of the answers.

The dry cell or battery (a battery is a group of interconnected cells) with which we are so familiar is known as the “Zinc-Carbon” after the materials used for the electrodes, or the “Leclanché” after its inventor. It is called a “dry cell” although, paradoxically, one of its components is—must be—wettish or damp. Also it is known technically as a primary cell, which simply means that once its energy has been released it is of no further use and can be discarded. A secondary cell is one that can be re-activated, such as an accumulator or car battery.

Mercury Cell

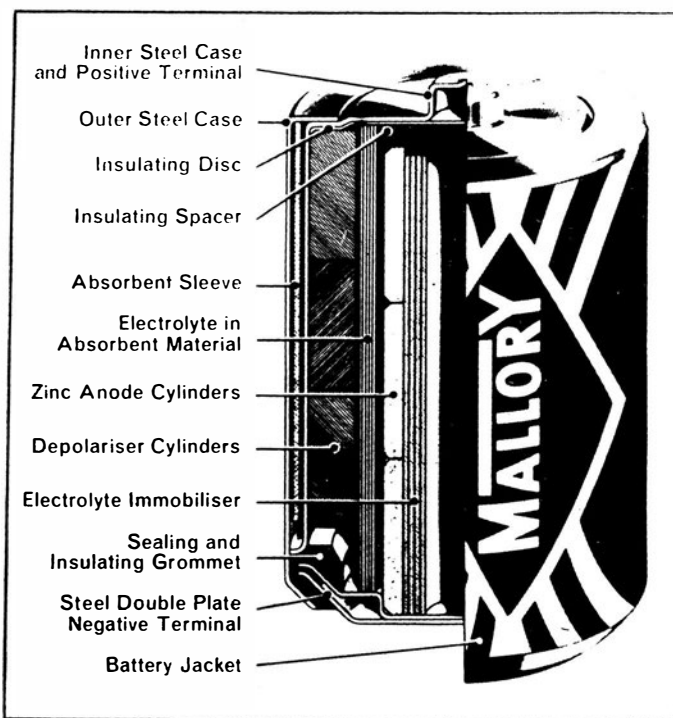
The first new system—developed during the war—is known as the “Mercury-Zinc-Alkaline” or more simply the “Mercury” cell, and is often referred to as the “Ruben-Mallory” or “Mallory” cell after its inventor and manufacturer. The most popular name for this type of primary cell will probably be “Mercury”, since the second new development, known as “Manganese Alkaline”, is also from the Mallory stable.

The Mercury system is extremely powerful, and lends itself admirably to miniaturization. It has made possible such applications as “within-the-ear” hearing aids and electric wrist watches—where other types of battery could not be made small enough and powerful enough to be of lasting use. The smallest commercial battery in the world is, in fact, a Mercury type. Mercury batteries have been commercially available in small sizes and packs to meet specific replacement requirements for some years, but now they are also being made available in conventional single and multi-volt sizes.

Manganese Alkaline

The second new system, Manganese Alkaline, has been available for some time in America, and is now being manufactured in this country in five popular single volt sizes. The batteries can stand up to heavy current drains better than normal types, and are being selected by many manufacturers for powering motor drives in recorders, cameras and so on. Broadly speaking, all three systems—Zinc-Carbon, Mercury and Manganese Alkaline—work in the same manner. Each contains two metals or metallic compounds separated by an absorbent or gel saturated with the electrolyte. When the cell is being used, an electric current is created by electrochemical action. The amount of energy stored by the three cell system differs, as does their ability to provide that energy. The capacity or ability to do work is determined by the performance of the cell under operating load conditions in the device it powers: its capacity cannot be determined by making simple off-load voltage measurements.

The amount of work a Mercury cell will do can be quoted, with reasonable accuracy, in terms of “milliampere-hours” (mA-H). Thus, if a cell has a capacity of 10,000 milliampere-hours, it will provide 10 milliamperes for 1,000 hours—erring on the favourable side—or 100 milliamperes for 100 hours. Provided that a maximum specified current



is not exceeded, the power providing ability of the Mercury cell is practically independent of the current taken or the frequency of usage: it could provide the expected service in one continuous session if called upon to do so. This is also true to a large degree of the Manganese Alkaline cell system, though these batteries are a little more susceptible to the frequency of usage and the amount of current taken: their life is extended when used intermittently, and performance is improved slightly at the lighter currents.

Dependent on current drawn and frequency of use

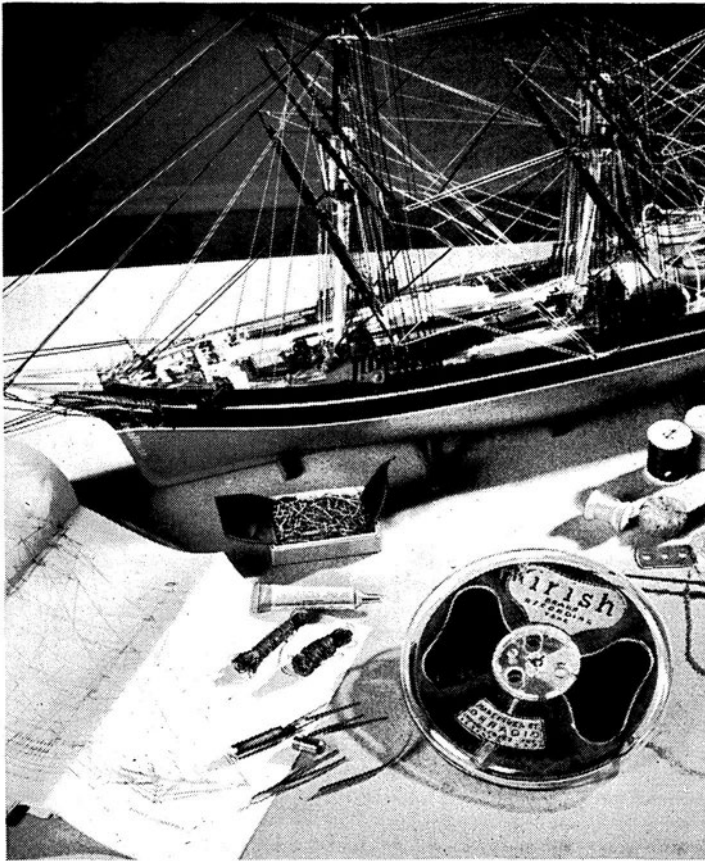
The power providing ability of Zinc-Carbon batteries, on the other hand, depends almost entirely on the amount of current drawn and the frequency of use: their expected life is shortened considerably when they have to provide heavy or sustained currents. This is best demonstrated by comparing the life of the three cell types under similar load conditions. One point should be mentioned first: the period of usage is deemed to be finished when the cell voltage drops below a certain level. Just what this level is depends on the application—some equipment will still give acceptable operation when the voltage is down to 0.7 V per cell, others will not work properly after the voltage has dropped below 1 V per cell. For comparison an end-of-life voltage of 0.8 V has been taken.

A Zinc-Carbon battery. (U2 size) can supply a *continuous* current of 50 mA for some 70 hours. A comparably sized Manganese Alkaline battery (Mn-1300) under the same conditions lasts for about 200 hours, and the Mercury battery (ZM-42) lasts 300 hours. With a continuous current drain ten times greater (500 mA), the life of the Zinc-Carbon cell is drastically reduced to some 2 hours, while the Manganese Alkaline and Mercury types last about 14 hours and 30 hours respectively. Under continuous usage conditions, therefore, the Manganese Alkaline cell outlives the Zinc-Carbon type by 3 times for light loads, 7 times for heavier loads: although only one size of cell has been compared, these results are typical. Mercury cells last from 4 to 15 times longer than Zinc-Carbon cells, depending on the load conditions.

Rest periods required

Zinc-Carbon cells do not fare well under continuous or heavy loads because of an internal polarising action—a film which forms causing resistance to the flow of energy. If the cell is given a “rest” every so often, the resistance is reduced and its life is extended. An idea of this can be gained from the fact that a Zinc-Carbon battery which would last, say, 60 hours when used 8 hours a day, five days a week, can be expected to last for up to 100 hours when used only 2 hours a day, five days a week. The life of a Manganese Alkaline cell is also improved under intermittent use. A Mercury cell gives substantially the same results however it is used.

