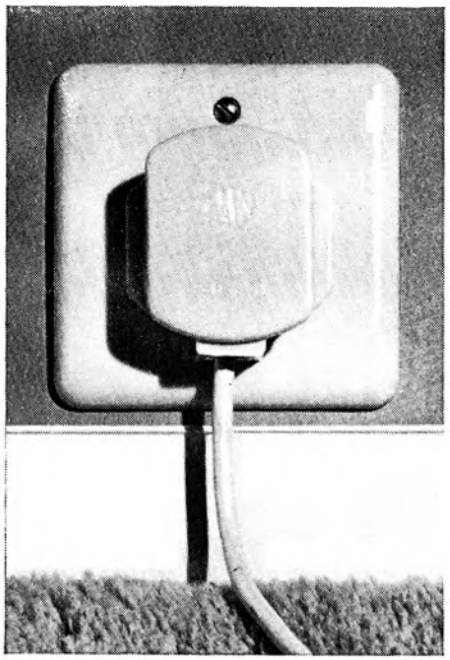
— INCORPORATING "SOUND AND CINE"

tape recorder

JUNE 1964 Vol. 6 No. 5 Price 2 /-

■ STUDIO MIXER ■ BATTERY PORTABLE FIELD TRIAL
■ TOWARDS BETTER TAPING ■ TAPE RECORDER SERVICE



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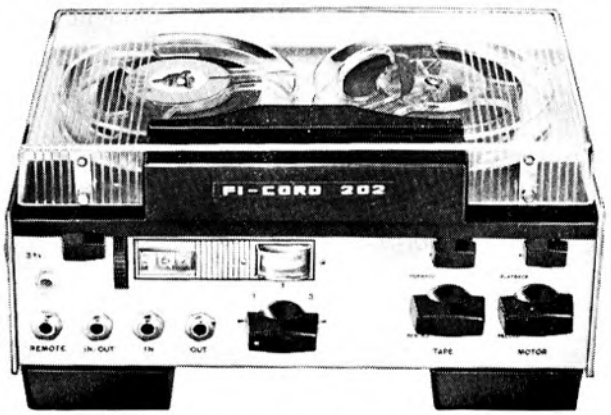
The FI-CORD 202 high fidelity recorder lets you off the lead for on-the-spot recording

No bigger than a satchel and just 6¾ lbs. the Fi-Cord 202—now available using rechargeable batteries—combines all the advantages of full size equipment with absolute portability. Hand-built to professional standards, this is the recorder chosen by major broadcasting companies throughout the world. No other equipment offers such flexibility at such modest cost.



FI-CORD 202

BRIEF SPECIFICATION

- ✳Wide frequency response: 50-12,000 c.p.s. ± 3 d.b. at 7½ i.p.s.
- ✳2 speeds: 7½ and 3¾ i.p.s.—giving up to 48 minutes of recording per track using standard 4″ spools.
- ✳Vu-meter and battery indicator.
- ✳Constant motor speed with wow and flutter figure of less than 0.3 r.m.s. at 7½ i.p.s.
- ✳Twin output sockets for any microphone with an impedance from 20-1000 ohms. Two microphones can be used simultaneously.
- ✳Separate batteries operating motor and electronics to reduce motor noise to a minimum.
- ✳Remote control socket for greater versatility
- ✳Built-in speaker for monitoring.
- ✳Size: 9″ x 6¼″ x 4½″.
- ✳Fast forward and fast rewind.
- ✳Many extras available including black calfskin carrying case, microphones, headphones, amplifier/speaker unit and transistorised mixer.

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Models TA-IM and TA-IS
The monophonic version (TA-1M) can be modified to the stereo version (TA-IS) by modification kit (TA-IC). Special features include the provision of a bias level control easy-to-read thermometer-type recording level indicators; large printed circuit boards. Both models have identical presentation. **TA-IM £19.18.0 kit**
TA-IS £25.10.0 kit TA-IC £6.15.0 kit
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TA-IS £35.18.0 Assembled


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Standard. High-quality stereo tape decks. D93/2 2-track for highest fidelity £36.15.0
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With TA-IS £58.10.0
D83/4, 4-track, for most economical use of tape. £29.8.0 With TA-IM £46.0.0
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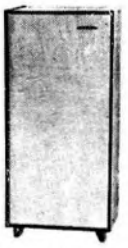
UMC-1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"COTSWOLD" MFS SPEAKER SYSTEM
A minimum floor space model. Size 36in. high 16½in. wide × 14½in. deep with performance similar to the standard model. Specially designed for small rooms.

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POWER AMPLIFIER 12-WATT Model MA-12. 0.1% THD at 10W. Wide frequency range. Ideal for use with USC-1 and UMC-1. **£11.18.0 kit**
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COLLARO "STUDIO" TAPE DECK. Operating speeds: 1⅞ in., 3¾ in. and 7½ in. p.s. Wow and flutter not greater than 0.15% at 7½ in. p.s.
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Push-button selection, accurately matched ganged controls to ½ 1dB. Negative feedback, rumble and variable low-pass filters. Printed circuit boards. Accepts inputs from most tape heads and any stereo or mono pick-up. **£19.10.0 kit**
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HI-FI FM TUNER, Model FM-4U
For your convenience, this model is available in two units sold separately: Tuning Unit (FMT-4U—**£2.15.0** including P.T.) with 10.7 Mc/s I.F. output, and Amplifier Unit (FMA-4U—**£13.3.0**). Built-in power supply; 7 valves. Total **£15.18.0 kit**


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HI-FI MONO AMPLIFIER. Model MA-5. A general purpose 5 w. amplifier with inputs for Gram., Radio. Presentation similar to S-33. **£15.10.0 Assembled £10.19.6 kit**

AM FM TUNER. Model AFM-1. This model is available in two units sold separately Tuning heart (AFM-T1 **£4.13.6** incl. P.T.) IF Amplifier (AFM-A1 **£21.16.6**) range 88–108 Mc/s (FM) 16–50, 200–550, 900–2000 (AM). Printed circuit board. Total price **£26.10.0 kit**

HI-FI STEREO 6-WATT AMPLIFIER Model S-33. Attractively styled. Printed circuit construction. 0.3% distortion at 2½ W. chal.; sensitivity 200 mV. ganged controls; low cost, compact unit for smaller rooms **£13.7.6 kit**
£18.18.0 Assembled

DE LUXE STEREO AMPLIFIER Model S-33 H. De luxe version of S-33 with many refinements. Ideal for use with Decca Deram pick-up. **£15.17.6 kit**
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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.
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SUGDEN MOTOR UNIT "CONNOISSEUR CRAFTSMAN". Heavy duty motor operating at 33⅓ and 45 r.p.m. Very heavy 12 in. turn-table. Virtually no rumble.
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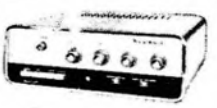
£37.19.6 Assembled



TRANSISTORISED TELEPHONE AMPLIFIER. Model TTA-1. Provides instant group listening and conversation. Freely portable for use with any telephone; hands-free operation; automatic switch; 9v battery operated; compact and neat cabinet.
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HI-FI SPEAKER SYSTEM Model SSU-1. This kit is easily assembled. It contains two speakers and balance control in its ducted port reflex cabinet. It is equally suitable for stereo or mono in average room. (Legs 14/6) Less legs, **£10.17.6**

