

the TAPE

PRICE 2/-

NOVEMBER 1963

Vol. 5 No. 10

RECORDER

INCORPORATING "SOUND AND CINE"



THOUGHTS ON DESIGN

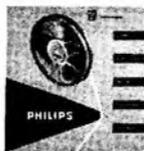


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Each 69 gns. (U.K. only)
Complete with moving coil
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Clinically professional in every line. Crisply precise in operation. Full and faithful in reproducing sound . . . this sums up the new Series 90—the finest yet from Truvox.

No concessions here to mass-market "styling". No fancy plastic moulding; no pretty-pretty cover fabrics. No "cosmetics" at all. Instead—clean, rugged and functionally austere, the new Truvox looks every inch what it is . . . a thoroughbred instrument for the enthusiast.

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Among the outstanding features of the Series 90 are:

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- * A cathode follower output.
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- * 'No-tape' autostop.
- * Mixing facilities.
- * Superimposition.
- * Forward facing Rola-Celestion loudspeaker.
- * 3 tape speeds—7½ 3½ 1½ ips.
- * 3 motor drive— Papst capstan motor.



**PD.93 2-track mono tape unit. PD.97 2-track stereo tape unit.
PD.95 4-track mono tape unit. PD.99 4-track stereo tape unit.
Each 59 gns. (U.K. only) Each 79 gns. (U.K. only).**

These handsome self powered tape units, in superb Afrormosia plinths, polyester finished, provide an ideal means of adding tape to the existing Hi-Fidelity system at a very economical price. They can be used with any amplifier at present available and be operated horizontally, vertically or any angle between.

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Ideal for use in the home, car or as a personal portable receiver. Features:—Solid leather case; Slide-rule tuning scale; Printed circuit board; 7 transistors; 3 diodes, 7" x 4" Loudspeaker. Full details available on request. £14 18s. 0d. incl. P.T.

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TA-IM and Collaro "STUDIO"	£30 10s. 0d.
TA-IM and TRUVOX D83/2	£47 2s. 6d.
TA-IM and TRUVOX D83/4	£45 5s. 0d.
TA-IS (illustration Centre)	£24 10s. 0d.
TA-IS and TRUVOX D83/2	£52 6s. 0d.
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A range of over a dozen equipment cabinets is now available to meet the differing needs of enthusiasts.

Designed for maximum operating convenience or for where room space is an over-riding consideration, this range includes kits, accurately machined for ease of assembly and "left in the white" for finish to personal taste, ready assembled cabinets or assembled and fully finished cabinets, and has at least one model to meet your requirements. Why not send for full details? Prices from £6 19s. 6d.—£29 8s. 0d.

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MFS

COTSWOLD HI-FI SPEAKER SYSTEM

This is an acoustically designed enclosure 26" x 23" x 14 1/2" housing a 12" bass speaker with 2" speech coil, elliptical middle speaker, together with a pressure unit to cover the full frequency range of 30-20,000 c/s. Capable of doing justice to the finest programme source, its polar distribution makes it ideal for really Hi-Fi Stereo. Delivered complete with speakers, cross-over unit, level control, Tygan grille cloth, etc. All parts pre-cut and drilled for ease of assembly and left "in the white" veneered for finish to personal taste.

"COTSWOLD" MFS SYSTEM

Similar performance to standard "Cotswold" but designed for the smaller room. Size 36" high x 16 1/2" wide x 14 1/2" deep. Either model. £23 4s. 0d.

Here are some other easy-to-build Heathkit Models for you



S-33

MONO CONTROL UNIT Model UMC-1. Designed to operate with the MA-12 or any amplifier requiring 0.25v or less for full output. Suitable for cabinet mounting or free standing. Size 10" x 7" x 4". Available shortly. £8 12s. 6d.

DELUXE 6 WATT STEREO AMPLIFIER Model S-33H. A stereo/mono amplifier with the high sensitivity necessary for light-weight ceramic pickups (e.g. Decca Deram). Deluxe version of the S-33. £15 17s. 6d.



MA-5

HI-FI STEREO 6 WATT AMPLIFIER Model S-33. Attractively styled, completely self-contained. Printed circuit makes it easy to build. Only 0.3% distortion at 2 1/2 W/chal. U/I output, ganged controls. £13 7s. 6d.



SSU-1

HI-FI MONAURAL AMPLIFIER Model MA5. An ideal general-purpose reasonably priced mono amplifier, 5 watts output at only 0.5% distortion, has inputs for Gram, Radio. Printed circuit board. Size 11" x 6 1/2" x 4 1/4" high. £10 19s. 6d.

HI-FI SPEAKER SYSTEM Model SSU-1. This kit is easily assembled. It contains twin speakers and balance control in its direct ducted port reflex cabinet. It is equally suitable for stereo or mono in average room. (Legs 14/6 optional extra). £10 17s. 6d.



AG-9U

AUDIO SIGNAL GENERATOR Model AG-9U. Delivers up to 10 volts pure sine-wave (less than 0.1% distortion; 20 c/s to 20 kc/s). Decade switch-selected frequencies from 10 to 100,000 c/s. Internal 600 Ohm N/I load or external. £21 9s. 6d.

POWER-AMPLIFIER 12-WATT Model MA.12. Single channel, ideal for stereo conversion. £11 9s. 6d.



MA12

COLLARO "STUDIO" TAPE DECK. Two tracks. "Wow" and "flutter" not greater than 0.15% at 7 1/2" p.s. Long Term Speed Stability better than 0.5%. £17 10s. 0d.

SUGDEN MOTOR UNIT "CONNOISSEUR CRAFTSMAN". Heavy duty motor, operating at 33 1/3 and 45 r.p.m. Very heavy 12" turntable. £16 6s. 6d.

HI-FI STEREO 18-WATT AMPLIFIER Model S-99. Within its power rating, this is the finest stereo amplifier available, regardless of price. U/I, push-pull output. Printed circuit construction. £27 19s. 6d.

TRANSISTOR INTERCOM, Models XI-1U and XIR-1U. Ideal for office or home. Each Master operates up to five Remotes, 9v battery operated. XI-1U £10 19s. 6d. XIR-1U £4 7s. 6d.

STEREO CONTROL UNIT Model USC-1. A deluxe stereo control unit with variable filter, switched rumble filter, printed circuit boards and many other refinements. Operates direct from tape heads. £19 10s. 0d.

TRANSISTOR PORTABLE RADIO Model UXR-1. Superbly styled hide case, with golden relief and crystal easy-to-tune dial; this completely self-contained 6-transistor dual-wave set performs brilliantly everywhere, even in a car. Reproduction is exceptionally good. Printed circuit. £12 11s. 0d.

SHORTWAVE TRANSISTOR PORTABLE Model RSW-1. Four wave-band seven transistor portable with telescopic and ferrite aerials, slow-motion tuning. Covers Medium, Trawler, and 6-26 Mc/s in four switched bands. Uses printed circuit board and latest circuit technique. Superbly styled leather case. £19 17s. 6s.

TRUVOX D83/3 AND D83/4 TAPE DECKS. High quality mono/stereo Tape Decks. D83/2 2-track for highest-fidelity. £31 10s. 0d. D83/4 (identical presentation) 4-track for most economical use of tape. £29 8s. 0d.

GARRARD AUTO/RECORD PLAYER Model AT-6. A 4-speed stereo/mono unit with manual or fully automatic record selection; adjustable counter-balanced arm. Fitted with Decca Deram ceramic cartridge £14 6s. 1d. or Ronette 105 mono/stereo cartridge. £13 12s. 1d.

GOLDRING-LENCO TRANSCRIPTION RECORD PLAYER Model G.L.58. Fitted with the G.60 pick-up arm and Ronette 105 mono/stereo cartridge, it has infinitely variable speed adjustment between 33 1/3 and 80 r.p.m. and four fixed speeds. 3 3/4 lb. turntable to reduce rumble, "wow" and "flutter". £18 19s. 2d.



S-99



RSW-1



UXR-1



GL-58



A.M./F.M. TUNER

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A new-era Grundig. No machine like it anywhere. Mains-operated transistorised portable tape recorder. Own built-in battery or car battery operated. Next-century design. Concert hall quality. Two speeds. Four hours play-back. Ask your Grundig Dealer for a demonstration of this brilliant new model. 65 gns. including microphone and triple play tape.

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- Speeds $3\frac{1}{2}$ and $1\frac{1}{2}$ i.p.s. • Frequency Response up to 13,000 c/s • 13 Transistors and Diodes
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TR/10

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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 on disc: mono/stereo**



53. These two suites, containing some of Bizet's most thrilling music, are given magnificent performances by the Sinfonia of London under Muir Mathieson. **Also on disc: mono/stereo**



19. Look Over Your Shoulder, My Lean Baby, White Christmas, Don't Worry About Me, Melody of Love. 12 top numbers sung by the fabulous Sinatra. **Also on disc: mono only**



56. All the magic of old Vienna! starring Jacqueline Delman, John Larsen, Linden Singers and Sinfonia of London conducted by John Hollingsworth. **Also on disc: mono/stereo**



33. Beethoven 5th. plus Egmont, Josef Krips and LSO in a titanic interpretation which matches the tremendous power of this celebrated music. **Also on disc: mono/stereo**



30. Ian Carmichael, Joyce Blair, star cast/orchestra. As Long as He Needs Me, Consider Yourself, all the hit numbers from Lionel Bart's great show. **Also on disc: mono/stereo**



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20. Answer Me, Nature Boy, Ruby and the Pearl, these plus 8 more favourites sung especially for you by the unique Nat King Cole. **Also on disc: mono only**



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29. Me and My Shadow, Among My Souvenirs, Mean to Me, How About Me . . . the fabulous Judy Garland sings 11 of her greatest songs. **Also on disc: mono only**



25. Ian Wallace, Joyce Blair and chorus. Some Enchanted Evening, I'm In Love with a Wonderful Guy, and all the unforgettable songs from this great musical. **Also on disc: mono/stereo**



34. Stardust, How High the Moon, Nearer to You, 'Round Midnight, King David—eight numbers by the vibraphone genius, Lionel Hampton. **Also on disc: mono/stereo**



48. Deep in My Heart, Drinking Song, Serenade—all the old favourites fresher than ever with Marion Grimaldi, Linden Singers and Orchestra. **Also on disc: mono/stereo**



37. Revolutionary Study, Polonaises A and A-flat, Fantaisie-Impromptu—12 favourites in all played by the pianist of Dirk Bogarde's 'Song Without End'. **Also on disc: mono only**



22. 12th St. Rag, Isle of Capri, Smile, Blue Moon, Bunny Hop Mambo, Satin Doll. 12 top numbers played in characteristic style by the Duke and his band. **Also on disc: mono only**



2. Grieg Piano Concerto. Alexander Jenner in an electrifying performance with the Bavarian State Radio Orchestra conducted by Odd Gruner-Hegge. **Also on disc: mono only**



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 on disc: mono/stereo**



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



45. Crazy Rhythm, Bijou, I Cover the Waterfront, Northwest Passage, Blowin' Up a Storm, etc. The master clarinetist plays 12 numbers in great style. **Also on disc: mono/stereo**



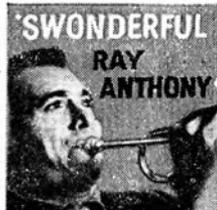
38. Hervey Alan, Ian Wallace, Marion Grimaldi and chorus sing the immortal favourites: Cobbler's Song, Robbers' Chorus, Chu Chin Chow, etc. **Also on disc: mono/stereo**



14. Tchaikovsky Symphony No. 5. Sir Malcolm Sargent and LSO combine to give this famous symphony a dramatic and colourful rendering. **Also on disc: mono/stereo**



43. Andy Cole, Barbara Leigh, Mike Sammes singers: High Society, Three Coins, Harry Lime, Gigi, The High and the Mighty. 11 top film hits. **Also on disc: mono/stereo**



41. Night and Day, King Porter Stomp, Pennies from Heaven, Christopher Columbus, Don't Be That Way, with the top American bandleader/trumpeter. **Also on disc: mono only**



42. Jericho, Swing Low, Shadrak . . . 12 of the best loved Negro Spirituals movingly sung by George Browne, Isabelle Lucas and Linden Singers. **Also on disc: mono/stereo**



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47. Brahms Violin Concerto. Superb playing by Endre Wolf and Sinfonia of London under the baton of Anthony Collins makes this a truly memorable performance. **Also on disc: mono/stereo**



46. Elizabeth Lerner, Andy Cole, Peter Knight singers. Exciting 'double' featuring highlights from two famous shows by Frederick Loewe and Cole Porter. **Also on disc: mono/stereo**

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Now you have the opportunity to play any WRC release on your tape recorder. Each of these 'tape records' runs at 3½ 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 3½ ips WRC pre-recorded tapes a standard of reproduction unattainable previously at less than 7½ ips.

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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 3½ ips tapes (or 12" LPs) over a 12-month period at the special club price of 29/- each. 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.

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

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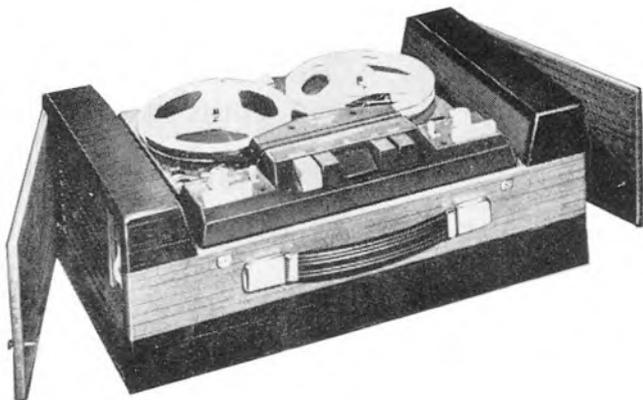
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If you're looking for a multi-purpose tape recorder buy a "Butoba." This range of battery operated machines is outstanding for purity of reproduction and is ideal for recording music, speech and bird-song. Easily transportable. "Butoba" will help to 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.

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Model MT7 38 gns. MT7R 43 gns. MT5 66 gns.

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EDITORIAL

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 AUDIT BUREAU
 OF CIRCULATIONS

THIS month we are using the "editorial column" as a medium for a request, rather than a discussion. Ever since we first published the *Tape Recorder*, nearly five years ago, our post bag has increased steadily. This is in itself not surprising, because the sales of the magazine have also increased regularly, but what has been puzzling us for the last two or three years is the fact that such a small percentage of all the letters we receive fall under the heading of "readers' letters". Most of them are technical queries, which are dealt with (as their writers know) by our team of advisers, and although a few of these are published monthly, together with their replies—when they represent problems that are likely to be of general interest—they do not reflect the views, opinions or ideas that normally make up an interesting and lively Correspondence Feature. We have often tried to stimulate interest in this direction, and each stimulus has brought about an increase of letters—but not of the type we seek. So this time in this column, we are not merely asking for the basis of a bright "readers' letters" page, but we are appealing point blank to those of our readers who are in touch with "tape" and some of the lesser known uses of "tape" to give us a lead, and to let us read about the other side of the picture. We have been surprised, during the past few months in particular, to discover how many unusual jobs that tape and tape recorders are doing in various trades and industries; and as a result of these discoveries we have briefed a member of our editorial staff to prepare a series of articles around the more interesting of these tape applications. The first of these articles will appear very shortly, and it will probably act as a stimulus for correspondence of the type we want in at least one direction. But what we believe is that quite a large slice of our readership is made up of people who work with tape in jobs which are, to them, very ordinary and routine, but which would prove to be extremely interesting to almost every other reader. We do not intend to give any leads, other than to say that we know that vast quantities of magnetic tape are used by science and industry each month—a tape total that makes the whole of the quite large domestic and semi-professional market look really small by comparison. We are quite certain that—can they be stirred to write to us about it—the people who help to use this tape have a lot to write about—excluding those people who would like to write, but who are naturally not allowed to do so because of defence or design secrecy.