(Continued on page 324)



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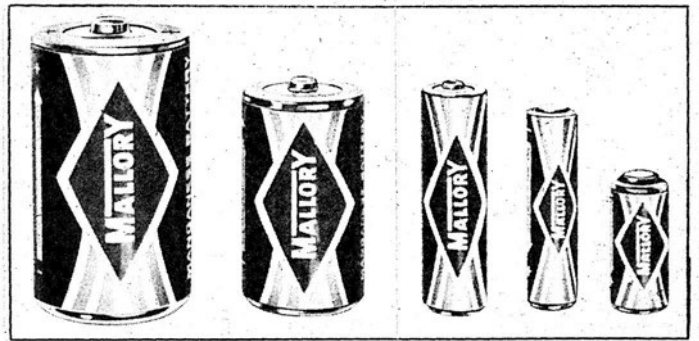
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MODERN BATTERIES—Continued

The operating voltage of Mercury cells under loads at rated drains is virtually constant—within 0.1 V or so—for almost their entire life. Only within a very short period at end-of-life does the voltage drop, but then it drops quickly. The voltage regulation of Mercury cells is so good on the lighter current drains that they are used as voltage standards in laboratories—supplying a useful current in the bargain!

Completely Leakproof

How long can a battery lie around unused? The chemicals inside a cell tend to react with each other before and in-between periods of usage. This "local action", as it is called, reduces the life of the cell, so substances are included to minimize the effect. The potential capacity of a Zinc-Carbon battery is reduced by about 10% after a year's storage at normal "room" temperature (21°C). Heat increases the local action considerably with this type of cell, the capacity being reduced by about 40% within 4 months if kept at 45°C. The newer cells can be stored for far longer periods before losing any appreciable capacity: it is claimed that they lose only about 7% of their capacity after two years at 21°C. Mercury cells lose only about 15% of their capacity after 5 years when stored at 25°C. Naturally every precaution is taken by wholesalers and



The batteries reading from left to right are:—Mn-1300, D size; Mn-1400, D size; Mn-1500, AA penlight size; Mn-2400, K or AAA size; and Mn-9100, N size

stockists to ensure that the batteries are kept in a cool place, so that they are as fresh as possible when purchased. Anyone who has had experience of a leaking battery will appreciate the damage it can cause to electronic and photographic equipment. Manufacturers were quick to realise this, and for some time a leakproof version of the Zinc-Carbon battery has been available. Both new types of cell are constructed to be completely leakproof, and a special vent is included to let only gases escape from the cell under adverse operating conditions—such as a continuous short circuit—thereby insuring against damage to the equipment.

Storage life

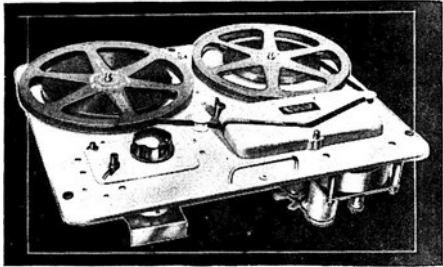
Most battery powered electric door bells, gas lighters, etc., work efficiently on a Zinc-Carbon battery—and the benefits of one of the newer cells would hardly be appreciated. But in a battery powered tape recorder—especially one that is used for long periods at a time—the newer cells would give a far better overall performance, and would cut down the frequency of battery changes. For applications that put a high continuous load on batteries—camera drives, tape recorder drives, and so forth—the Manganese Alkaline is probably the most efficient. Mercury batteries provide voltage stability and long life as well as miniaturisation within their capacity rating, making them ideally suited for transistor radio sets and amplifiers, hearing aids and powered camera irises. Without doubt, the initial outlay for a Zinc-Carbon battery is less than the other two types, Mercury batteries being the most expensive. There is no doubt either that for the heavier current drain applications, the Manganese Alkaline and Mercury batteries are more economical to run than the Zinc-Carbon types—used intermittently or continuously.

What about the future? Battery development and research is going on at breakneck speed—although it takes many years for a new system to be perfected and made a practical proposition. New materials, new combinations, new ideas, the need to keep pace with trends—it seems almost inevitable that more battery systems will become available, and with them, further improvements in equipment design.

... tape recorder workbench

by A. Bartlett Still

I hope I will be forgiven if I allow a little pride to creep into my column this month. It seems difficult for me to realise that the first "Workbench" article appeared in print about four and a half years ago. This thought prompts me to recall the first occasion that I came up against this business of tape recording. It must have been about 1950, I was connected with an amateur dramatic society at the time, and for one production some complicated sound effects were needed. Most were available on 78 r.p.m. discs, but some were recorded on tape



*
*An early model
of the Wright
and Weaire
tape deck*
*

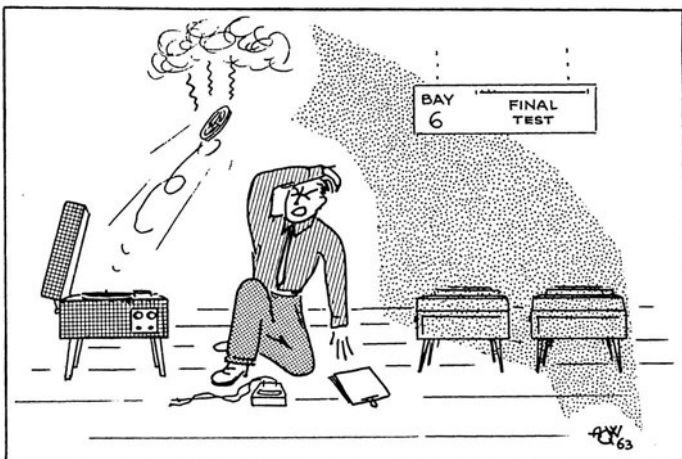
from the original. Eventually the whole sequence, disc and live, was put on tape to avoid mistakes, highly irregular as I later realised, but most valuable. The recorder, as I recall, consisted of home-built amplifiers attached to a Wright and Weaire deck, remarkably similar in operation and appearance to their current models, which speaks highly of the basic design. I have no idea of what the performance was really like, probably it was atrocious by present day standards, but it did seem to be magic at the time and made me determined to find out more about this tape recording business.

The Hard Way

It was actually about a year later that I finally purchased a tape deck and started finding out the hard way. It's true to say that I have been learning ever since, but the most instructive period was when I worked, for about three years, in the engineering section of a large tape recorder firm. I soon found out one thing, however, that it does not pay to work at one's hobby—you just have not got a hobby any longer. However, quite apart from the invaluable technical knowledge and experience that I gained, I learned a lot, from customer contact, of the many ways in which tape recorders are used (and misused!).

After the novelty has gone

The largest proportion of all machines sold, it seems to me, just collect dust after the first novelty has worn off. There is little that can be done about this, since the owners of such machines are scarcely likely to be readers of "The Tape Recorder", but should any readers know of instances such as this, then here is a challenge for you. Of those tape



"Can't this firm ever forget it made toasters?..."

recorder owners who have their machines in regular use, there would seem to be, or at least, this is the impression I have gained over the last few years, three "classes".

Earning its keep

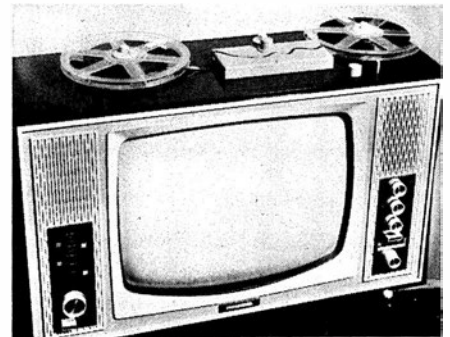
There are those whose outlook is strictly utilitarian, their machine has to "earn its keep", quite apart from any pleasure it may give in respect of recording music, etc. There are obviously many ways in which tape recorders can become a necessity rather than a luxury, but it is not always appreciated, perhaps, by the ordinary owner, just how useful his machine could be.

Scope for creative work

Another group, in my own private sub-division, is represented by those who experiment with their recording. Again, we have a very wide field, nature recording, effects recording, both real and artificial, and one must also mention experiments in microphone technique, both single, and multiple via a mixer unit. There is often scope for real artistic merit and creativeness, as has been shown by some of the entries for the recording competitions that are held from time to time.

Technicalities of Recording

My own interest, in common with quite a number of my readers, lies more with the technicalities of recording. Indeed, I sometimes feel that I have to keep a careful watch lest I become like one of those "Hi-Fi fiends" who "suffer the music in order to listen to the Loudspeaker"!