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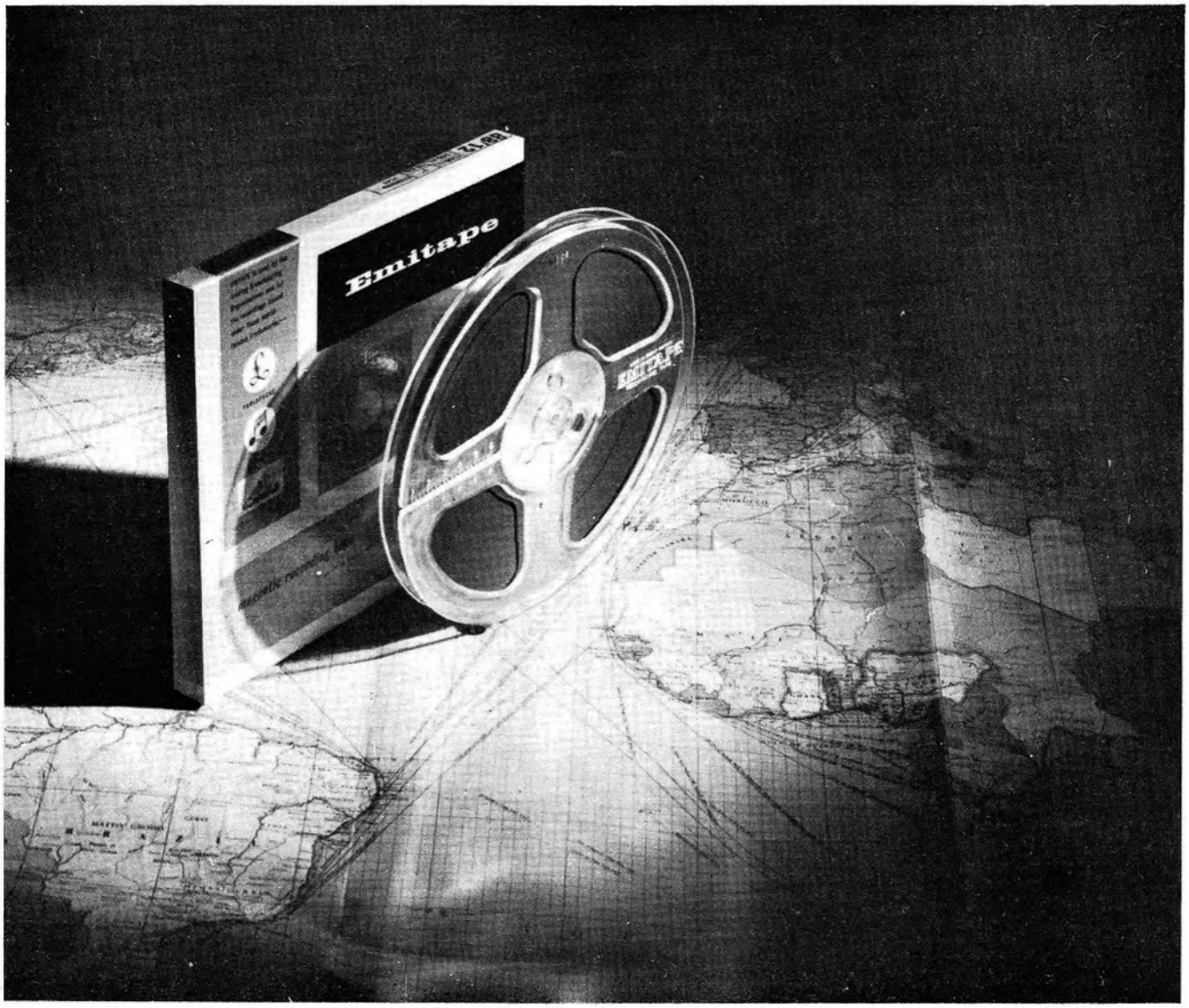

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EMITAPE was developed for use by EMI, the world's largest recording organisation. Emitape is the choice of the BBC, and the Emitape that meets the exacting requirements of these famous names is the tape you can buy from your local dealer.

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You can learn all about sound, through sound, on **EMIGUIDES**—six instructional tapes on the basics of recording . . . 8/6 each, or 51/- the set. To cap this series, Emitape have produced a book, *Emitape Guide to Better Recording*, by John Borwick. Clear and easy to follow, it costs only 2/6.

The Emitape Accessory Kit contains everything the enthusiast is likely to need. Three reels of leader tape, one of metallic stop foil, one of jointing tape, and a jointing block —all in a special Emitray container. And all this for only 37/6. Ask for Emitape by name. **You can rely on it . . . the BBC does!**

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Please send me a copy of 'Emitape Guide to Better Recording'. 2/6 postal order enclosed.

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TAPE RECORDER

JUNE - - - - - - - - - - - - - - - - - - 1964
VOL. 6 - - - - - - - - - - - - - - - - - NO. 5

Editor - - - - - - - - - - - - - **MILES HENSLOW**
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Advertisement Manager - - - - - - - - - **Robin Wells**
Editorial and Advertising Offices
Link House, Dingwall Avenue, Croydon, Surrey
Telephone - - - - - - - - **MUNicipal 2599 (12 lines)**

Contents

EDITORIAL

NORMALLY, when writing this column, one dips the pen into the editorial 'we' and shelters behind the cloak of impressive anonymity. This month, however, there is a very good reason for the use of the first person singular.

It is just over five years since I and my colleagues produced the first number of *Tape Recorder*. The print order was for 10,000 copies, and I remember how nervous we all were as we made the decision! To my complete amazement and gratitude we sold out. Furthermore dozens of readers took the trouble to write to say how much it was appreciated, and we received so many repeat orders that we ordered a reprint of an extra 3,500!

Five years is a long time, and almost every ensuing week of that time has brought its share of new and friendly contacts with the world of people who are interested in the various branches of tape recording —readers, advertisers, manufacturers, contributors. At first the 'contacts' were made at close quarters, but as the years passed the mailbag grew heavier and began to include postage stamps from every corner of the world.

These five years *Tape Recorder* has been an exhilarating experience and I am often bewildered when I think back over all that has happened at 99 Mortimer Street during the preparation and production of three score numbers of the magazine. And the reason for all these observations and reflections in the first person singular is that this is probably the last time I shall be writing for this column, for I am handing over the magazine to another publishing house as from this number—Volume 6, No. 5—and I want to be certain that all readers, advertisers, distributors and friends, in every branch of this thriving and growing hobby, know that I am personally deeply appreciative of the help and support that I have enjoyed.

The future of the magazine should be considerably brighter in its new hands than it could ever have been in mine, for *Link House Publications Limited* is a much larger and much more efficient organisation than *Miles Henslow Publications Limited!* Editorially, and in terms of advertising the policy remains unchanged, and the staff of both editorial and advertising departments will continue to work for the paper at its new address. I have been asked by *Link House* to stay with them in an editorial and advisory capacity and I am very pleased to do so.

In what little space remains in this column I would like to introduce *Link House* to readers who do not know the name, and to clear up one or two other points in order to avoid future confusion. If you are a 'do-it-yourself' enthusiast you will probably know the new company through the magazine of that name. It is also well known to other enthusiasts in different fields through its specialist publications, for example, *The Caravan* and *The Stamp Magazine*. It also publishes *Exchange and Mart* which is known the world over. In fact, there could hardly be a better and more suitably equipped publishing house to look after *Hi-Fi News* and *Tape Recorder*, and I am more than pleased to be able to leave these two magazines to new management—leaving myself with time to concentrate on book publishing.

On this page the address of the new editorial office is given, and subscribers, advertisers and contributors should write to that address *only* for anything and everything to do with *Tape Recorder*, brickbats and bouquets included. But please note that this change of ownership and address does NOT apply to the various books published from 99 Mortimer Street. All letters, orders and enquiries for and about *Hi-Fi Year Book*, *Cine Year Book* and the 'For Beginners' series of books, etc., should be addressed to 99 Mortimer Street, London, W.1, as before.

That said, may I once more say thank you to everyone who has helped me to make *Tape Recorder* what it is; and may I repeat my assurance that *Tape Recorder* should gain a lot in many directions from its new owners.

Miles Henslow

SUBSCRIPTION RATES

The Subscription rate to *The Tape Recorder* is 30s. per annum (within the British Isles) and 32s. 6d. per annum overseas (U.S.A. $4.50). This includes a free copy of the annual index. The same rates apply to *Hi-Fi News*,
Link House Publications Ltd., Dingwall Avenue, Croydon, Surrey.

COVER PICTURE

GRUNDIG sent us this lively picture from Germany. As will be seen, it is a good publicity picture for the TK6, showing it in action with stereo microphones. We do not know the name of the group but we guess that many readers would like such material for live recordings.

LOEWE OPTA

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FOR PERFECTION IN SOUND

OPTACORD 414

With the first-ever high frequency motor ensuring long life and constant speeds. Unsurpassed for a portable tape recorder. Single speed 3¾ i.p.s Twin Track. For use on mains, batteries and car batteries

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WORLD OF TAPE

The Language Bus

A MOBILE language laboratory built into a converted double-decker bus was brought into use recently by the Cambridge Education Authority. The laboratory forms part of an experiment being run by the National Extension College and was converted and equipped by Pye. Rural schools in Cambridgeshire are being toured regularly to provide pupils with French lessons. A programme is planned to ensure that each school is visited at least once each week.

The basic idea originated at Harvard University, U.S.A., where a group of teachers and research workers fitted a large trailer with language-teaching equipment. The massive trailer was, however, considered unsuitable for British roads.