It has always been a sore point with us, that we have so far failed to create for this magazine one of its most interesting features. It has also been a real mystery to us, because all the rules and laws of average which brush the publication of periodical journals indicate that the flow of correspondence increases in direct proportion to readership increase. If we do anything wrong or unpopular, then we are immediately told about it—by postcard, letter and telephone. We are constantly asked for advice about potential purchases. And, as we have already said, our requests for technical information increase steadily. But the type of reader's letter that we eagerly await—the letter that is so interesting that we can barely wait to have it set in type for publication—comes so rarely that it is a real event when it arrives. The reason for this is probably a

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result of our own shortcomings; if so, let us hope that we soon find out what it is! On the other hand, putting the cart before the horse, possibly the building-up of the feature that we so sincerely wish to create will itself point the way for us, showing us what we have to do to get the cart rolling—pulled or pushed by the afore-mentioned horse!

Before closing this subject (and this column) for the month, let us make a practical plea. Letters intended for publication should not exceed 200 to 250 words. Broadly speaking they should deal with tape or tape recorder subjects of general interest. They should *not* be a synopsis of what the average tape recorder owner does with his or her machine. They should not comprise a series of complaints about this, that and the other (we receive plenty of letters of that type! We refer them directly to the parties to whom they should originally have been directed!). They may deal with novel ideas, in which case a rough sketch should come with them.

Cover Picture

OUR cover photo this month was taken behind the scenes at Shepperton Studios, during the shooting of a musical, *It's all Happening*. The electronics, including professional and sound mixing equipment, is mainly from the EMI stable, and will be recognised from the various pictures that have accompanied reviews and reports of developments in this magazine.

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*.

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NEWS FROM THE WORLD OF TAPE

Strictly for The Birds

AN "audible poster" was heard in London recently, claimed to be the first in England. A tape recorder was used to relay the sounds of screaming birds to speakers placed behind an advertising poster in Shaftesbury Avenue, W.C.2. The gimmick was part of an advertising campaign by the Rank Organisation for Alfred Hitchcock's latest film about our feathered friends "The Birds". The tape was switched off however when complaints were received from the council, the Noise Abatement Society, and the police.

★ ★ ★

Long Play for Tannoy

THOSE of us who imagine our domestic tape recorders are overworked by Junior's interminable "pops" may take heart from the figures quoted recently by Tannoy, who have now bought RE301 machines from EMI, to meet their expanding requirements. Several of their regular machines, EMI TR51s, TR52s and TR90s have been in use for an average of 14 hours a day, six days a week, all the year round.

The RE301 machines were used for the first time at a large international congress at the Royal Albert Hall, this summer. About 33 hours of recording were made, in two languages. This was edited to six hours of special features and copied 100 times. The copies were flown to 56 different countries, re-edited to a 3-hour tape, copied many hundreds of times and now distributed on a world-wide basis.

★ ★ ★

Fi-Cord at Business Efficiency Exhibition

MAGNETIC recording tape cut by Miss Caroline Maudling, daughter of the Chancellor of the Exchequer, made an original slant to the traditional opening ceremony of the Fi-Cord stand, at the Business



Efficiency Exhibition in London. Miss Maudling later examined a version of the Fi-Cord 101 portable dictating machine which was made of 24 carat gold.

★ ★ ★

Hi-Fi Division for Sony

THE name of Sony, which has jumped to prominence in the world of tape recorders during the past two years is now to be linked more



Lists of "Talkative Types" which will end up in the homes of Worldwide Tapetalk members all over the world. Mrs. Florence Towers prepares for a big stamp licking job!

emphatically with the Hi-Fi scene. We have just heard from Tellux that they have formed a Hi-Fidelity division for the development of the sales of Sony products in the United Kingdom. These products include semi-professional and professional tape recorders and hi-fidelity equipment, including amplifiers and microphones, as well as tuner units, etc., of other manufacture.

We understand that a statement of the marketing policy and special promotional activities, to be undertaken by the new division, will be made at a later date.

The new division will be under the supervision of Mr. D. K. Perry, Tellux General Sales Manager. The offices of this division will be at Avenue Works, Romford. (Telephone No.: Ingrebourne 43971) where Mr. W. J. Evans will deal with trade enquiries and sales information.

★ ★ ★

Northern Audio Fair is Off

DUE to lack of support from manufacturers the Northern Audio Fair will not be held after all. The organiser, Mr. Cyril Rex Hassan explained that for the exhibition to pay its way at least 30 exhibitors would be needed. Only 22 firms had agreed to provide support. The fair was to be held at Harrogate.

★ ★ ★

Running a Tape Exchange

WE all have our problems in life, but Mr. Charles L. Towers of Harrow, Middlesex, must have felt life was treating him a little too lightly when, in June 1961, he formed the tape exchange **Worldwide Tape-talk**. Since then, every four months, he and his wife Florence have the arduous task of sending address lists and news to a membership which has now exceeded 600. On top of this each day brings dozens of letters and tapes from members throughout the world.

★ ★ ★

Price Reduction for Butoba MT7

DUE to increased production and greater demand for the Butoba MT7 transistorised battery portable tape recorder, the retail price has been reduced from £46 4s. to £39 18s. The reduction took effect from the 9th September.

★ ★ ★

Index to Volume 4 of THE TAPE RECORDER Available now - - - Price 2s. 6d.



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TEST TAPES AND THEIR USES

By: GORDON KING

A PERFECT tape recording system can be defined as one where the sound waves created by the speaker are identical in every way to the sound waves which activated the microphone in the first place.

The sound from the microphone has to be amplified and then stored in terms of magnetic patterns on the tape. Then the patterns have to be converted back to the electrical equivalent of the original sound, amplified a second time and then fed to the speaker. One of the big problems in the overall recording system is to ensure that the change of the signal from electrical to magnetic and then from magnetic back to electrical is performed with the least distortion.

To help us decide whether or not this conversion is happening as it should—or as we should like it to—there are available a number of test tapes. These are recorded to a high degree of accuracy under exacting technical conditions and contain various items of signal to reveal weak points in the tape mechanics and in amplifier equalising, as well as other things.

Frequency Response

Let us take frequency response first of all. If we have a good quality amplifier, replace the speaker with a non-inductive resistive load, across which is connected a voltmeter suitable for indicating audio voltages, and feed into the amplifier a signal from an audio generator we should expect to achieve a fairly constant voltage reading as a constant-level generator signal is varied from about 20 c/s to 15 Kc/s. On a hi-fi amplifier we should get the same results at fairly high power level, depending upon the rating of the amplifier.

This is all very well for amplifiers alone, but it does nothing to assess the performance of the tape section. Here, then, the idea would be to apply the generator signal—correctly matched—to the input of the record amplifier and make a recording of the constant-level audio over the required spectrum. The system would be good if now the voltmeter reading was constant (as connected across a loaded replay amplifier, as detailed above) when the tone-recorded tape was replayed.

To save all the trouble and pit-falls of creating one's own pure-tone test tape a number of firms are producing such tape records at CCIR characteristics mainly for $3\frac{1}{2}$ and $7\frac{1}{2}$ i/s.

When a recording is made over the audio spectrum with pure tone at constant level the various frequencies fail to be recorded at equal intensity. The peak occurs around about 4 Kc/s, depending upon tape speed, rising to this value from low frequencies and falling consistently afterwards until very little signal is recorded beyond about 15 Kc/s on the average recorder.

The tape itself has no inherent frequency characteristics of its own. Tape speed influences frequency response—the higher the recording speed the higher the upper limit of recording. The theoretical limit is reached when the wavelength of the sound signal being recorded approximates the width of the gap in the head.

Correction Standards

To secure a flat output when such a recording is replayed, therefore, the lower and higher frequencies need to be boosted, and slightly different boosts are required for different tape speeds. This is called frequency correction.

Equalising or filter circuits are employed for the boosting process, as these let through more signal at certain frequencies than at others. In Great Britain the correction is to a standard established by the International Radio Consultative Committee, called the CCIR standard. In America a slightly different standard is sometimes used—called NARTB.

The correction for different tape speeds is often given in terms of time, since the filters themselves are really time-constant networks; by defining in time engineers can design to a definite standard. Thus, test tapes may be signified in microseconds of time as well as in frequency and tape speed.

Some of the more expensive tape recorders feature pre-set adjustments for correcting the equalisation. These adjustments are established by the use of a test tape in conjunction with an output-meter. The pre-sets should be adjusted on *replay* to give a specific output at a specific fre-

quency, as indicated in the instruction book. 4 Kc/s is a value sometimes chosen for equaliser adjustment, and some test tapes thus feature a band of such recording.

Clearly, the CCIR characteristic embraces the replay channel as well as the record channel. Indeed, most of the correction is done in the replay channel, as intimated above. The tape is CCIR-recorded if a flat output is obtained when the tape signal is fed through a replay amplifier with the CCIR correction. In practice, some HF boost is given during the recording process.

Another important use of a test tape is in the setting of the azimuth or tilt angle of the replay head. The high-frequency performance of any tape recording depends very much upon how well the oxide side of the tape is in contact with the working surface of the replay head. If only a portion of the tape is in contact with the gap, both the sensitivity and treble response will be poor. Likewise, if the length of the gap differs in angle from a line drawn at right-angles between the parallel sides of the tape, there will be a loss of high frequency output.

By running through a 6-8 Kc/s test-tape, the azimuth angle is in perfect line with the recorded 'magnets' when the adjustment gives maximum output. The ear is insufficiently sensitive to aid much with this adjustment, and an audio output meter (or record-level meter if this can be arranged or switched to respond on replay) should be used to tell of slight differences in level as the adjustment is made.

"Wow" and "flutter" are other shortcomings that test tapes can highlight. Wow is produced by cyclic changes in speed up to about 10 c/s, and rapid wow produces an effect not unlike the tremolo features of a singer's voice. Flutter is caused by faster speed changes, up to about 100 c/s. It tends to "roughen" the reproduction and can make listening a fatiguing business, especially when the flutter frequency is high.

The effects show up most on sustained frequencies between 2 and 5 Kc/s, and test tapes recorded within this range are available. These, of course, must themselves be perfectly free from the effects, and the *EMI* test tape SRT13, for example, has wow and flutter contents below 0.08%.

Wow and flutter increases as the tape speed is decreased, and while a good deck may not produce the effects in excess of about 0.15% at $7\frac{1}{2}$ i/s, the same deck at $1\frac{1}{8}$ i/s may give up to 0.3% wow and flutter.

White-noise can be used instead of pure tone. White noise is the "hiss" that is present on hi-fi equipment when the gain is turned right up and no signal applied. Actually, white noise should contain all frequencies from zero to top audio. Such signals applied to any audio system will tend towards coloration as the result of peaks and resonances (if any) in speakers, transformers, inductors and filters. This in rather the same way as "residual noise" is coloured by holding an ear close to a sea-shell. The shell acts as a resonator and frequencies to which it is tuned are picked out of the residual noise background which is for ever present around us (especially by the sea).

White Noise Tapes

White noise is interesting to play with, but this is really another story . . . apart from saying that some nice white noise recordings are available from *Tutchings Electronics Limited*. This firm also has a tape giving full-range unfiltered noise.

Other uses for test tapes include speed checking, as, for instance, the *EMI* SRT13 which has strobo markings, background noise and bias checking, using a section of clean tape and for checking the general health of any recorder along the lines suggested in these notes.

For those of our readers who play tape records, test tapes are really essential to ensure that the machine is responding to recordings made on equipment other than that which is used for replay. While good treble may be attainable from a machine which replays the material it actually recorded, poor treble may be forthcoming when a tape record is played because of an incorrect azimuth. Remember that the azimuth is highly important on tape records. Maladjustment is barely revealed when the misaligned head both records and replays, for relatively the azimuth is correct even though the length of the gap in the-head is at an angle across the width of the tape; for the angle remains the same on both record and replay.

Probably the most useful of all the test tapes is *EMI* TBT1, a CCIR tape at $7\frac{1}{2}$ i/s covering the range 40 c/s to 10 Kc/s.

TAPE RECORDER SERVICE

NO. 23. SIMON RECORDERS

By H.W. HELLYER

JUST lately, there has been an increase in what my wife calls, condescendingly, "our fan mail". This is very welcome, for, pro or con, all letters from readers are appreciated. Nothing is more dispiriting to the technical writer than an apparent indifference. And even those who omit the courtesy of including a stamped-addressed envelope receive an eventual answer. Between the urgent chores—bathing the dog, pruning the roses, earning a living—we manage to squeeze in a few researches and offer a little advice.

But occasionally the letter arrives which taxes our literary powers, such as that from H. G. J. of Edgware, who asked baldly: "Could you give me a description of the various machines produced by Messrs. Simon Equipment Ltd., and indicate which you prefer?"

The latter part of the question is the easiest to deal with. Like the actor whose latest play is always indisputably the best, most of us would plump for the Simon SP5. As my colleague A. Tutchings observed in



his review which appeared in May 1962, this tape recorder can be warmly recommended. It is not cheap—but quality seldom is cheap. It has many original features, but before discussing them, let us look at the rest of the field, and answer the first part of H. G. J.'s question.

In July 1955 the SP2 was marketed. Again, it was not a cheap machine at 75 guineas, but the good amplifier, with its 10W. output, which made it a useful piece of PA equipment, justified the price. And the 2-speed, 3-motor, EMI deck with 7-in. spools ensured mechanical reliability.

Frequency response is from 50 c/s to 12 Kc/s ± 3 dB at $7\frac{1}{2}$ i/s. This is not particularly impressive by modern standards, but a look at the overall response characteristic shows that from 40 c/s up to nearly 20 Kc/s the variation lies within a $+3$ and -5 dB limit at $7\frac{1}{2}$ i/s. Better still, at $3\frac{1}{2}$ i/s the quoted response extends to 7 Kc/s but the overall curve takes up to well over 10 Kc/s, with similar limits to those stated above.

★ ★ ★

The circuit consists of an EF86 microphone pre-amplifier, an ECC83 two-stage amplifier (with a feedback loop over the two stages) followed by a comprehensive equalising and tone control circuit. This has separate bass and treble controls, providing a 15 dB swing at each end of the frequency spectrum, operable on playback. On some machines, an even more stable arrangement was incorporated, with variable feedback between the output of the second half of the ECC83 and the input of the first half, consisting of a 30-pF preset capacitor, with a neutralising circuit effected by 30 mfd. decoupling of the first cathode. In this circuit, the earthy end of the grid circuit of the 2nd half ECC83 is taken to a tap on the cathode bias—putting a 33 ohm resistor in series with the bottom end of the 2.2K. cathode resistor—and the anode load is reduced from 150K. to 100K. This is the sort of "quality" modification that could usefully be carried out by the experimenter, not only on this machine, but on many other less ambitious models.

From the equalising circuits the signal passes to the first triode of an ECC81 and is then directly coupled to the second triode, which acts as

paraphase amplifier, splitting the signal for the two EL84 output valves, which are in push-pull. A feedback loop from the secondary of the output transformer is applied to the cathode of the 1st half ECC81. On Record, the output to the R/P head is taken from the transformer secondary, as is the monitor signal (with a separate control) and the signal that powers the EL34 magic eye.