*
*The Telcan
Sound and
Vision
Recorder*
*

If one has a tape-deck of reasonable quality, however, there is so much room for experiment with the electronics as to make an absorbing hobby. Let there be no mistake, I have quite a large library of tapes, all of my own recording, that gives great listening pleasure.

From the practical point of view, my hobby is suffering at the moment. I am currently working away from home and, until we move house later in the year, spare time in the workshop just does not exist. My appetite for the future has been whetted by an advertisement in a trade monthly for a T.V. recorder to sell at 59 guineas. It appears that no technical details have been released, but the principle will become known in due course. Suffice to say that the programme is recorded on two-track standard audio tape. What really exciting news this could be—and it could raise some interesting problems in respect of the copyright acts!

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By RICHARD GOLDING

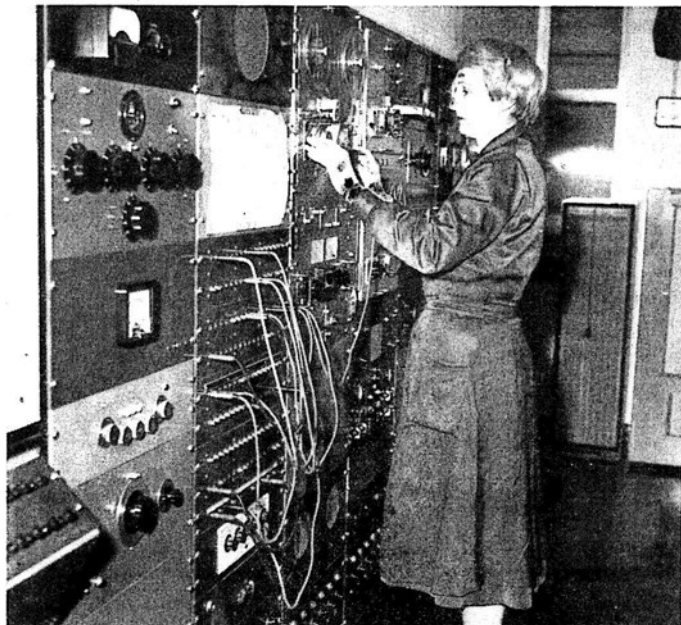
SOUND AND CINE

It was Friday afternoon and not a flowery adjective was to be heard in the sleeping streets of London's Covent Garden but close by the great market the head office of Stagesound (London) Ltd. was still buzzing with activity on all its six floors. Even so, Bill Walton, Managing Director of *Stagesound*, managed to take some time off to conduct me on a personal and detailed tour of his most interesting suite of studios and offices. The six floors of the King Street building house a studio large enough for a 16 piece orchestra, a main recording channel for the make-up and transfer of effects and music tracks (either to tape or disc), a tape-copying channel capable of turning out over 3,000 copy tapes per week, a library containing over 60,000 sound effects and a complete film dubbing studio.

The resources of Stagesound are directed towards supplying a high service to a very wide range of customers and, although the company began some fifteen years ago by specialising in tailor-made sound effects for the theatre it now caters also for a host of other sound applications. Television, Sound Radio, Documentary and Industrial Films make ever-increasing demands. Public Relations Officers, recognising the potential of recorded sound for sales conventions, fashion shows, civic functions, annual general meetings and many open air events find their problems eased by using the many facilities of Stagesound. *Son et Lumière* soundtracks now have a special place in the Stagesound scheme of things.

Effects and Music Library

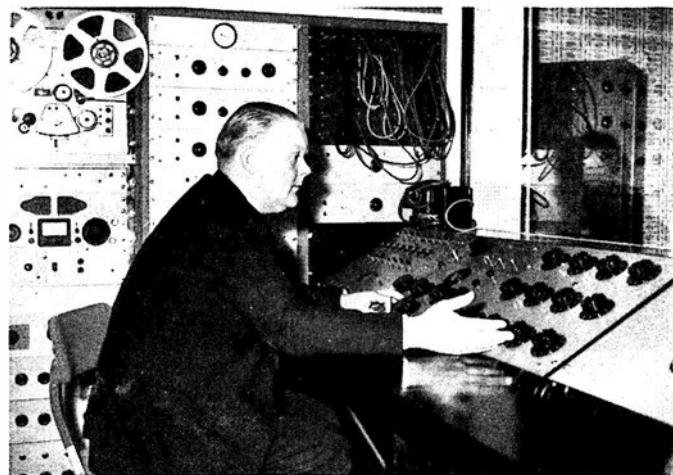
In the basement library all the master tapes of the 60,000 effects are available. These effects can be supplied recorded on any medium for use in theatre, television and sound radio, films, trade demonstrations and exhibitions. All the well-known background music libraries are held here so that a producer may select all his music and effects in one place—thus saving time. Stock effects can be combined, mixed, or altered as required, and copies will be supplied exactly as required. In no circumstances are master tapes allowed to leave the building, and all effects and music must be selected there. An appointment should



Main Dubbing Channel for Theatre Effects at Stagesound.

be booked at Reception to hear material. Copies can be supplied at short notice and an overnight service is operated for transfer.

In the basement is also the main recording channel No. 1. for the make-up and transfer of effects and music tracks. Apart from editing machines, this channel is equipped with two disc recorders for Stan-



Bill Walton in Studio B Control Room recording . . .

dard, E.P. and L.P. disc cutting; nine quarter-inch tape recorders allow tape copies to be supplied at any speed, either full or half track and there are four disc replay units. Comprehensive mixing and equalisation facilities are installed.

Close by is channel No. 2 which is equipped to undertake multi-copy tape production. It consists of one Master recorder and ten slaves, plus comprehensive characteristic and mixing equipment. Normally this channel turns out over 400 copies every day and is responsible for the duplicating of recorded radio programmes which are sent out all over the world. A normal week's output in this channel alone consumes over a half-million feet of *Emitape*.

Ground Floor Reception

All divisions are represented at "Ground Floor Reception" and it is there that all enquiries are made in the first instance. The ground floor also contains Studio B, which is the main sound recording studio. The studio is large enough to cope with an orchestra of 16 and has easy access to the street for instruments to be brought in. A grand piano is available in the studio. Great care has been taken in its construction so that plenty of daylight is available, both in the studio and control room, giving pleasant working conditions. Indeed, one of the features that appealed to me most was this emphasis on ease of working. Everything around the Stagesound building was so very clean and bright with hardly a foot of space wasted.

In Studio B up to 12 microphones can be used, and twin turntables are fitted for playing in effects or music. Tape backing tracks may be used and a comprehensive range of echo is available. The usual facilities for light cueing, talk-back, fold back and accurate timing are incorporated. This studio, apart from many varied jobs, is responsible for some six hours of recorded radio programmes for overseas radio stations every week. Programme lines are also available for direct transmission by land line or to link up any of the other studios or recording channels for more complex programmes.

First Floor Radio Suite

On the first floor is the Studio C, designed for the reception, production and transmission of radio programmes direct to overseas stations by GPO Private Programme Circuits. The company has a number of Private Programme lines which go to the International Maintenance Centre of the GPO. From the IMC, these private lines can be routed to any part of the world covered by GPO cables, or to short wave transmitters at Berne to beam signals not covered by lines. This means that from Studio C a commentator can talk direct to any part of the world.

Stagesound has a regular programme service to New York for the RKO Network and Mutual Broadcasting service, and for some four

years has been responsible for all direct news from Europe to these two stations. Regular morning reports are received by line from their correspondents in European capitals and recorded on tape. The London correspondent then edits them into a complete news picture for the day and adds the London news to the programme. The complete 13 minute programme is then transmitted direct via line to the New York transmitters of the companies concerned.

The Control Room

The Control Room is relatively large and allows for the increase of equipment needed for more complex programmes. The standard facilities allow for 3 programmes to be brought in and 2 programmes to be transmitted at the same time. The control engineer has 6 control lines to enable him to talk direct to overseas stations and provision is made in the studio for the commentator to receive instructions via headphones either from the control room or direct from the overseas station to whom he is broadcasting. Television is available in the studio so that he can comment on an outside programme being televised.