The lower deck of the bus is fitted with benches on its two sides and contains one tape recorder, a projector and screen. It is intended for use as a normal classroom. Two rows of five booths are situated on the upper deck, separated by a central aisle. The instructor's control desk is located, close to more projection equipment, in front of the booths.

The complete vehicle is on loan for one year from Pye, after which it will be returned in order that the results of the project may be assessed and possible modification made. Future projects may well be considered, depending on the results of the experiment.

* * *

Ilford and Zonal Merge

ZONAL FILM (MAGNETIC COATINGS) LIMITED, manufacturers of recording tape and film coatings, have been acquired by Ilford Limited. Their products will be added to the range of film and tape marketed by Ilford.

Future plans were outlined by G. A. Jones, Commercial Director of Ilford Limited, concerning the development of new recording materials for use in video-tape and computing equipment. It was emphasised that Zonal Film Facilities Limited is in no way affected by this purchase.

* * *

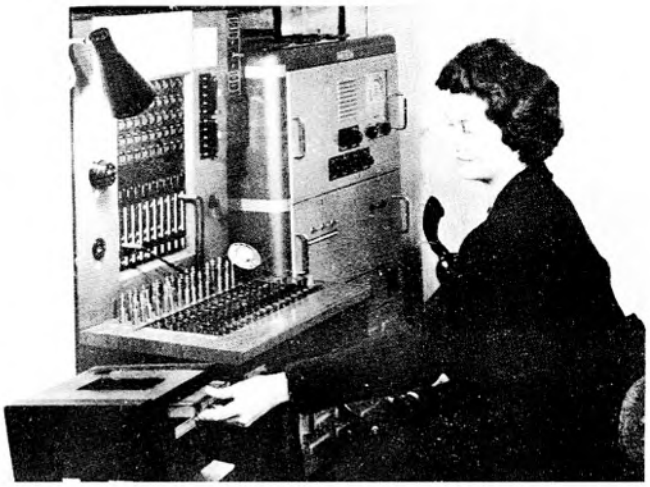
Church Bells on Tape

INTENDED for installation in large or small parish churches, the *Sound Coverage* electronic bell system comprises a 100W amplifier and tape deck feeding outdoor in-line speakers. The bell system formed part of a display at the Church and School Equipment Exhibition held at Olympia last month. In conjunction with *Cybernetic Developments Limited* the company also demonstrated language laboratory equipment. **Manufacturer: Sound Coverage Limited, 7-9 Kew Green, Richmond, Surrey.**

* * *

The Magneta Continuous Player

WITH an output of 7W obtainable from its own amplifier, the *Magneta Playdeck* contains a 90-minute endless cassette which will play continuously until removed. Although fully equipped for playing tapes through internal speakers, the Playdeck is designed for connection to external audio and PA networks. One of its most obvious uses is to provide a non-stop supply of 'canned' music in factories, supermarkets and canteens, where indeed it has already proved popular. **Manufacturer: Magneta (B.V.C.) Limited, Ackmar Works, Parsons Green Lane, London, N.W.6.**



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International Magnetic Recording Conference

TO be held at the Institution of Electrical Engineers in London from July 6th to the 10th, the International Conference on Magnetic Recording has been divided into six categories—covering audio, video, digital and analogue recording techniques.

At the time of writing, 67 papers had been submitted from several countries. These include a Japanese contribution describing slow-motion and single-frame reproduction on tele-recording equipment using two rotating heads. Colour television recording is covered in a paper submitted by three joint American authors, while helical scanning is the subject of a British entry. The design of a vacuum capstan is another feature of a proposed British paper. Further information is available from: **The International Conference on Magnetic Recording Secretariat, c/o The Institution of Electrical Engineers, Savoy Place, London, W.C.2.**

* * *

Uher Recorders for BBC

FORTY Uher *4000* battery portable tape recorders have been ordered by the BBC for use in outside news reporting. Distributed in Britain by Bosch Limited, several versions of the 4000 are available, including models equipped for stereophonic recording. These latter units are to be used in experimental stereo broadcasts.

Manufactured in West Germany, the recorder operates at $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ and $\frac{15}{16}$ i/s, with replay characteristics to CCIR standards. Recent orders for the 4000 have come from Anglia Television, Canadian Broadcasting, and the War Office.

* * *

M300 an Immediate Success

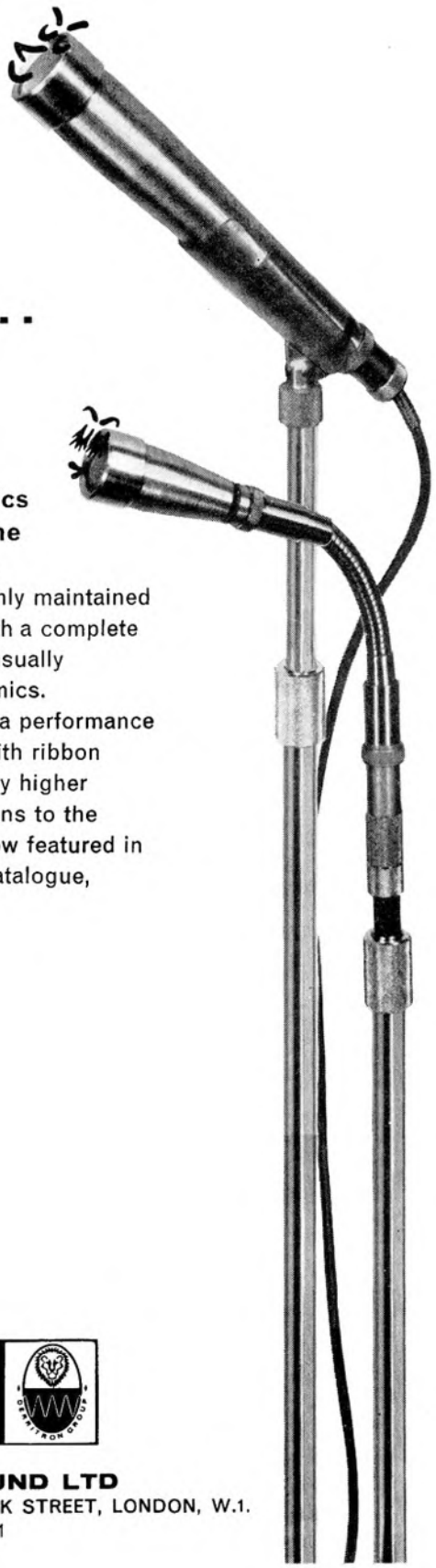
THE Telefunken *M300* battery tape recorder, which made its debut at the 1964 Audio Fair, proved such a success, claim the manufacturers, that all available supplies in this country were quickly exhausted. Further consignments are expected in July. **Distributor: Welmec Corporation, Lonsdale Chambers, 27 Chancery Lane, London, W.C.2.**

* * *

Ten Days on a Single Reel

DESIGNATED the *PI-500*, a new recorder manufactured by *Precision Instrument* is capable of monitoring geophysical and under-water phenomena continuously for ten days on a single reel of tape. Weighing 35 lb. it operates on batteries and runs at $\frac{3}{32}$ i/s and has a bandwidth of 17 c/s.

The tape used is $\frac{1}{2}$ in. wide and is wound on a 14 in. spool. Seven recording channels may be used simultaneously, two of which will record earth tremors through a portable seismometer and high-gain linear amplifier, while another channel calibrates time as received, through a $\frac{1}{2}$W radio, in the form of a 60 Kc/s signal transmission recently inaugurated by the American National Bureau of Standards.



New faces . . .

The new Pencil Dynamics microphones now join the celebrated Reslo family.

Frequency responses smoothly maintained from 100 c/s to 15,000 c/s, with a complete absence of the nasal effect, usually produced by stick type dynamics.

These microphones achieve a performance previously obtainable only with ribbon types - and at a comparatively higher output level. The new additions to the extensive Reslo range are now featured in the latest Reslo illustrated catalogue, available on request.

Reslo

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FIELD TRIALS OF BATTERY PORTABLES

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DANSETTE CADET

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Manufacturer's Specification: Speeds: 3¾ and 1⅞ i/s. **Number of tracks:** two. **Maximum spool size:** 4 in. **Rewind speed:** 2 mins. for 650 ft. tape. **Size:** 11⅛ x 5⅛ x 12 ins. **Weight:** 10 lbs. **Price:** £27 6s. **Manufacturer:** Dansette Products Limited, 112-116 Old Street, London, E.C.1.