Of especial interest is the oscillator circuit of the SP2, reproduced in fig. 1. The valve is an EL89, and both the anode and the grid circuits are tuned, but not directly coupled, except by inter-electrode capacitances. The procedure for setting up is for the anode circuit to be adjusted to give maximum output (valve-voltmeter across R/P head) while an oscillator is used to inject 55 Kc/s at the grid. Normally, the impedance of the oscillator (signal generator) and its attenuator is sufficient to damp the grid circuit, but in some cases it may be necessary to provide a lower impedance with an external shunt. After the anode circuit has been adjusted for maximum output, the signal generator and shunt are removed, then the grid circuit tuned for maximum output. The 10K preset in the grid circuit is factory-adjusted and should not be altered unless major repairs have been carried out. Its purpose is to adjust for minimum second-harmonic output—not for maximum oscillator output. This latter adjustment is made with the 25K variable resistor which is the screen grid voltage control. Normal setting is for a reading of 145V R.M.S. across the head.

Note that this screen voltage is interrupted by two switched points. S1 is on the deck, and closes when the motor control is in the Play position. S2 is the amplifier selector switch, and the H.T. circuit is made when it is in the Record position. There is one disadvantage with this type of circuit: it is necessary to allow the bias voltage to decay gradually when the machine is switched from Record to any other function, to prevent magnetisation of the heads. Therefore, normal operation is to switch the motor control to the brake position before switching the selector to Playback, from Record.

Inputs are: Mic., 1 megohm, 1.5 mV; Radio, $\frac{1}{2}$ megohm, 150 mV. P.A. inputs are: Mic., 2 mV; Rad., 200 mV.

Outputs: Monitoring via the internal 10-in. 3-ohm loudspeaker; high impedance headphones; or external 15-ohm loudspeaker.

When the amplifier is used for public address purposes a level response is obtained with the treble control advanced and bass control at zero.

Dismantling is straightforward, and the amplifier can be removed to the extent of its leads and operated remotely if turned on its side with the valves toward the open end of the cabinet so that the 5-pin and octal plugs can be re-inserted, and pins 3 and 4 of the 4-pin plug shorted (or the lead extended and plug re-inserted into the socket at the side of the amplifier). Remember, however, that a load must be provided under these conditions, and either the internal loudspeaker re-connected or a 15-ohm resistor connected across a jackplug inserted into the Phones/Ext. LS

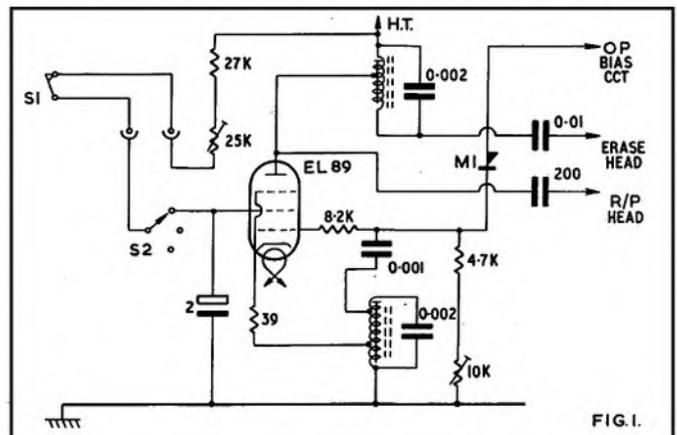


FIG. 1.

(Continued on page 407)

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MARK 5 Series 2

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The Mark 5 Series 2 tape recorder is a high quality machine capable of making outstanding recordings.

It is tastefully finished in medium grey with chromed fittings, and designed not only for use as a complete portable recorder but for incorporation into a Hi-Fi installation. (Deck, amplifier and power unit are available as separate items). A low level compensated output socket is provided for driving an external Hi-Fi amplifier.

Specification:

4 speeds 1½, 3½, 7½ and 15 ips • frequency correction at all 4 speeds • 3 independent motors • exceptionally low wow and flutter content • double-gapped ferrite erase head to minimise erase noise • narrow-gapped record/playback head to give extended frequency response • pause control • superimpose control • recording level indicator (meter extra) • takes 8½ in. dia. reels • fast rewind (1200 ft. in 45 seconds) • digital rev. counter.



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Tape Recorder Service—Contd.

socket. The one awkward part about the dismantling and re-assembling operation is the handling of the compensating switch bracket, secured by 4 BA nuts.

Two machines in a lower price bracket, using the Garrard Magazine Deck, are the *Cymbal* and the *Minstrelle*. The former, at 24 guineas, has an output of 3W. and a frequency response of 70 c/s—9 Kc/s. It was obviously produced for the competitive low-price market, and is completely conventional in design. Certainly, it compares very favourably with anything else in a similar price range, both as regards construction and styling.



The *Minstrelle* is rather more ambitious, and is produced in 2- and 4-track versions, with the addition of a matching amplifier. The 4-track version costs 41 gns. and the stereo amplifier 22 gns. With their attractive shaping and Spanish Blue Hide finish, they make a tasteful piece of home equipment, and the stylish *Cadenza* microphones, made in crystal and ribbon versions, are equally fetching. The Garrard magazine deck has already been dealt with in this series, and it is not proposed to waste space in discussing the quite conventional circuitry of these models. They present few servicing problems.

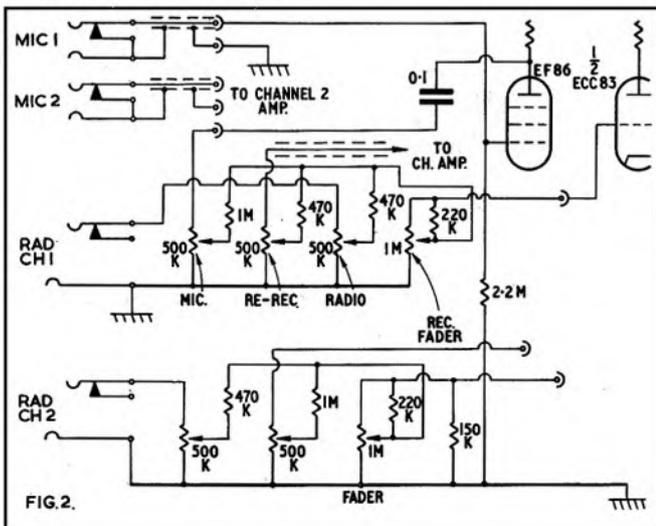
One model that was produced during the tape recorder "boom" period, 1958/9, but which is not in very wide employment, was the SP/4. Messrs. Simon used their own deck on this machine, playing in both directions with automatic reversal. at $7\frac{1}{2}$ and $3\frac{1}{2}$ i/s. The specifications are much the same as the SP2, except that a push-pull oscillator was used, and two loudspeakers fitted (a 4-in. high frequency unit, with diffuser, added to the 10 x 6 main speaker). Here I must be honest and admit that I have never had the opportunity of taking one to bits! Considering the wide range of machines that have landed on my bench during the past seven years or more, this admission must be a recommendation in itself! Therefore, if any well-breeched reader has one of these models tucked away in the lumber room, I would be glad of the chance to handle it.



The star machine of this month's round-up is the SP5. There is so much that could be said about the original points of design, construction and performance, that it becomes necessary to omit the specifications, and refer readers to the May 1962 review of the machine.

Servicing can be done at two levels, and it is certainly not advisable to tackle the more delicate adjustments. But in answer to several queries on the basic points of dismantling and setting up, the following notes have been prepared.

Head cover: the rear part of the plastic cover is removed by inserting a small screwdriver blade at the one end, near the tape slot, and levering gently upwards, then repeating at the other end. Do not attempt to prise directly upward until this easing process has been done, or you will simply break off the fixing pieces.

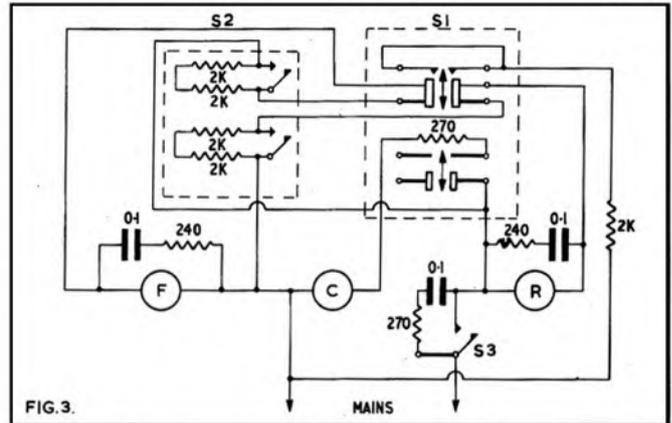


Base: when removing the base, tip the machine on to the back of the speaker enclosure, remove the wood-screws around the base and gently lower it to a horizontal position.

Power pack: after removing the four corner 4-BA nuts, this can be taken out, but care must be exercised to avoid straining the connections to the silicon rectifiers. Similarly, when removing the oscillator assembly, first take out the 9-pin plug, then remove the three 4-BA nuts and the assembly is free. The cable to the plug should be handled carefully, to avoid breaking off the fine inner conductors of the twin-screened cable.

Power amplifier: the plug on the printed panel must be removed by sliding off in a side-to-side movement, not by pulling up. The underside of the panel is accessible when the three 6-BA nuts holding it to the heat sink are removed.

Replay Pre-amp: one small catch here is the metal standoff pillar, which must always be returned to the same position on re-assembly; this



acts as the chassis return connection for the printed circuit. Similarly, the screws holding the Record Amplifier panel act as earthing points, and must be fully tightened before operation.

Meter: a short 6-BA box spanner is needed to get at the nuts countersunk in the loudspeaker baffle.

Normal replay, normal modulation, but poor or no recording: check the micro-interlink deck switch for poor contact and note that the end contact of the socket on the Record Amplifier panel may not be "making" properly. See that the end preset of the trio on the right-hand flanking panel is not shorting to adjacent capacitors.

Blown fuse: a rather tricky fault, persistent blowing of the 2A fuse in the 17.5V. supply line can be caused by earthing of the speaker system. Check that the leads are not touching the speaker frame, nor the metal gauze under the power amplifier shorting to the power transistor heat sink. If the meter is reading forward and cannot be zeroed, this may be due to blowing of the FS1 fuse. The FS3 fuse, if blown, will prevent fast winding, and this can be caused if the 2K resistors beneath the deck touch each other.

Intermittent replay: check the Phillips screws on the tone control panel and make sure the fixing tag is well soldered.

Instability at maximum treble: move the cables at the output sockets as far as possible from the track switch wiring. These may easily move during transit.

Bias adjustment: screwing the "set bias" trimmers anti-clockwise increases the bias. Take care not to overdo this, as it is possible to blot out the recording altogether in certain circumstances.

Intermittent Record: check the connections and circuitry of the input mixer network, shown in fig. 2. Pay especial regard to the plug and socket connections, and check earth returns.

Deck faults: the deck used on this model is the EMI Basic 2-speed, which is worthy of more detailed description at a later date. The motor circuit, however, is given in fig. 3.

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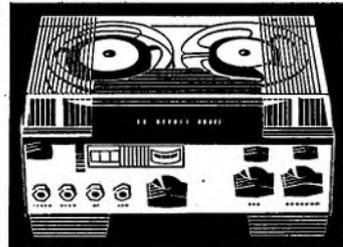
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Readers' Problems

★ 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—1ape". 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.

Motor Vibration

DEAR SIR, I purchased a Harting HM5 some five years ago, and the instrument has been in constant use since. Your advice on the following points would be very welcome:

(a) Mechanical noise and hum have always been disappointingly high, but motor noise has considerably increased recently. I have lubricated the bearings with no effect as the noise appears to be produced by the motor laminations. The idler wheel for $7\frac{1}{2}$ i/s has also defied my attempts to quieten it.

(b) I suspect that the head may now need replacement and would be glad for advice on the type and make. (I have recently acquired an S99 amplifier and GL70 player which, when used with my Paraline speakers makes my recordings sound very poor.

(c) Finally, are you able to recommend a reliable maintenance and repair firm for the Harting?

Yours faithfully, L. G. S., Reading.

As you are experiencing motor vibration on your Harting HM5, which lubrication has failed to cure, you are probably correct in assuming the laminations are the source of the trouble. If you have tightened them as much as possible, there is little else that can be done, short of stripping the motor and re-assembling the stack. Even a minute particle of grit between two laminations, or a poor electrical joint causing a high resistance instead of a short-circuit between adjacent strips can give rise to this.

Replacement heads depend on the physical mounting, and you would probably find either Bradmatic or Miniflux would be able to supply a suitable type at a cost of about £2, if you quote the machine type when writing for their sales literature.

The agents for Harting are: Technical Suppliers Ltd., Goldhawk Road, London, W.12. They would probably be happy to advise you of a local repair firm for your machine.

★ ★ ★

Pre-Amp for a Portable

DEAR SIR, I have built a portable tape recorder using a Garrard battery deck. I have had a lot of trouble with noise from the motor, picked up by the amplifier. This is a pre-amp only, and uses an OC45 and two OC71 transistors. I wrote to the makers of the deck about this and they sent me a paper on this kind of thing. However I have tried the circuit they recommend, and some of my own, using TV chokes, but with only 50% success.

I found that about 25% noise gets in through the face of the tape head, so I cured this by fixing a mu-metal screen to the pressure pad. The amplifier and deck motor have separate nine-volt batteries. Please can you suggest anything to suppress the rest of the noise?

Yours faithfully, D. A. T., Nottingham.

As you have discovered, the problem is acute, and no hard-and-fast rules can be quoted. So much depends on the relative positions of the parts of the equipment, length and routing of leads, etc. The pamphlet from Garrard, which I return to you herewith, gives most of the routine points. but, rather curiously, omits mention of the head leads and their screening.

First, a few comments on the Garrard recommendations, which you say you have followed with only moderate success. Note the ferrite beads. There is usually a tendency by constructors to leave these out. They are important, however, as a means of concentrating the field in the short length of unscreened lead between connections. Next, the soldered joints, especially those to the motor casing, should be impeccable. A dry joint here is a perfect noise pick-up device. Routing of cables, even when screened, is important, and you may try the device of running cables along the length of the motor before taking off to battery. Again, a screened cable touching chassis points along its length provides unwanted earth loops, and I find it advisable to use either insulated screened leads, or fit sleeving over the cable.

Head leads are also screened, but you may find it useful to experiment with the earth point of this screening. Take the screening right up to the

head, as far as possible, but earth it only at the amplifier end. Watch the routing of amplifier leads, and if you are utilising the switch, keep all leads as direct as you can.

Finally, try screening your pre-amplifier completely in a tin box, returning all chassis points to a common tag riveted or soldered to a point on the inner face, and earth the outer to the deck-plate.

★ ★ ★

Track Conversion

DEAR SIR, I own a PAR tape recorder which is fitted with a two track Collaro Studio Deck. I have acquired another Collaro Studio Deck which is fitted with a four track head. Could you please give me details of how to modify my recorder to accept the four track deck.

Yours faithfully, G.W., Hemel Hempstead.

Conversion of your PAR tape recorder, with Collaro Studio Deck, from two-track to four-track should entail very little alteration. The track switch need only be a two-pole, two-way type, with the common return leads of the heads earthed and the "live sides" taken through the appropriate contacts. You may need to increase the series capacitance of the network supplying the audio signal to the head. Usually a resistor with a small capacitance across it. Increase this latter to about 100 pf. It may be an advantage to stabilise the erase feed, too, by inserting a 330 ohm 1 watt resistor in the feed from the oscillator coil, to the erase head.

This is largely a matter for experiment, and no strict rules need be made. Your greatest problem will be the physical mounting and adjustment of the heads, and I would urge you to follow the advice on four-track head alignment that has been given in the Servicing articles several times.