Son et Lumière tracks are prepared in the studio on stereo. Two lots of information are required for this type of soundtrack, for you have many situations where two things are going on at more or less the same time—horses arriving in the castle grounds, for instance, while a prisoner is being tortured elsewhere in a dungeon. *Son et Lumière* is mainly the department of Bill Walton himself, for he loves the complexities that this involves. He estimates that for each *Son et Lumière* production he uses over five miles of tape in compiling one three-quarter hour track. Another section of his already busy life is taken up in installing and testing out new equipment. An *Ampex Master* is shortly to be added to Studio C and he will live with it for six months after which he will hand it over to another of his staff. The reason for this is that he must know everything about the new machine before handing it over—its capabilities, its limitations—and when he hands it over he must be sure that it works perfectly from every technical and operational point of view.

Multi-Tape Copying Channel

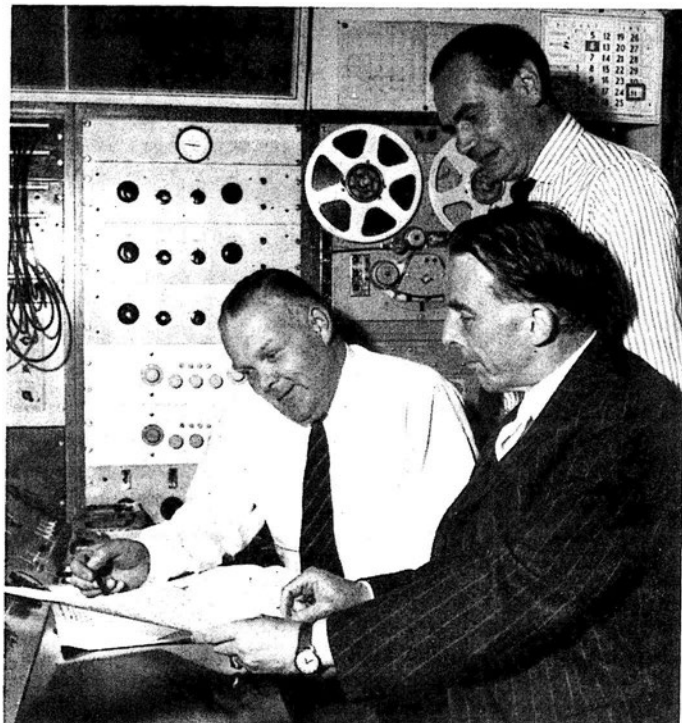
Going up through the second floor, which is mainly composed of offices, we arrived at Channel 4, on the third floor. This is a multi-tape channel that can make copies, at any speed, or either mono or stereo tapes. When in operation this channel normally turns out over 500 copy-tapes per day. (with *Emiguides*, probably four times this number). The two Masters are *EMI* Type TR90 machines, with various head set-ups so that they are capable of replaying tapes of either full track, top track, bottom track or stereo recordings. The two machines are provided so that two tracks of unrelated recordings can be transferred to the copy tapes. A unit is provided to control the level and frequency characteristic of the copy tapes. This control desk can then feed up to 15 copy recorders which have been supplied by *EMI*. This channel is normally employed in providing music copy tapes for use in factories, offices and shops.

Two other features on the third floor are the Stock Store containing the day-to-day running stock of tape and magnetic film used in the building, and the Film Cutting Room which is equipped with an *Editola* machine and a four-way editing bench. This room complements the floor above.

Film Dubbing Studio

The last floor is entirely devoted to film dubbing and consists of the dubbing theatre, quite a large and well lit room, the re-recording and projection room and the control room. Most of the film equipment is supplied by *Westrex* and consists of: One 35mm projector with provision for running unmarried prints; One 16mm projector with optical or magnetic sound; One 16mm magnetic and one 35mm magnetic recorder; Four 35mm magnetic and two 35mm optical reproducers; Four 16mm magnetic reproducers; One 35mm optical or magnetic loop reproducer; One 16mm magnetic loop reproducer; Full post-sync looping facilities. All this equipment may be run on sync supplies or in interlock at 24 fps or 25 fps (TV). The 16mm reproducers and recorder may be arranged for edge or centre track operation.

In the control room a 12-way mixing console is sited which can be split to work stereo if required. A comprehensive range of equalisers (any equaliser on any key) and compression is available. Up to 6 non-synch record units are available and facilities are provided to replay 1/4in. tape loops as well as straight spools. A TR90 1/4in. full track recorder is also installed. Full talk-back intercom and arc light facilities are installed and an electronic footage counter is coupled to both pro-



Bill Walton (left), The Dean of Worcester (right) and Christopher Ede (top) planning *Son et Lumière* for Worcester Cathedral.

jectors. The footage counter is set below the screen in the dubbing theatre and is large for easy reading. Line facilities make any of the other studios or channels available to be used in conjunction with this suite.

I was able to discuss with Bill Walton some of the small problems that forever haunt the recordist. Extraneous noise, for example, and the difficulty of suppressing it—the hundred and one little wheezes of the accordion—the breath noises of flutes—the cuff buttons striking desk edges—and the jingle of the female commentator, her earrings and her charm bracelets. The script noise is the main problem, however, especially when the script is written on rice-paper as with the Chinese (Stagesound receive commentaries in 63 languages).

Stagesound and the Amateur

We also, discussed, the attitude of Stagesound towards the amateur film maker. Bill Walton indicated that he had a healthy respect for amateurs in the theatre (there are 6,000 registered dramatic groups using Stagesound Effects) and that he would like to help the film maker as much as possible. In fact, he had investigated the possibility of 8mm stripe but at the moment he was waiting for further developments before committing money and equipment in that direction. However, all the film dubbing studio equipment was at the 16mm amateur's disposal, the only snag being the high cost of dubbing a complete track. He was prepared, however, to suggest ways to cut out unnecessary work so that the film maker would spend only £20 instead of, say £200.

There was no time to discuss anything more; for instance the Stagesound Service Division which has developed its own "brain equipment", providing complete control of programme switching and sound level adjustment for use in *Son et Lumière*, or the extensive hire services of most complex equipments; but this is all another side to Stagesound of London.

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TAPE SERVICE RECORDER

No. 21 THE HAGEN 4-T DECK

By H. W. HELLYER

A couple of months ago, in his punchy column *frankly speaking* that appears regularly in *Hi-Fi News*, John Berridge was lamenting that the diversity of design made life difficult for the audio enthusiast. Indeed, he went further, and called it "wild inconsistency". He envisaged rows of designers, each strictly isolated, furiously designing tape recorders and audio gear. "... on pain of instant dismissal no one is allowed to use the same design more than once. Needless to say, each design works perfectly and complete chaos reigns at the consumer level".

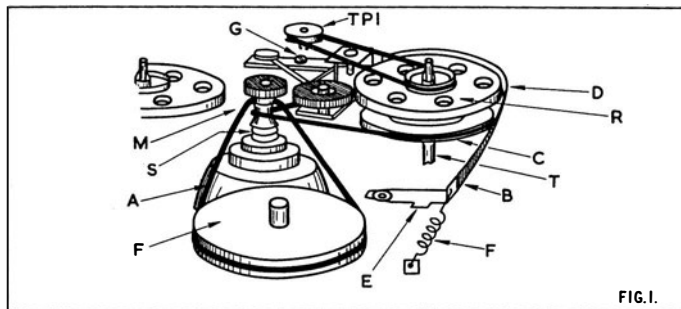
An Advantage to the service engineer

True, he was talking of the present flood of Japanese equipment, which, like Topsy, when it is good it is very, very good (see *Sony* and *Akai*), but when it is bad... But his remarks are cogent here, for the great and growing diversity of design makes it difficult for the ordinary chap to appreciate the niceties of his own machine. Very often, a small fault that may be common to a particular system—say, the wrap-around brake, or the "lifted" clutch—can be perplexing unless it has been met before. The service engineer, handling this wide range of machines, has the advantage. This is why, in these articles, as wide a variation of machines has been chosen as is possible in the space available. In the notes on one kind of deck readers may find some hint or tip that will help iron out the bugs on another.

The *Hagen 4-T* deck has several features that should commend it to our attention. It was used on a number of tape recorders, but is principally found in the *Kolster-Brandes TT 40*. The following notes will refer to its incorporation in this machine. It has some quite interesting mechanical features, including wrap brakes of a rather different style than we have discussed in previous articles, a very positive function selection, with sprung levers, belt drive to capstan and clutch plate, and intermediate wheel drive to forward fast wind, with direct engagement for rewind. **fig. 1** shows the principal drive components and is approximately the view obtained with the head plate and pressure mechanism removed.