PLACED on the market early last year, the Dansette *Cadet* closely resembles a small record-player. Measuring approximately 12 x 12 x 6 in., it is finished in mottled red and white Rexine and has a strong wooden case. The recorder is supplied complete with batteries (six 1·5V cells), an Acos *Mic 40* microphone, and a 4-inch reel of tape inside a Garrard Cassette. As the batteries were already inside the recorder it was ready for use as soon as it had been unpacked.

On opening the lid, which is held by two catches on each side of the case, the operator is confronted with a Garrard battery tape-deck, in front of which is a plastic panel housing the amplifier controls. The lid is pushed back until it is right-angled to the deck and is supported in position by the hinges.

Straightforward Operation

Operation of the deck is quite straightforward and is accomplished by two switches to the left and right of the head channel. The right-hand switch controls the record and playback functions. A 90-degree turn in an anticlockwise direction sets the machine to playback, whereas this same action, accompanied by the depression of a red button built into the switch, sets the unit to record. The left-hand switch can be rotated through 45-degrees in a clockwise and anti-clockwise direction to give fast rewind and forward wind.

Tape-speed can be altered from 3¾ to 1⅞ i/s by a switch beneath the cassette. Being in this position, it is necessary to withdraw the tape before changing speed. The forward-wind speed is affected by the tape-speed control, being considerably slower when the speed is set at 1⅞ i/s than when it is at 3¾ i/s. The rewind, however, is not affected.

The Amplifier Controls

Turning now to the plastic panel there are, from left to right, a volume control, microphone and radio inputs, recording level indicator, tone control, and microphone storage cavity. The volume control also serves to vary recording gain level for both high and low level inputs. It is calibrated from zero to 9, the larger figure giving the higher amplification. The tone calibration, however, is slightly less logical. On this control the figure 0 gives maximum treble while 9 gives complete treble cut. A tape containing music, recorded at 3¾ i/s on another machine, was played on the Cadet. The high frequency response was excellent and the overall sound was improved by closing the lid. Slight 'boxiness' was noticeable, as was electrical interference from the motor during quiet passages. This motor interference proved very annoying when pre-recorded speech was played and necessitated a complete cut of treble. When the Cadet was used for recording *and* replaying the motor interference reached a very high level—being almost as loud as the recorded speech.

Another rather illogical feature of the control panel was the fact that the microphone and radio-lead plugs were black and red respectively, whereas their corresponding sockets were red and black. A piano was the subject of the Cadet's next recording session. Although the microphone was only four feet from the piano it was impossible to register an overload on the valve-type 'exclamation mark' indicator. The recording level was therefore set for maximum gain.

The recording, when replayed on the same machine, showed that in fact the amplifier *had* been overloaded so it was repeated at half-gain. This time, with the indicator responding slightly, a reasonable recording was made. No wow was apparent at 3¾ i/s but the electrical interference was more than apparent. At 1⅞ i/s the recording was, if anything, slightly clearer, as the motor speed, and consequently the interference frequency, was halved. Again, little wow was noticeable.

Good General Quality

The general quality of the recording, provided one was careful not to overload the amplifier, was quite good, and pointed to the fact that if the motor had been screened the recorder would have given a very good account of itself.

The next test for the *Cadet* was an outdoor-recording trial. The Acos microphone showed a tendency to pick up wind sounds fairly easily so it was necessary to shield it with a cloth or handkerchief and place it close to the subject.

The recorder was not affected by movement and could be used quite satisfactorily while being carried. No provision was made for closing the lid while recording as there is no sloth through which the microphone lead can be threaded. In actual fact it was possible to force the lead through a tiny crevice between the lid and the deck, carefully jamming the catches shut. This was a very poor solution, however, and will probably lead to the keen owner cutting a slot himself.

A Useful Appearance

One advantage of the Cadet's similarity to a record-player was that one could make recordings in practically any surroundings, providing the microphone was handled discreetly, without being likely to cause embarrassment to an unsuspecting subject. If one *must* make a recording on a tube train this is the ideal machine for the job.

Some trouble was experienced with the handle, which was too small to house four average-sized fingers. It was also positioned too close to the rear to keep the recorder on an even balance. Just why the handle was not centralised over the centre-of-gravity was not clear. There was certainly ample space.

(*Continued on page* 186)

FIELD TRIAL—(*Continued*)

Cassettes and Spools

The Cadet is designed to take Garrard cassettes but normal spools of up to 4-inch diameter can be fitted on in the normal way. The cassette can be dismantled and fitted with another tape if required, but this is rather pointless Two rubber hub-caps prevent the spools from falling from the deck, making it possible to record upside-down if so wished.

Tapes copied from another recorder via the direct-lead were of considerably better quality than microphone recordings. This suggests that the Cadet might well do justice to a better microphone than the one supplied. Interchanging tapes between several recorders showed the Garrard deck to have a consistent speed; even after many hours use, with the batteries presumably very much weaker, no variation from $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s was detectable.

No Output Socket

Unfortunately no output socket is provided, thus dubbing from this machine would necessitate recording from the loudspeaker. The speaker is situated behind a forward-facing polished metal grill, and receives, according to the manufacturer's specification, up to 1W from two OC81 transistors in push-pull.

Garrard Battery Tape Deck.

The comprehensive instruction leaflet supplied provides circuit details and diagram, showing the Cadet to have five transistors and a DM70 cathode indicator. Full operating instructions are given, together with details concerning battery changing. The batteries are housed behind a small (4 x 2 in.) plastic cover that can be unscrewed with a coin. No indication is given as to the probable life of the batteries. One fault that occurred towards the end of the field-trial concerned the recording switch; this can be turned 45-degrees anti-clockwise in which position it should light the recording indicator, allowing the user to set the modulation level without running the tape. (The motors, however, do run in this position.) It was found that the light failed to go on and the motor failed to operate. This trouble may possibly be confined to the model sent for test.

Summary

Summarising the whole trial, the most annoying fault lay in the interference caused by the motor. The Garrard deck is extremely good, having a good wow-free transport, and a really fast wind. The Cadet amplifier, particularly the playback amplifier, is also quite good for battery standards, although the recording side is not so praiseworthy.

OPERATION TAPE TO DISC

By Derrick Marsh

SO you want an LP record made from your tape? Perhaps for friends without a tape recorder, or for permanent storage without risk of print-through or accidental erasure.

Whatever your reason you will probably obtain the transcription through a small recording studio. There are many such firms, either specialising in the work, or operating alongside a retail business.

Most firms issue a brochure giving details of cost and time. Having obtained this information you can simply post the tape, together with recording details of speed, duration and disc requirements, to the selected studio.

The following details apply to only one such company who do this work exclusively, 12 hours or more each day, and have a large studio for professional work with advertising film equipment, and another for commercial recording and tape-to-disc.

A Smaller Studio

As amateur tapes would not play on this equipment due to the different track widths, tape speeds and uncontrolled peaks which would damage the delicate cutter heads, a smaller studio is operated exclusively for domestic tapes, using Ferrograph, Brenell and other better quality semi-professional machines into moving coil disc-cutters.

On receipt, the tape is checked, accounts recorded and the tape is placed in a special cubbyhole to await its turn, on whichever machines are most suitable for that particular tape or disc requirement.

Each morning the machines are checked over, demagnetised, and heads cleaned. Then the first tape goes on for azimuth alignment to get the tape tracking across the head for best response. Speeds are set, tape often needs timing as enthusiasts often have little idea of the duration of their tapes. Tracks are selected—full, half or quarter—as required, and the machine warmed up with a test run.

In the meantime the disc-cutters are being warmed up and the bottles holding the swarf emptied. The swarf cut out of the groove is sucked away by an alloy nozzle just behind the cutting styli along a rubber tube and into a large bottle, where it is trapped.

This is done by a large suction pump and motor hidden under the floor. The disc-cutter stylus heaters are switched on—this is a unit giving a DC supply to the tiny coil heaters around the cutting styli which heat the sapphire cutter so that it cuts through the disc material like a hot knife through butter, without tearing the material. The facets of the rear edges of sapphire burnish the groove leaving it shiny and noiseless. This heat is adjusted by a meter and increases slowly as the cutter moves towards the centre of the disc being cut, where the slower cutting speeds need more heat.