★ ★ ★

Faulty Erase

DEAR SIR, I have an Elizabethan FT1 recorder which, of late, has not been making a clean erasure when recording over old material or cleaning a tape in the approved manner, i.e. all controls to zero and the machine on "record". I have tried aligning the erase head but this made no improvement. A would-be tape recorder expert tells me that a valve is the cause of the trouble but as I am not very well versed in electronics I thought I would check with you first.

Yours faithfully, E. H., Swansea.

The problem of incomplete erasure on your Elizabethan FT1 tape recorder could be caused by one of several faults.

Your adviser who stated that a valve was probably the trouble was only guessing, and although it is possible that the ECL82 oscillator is faulty, this is not the prime suspect. Generally, when an oscillator valve fails, oscillations cease, and the resultant distortion due to lack of h.f. bias is very apparent. You can prove this by recording on a section of clean tape and noting whether the signal is distorted. If not, you should rule out the oscillator valve.

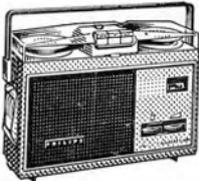
A possibility is that the head facing has gathered a slight coating of foreign matter (tape oxide, dust, etc.), and the obvious cure is cleaning. Use only methylated spirit or a proprietary tape cleanser, and do not employ any metallic instrument, or for that matter, anything sharp or too hard.

Another cause could be failure of the erase head feed capacitor. This component should be a good quality one, and the value may need to be increased to 0.003 mfd to obtain the current feed you require. You may have noted an exchange of correspondence in the April and May issues of this magazine. Reader A. H. S. had a similar problem with his Elizabethan LZ29, and Messrs. Elizabethan stated in the following issue that our diagnosis of possible head misalignment was "a little misleading". They suggested using a replacement feed capacitor. I would advise you to try a similar cure—this component is a popular culprit on many machines.

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by Richard Golding

SOUND AND CINE

A LOOK AT ANGLIA TELEVISION

WHEN Anglia Television took over the old Agricultural Hall in the centre of Norwich in 1959 they were more than set on just converting one big building for use as another, they were about to supply one of the most valuable regional services that radio or television had ever known.

The task of conversion alone was interesting, for it consisted of placing an entirely new block of studios and offices inside the shell of the old building without altering the appearance of the exterior.

In the Agricultural Hall, there were originally two smaller halls. At the front, sideways to the main road, was an assembly hall and behind it a larger exhibition hall. The former assembly hall now contains the reception centre and three floors of offices. The old exhibition hall at the rear now houses four studios under one structural re-inforced concrete frame which never touches the original walls. Sound insulation of this frame is effected by covering the walls both inside and outside with acoustic tiles, and by making all entrances into "wind lobbies" (recesses with two doors which act as wind buffers).

★ ★ ★

The first thing to be seen when entering the ground floor reception is "TOPSIE" or, in other words, the Tape Operated Programme Switching and Indicating Equipment. Through a huge plate glass window all the master engineering controls can be seen which can be operated automatically by punched tape if the need arises.

In the same room, but not visible from reception, is the Telecine and the Ampex VTR. Telecine is a word used to refer to television-film operations and includes film projectors, slide projectors, special television cameras in circuit directly with the projectors, and television shading control units. The Anglia Telecine consists of four channels of Rank Cintel Flying-Spot Telecine, each capable of handling 16 mm. or 35 mm. material with all classes of married and unmarried sound. Two channels are also capable of handling slides.

Telecine operations can be explained by describing the production of a typical television news programme. In this the news reader and the weather reporter are live, but all news inserts are on film and are projected from the Telecine room on cue from the producer. When slides are employed they are projected in the same way.

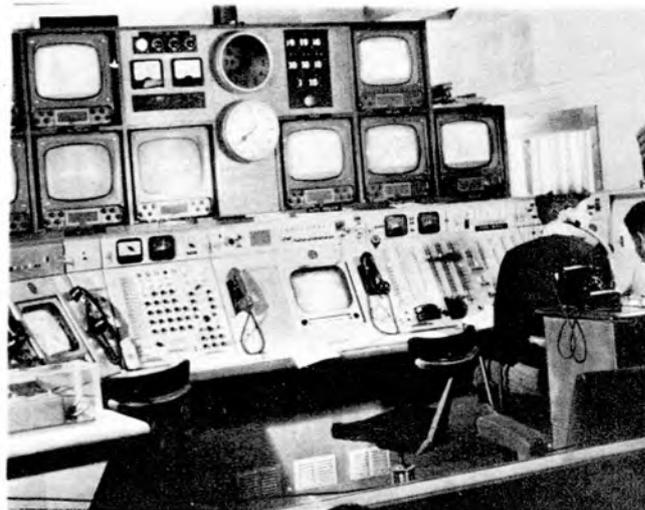
★ ★ ★

The Ampex Videotape Recording machine is a permanent fixture (there is a mobile Ampex for O.B. work) and is used mainly for recording television programmes off the air and to retelecast them at a more appropriate hour, for repeats and for location inserts in plays. The basic principle of VTR is much the same as ordinary tape. The magnetic head places the electronic impressions on the tape and the programme is produced by reversal of the electronic process. High head-to-tape velocity is required, however, to record the high-frequency signals of the television picture. This is achieved by using a 2 in. wide tape moving at 15 i/s together with four switched magnetic heads mounted on a single revolving disc. The signal is thus recorded vertically rather than horizontally, resulting in a series of 120 degree arcs transversely across the tape. This is made possible by the heads being mounted each with microscopic precision at 90 degrees from the next head on the disc. With a disc diameter of about 2 in. and a rotational rate of about 240 r/s the writing speed or relative head-to-tape velocity is about 1,500 i/s.

The Video tape contains three other synchronised magnetic tracks: the normal sound track that accompanies the picture; the control track which comprises a record of the alternating currents which feed the rotating-heads motor during the recording and which acts as a reference point for editing; and the cueing track. This last track is used by the producer to indicate points at which he requires the various camera positions to be edited in and so on.

★ ★ ★

From this master control room the studios are reached by corridors running down either side of the building and when one is walking through



The Master Control Panel. First to be seen when entering Anglia House.

these corridors the architectural effect is quite dramatic. On one side, the offices, on the other side, the concrete, brick and tile box of the new studios towering up to the very roof of the old building without actually touching it. In between, all the services that a busy television centre needs—the biggest and bulkiest being the great runs of trunking required for air-conditioning—with six huge fans to maintain the different circuits.

Inside the studios the ceilings have a specially designed lighting grid made up of a slotted steel platform. This enables lighting and scenery to be fixed up and to be moved about with complete flexibility. The four production studios are as follows: Studio A, 52 x 62 ft. (3,224 sq. ft.); Studio B, 25 x 41 ft. (1,031 sq. ft.); these two studios can be operated singly or as one unit; Studio C, 18 x 13 ft. (231 sq. ft.) for continuity, news, weather bulletins and talks; and Studio D, 9 x 6 ft., for commentaries. The two main studios are equipped with Pye 4½-in. Mark V Camera Channels and the latest sound and lighting equipment.

Both Studio A and B have control rooms on the first floor, with soundproof double-glazed windows. The corridor which gives access to them is the gallery of the old exhibition hall and here again old and new are juxtaposed in an exciting fashion. Rearing up every few feet are the girders of the Victorian roof, resplendent in blue and gold, the elegant ironwork frills contrasting with the modern, direct extract trunking. Finally, as not an inch of space could be wasted, the area above the studios contains production offices under the redesigned roof of the old hall.

In that, Anglia employs around 350 on the regular staff, with many more under contract for particular programmes. For news coverage of East Anglia, there are two permanently attached film units consisting of 100 correspondents, 25 free-lance cameramen and the usual news-room production staff and copy takers. The Natural History Film Unit travels the world obtaining information for *Survival* programmes and has been associated with two of the World Wildlife Fund's most important rescue operations. The first of these was the classic removal of the few remaining white rhino in Uganda to an area of safety in a National Park. The second was the rescue of thousands of flamingo fledglings trapped in the soda crust of Lake Magadi.

In addition to a wide variety of local programmes produced in the studios for East Anglia's 2½ million viewers, Anglia dramas and documentaries are frequently transmitted nationwide on the ITV network and have a high reputation as serious quality productions. The latest development from the Drama Department is the 30 minute "quickie"

(Continued on page 413)

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SOUND AND CINE—continued

play exchange between regional companies pioneered by Anglia and now gaining network distribution. With the half-hour drama, the writer has to develop character and plot much earlier and this calls for a different writing technique. It allows, however, the smaller television companies the opportunity to produce their own plays in their own way and to co-operate in producing a high quality series.

★ ★ ★

I was present at the first Ampex run through of a new 30 minute drama which had just been edited together. This was *The Simple Truth* starring Renee Asherson as the frustrated and unhappy wife of a naval officer on Gibraltar. I won't tell you the plot as this would spoil the whole effect should you see it but it has an exceedingly clever twist halfway where the Commercials fit in and a surprise ending giving lead to much conjecture on what could happen afterwards.

Another thirty minute drama in this series had been shot almost entirely on location by the Outside Broadcast unit. The O.B. unit is in constant demand and carries two Pye 4½-in. Mark V Camera Channels and the Mobile Ampex VTR machine. The play—*They Don't Make Summers Like They Used To*—is the story of two people caught up in a threatened transport strike and who take time off to cycle into the countryside on a sentimental journey. The sequences were shot around the picturesque countryside of Norfolk and Suffolk and much of the play was actually taped on the move as the Ampex trailed behind the cyclists! The production unit was lucky to have the only two weeks of fine weather that this last summer had produced, for as soon as the shooting was finished the weather reverted to normal, thus, for the unit, giving an extra truth to the title of the play.

★ ★ ★

Anglia Television is a most progressive company, always alert for the new idea and, of course, the new writer. Drama material required is for 30, 60 or 90 minute plays in *script* form. Outlines of ideas are not acceptable unless submitted by authors who have had previous experience in television writing. All submissions should be sent to the Drama Department which is located at the London office at Brook House, Park Lane, W.1, but must be handled through a recognised literary agent.

A limited number of tickets are available for audiences at certain shows, the maximum capacity for Studio A being 200. Applications.



Production still of a Magazine programme on East Anglia. Here we see Oscar Heidenstam demonstrating how to keep fit to women.



Studio A Control Room.

enclosing stamped addressed envelopes, should be made to: "Audiences" Public Relations Department, Anglia Television, Anglia House, Norwich 07A. No audiences are admitted to drama productions or to "About Anglia".

★ ★ ★

Cinematography Course

For London readers I have details of what appears to be a most interesting course of lectures. The lecturer is Gerald Wooller-Jennings, MBKS, author of the Introduction to Projectors in the 1963 *Cine Year Book*, and the venue is at the Stanhope Institute, Queen Square, W.1 (5 minutes from Holborn Underground). The purpose of the series of lecture-demonstrations is to provide the amateur film-maker with a clear understanding of the basic principles of cinematography, to explain, and advise on, the operation of equipment, to discuss students' difficulties in the use of 8 mm. and 16 mm. cameras and projectors and to provide facilities and help in the construction of simple but useful accessories. Individual assistance will be given and the class will have opportunities for general discussion.

Studio, darkroom and workshop facilities will be available at certain times during the course and several visiting lecturers will speak. Times: Mondays—6.30 to 8.30 p.m.

This course is intended for those who have already attended the introductory course on *Filming for Pleasure* at the Stanhope Institute, Stanhope Street, N.W.1 (Fridays—6.30 to 8.30 p.m.) but others who have the requisite experience, and access to the required equipment, may be admitted.

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RECORDING IN SWITZERLAND

By Bob Danvers-Walker

★ *Another contribution from Bob Danvers-Walker, whose missions abroad to record material for broadcast programmes frequently involve him in high adventure. In this issue he recalls recent visits to Switzerland and Sardinia.*

THE ratchet railway slowly climbed its way from Grindelwald, the "village of the glaciers" in the Bernese Oberland, to Kleiner Scheidegg 6,800 ft. up in the heart of the Jungfrau group. This was to be an important day for me during this visit commemorating the Centenary of the first conducted tour of Switzerland. Two remarkable demonstrations were to be given; a "cannon" would fire ten rounds to produce echoes off the 13,449 ft. face of the Monch, and an alhorn would attempt to bounce its note off the North face of the Eiger.

I arrived at the terminus of the Wengernalp line to see a fine old piece of field ordinance shining brightly in the brilliant sun and manned by two artillerymen dressed in uniforms of the period. Beside them, in costumes of a hundred years ago, stood the party of excursionists simulating in excellent detail the experiences of the original travellers who came here with a Mr. Thomas Cook of Leicester exactly a century before. The purity of the air, the almost audible silence of alpine regions and the fantastic distance over which noise can be heard, were factors to be considered in attempting to record such contrasting sounds.

I stationed myself a hundred yards from the field gun, which was as far as I could go and still keep the gunners in sight so as to observe



their signals to fire. To my Fi-Cord 202 I connected the M.219 Beyer omni-directional microphone in preference to the M.66, as I wanted to capture the omnipresent characteristic of sound in this environment.

Right from the first shot my problem was to stop down low enough on my volume control for the sharp detonation, then to fade-up to almost three-quarters open to catch the thunderstorm effect of the explosion reverberating off the snow and ice-clad peaks of the Jungfrau massif. I experimented with every one, not knowing with what success, as the shots were fired in varying and unexpected intervals permitting no time to make quick playbacks. I could tell well enough that during the six second gap between the shot being fired and the ensuing echo I would not escape recording the giggles and chatter of the spectators. And indeed it was this that spoilt nearly all the takes, since I could not escape them as they merged into the rumble coming to me like the sound of an avalanche.

According to my log Take 9 is the best. On this I turned away from the gun for the shot, delayed fade-up until the last moment, and for some reason no one spoke. I don't like that momentary fade-down because it loses atmosphere.

★ ★ ★

As a Travel Correspondant it is my job to encourage people to go abroad. But how I wish they were not there when I am recording bird-calls, cattle-bells, babbling brooks and . . . alphorns. Seeing my three alhorn players positioning themselves for the experiment to record their music off the Eiger face, people jangling with cameras and binoculars bore down on us. And why is it that as soon as I level my microphone and make a signal for silence, someone in the crowd says "Oh look, Television"? It happens time and time again. Three 15 ft. long horns valued at about £50 each reached out from the lips of the three skilled players. The horn ends resting on the ground were directed towards the granite face of the cruelest mountain in Europe. I switched on and waited for them to start. The slow, measured notes droned out and diffused themselves in the distance. Like bagpipes and shepherds flute, the alhorn is an instrument for the mountains and the still places of nature.

The air they played was the same as the one I recorded at 4.28 a.m. on another day when an alhornist on the Rigi Kulm played to welcome the dawn. The echoes were lost to me. Maybe they stayed and died on the North face of the Eiger which has claimed so many human lives.

I left Switzerland with what I would claim to be an extremely rare if not unique tape recording of a sound which has never happened before nor is ever likely to happen again. This was made in Lausanne beside the 700 year old Cathedral. For 300 years it has been the custom every night for a watchman to deliver his cry of "Eleven o'clock and all's well" from the belfry. On the night I was there, in commemoration of the Centenary celebrations, he made his cry in English—the only time it has ever been done and unlikely ever to be repeated again.

★ ★ ★

DIRECTOR/CAMERAMAN Martin Rolfe and I had flown to Sardinia by BEA "Vanguard" on the direct flight to Alghero. Fertilia Airport is only three hours away from Heathrow, so the day lay before us as we dumped all his camera gear and my recording equipment on to the car which we use when Martin goes colour film gathering and I go in search of sound for radio broadcasting. Martin's working "payload", comprising 35 mm. camera, film, battery, tripod and reflector boards, weighs about 250 lbs., while mine is an all-up weight of 8 lbs. concentrated into a Fi-Cord 202, Carrying case, two 4 in. tape spools and a microphone plus tripod. I am not saying which of us actually carries the most, but I am thinking of getting some shoulder pads made up.