Motor Revolves Anti-Clockwise

The motor pulley, *M*, is a press-fit on the motor spindle, and has a compression springs beneath it. If there is occasion to remove or replace it, remember that the motor revolves anti-clockwise (viewed from above) and it is necessary to hold the motor and press down the



pulley on its shaft with a clockwise screwing motion, finally securing the pulley in place with a spring clip. Replace the two washers, one above and one below the pulley; these are bakelite.

Shaped Belts

There are two grooves on the lower section of this pulley, to take the two belts, *A* and *B*. The first, or upper belt *A*, drives the flywheel, *F*, on which the tape drive capstan is mounted. The lower belt, *B*, is used to turn the lower clutch plate *C* of the right hand spool *R*. Between the

top of this plate and the bottom of the spool carrier there is a felt disc, which provides sufficient friction for take-up during Record or Playback. These are shaped belts, and care must be taken to see they lay correctly in the grooves and that the levels of respective drive items are in order.

Check brackets and Levers

The friction at the lower part of the right-hand spindle is taken by a double-section bracket, with a friction ring, a felt washer and a compression spring and a circlip between the two sections, so that the spindle "rides" in a floating bearing. The main bracket of this assembly is bolted to the underside of the deckplate with three screws, the top

*
Kolster-Brandes
TT.40
Recorder
*



flange of this bearing being threaded. Make sure that these screws are tight, and that the 4BA screws holding the upper section of the bearing bracket to the upright side of the bearing are also secure. **Fig. 2** shows the assembly in detail. In this drawing, and in **fig. 1**, *T* is the spindle of the right-hand turntable, *U* is the upper section of the double bracket, *L* the lower section, and *S* the compression spring.

Referring again to **fig. 1**, note the brake-band *D*, fastened at the outer end to the swivel bracket *E*, with a spring *F*, tending to hold it in engagement. In **fig. 3**, this arrangement can be seen again with the parts similarly lettered. The small lug on bracket *E* is pushed forward, releasing the braking pressure, when the main lever moves sideways, by the shaped cutaway. It is important that these brackets and levers shall be level, and no parts tending to ride over others where they should engage. This can happen if retaining circlips are broken or lost—or, it must be added, if any of the bakelite washers are omitted on re-assembly. The left brake is identical, as can be seen from **fig. 3**. There is no adjustment other than the tensioning of the spring. The inner end of the brake band is attached to a press-up lug.

Fast Wind

The method of obtaining fast wind on this deck is again rather different than those we have seen before. In **fig. 1**, a bracket *G* is partly drawn. The lower end of this bracket bears the idler wheel which engages the right-hand turntable. This looks a rather complicated arrangement, but the reason for it can be seen when we consider the way in which both fast forward and reverse winding is effected.

Referring this time to **fig. 3**, it is seen that the motor *M* is mounted on a plate (shown dotted—beneath the deckplate) with the two forward mounting posts brought up through angled slots, *J*. Fastened to the front of the plate is a spring steel piece, *H*, with a hardened pin that comes up through the deckplate and is moved by the lateral slide of the main lever *K*. When the motor is moved to the right (plan view), the rubber tyre at the top of the pulley engages the idler wheel and presses it, against spring action, to the edge of the spool carrier giving full torque. Actually, the fast wind time for a 5 inch spool of standard tape is 3¾ minutes. Irregular winding can indicate the wrong positioning of the assembly *H*. There is some adjustment by the positioning of the

(Continued on page 330)



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Tape Recorder Service—Contd.

plate, whose fixing screws are inserted in a long slot. But care must be taken not to over-emphasise the forward wind at the expense of the reverse, which is obtained by the opposite movement, the motor pulley tyre engaging directly with the left hand spool carrier. In the "normal" position, the idler wheel must have clearance from both the motor pulley and the spool carrier; hence the swivel bracket with its

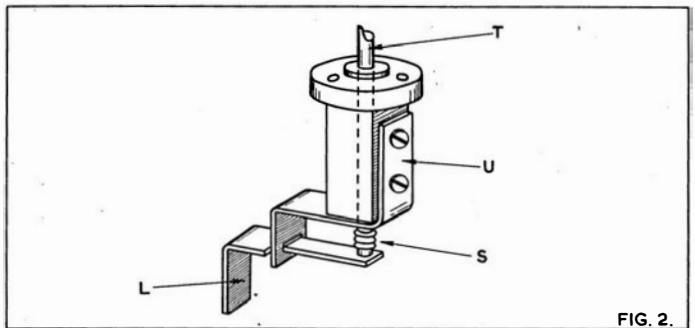


FIG. 2.

two piano wire springs. It is essential that the pivot of this bracket, and the swivel post that holds the idler mounting, be clean and free to move.

These piano wire springs are found in several other positions, secured by simple looping under screw-heads. Notable examples are the two small springs on the pressure pad bracket, not shown in sketches, and the angled spring that sits to the left of the eccentric wheel *W*. This wheel, and the cutaway cam *Q*, are made of plastic, and should be checked for wear at the corners of the angles where the record locking tongue slides (*Q*) and at the edges where the raised lugs of the main lever press (*W*). Some adjustment can be made for lateral play by bending these vertical lugs with a flat-nosed pliers. But take care not to overdo this action, especially with the locating piece *X*, whose function is to push the outer end of the pressure bracket forward, disengaging the pressure roller *P*, and the pressure pad assembly. As this bracket is angled, and pivoted near its central point; quite a small movement at the outer end can make a difference to positive engagement. This is aided by the spring *N*, which should be checked if problems of "wow" crop up.

Positive action of the main lever is also affected by the correct pressure of the spring-leaf *Y* in the toothed offset from this lever, and the

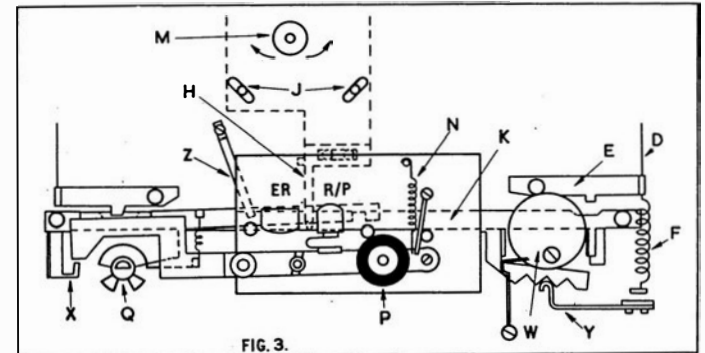


FIG. 3.

position of the retaining lever *Z*. Some queer effects can be noted if the fixing screw of *Z* works loose, allowing the two angle levers to ride up as they slide. A minimum of lubrication is needed—cleanliness is all-important, as with sliding members in general.

The bias voltage can be measured across a 100 ohm resistor inserted in the return (white) lead of the head. On the K-B model, this can be located at the base of the amplifier panel. For tracks 1-2, the resistor can be inserted in the earthed white lead, and for tracks 3-4, in the adjacent white lead. A reading of 20 to 25 volts, A.C., is normal. To check the erase voltage, simply meter between the head lead, (green for tracks 1-2 and blue for 3-4) and chassis, to obtain 7.5 volts R.M.S. Tolerance here should not exceed + 0.5 volts. Note that the dummy load, consisting of an inductance, nominal 0.75 ohms, is switched in when the superimpose switch is operated. Make sure it is out of circuit before making this test.

Azimuth adjustment is by the rear right screw of the head mounting. This screw has a spring washer. Four track adjustment is as noted in previous articles.

By R. WILLIAMSON

A TRANSISTOR MICROPHONE PREAMPLIFIER

THE need for an all-purpose preamplifier arose during development work on an experimental condenser microphone described some time ago by the writer (*Hi-Fi News August 1960*). In accordance with common practice the final design incorporated a transformer to provide a 30 ohm balanced line output. Consequently another transformer would be required to match the low impedance line to the high impedance at the tape recorder (or mixer) input. Suitable transformers usually have step-up ratios between 1:50 and 1:100. However, it was soon discovered that the cost of commercially available types capable of matching the high performance of the microphone was, without exception, quite high and not less than £3.