The powerful feedback-damped amplifiers are now switched on, a spot of fine oil here and there and we proceed with a test cut from the first tape, using an inch or so of disc to get the required frequency response and tonal correction, this is played back via main amplifier and large speaker system; if correct, the settings are noted on customers' job card and the tape is run back ready for the actual disc cutting.

Age-hardening Discs

A new disc of suitable size is taken from their special storage tins, once cut these age-harden and after a time are unsuitable for cutting, so correct storage is essential. We get discs back after 3-5 years, for copying, which are so hard a nail would not mark them.

A quick check on stroboscope speeds, tape settings, cutter heat, main amplifier controls and client's instructions, and we are off.

The cutter-head is moved in to the very edge of the blank disc and the sapphire cutter, now too hot to touch, is lowered to commence the run-in spiral. The swarf suction picks up the tiny black thread as it first leaves the groove after a crafty puff of wind from the lips of the operator, otherwise the swarf goes round the disc and is caught by the hot stylus, and as it is then inflammable, it burns instantly.

The cutter is moved in to the correct starting diameter and the tape started whilst the volume is increased to required level, this having been decided during the test cuts. All is safe now and a matter of close watch on the special volume indicators connected to the cutter-head, to avoid any sudden bursts that would force the stylus over, causing both distortion and cutting through into next groove.

Variable Pitch

The record is turned over and the same operation on the other side completes the operation. A far cry from the old days of 78s when one operation dropped the cutter head, usually no run-in spiral, and a brush removed the swarf, usually hand-operated.

Now, a dozen things have to be exactly right all the time, one mistake in any and the disc is ruined. If any mistake is to happen it will invariably occur in last five minutes of cutting!

After a quick test of portions of the record, it is labelled, sleeved in polythene and card and prepared for despatch, usually within 48 hours of receipt.

This precision working, plus the very expensive microgroove disc-cutters required, wiped out many of the 78 operators and the few who bought the new equipment, and operated spasmodically, found that the deftness of touch required was only acquired and maintained by everyday operation of this machinery. Mixing, inter-item banding, speed changes, groove joining and other facets of this work need another article, whilst the satisfaction and pride after successfully operating two or more machines at one time, whilst mixing in from 3-4-5 tape recorders for different bands on the records is great indeed, and must make many players of the once-mighty *Wurlitzer* green with envy at the dexterity of the operators.

A Far Cry From the Old Days

If variable pitch is required to get maximum playing time, it has to be operated during the cutting, this gives finer grooving on quiet parts of tape and opens out the grooves to allow more movement of the groove modulations in the loud passages. This is limited normally, but on some special works is controlled from the musical score the whole time one is cutting the disc.

Whilst this cutting goes on an adjacent machine is set-up for operation from another tape to save time and allow fulfilment of the quick postal return service to which this specialist firm adheres.

At the required point, the amplifiers are faded down, the tape stopped, and the run-off spiral commenced. The final connecting join between the grooves being critical to a fraction of an inch, otherwise the stylus will run again into the same groove and damage itself, with resultant delay and replacement of these expensive, although tiny, essentials. This operation and groove depth are observed via a microscope during cutting.

TOWARDS BETTER TAPING

Part 3—Using External Loudspeakers

AS the tape novice gradually becomes accustomed to the art of tape recording, the question will arise, with increasing intensity, "could improved replay quality be obtained by the use of a better loudspeaker system?" The answer to this is almost certainly 'yes', with with certain reservations.

Most of the portable kind of tape recorders within the popular price range embody a speaker and enclosure which are far too small to do full justice to the range of frequencies which can be recorded upon the tape and which can be reproduced by a replay head of modern design.

Electrical Noise

The exercise is generally to employ a small elliptical speaker unit and arrange this in the cabinet so that the cabinet itself serves in some ways as an 'infinite baffle' enclosure. It is really surprising how well the reproduction can sound under these conditions at moderate volume levels. However, when greater sound output is needed all sorts of spurious noises are created by the mechanics of the tape deck and the valves of the amplifier setting up vibrations in sympathy with the programme sound!

Forced vibration of this nature upon the valves is not a good thing, anyway, for it tends to make the valves electrically 'noisy' and microphonic. Thus, in addition to the mechanical vibrations produced by these components, electrical noise signals are also added to the reproduction. For example, ringing sounds may be set up by the valves and crackles by these and other components.

By the use of an external loudspeaker system, the sound can be taken well away from the tape recorder as a whole and not only can much more usable volume be obtained, but also in many cases the quality of the sound is much improved. With this in mind, the designers of certain tape recorders provide facilities for the connection of an external loudspeaker.

Switched Jack Socket

Some machines incorporate a jack socket arranged in such a manner that when the jack plug connected to the external speaker is inserted into the socket othe internal speaker is automatically disconnected while the external one is connected. The jack socket, of course, is of the 'switchable' type and is wired as shown in **fig. 1.** An enthusiast reasonably conversant with the arts of circuits and soldering would have no difficulty in adding such a facility to his own recorder.

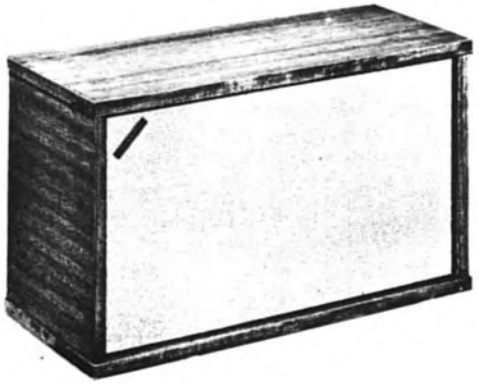
From the diagram, it will be seen that the internal speaker is connected across the secondary of the output transformer (its normal position) via the jack switch. Now, when the plug is inserted into the socket the switch changes over, disconnects the internal speaker and applies the external speaker in place across the secondary winding of the transformer.

There are two points of major importance to be borne in mind when using an extension speaker. One is that under no circumstances must the secondary of the output transformer be left without a speaker or equivalent load resistor across it. This action could cause high peak voltages to develop across the primary of the transformer and at the valve anode *if the replay amplifier is passing signal*, and failure of these components could result. The other point is that the external speaker should have an impedance equal to that of the internal speaker.

It is possible to operate an extension speaker along with the internal speaker simply by connecting the extension in parallel with the internal speaker (e.g., one across the other). This arrangement does give a mismatch, since the impedance as 'seen' by the output transformer is then halved if the extension speaker has an impedance equal to that of the internal unit. Nevertheless, reasonable results are possible in practice, though it is not usually a good idea to employ such an arrangement if the best reproduction from the extension is required.

Many of the popular range of tape recorders incorporate internal speakers with 3 ohms impedance which makes it a bit of a problem to connect a hi-fi loudspeaker unit while maintaining a good impedance match. One way out of this problem is to use an impedance matching transformer on the extension circuit, as shown in **fig. 2.**

Here the secondary of the tape recorder's output transformer is



TOWARDS BETTER TAPING

By Gordon King

connected to the two centre tags of a double-pole changeover switch (which can be the toggle type); to the two tags on the side corresponding to the 'internal speaker' position is connected the internal speaker (which, of course, has first been disconnected from the internal transformer); to the remaining two tags is connected the extension speaker, via a suitable impedance matching transformer.

Hi-fi and good quality extension speaker systems are usually rated at 15 ohms impedance, which means that if the output impedance of the tape recorder is 3 ohms, a transformer to match 3 ohms to 15 ohms is needed on the extension circuit.

This type of transformer is readily available from audio dealers, and one which has been used successfully by the author is the *Universal Speaker Isolating Transformer* by *Radiospares Ltd.* These retail at about 13s. 6d., are double-wound for complete isolation, and have primary and secondaries tapped at 3 and 15 ohms to match any speaker to any load.

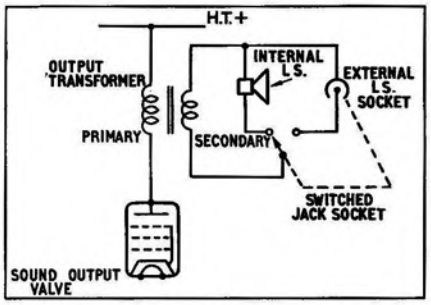


Fig. 1. *This diagram shows how a switched jack socket can be wired to the loudspeaker circuit so that when the plug carrying the external speaker is inserted the internal speaker is automatically switched out of circuit.*

Where possible, the changeover switch and the matching transformer should be housed in the tape recorder cabinet. Two sockets can then be fitted somewhere at the rear of the cabinet, according to the design of the recorder, to take the cables to the extension speaker.