Just outside Alghero at Capo Caccia is Neptune's Sea Grotto where one may penetrate deep into the great cliffs and walk along passages and galleries festooned with stalagmites and stalactites (tites hang down and mites stick up). There are two ways of getting there—road or boat. If one takes the land route one has to descend the cliff-face by what is known as the "Goat's Stairway"—hundreds upon hundreds of precipitous steps. Martin's keen eye for a picture determined which route we would take. So I heaved the camera tripod on to my shoulder, waved

RECORDING IN SWITZERLAND



goodbye to the boatload of passengers far below and we made for the stairway comforted by Martin's encouraging remarks about the sea bird cries I could record on the way down.

Those who suffer from fallen arches, smokers cough or are prone to dizzy spells at heights should never attempt the Goat's Stairway route. Twenty feet down the cliff face I popped the wind filter over the microphone and knocked off sixty seconds of new seagulls for the BBC. The entrance to the Grotto is through a gash in the sheer hump of rock sticking 500 ft. out of the dark blue sea. Surging against the red stone, its depth at one point is said to be four and a half miles.

Once inside I was on my own. Although electrically lit, the galleries need extra illumination when filming for the cinema. So I slithered my way along the timbered cat walks deep into the interior and recorded the marimba-like notes given off when the various carbonate formations resembling velvet drapes and organ pipes are struck carefully with the flat of the hand. From these notes I have recorded a scale which anyone like Jack Jackson could make into a recognizable tune.

Towards the end of our stay in Sardinia we found ourselves in the fabulous town of Nuoro and based at the Ortobene Hotel which literally adheres to the mountainside in the Gennargentu massif overlooking the town 3,300 ft. below in the wild country known as the Barbagia. During the night and early morning a violent thunderstorm put the whole electrical system out of action. The extraordinary thing was that it was all happening below us. Martin and I had our breakfast in sunshine on the roof terrace while thunder banged and clattered among the foot hills below and clouds scudded under foot.

Incidentally, rain, waterfalls, rivers and sea effects are among the hardest things to record; they all sound like wind blowing through trees. A tinkling brook or stream gives one the only truly watery sound.

The next day we set off for Orgosolo, notorious for its evil reputation. For hundreds of years this region has been the centre of banditry,

briggandry, feuds and vendettas. At one time the names of locals due for liquidation would be chalked up on the wall of the church. The inhabitants still wear traditional costume and the scenery and buildings are all made for filming. In fact it was here that the Venice Festival award-winning film "Bandits at Orgosolo" was shot. Most of the villagers dislike cameras, believing them to be possessed of an evil eye. Furthermore, since they detest all forms of control or discipline, they associate them with police photos and react angrily, sometimes violently, when confronted with one.

★ ★ ★

My particular search was for someone who could play the curious triple-shanked pipes known as the launeddas, the only existing instrument of its kind in Europe. It must have been the combination of microphone and cine camera which suddenly triggered off a woman working with a pick-axe on some sort of demolition work. Before you could say "Take to the hills men" she had swung round and came at me brandishing her pick.

Now there are two things I always count on in situations abroad where emergencies crop up: a packet of English cigarettes and a show of impassiveness. "This won't do at all my old darling" I said as I whipped out a packet of twenty (the great thing is to keep talking—say anything, and above all communicate a sense of friendliness). "Here, have a snout you old battleaxe" I said, thrusting the packet towards her and looking as sexy as my advancing years would permit. Disarmed by my attitude and won over by a filter tip, the red mist seemed to clear from her brain and she lowered her weapon. Not wishing to push my luck further, I slipped the fags into her hand and wrote the incident off as "experience". Funny how a thing like this can happen on an island which is trembling on the brink of becoming one of the most favoured holiday spots in the Mediterranean.



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FUNDAMENTAL BUILDING ACOUSTICS

By M. F. Woodward

The last articles have considered general principles of sound propagation, this one applies them to specialised applications.

Rooms for Speech

These include Lecture Theatres, Courts of Law, Debating Chambers, where intelligibility of the spoken word is paramount. The fundamental question to be answered is firstly, whether the speaker is to be placed at one position (Lecture Theatre) or to be placed anywhere (Debating Chamber, Courts of Law).

Human speech is a delicate aspect of sound, involving subtle inflexions and transients, quite apart from the fact that the majority of people have no idea of speaking up, or perhaps as in Law Courts, have no intention!

Thus the prime requirement is: (1) a quiet situation with no intrusive external sound, (2) the suppression of unnecessary internal noise such as the shuffling of feet, (3) the avoidance of over long excess paths for reflected sound, and the encouragement and reinforcement of direct sound wherever possible. All this produces a room of small volume (100 cub. ft. per person) with a low ceiling, soft flooring, upholstered seats set at a substantial rake so that each row can see the speaker(s) clearly and, in the case of a lecture hall, hard reflective and diffusing surfaces over and on each side of the speaker.

Debating Chambers on the other hand need their reflectors and diffusers set for speakers at any place in the room.

Rooms as described above should be satisfactory without additional acoustic treatment, if however, the reverberation period exceeds the recommended maximum then absorption should be placed where excess paths for secondary sound might cause echoes such as the rear wall or a balcony front and not please note, necessarily on the major part of the ceiling which can act as a useful reflector of secondary sound over the floor area.

The audience accounts for much of the absorption in a speech room and precautions must be taken, by the use of well upholstered chairs so that when partly empty the room has adequate absorption (when the room is full of course, the audience largely blankets the chairs and thus cancels out their absorption.)

General Purpose Rooms

General Purpose Rooms are a compromise requiring very close study. I feel that if, as in the case of a School Hall, speech is at certain times all important then the design should veer as far as possible towards the requirements of rooms for speech. This means a short reverberation period not entirely suitable (but tolerable) for music. To err on the other hand and to have too long a reverberation will make the room more attractive for music but quite intolerable for speech. Thus one should watch very carefully for any implied paramount requirement for a "General Purpose Room".

The G.P.R. will be used for dances, stage plays and may even have a stage. The floor must be flat for the most part thus sight lines (and therefore "sound lines") to a stage require careful consideration. The stage proscenium and wings should be splayed and reflective to encourage reinforcement of direct sound from the stage. Many G.P.R.'s have hardwood floors and temporary seating which will be light in weight and non-absorbent. Thus there is a risk, especially with a small audience present, of "flutter" echoes occurring between floor and ceiling, this should be guarded against by avoiding a wholly flat ceiling (not necessarily by placing absorbents on to it). If absorbents are required then they should go on the end wall opposite the sound source, the ceiling perimeter or upper parts of the side walls.

Of all G.P.R.'s the church poses the greatest problem. Speech must be heard, the building must be a good one in which to sing, and organ music requires to be heard, all in a building which must be big enough to hold a congregation for an Easter Mattins or a wet Winter Evensong. What a hope of getting a successful compromise! A large building is the least difficult, for there, a proper time delay amplification system for reinforcement of the voice, will almost inevitably be installed and thus



the reverberation period can be biased in favour of music. Where the spoken part of the Service is all important nothing can be done for music and the design must be based upon Speech Room principles, and music lovers must go elsewhere.

Note the effect which large projecting galleries have upon sound quality. All the principles contained in these notes assume an acoustically simple space, however a wide gallery on three sides of a church has a considerable effect on the indirect sound pattern and consequently the reverberation period. High naves and low aisles also complicate matters. Choirs and Clergy benefit from reflecting surfaces around and over them, whilst organs should have ample height and speaking room and should preferably stand in the Nave, not be bottled up in a tiny chamber speaking across the Choir. The average Continental Church with its "West" end organ or the average English Non-Conformist Church with the organ spread out across the "East" end are examples of good placing.

Halls for Music

Halls for music are once again fruitful fields for compromise, requirements varying from Chamber music where a crisp precise effect is required to romantic organ music and Wagnerian opera where a long reverberation is desirable.

As halls for music are generally of some size, apart from the basic requirements of the reverberation period, attention must be given to adequate reinforcement of direct sound by strong secondary reflections beamed into the furthest corners of the hall, and the attainment of a smooth well diffused die-away of sound.

Other problems are associated with the size of the sound source, an orchestra, choir and organ can sometimes occupy 2,000 sq. ft. and over, and careful design is needed to blend the individual sound sources into one, and to avoid a ragged effect.

Continued on page 419

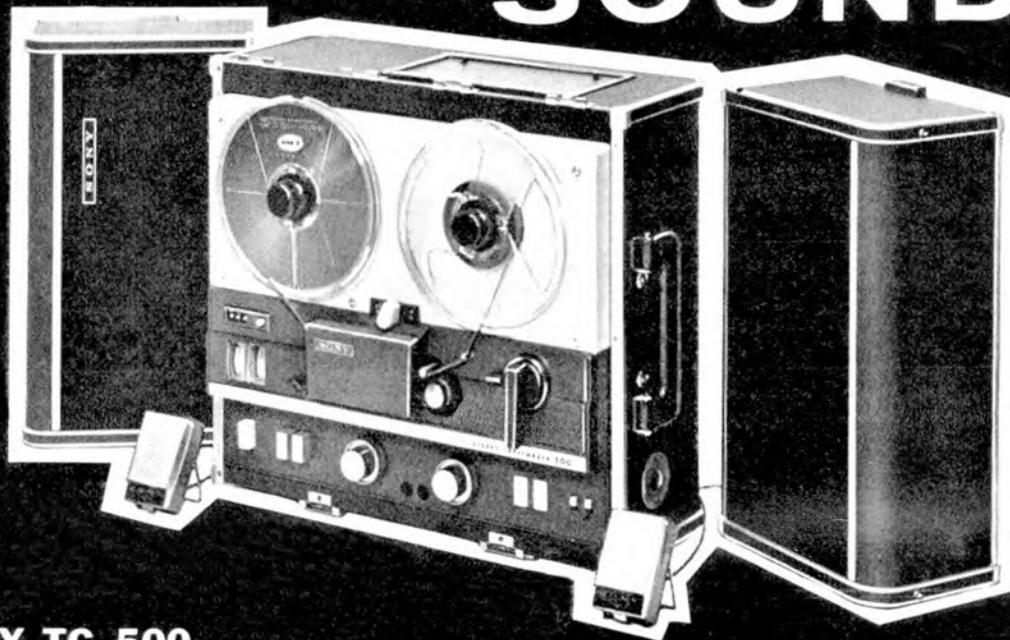
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FUNDAMENTAL BUILDING ACOUSTICS — Continued

The audience provides a considerable amount of absorption in Music Rooms, thus to obtain a reasonable reverberation period it is essential to have a fairly large volume, and figures from 200 up to 300 cub. ft. per person are needed. A volume of this size means a large building and can result in possible risks of echo due to excess paths for indirect

**Current Reverberation Periods (in seconds)
of Broadcasting Studios (at 1 Kc/s)**

1	Small talks studios	0.20-0.23
2	Medium talks studios	0.23-0.35
3	Medium general purpose studios	0.26-0.54
4	Medium music studios	0.60-1.00
5	Large music studios	0.80-1.80

*Information supplied by Engineering Information
Department of the BBC.*

sound. This is generally combatted at the sound source by a large reflector set directly over it, carefully designed so that sound is reflected forthwith into the furthestmost seats. Further use is made of reflecting surfaces below balconies and on the main ceiling to reinforce sound where it is needed.

Sight lines (and thus "sound lines") are once again of paramount importance, and a substantial rake must be given to all seating to obtain this.

Surfaces surrounding the sound source should be hard and reflective, and every care should be taken to ensure good diffusion of sound and avoidance of flutters by splaying and breaking up wall surfaces, such as incorporating projecting boxes, all of which helps in addition to attain that rather ephemeral musical quality which marks a good hall. It is of course absolutely essential to avoid intrusion of sound from without and great efforts are made by screening lobbies, even discontinuous construction to attain this ideal. When, as at the Royal Festival Hall, London, external sound includes nearby electric trains crossing a steel girder bridge, the size of the problem can be gauged.

Before leaving Concert Halls I am going to stick my neck out and pass the opinion that too many Concert Halls have been built recently with too short a reverberation period, clarity is all very well but the effect of much music can be very satisfying when heard in a 2 to 3 second reverberation period (even more for organ music), and will not be heard as "mush" if properly played. Perhaps the pendulum has swung too far away from the long "Wagner" reverberation period.

Cinema Acoustics

Cinema acoustics are concerned chiefly with the avoidance of resonances, echoes, flutter or a reverberation period of significance. In other words, the deader the better and turn up the volume control! One of the least satisfactory artistic experiences of this life is to hear a live performance of orchestral or piano music in a well damped cinema.

Small Rooms

The acoustics of small rooms (under say, 5,000 cub. ft.) depend more on judgement and less on science than larger ones. Apart from studios, this sort of room exists acoustically as small classrooms or domestic living rooms used for high fidelity playback.

Due to hard floors and desks, and areas of hard plaster and glass, classrooms can have an overlong reverberation period, making the spoken word indistinct. Principles outlined earlier in "Speech Rooms" should be applied, modified as necessary (no raking of desks!) and a reverberation period of .5 seconds aimed at.

Flutters must be guarded against, and where acoustic absorption is required it is best applied to the rear wall, (opposite the speaker in other words), the perimeter of the ceiling, and the upper 2 ft. of the walls. Beware the destructive tendencies of little boys however and use indestructible materials, or keep the materials well away from boy level (I once saw the walls of a telephone booth lined with fibre acoustic tiles—

very effective acoustically but the temptation was just too much for the Great British Public who in a short time decorated and damaged the tiles beyond repair).

Domestic rooms for high fidelity playback are generally well damped by carpets and furnishings and the reverberation period can well, as a consequence be negligible. For stereophonic playback there is everything to be said for a "dead" acoustic, in fact over reverberant rooms should be acoustically treated, (generally once again, on the wall opposite the speakers). I feel personally, that monaural playback realism is aided by a little reverberation, say up to .3 seconds. Such a time cannot be easily calculated or measured with accuracy, and the only thing to do, if the room sounds too dead, is to roll back the carpet and see how that sounds. If acceptable audio-wise, but not wife-wise fill the cracks between the floor boards with filler or mashed-newspaper-and-glue mix then borrow a Power sander and sand the floor boards smooth. Stain the whole lot black, seal it with a polish then scatter a few coloured rugs about—the result is quite nice.

Sound insulation can be important in playback rooms,—for the neighbours' welfare—not the occupants!

Finally, that very specialist subject of recording studios. There appears no doubt for monaural recording that the reverberation period should be shorter than for equal speech or music heard live. The reason for this is that the ears and eyes join together in a live performance to discriminate against random reverberant sound, and tend to prefer direct sound from the original source. When both direct and reverberant sound come however from one speaker the eyes cannot help the ears so to discriminate.

Typical studio reverberation periods are given in table 1, and if you propose to calculate the very short reverberation periods required for some studio work, Eyring's modification of Sabine's formula should be used. this formula, given at the end of the article gives much more

Modification of Sabine's formula

Eyring's formula:

$$R = \frac{0.049V}{S [-\log_e (1 - \bar{\alpha})]} + (xV)$$

Where:

R = Reverberation period (seconds)

V = Volume (cub. ft.)