Cheaper transformers usually had an inferior bandwidth to the ± 1 db, 20 c/s to 20 Kc/s regarded as the minimum acceptance specification. So it was decided to investigate the possibility of using a transistor amplifier as the "matching" stage. It is well known that transistor amplifiers are inherently low impedance devices and transformers can often be dispensed with altogether. In this instance, since the transistor has an unbalanced input, a balance to unbalance transformer is still necessary if the maximum signal to noise ratio is to be preserved.

Easy to wind by hand

However, the turns ratio of the transformer required is far lower than the 1:50 or 1:100 already mentioned and the average enthusiast is quite capable of winding this component by hand since there are relatively few turns in the primary and secondary. To simplify matters even more, a complete set of laminations and bobbin is available, the address of the suppliers being given in the Appendix. The wire can be purchased from almost any dealer. The windings should be wound on to the bobbin with reasonable care and as even as possible; no interleaving insulation is necessary (fig. 1). It is not essential to shroud the completed transformer but if the constructor wishes to minimise hum "pick up", a "mu-metal" pot is available from the suppliers of the transformer kits.

Battery may be permanently connected

A few words about the transistor circuit (fig. 2). This is an orthodox common emitter design but turned "upside down" to facilitate use of +H.T. lines if desired. The consumption is so low that a battery supply may be used and left permanently connected. The use of an R.F. type transistor is now common practice in low level audio applications and

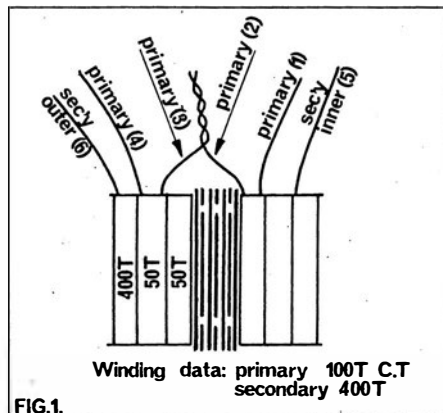
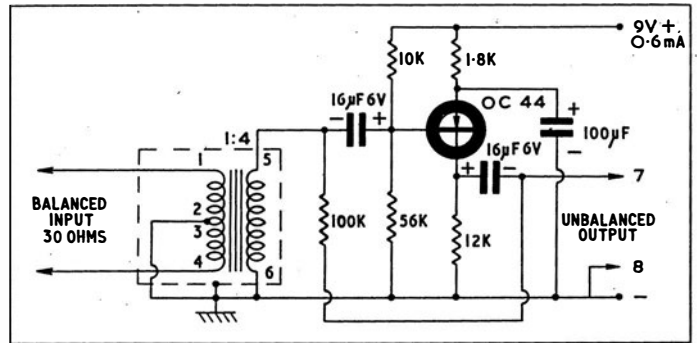


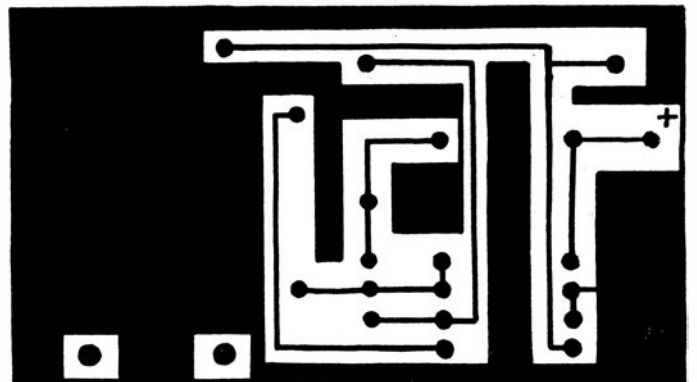
Fig. 1 Winding details of the transformer

the Mullard OC44 is a satisfactory choice. Those familiar with transistor circuitry will have noticed that a 1:4 transformer is not an optimum match to the input of this particular circuit and transistor. It has been pointed out elsewhere in an excellent article on the subject of low level transistor amplifiers that such optimum matching would not necessarily enhance the signal to noise ratio! The matching should be to a somewhat lower value—in this instance, approximately 500 ohms; the only disadvantage being that one does not realise the maximum possible gain from the amplifier. This is relatively unimportant, since the gain is more than high enough for all but the least sensitive microphone, good signal



to noise ratio being the paramount consideration. Some microphones are a little "conscious" of the matching impedance presented to them and there may be, for example, some modification of frequency response if there is any appreciable deviation from their recommended load impedance. To take care of this possibility, a small amount of shunt negative feedback is applied which adjusts the input impedance to the required value, i.e. 30 ohms. The output impedance is also lowered permitting an appreciable length of screened cable between the pre-amplifier and the associated equipment without high frequency losses. The remaining benefits of negative feedback need not be enlarged upon.

The photograph shows the prototype model mounted on a printed circuit board (a twin version is also in the background). Whilst a printed circuit is by no means essential it does make a neat, compact unit. For those who wish to use such a layout a scale drawing is shown which



may be photographed or traced direct on to copper laminate. Where only one or two are required the photographic method is uneconomic and the circuit can be drawn direct with resistive ink (brushing cellulose with a little thinners added is a good substitute). It can be applied with

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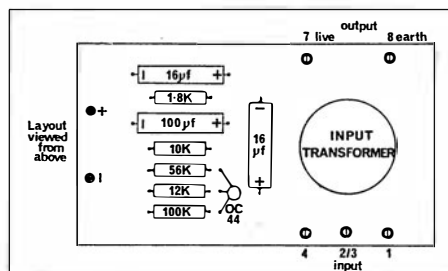
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A TRANSISTOR MIKE PREAMPLIFIER—Continued

a brush or better still a "Uno" pen. All areas not carrying circuitry should be blocked off since unnecessary removal of copper exhausts the etch bath. It is good practice to connect these unused areas to the "earthy" side of the circuit. Etching in a strong solution of iron perchloride takes up to an hour but the time may be shortened by frequent



agitation and warming the etching bath. After etching is completed the board is thoroughly washed and dried. The rest may then be removed with a wad of cotton wool soaked in acetone.

The preamplifier has been in use for some months and has proven satisfactory with all types of low impedance microphone including ribbon and moving coil. The noise and distortion figures are taken at extremes of the normal operating range and the frequency response is comparable with the most costly line to grid transformer.

Ref. 1. Journal of the B.S.R.A. November 1961. "Low Distortion Amplifiers" (P. J. Baxandall).

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APPENDIX

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TAPE, RECORDERS & ACCESSORIES

FIRST DETAILS OF NEW PRODUCTS

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



Mayfair Portable Recorder

A newcomer to the field of portable recorders is the Ajax Mayfair. A 5 transistor circuit provides a claimed frequency response of 200–7,000 c/s with a pushpull output of 400 mW. The Mayfair records on two tracks at speeds of $3\frac{3}{4}$ and $7\frac{1}{2}$ i/s. Maximum spool size on the Super De Luxe is 5in. and operation is from three 1.5v and one 9v cells. Other points listed in the specification include: Permanent magnet erase, D.C. bias, and a $2\frac{3}{4}$ in. speaker. Rewind time is two minutes for 600 ft. of tape. This machine is shown on the left of the photograph, the other being the Mayfair "De Luxe". The De Luxe takes 5in. spools only with the lid open and costs £18 18s. The distributors are Acme Electrical Co. Ltd., 63 Great Eastern Street, London, E.C.2.

Philips Transistor Pre-Amplifier

OWNERS of Philips EL 3549, Cossor CR1604 and CR1605, and Stella ST458 and ST459 will welcome the new Philips transistorized pre-amplifier, the EL3787, that will adapt the machines to play-back pre-recorded stereo tapes with the addition of an external power amplifier. The machine also provides facilities for transferring recordings from one track to another while also adding additional sound. Its power (22v) is supplied by the tape recorder and the cost is £6 10s. The unit is manufactured by Philips Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

Kodak Sound Recording Tape

KODAK Limited have introduced a new range of high quality $\frac{1}{4}$ in. sound recording tape which is available in four types to meet the needs of both amateur and professional users. These new tapes have acclaimed high output sensitivity, low noise performance, full audio frequency range response, and double lubrication for smooth transport. They resist scratching, tearing and stretching.

Each "Kodak" Sound Recording Tape is enclosed in a polythene bag and attractively packaged in a box or carton, according to reel size. Boxes and cartons have printed rulings on the back to provide an index of contents. Each type of tape has a different coloured label for rapid identification.

A booklet "Kodak" Sound Recording Tape will shortly be available free of charge.