Economic Folly

Economy-wise, just how good an extension speaker system can be, when added to a relatively inexpensive tape recorder, is often the matter of some discussion. Unfortunately, experience has revealed that it does not always follow that the better the extension speaker used, the better will be the reproduction. It would, in fact, be economic folly to invest in an expensive hi-fi speaker system just to work with an inexpensive tape recorder.

Designers of amplifiers for the popular type of tape recorder are forced very much to work to a tight budget in view of strong competition from other makers of like machines. The designer, then, considers the type of speaker system that will be integrated with the instrument as a whole, and if this is capable of responding up to, say, only 8 Kc/s and down to 100 c/s, the designer will definitely not waste money on the

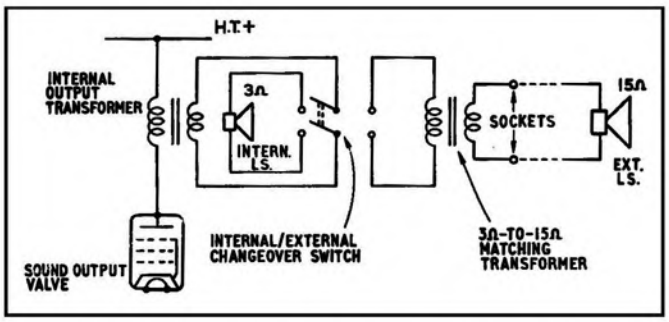


Fig. 2. *It is often necessary to apply the correct matching to the extension speaker system, and this diagram shows how a matching transformer can be used for this purpose.*

design of an amplifier which greatly exceeds these limitations.

Indeed, the frequency response of the amplifier may sometimes be tailored to suit the speaker and acoustics of the tape recorder cabinet.

It follows, therefore, that by connecting a very high quality speaker system to an inhibited amplifier, flaws in the reproduction which are not apparent on the internal speaker will show up on the external system. The tweeter of a hi-fi speaker, for instance, may reproduce higher audio frequency harmonics due to amplifier distortion which are almost totally suppressed by the limitations of the internal speaker.

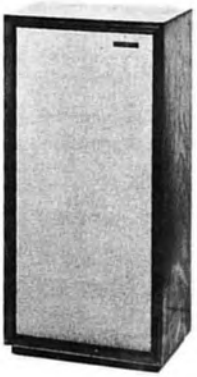
Less Coloration

In other words, the addition of a hi-fi speaker system will not in itself add to the quality of the sound provided by the amplifier. It will, however, reproduce the sound that the amplifier provides with less coloration than the internal speaker. The noise produced will generally be an improvement over that produced by the internal speaker, but one should not expect it to be up to full hi-fi quality simply because an expensive speaker system has taken over.

If the enthusiast already has a good quality hi-fi speaker system available, then its connection as shown in the foregoing paragraphs would be an exercise well worth testing. But if the enthusiast wants a better speaker simply and always to use with this inexpensive tape recorder, then one of the inexpensive cabinet type of extension units would serve well. On the other hand, if the enthusiast intends ultimately to increase the quality of his audio equipment, the initial purchase of a better class of speaker system may well be desirable.

So far we have considered the inexpensive class of tape recorder. There is a class which is a stage or two above the so-called 'domestic' tape recorder, however, and with this quite good quality without the limitations expressed above is often possible by the use of a hi-fi speaker system. This type of recorder features almost a fully-fledged hi-fi amplier system for replay with a push-pull output stage and liberal negative feedback.

To sum up, then, a hi-fi speaker system will tend to emphasise any amplifier shortcomings in terms of spurious frequencies, such as harmonic distortion and hum, which suffer considerable de-emphasis when fed to the internal speaker. All sounds will be reproduced better —distorted as well as undistorted ones. The nett result is often one of improvement, depending upon the design of both the tape recorder and the speaker system. The best exercise is to try it and see without spending too much money.



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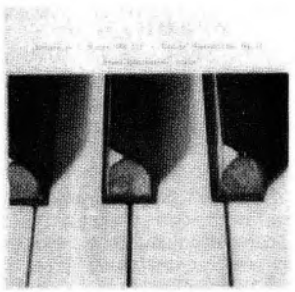
TAPE RECORDS REVIEWED



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WE begin this month with the very last of the backlog of tape records which made such a formidable pile on the editorial desk when these reviews began in September. The item is *Symphony No. 6* by Shostakovitch, played by the London Philharmonic Orchestra under Sir Adrian Boult on *WRC TCM 28*.

Since the deaths of Sibelius and Vaughan Williams, the mantle of 'chief symphonist' seems to have fallen on Shostakovitch, though the actual form of his works carrying this label is often very unconventional. The sixth is a case in point, as not only has it a mere three movements but two of these are (almost) scherzos. The first movement is long, slow and contemplative—at times almost pastoral, but elsewhere with an introspective questioning character. There are many quite beautiful passages, especially when solo woodwind instruments are set against a background of strings.

The second movement is a whimsical scherzo using the full resources of the orchestra, and the last also has a rapid bouncing rhythm which sets the mood right through to the end. The climax of this third movement has an extravert gaiety of almost fairground quality in such utter contrast to the symphony's opening that a casual listener would hardly believe that the same composer was at work. This hardly makes for symphonic unity, but any lover of orchestral music should get much pleasure from this work.

The performance is very pleasing and the recording is also generally good, though there was a slight lack of treble brilliance, and some drop-out during the first movement, on our copy.

A more recent recording from the same source (*WRC TT296*) on which the technical quality is very fine—in fact just about the best one could expect from 3¾ i/s mono—carries six orchestral pieces by Elgar. The conductor is the late George Weldon, with the Royal Philharmonic Orchestra playing the *Cockaigne Overture*, *Serenade for Strings in E Minor*, *Chanson de Matin* and *Chanson de Nuit*, and with the Pro Arte Orchestra playing *Pomp and Circumstance Marches Nos. 1 and 4*. These latter are, of course, the well-known 'pop' tunes played to the death on countless patriotic occasions. This makes it almost impossible for a British person to hear them simply as pieces of music—which is a pity. The *Cockaigne* is a somewhat more substantial piece in the form of an episodic tone poem about London at the turn of the century. The two *Chansons* are pleasant early Elgar, and the *Serenade* contains some lovely unemphatic string music in total contrast to the Marches. The performances are for the most part very satisfactory, and the *Serenade* is excellently played. The tape is good value for any Elgar lover.

Quite a different type of fan will be interested in *WRC TT169* on which *Nat 'King' Cole Sings More Favourites*. A dozen pieces are sung or played in Nat's own special style with the support of a band and (occasionally) other vocalists. The tape is strictly for Nat fans, and the recording is clean and clear.

For vocal music with a difference we go back 3½ centuries to Monteverdi. Three *Psalms*, two *Hymns* and two *Motets* are performed by a French team with the orchestra of La Mouvelle Societé Bach directed by R. P. Emile Martin. Working a century before Bach, Monteverdi was in many ways the founder of dramatic opera as well as a master of church music, and his creations have a surprisingly direct and emphatic impact considering their setting in the age of the madrigal.

The items on this tape (*WRC TCM48*) are typical and receive pleasant performances, but although the recordings were made in Notre-Dame du Liban in Paris, a somewhat more cathedral-like acoustic would sound more authentic. The recording is a trifle edgy—but clear.

We pop back to a mere 20 years ago for some 1944-vintage recordings collected together on *The Tommy Dorsey Legend, Vol. 2* (*WRC TT283*). This features Tommy Dorsey and his orchestra in eleven pieces, some played, some sung, including *Song of India*, *Swanee River*, *On the Sunny Side of the Street*, and *I'm Getting Sentimental Over You*. This last has one of the very few good solo trombone passages by Dorsey on the tape, which is a pity as many people would buy such a tape primarily for these gems. However, the recording is very clear despite its age and there is some good solid 'swing' here with much fine playing by other instrumentalists in a great band.

Finally, some Beethoven piano pieces played by Shura Cherkassky on *WRC TT271*. These are *Sonata in C Minor* and *Variations in E Flat Major*. The Sonata is in two movements only and receives a fine performance with excellent contrast between the dramatic fire of the first part and the delicate range of pianistic effects in the second movement. The latter is essentially a set of variations.