S = Total surface area of particular absorbent (sq. ft.)

log. e = Napierian or hyperbolic logarithm

$\bar{\alpha}$ = Average absorption of coefficient (Sabins)

(obtained by working out the total absorption coefficient of all surfaces and dividing by the total surface area) i.e.:

$$\bar{\alpha} = \frac{\sum s_1 \alpha_1 + s_2 \alpha_2 + \dots + s_m \alpha_m}{S}$$

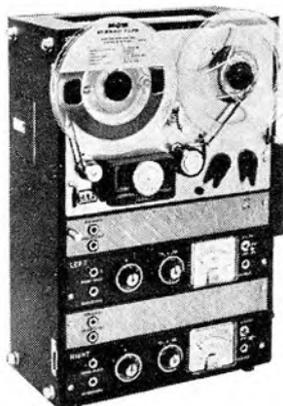
x = Absorption coefficient for air (Sabins)

accurate results when a lot of absorption is required, but requires more maths!

Drama Studios may require to be very live and reverberant for certain work, yet at the same time may need to be "dead". The question of adjustable acoustics is often raised, but as any given effective absorption needs roughly to be doubled to make a significant aural difference it will be appreciated that difficulties exist here. Quite a useful way is to start off with a "live" studio and to make a "gadget" out of framework 8 ft. high by say 4 ft. x 4 ft., clad on three and a half sides by highly absorbent material facing inwards. This sarcophagus like object can be used when a "dead" effect is needed, the characters and microphone working inside. This is just a basic idea, and any fertile mind can develop it to have different sizes and functions, and by hinges and wheels to have more flexibility.

Studios more than any other subject need to be absolutely free from intrusive noise; aircraft, traffic, trains, footsteps, dogs, insects, plumbing and afar off flushing W.C.'s can all ruin a recording, thus every care must be taken to cover every eventuality. This brings us conveniently to the subject of sound insulation which, in theory and practice is a most interesting matter and is in fact dealt with in the next article.

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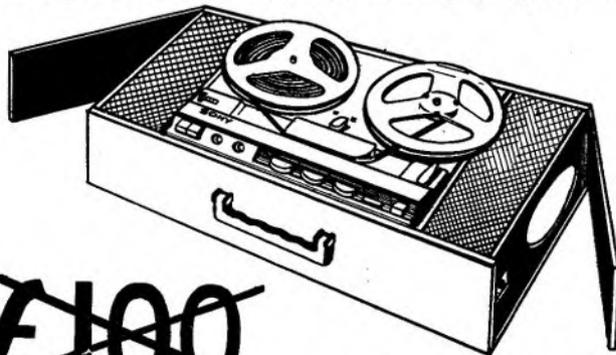
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our readers write . . .

. . . about the causes of flutter

From: Dr. J. D. Poldy, 37 Queen's Road Central, Room No. 1102, Hong Kong.

DEAR SIR, Allow me to take up the point of "flutter" with Mr. R. J. Crome, following his article in your magazine of August 1963. Needless to say, all his practical advice is much appreciated, especially. I imagine, by certain readers who would otherwise not get over their first small troubles with tape and might give up.

One cause of flutter was not mentioned, perhaps because it is not so prominent in a cool climate; a deteriorated belt causing slippage was mentioned, but not the uneven motion due to a belt that is clean, but "cooked" or over-aged. The symptom is more akin to flutter than to wow, the cause apparently being a belt between the motor and the capstan.

From most annoying experience I have come to rule out for purchase any machine that has such a belt, and these are unfortunately by far the majority of the medium priced, and otherwise very good makes. The glorious exception, as far as I know, being the whole range of "Sony".

If to replace a belt were a quick and easy job, one would not mind. However with most machines the motor-to-idler or motor-to-flywheel belt is very hard to extricate and replace, not a job for the average user to do at home.

Rubber is probably most suitable for all manner of friction drive but only while new. If it is loaded for stretch it deteriorates very quickly. If loaded for compression, as on idler wheels, this deterioration is so slow that no extra trouble results during the life of the magazine.

I can therefore not understand why manufacturers do not concentrate on the elimination of these belts. Since the interest of the user is also that of the industry, I think Mr. Crome would contribute significantly to progress in this field if he wrote an article on this point only.

Yours faithfully, Dr. J. D. Poldy, Hong Kong.

★ ★ ★

. . . about the Audio Festival

From: Mr. G. L. Court, 313 Upminster Road, Rainham, Essex.

DEAR SIR, I was interested in your remark in the editorial of the August issue of "The Tape Recorder" about the Audio Festival. I do not think Olympia would be as favourable as you suggested as, when I visited the Do-It-Yourself Exhibition there, two years ago, there was not much room to move about. The best place, in my opinion, would be Earls Court, where the Radio Show is held. It would be as a separate exhibition of course. There would be a lot of work involved, I know, as sound-proof rooms would be needed but it should be possible to pre-fabricate such rooms that could be used every year. If more Hi-Fi firms would exhibit their equipment at the Radio Show this would get people interested in sound who, as yet, have given very little thought to it. This would, in turn, benefit trade.

Yours faithfully, G. L. Court, Rainham.

★ ★ ★

STOLEN RECORDERS

Between the hours of 8.00 p.m. on September 4th and 6.00 a.m. on September 5th a delivery van belonging to Robuk Electrical Industries Ltd. was stolen from the junction of Fortress Road and Raveley Street, N.W.5. An Austin Mini-Van, registration number 348 CXX, it contained fourteen tape recorders all in cartons bearing the company's name.

The serial numbers of these machines are as follows:

Grey & White (R.K.4)	Pink & Buff (R.K.3)
44220	40637
44237	40792
44163	40861
43608	30984
43787	41957
44010	35945
50559	33615

Numbers in italics not new machines, ex-service dept.

Any readers who comes across one of these machines should get in touch with *The Station Officer, Kentish Town Police Station, Holmes Road, London, N.W.5.*

BOOK REVIEWS

Modern Tape Recording and Hi-Fi—by Ken Peters, 247 pages, illustrated. £1 10s. Published by Faber & Faber.

THIS is one of the most comprehensive books for the beginner I have ever read. It deals with everything from acoustics to tape-spondence, hi-fi to fireside plays. Unlike the majority of books written for "beginners", the author does not assume that because his readers are new to tape recording they are therefore ignorant. He takes the reader, in straightforward non-technical language, into the complexities of microphone technique, recorder maintenance, editing, and so on. Several chapters are devoted to the uses to which a tape recorder can be put: recording humorous skits, exchanging tapes with other recordists both in England and overseas, and joining in the activities of local tape clubs. The author has devised a number of games that can be played in conjunction with a recorder. For those who would like the ability to understand and converse in "technical jargon" a sound vocabulary is given. I fully recommend this book, a complete course in tape recording and hi-fi, to beginners and semi-technical readers.

D. K.

★ ★ ★

Magnetic Sound Recording—by D. A. Snel. 230 pages, illustrated. £1 6s. 6d. Published by Philips Technical Library.

THIS book is an enlarged edition of the popular original by Snel. Written for the enthusiast as well as the expert, it contains a great deal of useful information laid out in a pleasant, easily understood, manner. The author gives a detailed explanation of the theory of magnetism, recorder design, tape, amplifiers, loudspeakers and microphones. He describes how the recorder can be used in education as well as an entertainer in the home. This book deserves a place on every enthusiast's shelf.

★ ★ ★

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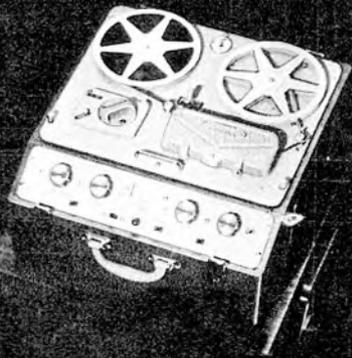
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TAPE RECORDS REVIEWED



THIS month we have half a dozen 3 1/2 i/s mono tapes, covering modern Russian ballet, ballroom dance music, pop songs, jazz, Viennese and Czech Operettas, and German Lieder.

Starting in Russia, there is a suite of pieces from the ballet *Gayaneh* by Khachaturian. This is performed by the London Symphony Orchestra under Anatole Fistoulari on *World Record Club TCM 41*. The suite commences with the well-known *Sabre Dance*, made popular through innumerable performances in various arrangements by Western bands and orchestras. The rhythmic impact of this piece is typical of Khachaturian's wilder moments, but the music is colourful and lively throughout, with bright rhythmic sections interspersed with quieter passages on the strings. Much of the material is based on Armenian Folk music.

The whole tape is delightful, and one is constantly impressed by the fact that good modern ballet music can be so very tuneful, rhythmic and pleasant. The recording is very clear and clean.

★ ★ ★

We now move from the studied choreography of the stage to the informality of *Come Dancing*, with Joe Loss and his Orchestra on *HMV TA-CLP 1370*. This tape is simply what its title implies: an invitation to dance. There are six quicksteps, four waltzes and two foxtrots, all played very clearly in a good, lively, foot-tapping style. This is excellent stuff in the Joe Loss tradition, and many well-known tunes from the Shows have found their way into his arrangements. The recording is bright and crisp.

★ ★ ★

A smaller group of players provides some good listening on a tape called *Jazz Giant*. This is *Saga STG 8062*, with Coleman Hawkins (the "giant") on tenor saxophone, Wendell Marshall (string bass), Eddie Bert (trombone), Earl Knight (piano), Ernie Royal (trumpet), Sidney Gross (guitar) and Osie Johnson (drums).

This is fine modern jazz, comprising eight items which give the various soloists their chance. But Hawkins is obviously the cornerstone of the group with his outstanding saxophony; in the item *I'll String Along With You* his expressiveness is so fine that one is brought very near to the sound of a voice. The recording brings the sax appropriately near, and our one objection is to the use of the worst type of electronic organ tone as a background fill-in at times.

For a big contrast we move from the modern improvised chamber music called jazz to the tuneful sparkle of Viennese Operetta in the form of *The Chocolate Soldier* by Oscar Straus (unrelated to the Strauss family). On the same tape, *WRC TT 210*, is *The Firefly* by Rudolf Friml, who came from Prague. The performers in both are Laurie Payne, Stephanie Voss, Barbara Elsy, Pauline Stevens and the Linden Singers.

Five items and an overture are included from each work, and performances are competent though lacking the zest of a stage production. These two Operettas are full of memorable tunes and will probably have a nostalgic appeal for some older folk. *The Soldier*, believe it or not, is based on G. B. Shaw's *Arms and the Man*, and *The Firefly* includes that famous piece known as the *Donkey Serenade*.

★ ★ ★

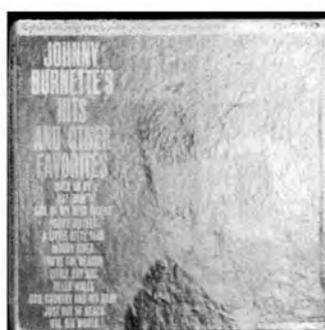
From pop music of yesterday to that of today. On *Liberty TA-LB 1006* a pop singer puts over his dozen best pieces is *Johnny Burnette's Hits and other Favourites*. Johnny is supported by a chorus and instrumentalists (mainly guitar) in songs which are all tuneful, lively and sentimental. A fine tape if you like this sort of thing.

★ ★ ★

Solo singing of an utterly different kind is found on our last tape as a *Lieder Recital* by Matti Lehtinen (baritone) accompanied by Hubert Giesen (piano), on *WRC TCM 37*. Lehtinen sings seven songs by Schubert, two each by Brahms, Schumann and Richard Strauss, and four by Hugo Wolf.

This is fine, well-controlled singing with a good feel for the music's mood. The piano is also very well played, providing a suitably dramatic accompaniment at times. Schubert was, of course, the song writer of all time—oh that we had an equivalent to set the English poets so sublimely as he did the German! This tape would be worth buying for the Schubert alone. Just try *Am Meer*, to learn how profoundly sad and moving a song can be when well sung.

Really one needs the equivalent of a disc record's sleeve notes on a tape such as this, especially when a foreign tongue is involved. Indeed one misses the extensive programme notes on all tapes when compared with discs; perhaps the tape people could think of a solution to this which does not involve great expense. There is a bare expanse inside the lid of all tape boxes which could be utilised.





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THOUGHTS ON DESIGN

THERE are, broadly speaking, four main groups of tape recorders. Professional, or studio instruments, plus their portable counterparts; semi-professional recorders which, in good hands, can do all but the most exacting work; domestic models for record and replay; and small battery portables. Of all these, only the first and the last groups can be said to be "ideal" for their respective jobs. Professional recorders are as near perfect as they can be because they are the result of a pooling of ideas—a combination of what users want and what tip-top designers and engineers are able to create. Small battery portables are relatively simple machines without the many frills that so often breed troubles. In the middle two groupings, "semi-professional" and "domestic", there are many fine instruments but, in my personal view, there are none that are truly "ideal". In these articles I intend to mention a few well-known names, primarily for the purpose of illustrating good points. If I omit to mention other names in those same connections, no offense is intended.

The semi-professional machine is in a difficult category, so far as its manufacturers are concerned, and I would not like to try to fix the boundaries in terms of specifications. From the user's point of view, however, the division is quite clear. He wants a machine that is out of the normal run in terms of quality, and his upper limit is fixed by the amount he can afford to pay for what he wants—plus, of course considerations of size, weight and mobility, and the senselessness of paying for facilities that he does not need. Semi-professional machines are used in large numbers by many people and numerous firms for very "professional" work. For example, a studio which is only interested in first-class speech recording and reproduction can get all it wants from such a machine, costing perhaps £200. It would be pointless to spend £600 on a more "professional" model.

From a quick glance at the instruments which are usually grouped as "semi-professional", and memories of handling most of them, there are a host of fine features to be found. Some possess more than one; none have all, and I am still waiting—and hoping—for the "ideal" semi-professional recorder to come along. The argument against such hopes being realised (always assuming that my "ideal" would be that of every-one else!) is that the money which would have to be spent upon its development would demand far greater sales than the "semi-professional" market could promise. I do not agree with that argument, for two very good reasons. First, I am very confident that there is a large and rapidly growing potential market for better quality recorders; second, the machine that I have in mind, in outline, could automatically be priced by its purchasers, according to needs of the moment.

Vortexion (I believe) were the first to introduce a bias adjuster on their recorders, enabling the level meter to be used for this adjustment when using different types of tapes. Bradmatic pressure pad arrangements facilitated editing, and this firm offered electromagnetic button control. Wearite, Brenell and Bradmatic decks make provision for extra heads. All these features would be part and parcel of my ideal, which would also have tape tension arms to isolate both spools from capstan and heads. EMI went a long way towards my ideal, in one direction, and then stopped short of it in others. The EMI TR52 has some really excellent features, and its electronic arrangements are exceptionally good—five slide-in units, replaceable in a matter of a minute, fitted with plug connections—2 record amplifiers, 2 replay and 1 monitor. If one of either of the *record* or *replay* units develops a fault it can be swapped round, pending a re-conditioned one's arrival.

But how about a deck, as the basis for the "ideal", with plug-in positions (or bayonet lock-in) for full track, half track and quarter track heads, for *record*, *replay* and *erase*—a deck with isolating tape-tension arms, (or hubs), with rheostat control to govern *fast wind* speed in either direction, with electromagnetic controls and indicator lights, and a

positive tape position indicator driven by the tape as it travels. The EMI professional TR90 has the last 4 items.

Such a deck would naturally be expensive—but not prohibitive. It would be advantageous to have the capstan motor running at constant speed, for instant stop and re-start of tape, and tape hub spacing should be sufficient to accept NAB spools. 2-speeds would suffice.