Prices are as follows:—Standard T.100 600 ft. 5-in. 18s. 1200 ft. 7-in. £1 10s. Long-Play V.150 300 ft. $3\frac{3}{4}$ -in. 11s. 900 ft. 5-in. £1 8s. 1800 ft.

7-in. £2 10s. Double-Play P.200 400 ft. $3\frac{3}{4}$ -in. 17s. 1200 ft. 5-in. £2 5s. 2400 ft. 7-in. £4. Triple-Play P.300 450 ft. 3-in. £1 1s. 6d. 600 ft. $3\frac{3}{4}$ -in. £1 7s. 6d. 1800 ft. 5-in. £3 5s. 6d. 3600 ft. 7-in. £5 15s. 0d. Manufacturers Kodak Ltd., Kingsway, London, W.C.2.

Beyer Microphones and Headphone

FI-CORD International are now marketing two new microphones and a headphone set manufactured by Beyer in West Germany.

The first of these is the high quality M66 cardioid dynamic moving coil microphone with a 180 degree suppression effective for the lowest frequencies. It suppresses all unwanted sounds and there is claimed to be no distortion even with high sound pressure. The frequency range is stated to be 40–16,000 c/s. To suppress the pickup of noise through the body of the microphone, the internal unit is mounted in rubber. The price is £42 17s.

The other microphone is the M219, which has an omni-directional pattern and is also a moving coil type. The claimed response is 50–16,000 c/s. The price is £16 10s. 1d.

With a response of 30–17,000 c/s, the D96 headphones have been produced for high quality music reproduction and acoustical tests. The capsules are connected to a resilient headband without special leads to eliminate breaks. Sufficient volume is guaranteed even from low power voltage outputs. The price is £9 14s.

The distributors for these new products are: Fi-Cord International, 40a Dover Street, London, W.1.

Sharp
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A N ingeniously designed new battery portable recorder is the Japanese TRC-1004. The most outstanding feature of this machine lies in its tape transport mechanism. The spools are stacked vertically on a specially designed coaxial shaft. The machine is in two sections, the actual recording unit and the detachable playback amplifier. This makes it un-necessary to carry the amplifier around when recording only is required. The tape speed is $1\frac{1}{8}$ i/s and rewind time is three minutes for 300 ft. of tape. Frequency response is claimed at 200–3,000 c/s + 3 dB. Battery life is four hours with four UM-3A cells, continuous use. The dimensions of the TRC-1004 are $3\frac{3}{4} \times 5\frac{1}{8} \times 2\frac{1}{8}$ in. and the manufacturers are Hayakawa Electric Co. Ltd., Osaka, Japan. Agents: Wholesale Supplies (Swinton) Ltd., 16–18 Worsley Road, Swinton, Lancashire.

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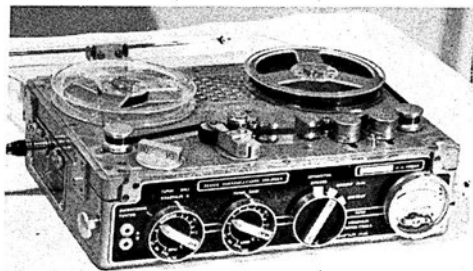
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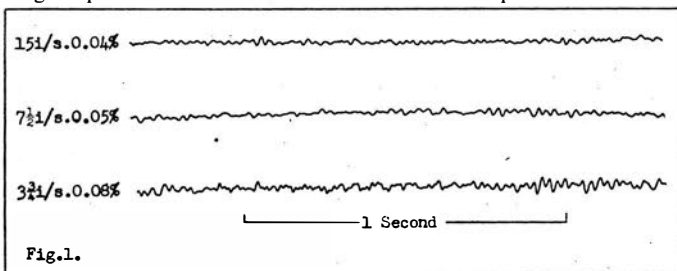
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**NAGRA III
PROFESSIONAL
PORTABLE
RECORDER**
*



Manufacturer's Specification: Overall dimensions: 14 × 9.5 × 4.3 in. **Weight with batteries:** 13 lb. 13 oz. Weight of recorder with batteries, microphone, Eveready leather case and microphone cable: 18 lb. 11 oz. **Reel sizes:** 7" diameter with cover open, 5" with cover closed. **Power supply:** 12, 1.5V cells or external battery or mains supply unit up to 25V D.C. **Speeds:** 15 i/s, 7½ i/s and 3¾ i/s. **Frequency response:** 30 to 18,000 c/s + 1dB. at 15 i/s. 40 to 15,000 c/s + 1dB at 7½ i/s. **Speed stability:** adjusted at factory to +0.1% at 15 and 7½ i/s. **Wow and flutter:** 0.06% at 15 i/s, 0.08% at 7½. **Weighted signal to noise ratio:** 62.5dB with good tape. **Weighted system noise:** 70dB. **Inputs:** microphone 0.2 to 10mv with 200 ohm microphone, 0.1 to 5mv with 50 ohm microphone. **Line input** 0.5 to 10mv at 100K, or 10mv to 1v at 2.5K. **Outputs:** blanced line output 4.4v into 600 ohms, **Monitoring sockets** for 50 ohm headphones. **Price** £339. **Distributors** Livingstone Laboratories Ltd., 31 Camden Road, London N.W.1.

THIS recorder is made in relatively small quantities by Kudelski of Paudex-Lausanne Switzerland. It is a fine sample of Swiss craftsmanship; the case is fabricated in heavy gauge aluminium alloy, and every knob, roller and control has that indefinable feel of perfect engineering.

The top plate, which carries the tape transport mechanism and heads, hinges open like a book to reveal an interior well packed with small



printed circuit boards and filter and transformer boxes. It is evident that the same scrupulous attention to detail has been carried through to the transistorised electronics.

Particular care has been taken to provide high speed stability over a very wide range of battery voltage. The internal batteries start life at 18 volts total and can be run down to 11 volts with no measureable effect on the speed or performance of the recorder. At the other extreme D.C. supplies up to 25 volts can be used with negligible effect on tape speed or behaviour of the electronic circuits, which have their working voltage stabilised at 10.5v.

Audible Battery Warning

As an example of the thought put into the design of this machine the 'audible battery warning' deserves special mention; when the battery voltage falls below 11 volts an audible tone is superimposed on the headphone monitoring circuit to warn the engineer in charge that the batteries should be changed as soon as possible; naturally this warning signal is not recorded on the tape!

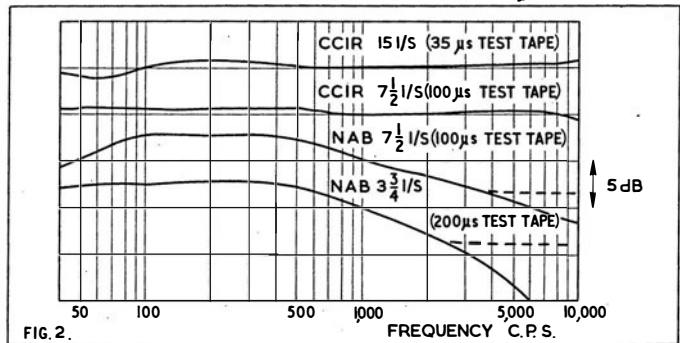
An automatic control of recorded level is available for speech recording; this is particularly useful for one man operation in difficult

conditions, where sudden changes in sound level are liable to occur, and visual monitoring of the signal is not possible.

Speed Wow and Flutter

The actual tape speed, as distinct from the surface speed of the capstan, is measured directly by the two stroboscopically marked rollers which hold the tape in contact with the erase head; the right hand one is for 50 c/s illumination, and the left hand for 60 c/s. As the tape speed is set at the factory against a crystal standard to very much better than 0.1%, and as the strobe pattern was rock steady on my particular mains frequency, I do not propose to argue about the absolute tape speed.

The short term speed variations, known as wow and flutter, were measured on my standard flutter bridge and the high speed pen record-



ings of the very minute speed fluctuations are shown in fig. 1. The R.M.S. readings of 0.04%, 0.05% and 0.08% at tape speeds of 15, 7½ and 3¾ i/s are the lowest measured on any tape recorder so far tested or reviewed.

Oscillator tones sounded absolutely steady in pitch with no hint of any periodic variations caused by rotating parts.