The whole of the other work is a set of *Variations* on the theme used in the last movement of the *Erioca Symphony*, and although the piano work was composed before the Symphony, no lover of the Beethoven's symphonies will be able to listen to the *Variations* without a mental 'picture' of the orchestral treatment. Nevertheless, the piano—at least in the hands of this soloist—makes its own very convincing case.

TAPE RECORDER SERVICE

By H. W. Hellyer

No. 30—WALTER METROPOLITAN MAINS/BATTERY

ALTHOUGH the *Walter* company has been defunct for quite a long time—as time may be measured in this rapidly changing world of tape recording—there are quite a lot of the various models still in existence. The basic Walter deck was described in some detail in the number seven of this series, way back in July 1962. This present article is not a desperate attempt to fill a space, but an attempt to answer some of the questions that have reached the *Tape Recorder* office about a machine that has been steadily re-appearing and may be obtained at quite reasonable prices.

The *Metropolitan* appeared on the market just before the Walter factory closed down. At its inception, it was ahead of its time. A mains/battery portable, single-speed, half-track, with a stable transistorised circuit, of compact design and quite respectable output, it was an ambitious project by any standards. The complete stock of new, unsold machines has been procured by *J. E. Sexton Ltd.*, and is now being distributed through the radio retail trade, and appears on the market from time to time at bargain prices. Readers ask: is it really such a bargain, and are spares available should things go wrong?

The best answer to the first part of the question is a review of the specifications; to the second part, a description of the machine, and some hints on its servicing.

The weight of the Metropolitan, less batteries, is 17½ lbs. Size, overall, is 17 x 15½ x 5½ in. The cabinet is of stout wood, rexine-covered, with plastic escutcheon, in two-tone grey. A large, substantial handle also acts as a stand, and the lid is completely detachable. Main control is the familiar Walter 'joystick', with the usual four function positions and central neutral. Electronic controls are Volume/on-off and Tone. Other controls (button-type) are for pause, superimposition, and safety-record. More about these later.

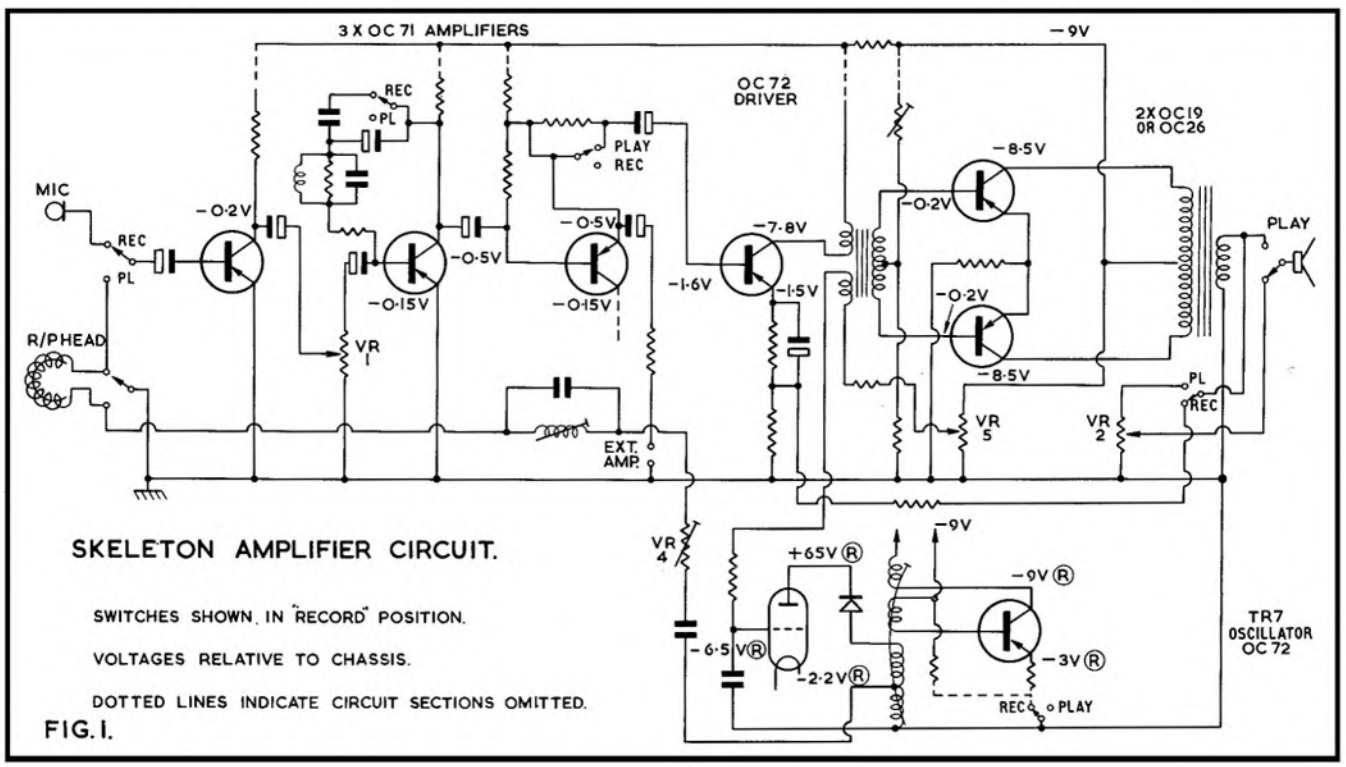
The tape speed is 3¾ i/s. Drive and spooling is by two *Staar* low-voltage motors, direct to the flywheel in the first case, and via rubber idler wheels in the second. Braking is by spool-hub contact, lever operated. Spool diameter is 5¾ in., giving an hour per track with long-play tape, and fast winding and rewind time for the 1,200 ft. spool is 2½ minutes. The tape position indicator is a revolution counter type, and the recording modulation level indicator is a DM70 magic eye.

The power supply is mains or battery, selected by swivelling the blanking plate over the mains socket, an automatic safety device. Mains voltages of 200-250V or 100-125V, at 50 c/s are provided for. The batteries are three PP9, or equivalent. Two of these in parallel give the 9V supply for the amplifier and the third powers the motors. This system is an attempt to provide even rates of deterioration. It is quite important with machines of this type that batteries should not be changed around in an attempt to give longer life.

Seven Transistor Amplifier

The amplifier uses seven transistors: an OC71 pre-amplifier, two OC71s in the main amplifier, an OC72 driving two OC26 transistors in push-pull, and an OC72 HF oscillator. The mains rectifier is a full-wave, bridge-connected MR1, delivering 9V, the mains voltage being reduced to correct limits by a substantial transformer. Inputs are high impedance (crystal) microphone and radio/pickup, and outputs are 2½W into a 7 x 4 in. 3-ohm loudspeaker, extension loudspeaker, and a high impedance output to feed an external amplifier. Signal-to-noise ratio should be better than 40 dB. The frequency response is from 50 c/s-9 K/cs when used as tape recorder, and this is improved to 40 c/s-15 K/cs if the machine is used as a straight-through amplifier. The oscillator provides 40 Kc/s bias for the recording head, but DC erase is employed, and the method of superimposition is to swivel the erase head clear of the tape by manual operation of the button on the tape head cover. For further electrical details, refer to **fig. 1,** and the service notes given below.

Mechanical factors first. Reference to **fig. 2** and **fig. 3,** shows the principal drive system and tape transport. The motor M in **fig. 2** engages the rubber tyre in the upper part of the perimeter of the fly-wheel F, driving the capstan spindle C. Most important factor here is the motor spring S, shown in end view. It should be noted that the motor



SKELETON AMPLIFIER CIRCUIT.

SWITCHES SHOWN IN "RECORD" POSITION.

VOLTAGES RELATIVE TO CHASSIS.

DOTTED LINES INDICATE CIRCUIT SECTIONS OMITTED.

FIG. 1.

is encased in rubber and mounted in a cradle, the pivots of which rest in grooves hollowed in the main casting. The plate B is held by a fixing screw, and serves to retain the motor in its correct lateral position. Make sure this is firm, and that the motor allows the pulley to make a positive contact with the flywheel rim. Note also that the screened cable carrying the motor supply is positioned so that there is no mechanical strain, and that the screening is anchored to the tag adjacent the forward side of the pivot. When replacing the motor—to do which, it is necessary first to take off the loudspeaker and its baffle—always ensure that correct polarity is observed. The motor polarity is marked on the outer casing near the contact lugs. Note that these lugs have a very fine insulating washer, and when soldering take care that no chort-circuit is caused.