To accompany this "ideal" deck would be a standard series of tape heads and a series of electronic units, slide-in, plug-in, on the EMI principle. The user who merely wanted a good deck, plus full-track mono *record* and *replay* facilities, could thus buy the deck and frame and power pack, together with 3 full-track heads and 2 amplifiers. The user who wanted half-track facilities would buy them instead. He could later convert to stereo *replay* at the cost of one more head and one amplifier. Another stereo head and *record* amplifier would give him full stereo. He could then, if he wished, complete the outfit by using a stereo *erase* head, instead of full-track.

There could be more advantages in such an "ideal" combination than are immediately apparent. The ability to purchase a fairly simple set-up, with the knowledge that its future usefulness and potentialities and elaboration were assured at the time of buying, would certainly be a very great attraction. Servicing of all electronics would be tremendously simplified, and it would be reasonable to imagine that dealers handling such equipment would also carry "one each" of the standardised electronic units. With a careful control of all heads, so that their characteristics were within the range of the adjustments on the amplifier units, the setting-up of the recorder after any change would be a simple matter.

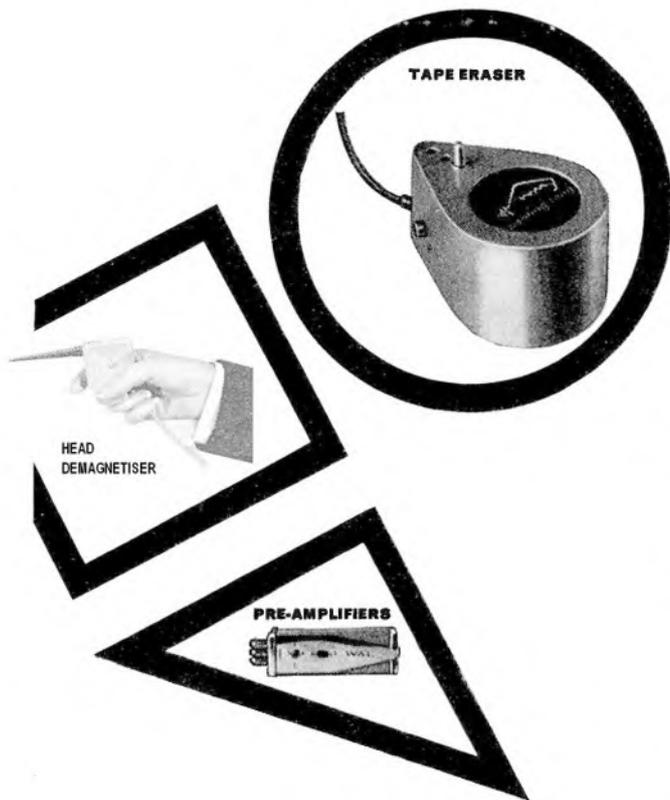
However, so much for a lovely pipe dream. It will take more than a few dozen "hear-hears" to encourage any manufacturer to produce such an outfit, however much he might like the idea. Even less would he like the task of adding one final master touch, which might open the doors to the very interesting small-gauge cine market—making provision for a sprocket attachment to replace the normal capstan/pinch-roller drive, so that perforated tape could be recorded for the dubbing of smack-on sound to edited, magnetically striped films! But even though we may still be a long way from such things, there are surely one or two items from all the above that could be incorporated into decks, or recorders in the "semi-professional" category.

Fast Wind should be really fast, but it should be controllable. The rheostat form of control used on professional machines is a relatively simple idea. At central, or "zero" position the voltage on both rewind motors is balanced, and the tape is held stationary. According to the direction and degree that the control knob is turned, so are the voltages varied, giving a free swing from full ahead to full astern.

Electromagnetic controls, operated by finger-light push buttons, are not an extravagance to ask for in a mains-operated machine. These, coupled with control of *fast wind* speed, make serious working with tape a pleasure, and they save hours of time in a busy week. Also, as users of professional machines know well, the only accurate method of place-finding involves the use of an indicator driven by the moving tape—not by the spool hub.

A capstan motor that runs continuously when the recorder is switched on, and which does not stop when the tape transport system is switched off, makes certain of clean stops and starts in recording. It cannot be a very costly facility, for it only involves a change of switching. The provision of a pair of sprung arms with rollers, one on each side of the head assembly, would take away many "wow" headaches that are caused by sticking tape or uneven spools.

Perhaps, somewhere, someone is at work on the drawing board, planning a deck as the basis for next year's "semi-professional" model. Perhaps, if so, he may be tempted to add in one or two of the above features? Perhaps all of them. I can promise him one customer if he does!



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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.



★
Truvox R.92

★
THE TRUVOX R.92 is one of the latest recorders to be introduced in the Series 90 range. It is available with two or four tracks. Recording level is shown by a meter and mixing facilities allow simultaneous recordings to be made from microphone and radio. The machine has three speeds; $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{3}{4}$ i/s. Wow and flutter is claimed at $\cdot 1\%$, $\cdot 15\%$ and $\cdot 25\%$ respectively. Spools of up to 7 in. diameter can be used and fast-wind speed is sixty seconds for 1,200 ft. Frequency response at $7\frac{1}{2}$ i/s is given as $40 - 17$ Kc/s ± 2 dB. The price of the R.92, and its four track equivalent the R.94 is £72 9s. Manufacturers: Truvox Limited, Neasden Lane, London, N.W.10.

★ ★ ★

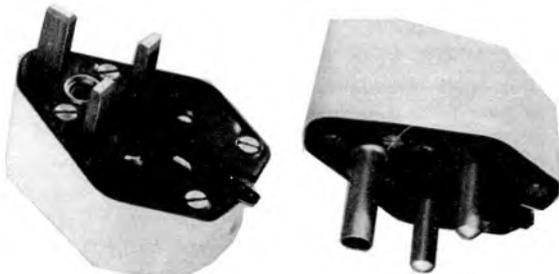
The Nusound "Nukit"

NUSOUND have just announced a cleaning kit designed for use with domestic tape recorders, the *Nukit*. They claim that 60% of tape recorder faults could be avoided by regular cleaning and lubrication. To this end they have formulated a hypodermic motor-oiler, a bottle of cleaning oil, a cleaning agent for neoprene capstans, a fluffless cleaning cloth, a head cleaning brush, and three soft-wood cleaning sticks. The price of the complete outfit, packed in a transparent plastic case, is £1. They can be obtained, post free, from: Nusound Recording Company, 93 Mortimer Street, London, W.1. (Note change of address).

★ ★ ★

Universal Mains Plug

ONE of the greatest problems experienced by recorder owners is the fuss and difficulty which occurs when machines are taken to club meetings or friends who, invariably, have different mains plugs and sockets. A universal mains plug is the only satisfactory solution to this annoyance and it is surprising that such a gadget was not invented long ago. Now, however, such a plug, the *Fitall* has been introduced which is easily adjustable to fit 13A square-pin, 5A three-pin, 15A three-pin, 15A two-pin, and 5A two-pin sockets. Incorporating a built-in fuse, the



plug is adjusted by means of a selector lever which ensures the selection of the correct pins for the particular socket required. Available only in white, the *Fitall* costs 11s. 6d. plus 1s. postage. Details are available from the suppliers (send stamped addressed envelope): J. L. Tofts, 305 High Street, Ponders End, Enfield, Middlesex.

★ ★ ★

S. T. C. Microphone

A NEW microphone recently brought out by Standard Telephones and Cables is designed for the recording enthusiast of limited means who nevertheless wants to improve the performance of his equipment. The new microphone, the *STC 4118* is a moving coil "stick" type available at 200 ohms and 50,000 ohms impedances. Frequency response is claimed at 100 c/s to 10 Kc/s ± 4 dB and the list price is £4 19s. 6d. Manufacturers: Standard Telephones and Cables Limited, Connaught House, 63, Aldwych, London, W.C.2.

★ ★ ★



★
Telefunken Portable
Tape Recorder

★
THE latest recorder to be announced by Telefunken, the *Magnetophon 300*, is claimed to be the smallest amateur battery portable manufactured in Germany. Measuring approximately $11 \times 10\frac{1}{2} \times 3$ ins. it has a maximum spool size of five ins. An unusual feature is the location of the pause and gain controls in the handle. Frequency response is specified as 40 c/s to 13 Kc/s at the single speed of $3\frac{3}{4}$ i/s. The distributors of this recorder, the price of which has not been given, are: Welme Corporation Limited, Lonsdale Chambers, 27 Chancery Lane, London, W.C.2.

★ ★ ★



★
Weircliffe Bulk Eraser

★
DESIGNED for professional and semi-professional recordists, the *Weircliffe Bulk Tape Eraser* is designed to remove all recorded matter from tape reels and cassettes. Two standard models are available, *Model 6* taking spools up to $8\frac{1}{2}$ in. diameter, and *Model 7* taking cassettes up to $6\frac{3}{4} \times 8$ ins. Both models are housed in mahogany cases with perspex panels. Dimensions are $11\frac{1}{2} \times 12\frac{1}{2} \times 7\frac{1}{2}$ ins. and the weight is 33 lbs. Current consumption is approximately 14A. The price of the eraser is £29 and the manufacturers are: Amos of Exeter Ltd., Weircliffe Court, Exwick, Exeter.

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" ST454	...	57	6
" ST459	...	84	-
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" TK.8	...	63	-
" TK.14 & 23 & 18	...	59	6
" TK.20	...	52	-
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" TK.25	...	55	-
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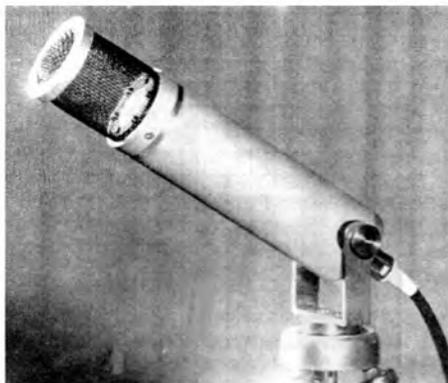
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EQUIPMENT REVIEWED

★
MICROKIT
CONDENSER
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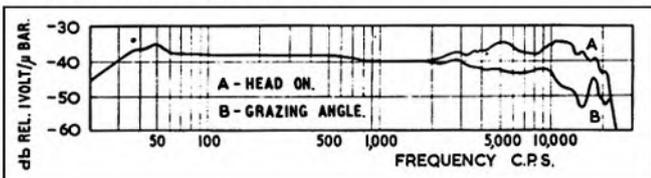
★

Manufacturer's Details: Condenser microphone with precision capsule. **Directional properties:** Substantially omni-directional but cardioid on axis of capsule. **Output impedance:** 600 ohms cathode follower. Available in kit form or assembled and tested. **Price:** Kit, 20 gns.; assembled, 25 gns. **Distributor:** Chateau Productions Ltd., 25 Denmark Street, London, W.C.2

THE description in the February and March issues of our sister publication *Hi-Fi News* of the Microkit Condenser Microphone (which must surely be the world's first 'do-it-yourself' microphone) aroused considerable interest (and a little envy) on the part of your reviewer. The articles showed that considerable thought and ingenuity had been expended in producing a complex and precise piece of electro-acoustic engineering.

The condenser microphone is as old as the art of sound reproduction and examples were produced during the 19th century; but it was not until 1919, when Wenthe and Thuras produced their famous Condenser Transmitter at the Bell Telephone Laboratories in the United States, that a workable Condenser Microphone was produced. This microphone was the first high fidelity unit to be produced anywhere and, it is suggested, owes much to the inherent basic simplicity of the condenser microphone (which consists of nothing more than a thin diaphragm supported at a suitable distance from an insulated backing plate which forms the live electrode). I said "nothing more" with my tongue in my cheek because the diaphragm itself must be perfectly flat, perfectly stretched and of only a few microns in thickness. The separation between the diaphragm and the backing plate is usually of the order of a thou' or so and the system must obviously be of extreme mechanical rigidity and stability.

The original Wenthe microphone underwent a number of changes and the reviewer is still using one Western Electric microphone produced according to the Wenthe philosophy in the early '30s. It is rather a large beast, about 3½ inches in diameter, with a diaphragm resonance at about 6 Kc/s but a rather large cavity resonance at 2½ Kc/s. These were originally equalised by means of electrical circuits and for the last 15 years it has worked as a master transducer in a standard artificial ear. Periodic checks of the microphone show a long-term stability better than 1 dB!



Condenser microphones have been extensively used in the past, particularly in film recording studios where the magnetic shielding of dynamic microphones can be difficult, but they never caught the fancy of either the broadcasting authorities or the general British public until recently, with the advent of Neumann and, later, the

A.K.G. microphones. These are beautiful instruments but are completely out of the range of the pocket of the average home recording enthusiast. Whilst the performance of the best ribbon and moving coil microphones is beyond reproach, this performance is obtained by various artifacts and not from an inherently resonant-free system. As mentioned before, the condenser microphone should only have one fundamental resonance, usually in the 7 to 10 Kc/s region. This resonance can be damped until it is aperiodic by means of acoustic damping provided by small diameter holes in the back plate, after which the pressure response drops at -6 dB per octave. The response is, however, maintained to about 20 Kc/s due to the obstacle effect of the microphone diaphragm and housing.

The response curve shows that the microphone is sensibly flat from 30 c/s to 20 Kc/s in the 'head-on' position. The two peaks at 5 Kc/s and 11 Kc/s are due to the diaphragm resonance and the first mode resonance of the front case respectively. At grazing angle, the response drops 2 or 3 dB at 10 Kc/s and then dies rather rapidly, apart from the peak at 18 Kc/s. The result is that when the microphone is used under studio conditions, the response is substantially flat to a limiting frequency of 18 to 20 Kc/s, and this, ladies and gentlemen, is no mean feat in a microphone selling for £20; it would do credit to microphones costing five times that amount. The measured distortion is less than 0.5% over the whole frequency range at a level of 100 phons, rising to 7% at 30 c/s at a level of 140 phons. As the loudest orchestral crescendo is never likely to be more than 105 to 110 phons, the distortion introduced by the microphone is negligible compared with that of other links in the recording and reproducing chain.

When Mr. Morris delivered the microphone to me, he brought with him a tape produced by an amateur at a rehearsal of a midlands Symphony Orchestra. The balance was extremely good, the string tone having a 'bite' that one expects from an excellent transient response and smooth frequency characteristic. Not having the resources of a Symphony Orchestra, your reviewer had to make do with piano and voice recordings. A TR 52 Recorder was used and we met some matching problems. A 600 ohm/25 ohm matching transformer was, however, completely satisfactory and no trouble whatever was experienced due to magnetic hum pick-up or earth loops. (It should be noted in parentheses that the output of the microphone is taken through a normal coaxial audio socket of the power supply, the ground of which is isolated from the power supply carcass. The only earth used on the system was taken from the Recorder, no earth being used on the microphone directly.) The second test was used with the Revox Tape Recorder E 36, the output of the microphone being connected directly to the microphone input of Channel One. The sensitivity was more than adequate and the background noise to all intents and purposes negligible.

My wife's lounge doubles as a studio for these experiments and is about 18x15x10 ft. A 7 ft. 6 in. Bluthner piano is the source of sound, and in my opinion (hotly disputed by the distaff side) due to

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EQUIPMENT REVIEWED—(continued)

inadequate drapes and furnishings, the room is live and reverberant; additionally, due to the Aliquot tuning of the Bluthner the two top octaves have a 'live' singing quality. This makes it a most difficult instrument to record satisfactorily, although when conditions are right it sounds magnificent.

The microphone was tried in various positions of the room, and eventually the optimum position was found in the open doorway facing the open lid of the piano, situated about six feet away. Balance was good, the sound was not too reverberant, and the bass response was well maintained. The results were replayed through an EMI TR 135, Quad 22 Amplifier, and my own Loudspeakers, and A/B changing from recorded to live showed a high degree of realism, especially when one listened through the open door in the hall.