Playback Only Responses

The playback responses were established by playing test tapes recorded to known surface induction characteristics. Fig. 2 shows the responses; the time constant of the test tape used for each test is indicated in brackets against each curve. The C.C.I.R. responses are level within plus or minus 1db, showing that the playback characteristics are the exact inverse of the surface induction characteristic of the test tapes used for these tests.

The N.A.B. playback responses, using C.C.I.R. test tapes, should show a 6dB step at mid frequency with a level response at high and low frequencies. The low frequency responses are sensibly level at both speeds, but the high frequency responses continue to fall instead of levelling out as shown by the dotted curves. I see that the instruction book talks about 'Ampex' responses rather than N.A.B. or N.A.R.T.B.

(Continued on page 337)

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EQUIPMENT REVIEWED—Continued

responses. I have never seen a published Ampex response, but it looks as if the recording pre-emphasis is even fiercer than the N.A.B. high note lift. The result of such combined record and replay characteristics will be to reduce the hiss at very high frequencies, leading to an improvement in signal noise ratio, but overload at high frequencies is an ever present danger, and great reliance is placed on the 'average' spectral distribution of energy within the audio range for normal speech or music.

Record Play Responses

Fig. 3 shows the overall record-play responses recorded at a level 6dB below test tape level (18dB below peak recording level) for the three speeds and alternative 7½ i/s equalisations.

No effort has been made to extend the high note response at the lowest speed of 3¾ i/s beyond that obtained with optimum bias for the

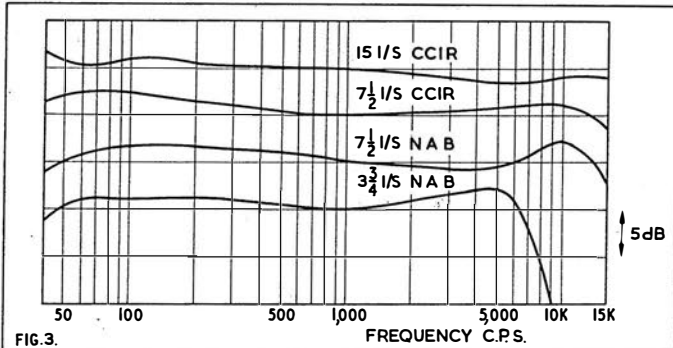


FIG. 3.

two higher speeds—and hereby hangs a lesson for some of our domestic recorder designers!

0dB on the meter type record level indicator records a signal 12dB above test tape level, and this can be increased to full scale (12dB) with no perceptible distortion of the recorded signal). This shows that the bias has been set for minimum distortion rather than for an abnormally frequency response.

Signal noise ratio, measured by recording a signal at peak recording level (0dB), and then erasing on the machine and measuring the wide band amplifier and recorded tape hiss, is better than 50dB. The manufacturers are careful to point out that such a measurement bears little

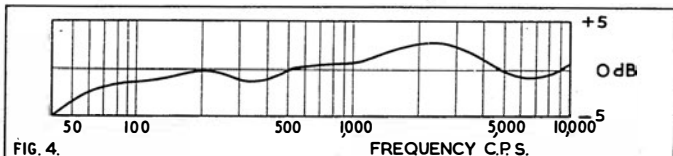


FIG. 4.

relation to the subjective impression of dynamic range as the amplifiers used in this recorder have a response which extends to 'several hundred kilocycles'. Their figure, taken with a band pass filter limiting

(Continued on page 339)

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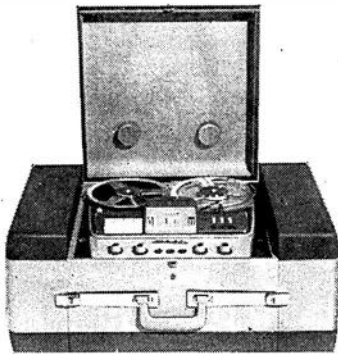
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EQUIPMENT REVIEWED—Continued

the range to 30–16,000 c/s and weighted to correspond to the ear's response at low levels, is 70dB and wide range headphone tests (about the only practical way of measuring this range without masking by very low ambient acoustic noise levels) bears out this figure.

In almost all the record play tests, the tape is the limiting factor, as all system noises have been reduced to better than 70dB below peak recording level.

Microphone Response

Fig. 4 shows the response of the Sennheiser MD21 moving coil microphone supplied with this recorder. This response was measured on axis in a white noise sound field and it proves that this microphone is a worthy companion to the Nagra 111 recorder.

Circuit Notes

Detailed circuit diagrams were not supplied with this recorder, but a block diagram and descriptive write up indicate that the really novel feature of this instrument is the servo amplifier control of the motor speed over a wide range of input voltage, temperature and conditions of use.

A 400 tooth phonic wheel on the capstan shaft generates a tone in a pick off coil, this is amplified by a tachometer amplifier and passed to a frequency discriminator which produces an error voltage proportional to the difference between the phonic wheel output and the desired capstan speed frequency; this error voltage is applied to the motor servo amplifier to alter the motor speed until the error is exactly cancelled.

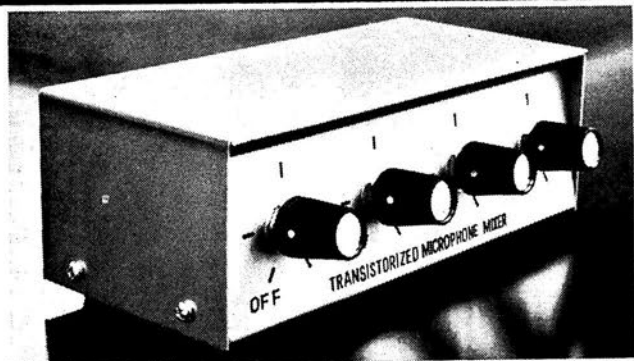
Comment

Comment is superfluous on this machine, the specification and test figures speak for themselves. We know from previous reviews that a high price does not necessarily guarantee a superb performance, but this recorder is worth every penny of the price asked for it to an individual or organisation which can make full use of its capabilities.

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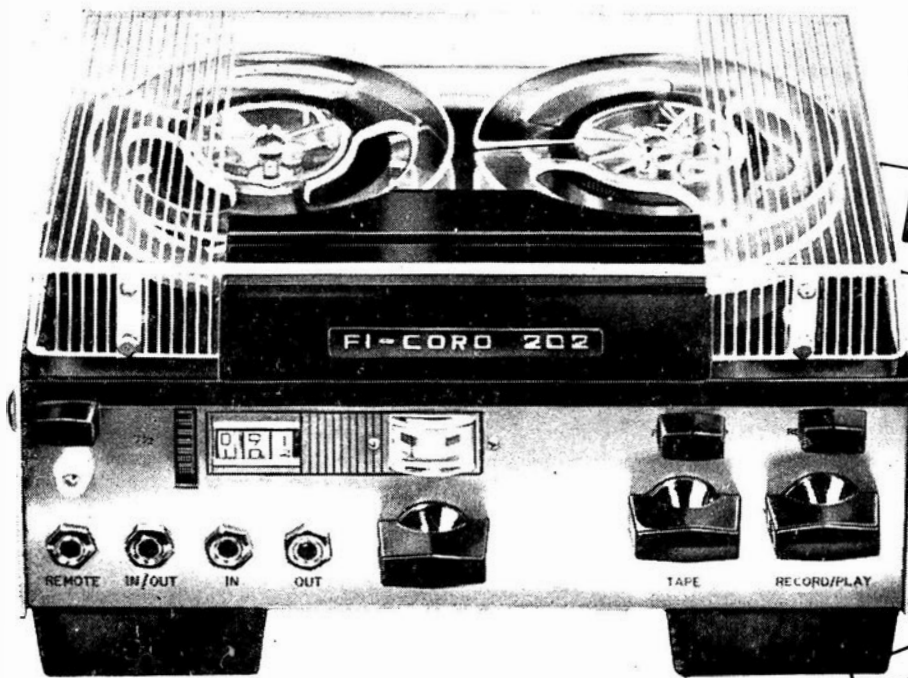
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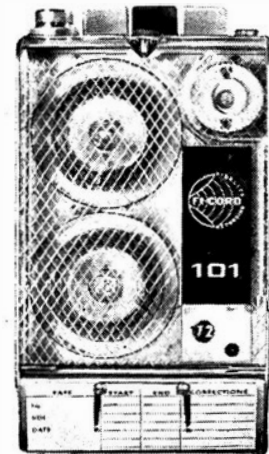
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