Voice is especially good, there is no chestiness sometimes found with ribbon microphones used at close distances, and due to the omnidirectional sensitivity, positioning of the speaker or singer is not important; although in some circumstances the bidirectional characteristics of a ribbon can be helpful.

The microphone was delivered for review completely assembled and was, I believe, assembled by the manufacturer of the kit. The finish is well up to semi-professional standards, the microphone in particular having a strong family likeness to the studio condenser microphone currently being used professionally. I understand that the microphone capsule itself is now being supplied as the complete unit rather than risk damage to the foil diaphragm at the hands of those not quite as skilled as should be in the mechanical arts. Having had considerable experience in the production and use of thin metallic films I heartily applaud this step and add a word of warning to any purchasers of this unit: Do not, under any circumstances, approach the diaphragm with index finger, screwdriver, or other instrument. If the diaphragm is touched it will most probably be damaged beyond repair! The connecting cable between the microphone and pre-amplifier power supply was very flexible, considering the five conductors, shielding, etc., and of adequate length (in this case, 15 feet).

I have two criticisms. The power supply case is sand-blasted aluminium and because of the handling it received during these tests the surface has become dirty and rather scratched and now looks somewhat scruffy. Doubtless either anodising the case or a coat of lacquer would obviate this particular point. The other criticism is a little more serious. When the plug is inserted in the bottom of the microphone housing it is not possible to put the microphone in a vertical position. It can, of course, be argued that no one wants the microphone in a vertical position, but a swivel is provided to allow for adjustment of the operating angle—if it is made about an inch longer all will be well.

To summarise: The performance of the microphone is excellent, the sensitivity is more than adequate for all normal domestic recording situations. It is mechanically robust and stable and the components are of excellent quality. In common with all other pressure microphones in which polar response is omnidirectional, care must be exercised in correct placement of the microphone, but when used properly the results are certainly as close to professional standards as make no matter. Taking into account the minor mechanical criticisms, this microphone is excellent value for the money and can be confidently recommended to the enthusiast who wants something better than the 'run of the mill' dynamic microphone at present offered to the recording enthusiast.

Stanley Kelly.

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AC adapter NC1 £4 4s. Distributed by C. Braddock Ltd. The Tape Recorder Centre (Blackpool) Ltd., 266 Waterloo Road, Blackpool, Lancs.

REGULAR readers will know of my interest and enthusiasm for portable tape recorders. I think they offer a challenge to the designer which is much more difficult to satisfy than that of a static home recorder where weight, size, power supply, etc. are not limited.

I also find that most of the events I want to capture in sound occur well away from mains supplies, or would be lost if time were spent in locating a mains point, changing plugs, etc. With a good portable recorder you are as free as the air. In a glider or down a coal mine you can record comments or sound pictures which could not be obtained in any other way. This is not to say that the static mains recorder does not have a place in the scheme of things. It can be used to play recordings made on the

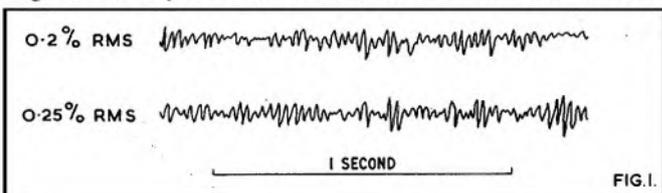


portable recorder, or to re-record sounds recorded on the portable machine together with a linking commentary to join the fragments of sound into a coherent pattern.

The second machine allows copying, dubbing, re-recording with different levels and frequency balance, etc., and can save an enormous amount of tedious tape editing. Not all portable recorders are suitable for this work; these must be a constant tape speed so that recorded tapes can be played on the static recorder; dynamic range must be high so that the minimum of noise is added to duped recordings; and a wide range of tone control is desirable so that recordings made in different locations, or at different times with various types of microphone, may be blended without obvious and annoying changes of quality.

The reason for all this preamble is that the machine under review does all these things extremely well, as can be seen by the following tests.

Combined wow and flutter remain constant at between 0.2 and 0.25% RMS (fig. 1). Wow is extremely low due to the use of a fairly large diameter capstan which runs true to fine limits. Flutter at 50 c/s



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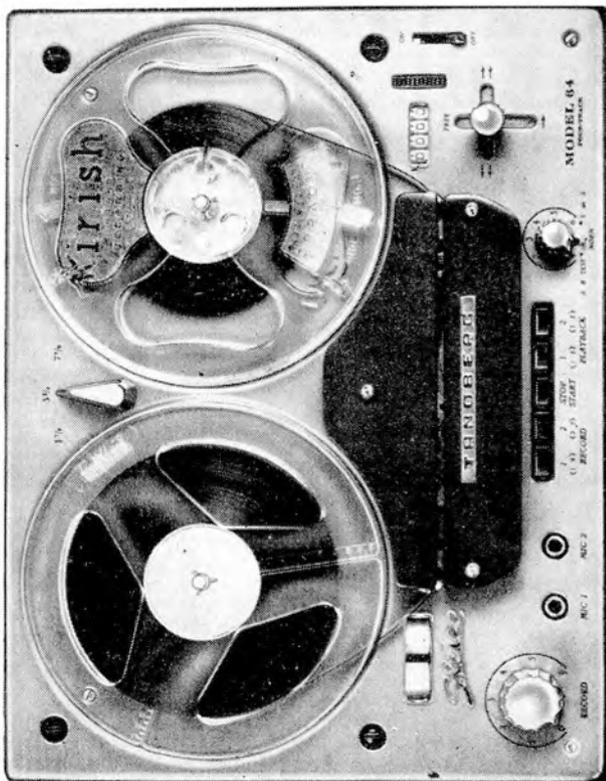
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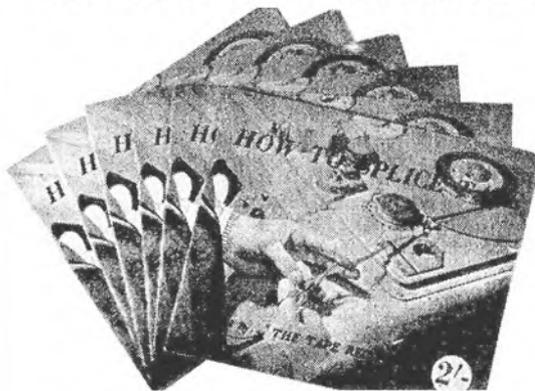
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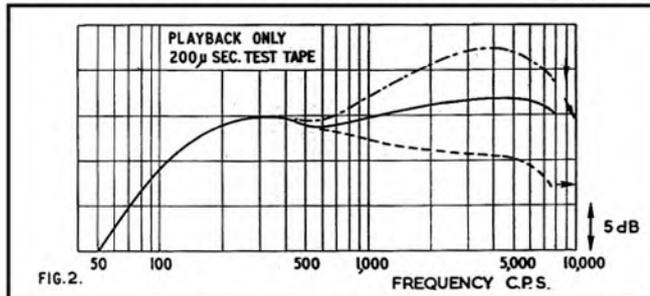
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EQUIPMENT REVIEWED—Continued

accounts for most of the combined reading, and this occurs at the drive motor speed of 3,000 r.p.m. As mentioned in other reviews, the ear is very tolerant to high frequency flutter, and the amount measured on this recorder is not audible on most programme-content. This is all the more remarkable when one realizes that there is literally no flywheel in this unit; the high speed rotor of the motor does the main smoothing; the disc attached to the capstan is used as a speed reduction device and has little mass. If it had, it would be more of a liability than anything else as the machine would be much more sensitive to movement.

Playback only Response

A CCIR 200 microsecond $3\frac{1}{2}$ i/s test tape was loaded on the machine and the response measured at the line output at various settings of the tone control (a word of explanation of the arrow markings on fig. 2 is



called for here. The tone control ring knob, which is coaxial with the volume control knob, has no calibration markings, but, on my machine, the grub screw was at 6 o'clock when the ring was turned fully clockwise). It will be seen that this is rather more than a simple top-cut control, it does in fact vary the time-constant in a feed-back circuit so that it can be used for fairly accurate matching of various recording time-constants. The range of control shown on fig. 2 is covered by a quarter turn of the knob; turning the knob further in an anti clockwise direction tilts the response even further in the direction of the lower curve.

Record Play Responses

Fig. 3 shows the overall record replay response from radio input to line output. The tone control arrows have the same meaning as in

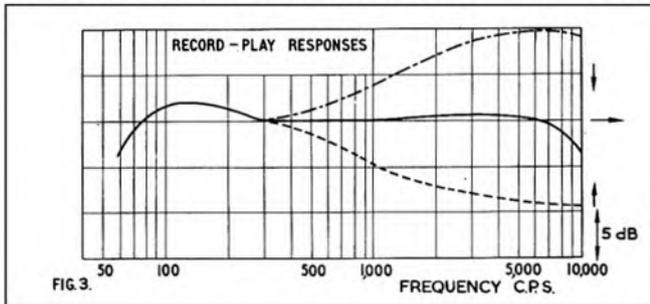


fig. 2. As the most level response, indicated by the solid line, is obtained with the playback tone control at 3 o'clock, corresponding to the lower curve of fig. 2, it can be deduced that the recording characteristic is close to the 100 microsecond characteristic favoured by many Continental designers.

Indicated peak-recording level, with the magic line beam just extinguished was 10 dB above test-tape level, but the level could be increased a further 3 dB without noticeable waveform distortion.

Signal-Noise Ratio

System noise, with no tape running, was 45 dB below test-tape level or 57 dB below peak recording level. Bulk erased tape noise was 40 dB below test-tape level or 52 below peak, and tape erased on the machine with the gain control at zero was 38 dB below test-tape or 50 dB below peak. With system noise so low, tape noise becomes the limiting factor and readers can see why I can recommend this little machine for dubbing or copying tapes.

Continued on page 435

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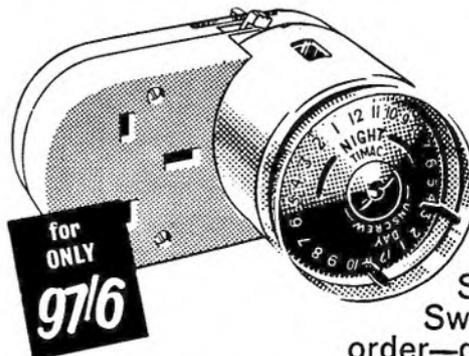
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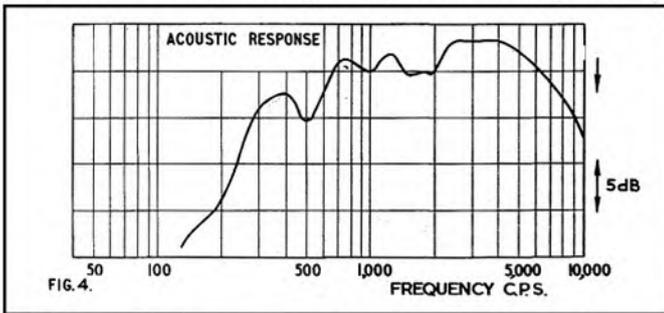
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EQUIPMENT REVIEWED—Continued

Acoustic Responses

The combined responses of the electronics and loud speaker were measured by recording bands of filtered white-noise and measuring the sound output on replay with a calibrated microphone. Fig. 4 shows the response with the tone control fully advanced for maximum top response.

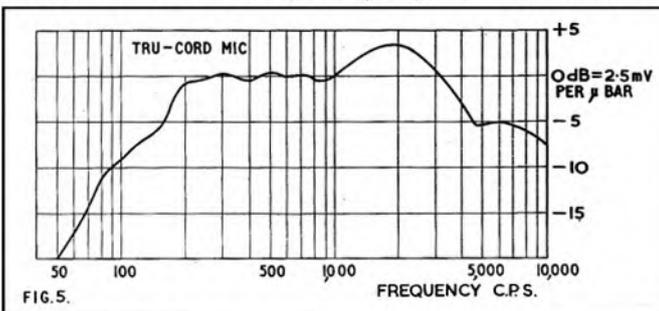


The microphone response was also measured in a white-noise sound field and its response is shown in fig. 5.

Mechanical motor noise was very low indeed and the microphone could be held in the same hand as the recorder with practically no indication of their close proximity on the recorded tape.

Circuit Notes

An unusual feature in transistor circuits is that the input stage is connected as an emitter-follower during recording so that the input impedance is quite high. The microphone supplied is a dual impedance model, but the 50K output is the one used with this machine. A crystal microphone can be used, although the input impedance is not really high



enough to record a level response from such a high impedance device. Nevertheless the wide-range playback tone control can be set to give excellent speech quality from such a microphone.

Motor speed control is effected by the OC79T transistor, and efficient filtering accounts for the very low electrical motor noise in this machine.

Comment

A versatile and extremely well designed little recorder, ideal as a "number two" for the enthusiast who wants to extend the scope of his recording activities as suggested in my opening paragraphs. On the other hand, it gives an extremely good account of itself when powered from the AC adapter type NC1 as a semi-static main recorder.

I was very intrigued to find that the adapter plug could be removed or inserted into the recorder socket, to change over from battery to mains or vice versa, with no break in a recording, or playback of a recorded tape.

I did find it essential to press the playback key *before* the R.H. knob is turned to put the tape into motion. If it is pressed after the tape is started, a low frequency "bonk" is added to the recording which will only be noticed when the tape is replayed on a later occasion. **A. Tutchings.**

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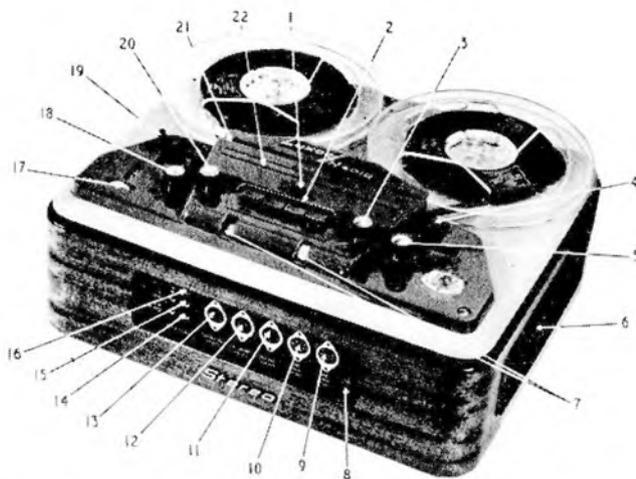
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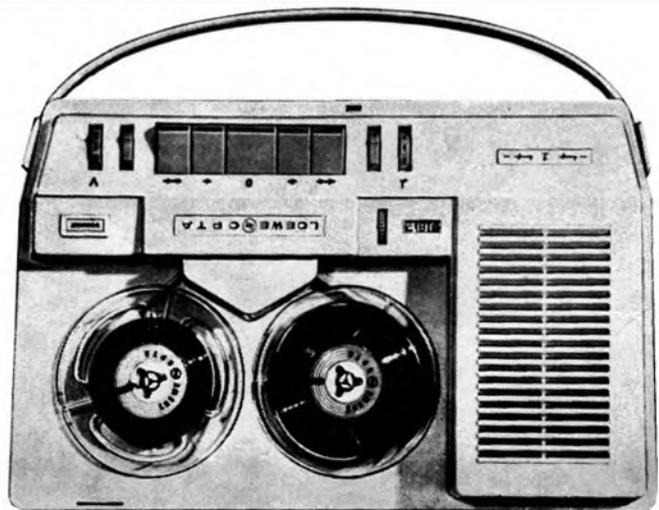
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