There are many similarities in the basic mechanical arrangements of the function selector of the Metropolitan and the earlier machines. The joystick formation, for example, was previously described, and it is not proposed to repeat these details here. The end result is what matters, and this is the movement of the arm or lever A to allow the pressure roller P to engage the capstan. It will be seen that there are two terminal springs; one to aid engagement and the other to ensure positive release action. The roller pressure should be 200-250 gms, in the play function, measured from the roller spindle. The pressure pad should be in firm contact with the head screen at an approximate pressure of 45 gms. The pressure is also applied to the left-hand tape post, and this should not be more than 10-12 gms. These pressure pads are spring mounted and may need adjustment from time to time.

The action of the record-safety-lever is essentially simple. Whereas the main control serves to bring the pressure roller, etc., into play, the record lever, actuated by the red button, removes the stop from the main lever action, switches the amplifier to record and brings the erase head E into play by the pivoted lever L. The lug at the inner end of this lever acts as a manual superimpose control. One fault that should be checked is erratic action due to the levers rubbing in the slots or against the underside of the plastic head cover.

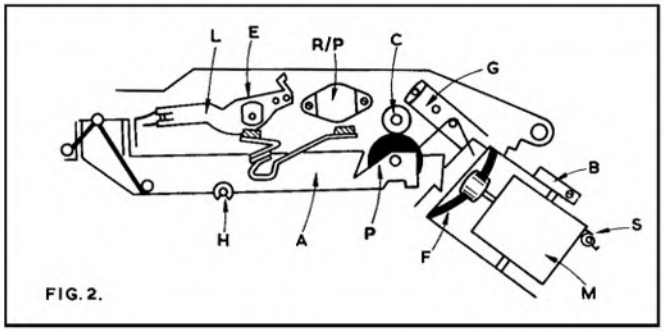


FIG. 2.

Head adjustment is by the conventional two-screw method. Take-up drive is via a rubber belt, from the flywheel to the lower section of the right-hand spool. See D and R of **fig. 3.** The clutch is simply gravity operated, and should need no adjustment other than the usual cleaning. The belt is easily removed by placing the function lever in the Fast Foward or Reverse position, then lifting the belt over the right-hand turntable and easing it between brake pad and rim. To take it completely from the machine, the trick is to slacken by removing it from the spool as stated above, then bring it from lower to upper side of the flywheel, drawing it through the hole around the capstan spindle, finally looping it over the spindle to clear completely. A hooked piece of stiff wire is handy for this job.

Taking out the flywheel for servicing is a bit more difficult. Start as before, but leave the front end of the belt loop under the flywheel. Unsolder and draw clear the capstan motor and recording head leads. Take the two springs S-S (**fig. 3**) from their support pillars. Release the Safety Record Lever (G in **fig. 2**) by removing the circlip and spring and lifting away. Undo the four Phillips screws and remove the motor mounting plate. Select 'Play', then pull the spring and bracket to the left of the flywheel toward the front, and gently lift the flywheel clear. It is important when re-assembling to see that the flywheel drops absolutely vertically in its bottom bearing, then to check that the motor pulley engages correctly and the head and pressure pad adjustments are as given previously. While the machine is in this part-dismantled condition, it is a good idea to remove and clean the pressure roller, which is best done by removing arm A, after taking the circlip H away and switching to Play once again. The spindle of the pressure wheel

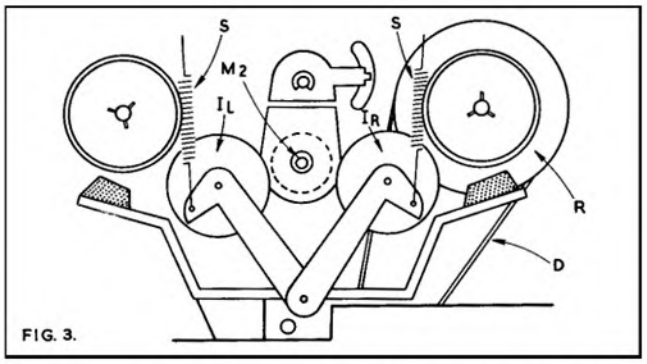


FIG. 3.

is simply pressed into rubber grommets. It is necessary to hold back the pressure pads with the fingers when removing and replacing the arm, and to ensure that the tension spring at the right-hand end is properly located after re-assembly.

The brake assembly is quite straightforward, as shown in **fig. 3.** Brake pads engage only when the machine is in the neutral position, and the main lever is centrally balanced.

The rewind assembly is a plain pivot, with the motor M2 swivelling to engage either rubber idler IR or IL. Only points to watch are the placements of the torsion springs, adjusting for adequate clearance when the Rewind or Fast Forward position is disengaged. During Rewind, the brake lever is actuated by the main control bar, but when returning to neutral from Record or Play a separate lever movement is used to hold the brake lever off. Make sure when carrying out any of the above actions, that grease and oil are not transferred to the friction surfaces, i.e., rubber idlers, belt, or capstan and flywheel.

The Basic Circuit

The electronics needs a separate note. **Fig. 1** has been drawn to show the bones of the circuit, leaving out all the frills, but leaving in the main adjustments and voltage tests. These voltage readings were taken with an Avo 8, but any comparable meter of 20,000 ohms-per-volt or better should give similar readings. All voltages are taken in the Play function unless marked 'R' for record, and were measured on the 10V range of the meter—except, that is, for the magic eye readings, which need to be read on the higher voltage ranges, as this circuit makes use of a rectified voltage from an overwind on the oscillator transformer, and the impedance of the meter would tend to 'kill' this if the lower voltage ranges were employed. The signal level of the modulation feed to the DM70 can be regulated by the 10 K preset VR5.

Correct playback gain is for a reading of 0·6W at the secondary of the output transformer, using an output meter, when a 1 Kc/s tone at 1 mV level is fed to the head connections, disconnected from the head itself. Recording gain is measured by rendering the oscillator $\frac{2}{3}$ inoperative by disconnecting TR7 base, inserting 100 ohm resistor in the red lead to the head, as near the head as possible, connecting a valve-voltmeter across this resistor and measuring not less than 6 mV when a 1 Kc/s signal is fed to the microphone input at 1 mV. Recording level control should be at maximum.

Injecting a similar input, but at 100 mV, to the Radio input socket should give the same reading. If this is then reduced to 40 mV, the magic eye can be tested. The column of the exclamation-mark illumination should just meet the spot under these conditions.

Finally, reconnect TR7 and measure the bias current with a valve-voltmeter across the 100 ohm resistor. With conditions as above, a reading of not less than 170 mV should be obtained. To check the noise level, revert to Play, short-circuit the head, turn all controls to maximum and check that no more than 0·1 mW is measured across the output transformer secondary.

Combined Tone/Monitor Control

It is worth noting that the tone control VR2 of this machine also acts as monitor control by being switched in series with the loudspeaker during Record. Allowance must be made for this circuit alteration when making tests.

From the foregoing, even if the test instruments are not available, some clue should have been given to the operation of the Metropolitan, and, indirectly, guidance as to the general maintenance of the machine.

A TAPE RECORDER IS ONLY AS GOOD AS ITS DECK

This one is very good indeed

To judge the technical perfection of the new Ferguson model 3204, you have only to study the tape deck. Designed and precision-built by Ferguson's own engineers, it is the foundation on which is built a superb piece of equipment with meticulously balanced sound amplification and finest quality reproduction. Clarity and purity are combined with a multiplicity of features for infinite variety in your sound recording, compactly contained in a cabinet with a style to match the performance.

MODEL 3204
TAPE RECORDER
4 tracks, 2 speeds

33 GNS *complete*
with remote-control microphone,
850 ft. tape, take-up spool and connecting lead.

Controls. Volume/Recording level. Tone combined with mains On/Off. Piano-key tape motion controls comprising: Play/Record, Pause (temporary stop), Fast Forward, Fast Reverse, Stop. Record button interlocked with tape motion keys. Playthrough/Superimpose button. Track Selector push buttons. Speed Selector switch. Digital Tape Position Indicator with instant zero reset button.

Speeds. 3¾ i.p.s., 1⅞ i.p.s.

Spool Size. 5¾" maximum.

Tracks. Four. Recording sense to generally accepted standards (1st and 3rd tracks left to right).

Playing Time. Using four tracks and maximum spool at 1⅞ and 3¾ i.p.s.

Standard Tape	3 hours	6 hours
Long Play Tape	4 hours	8 hours
Double Play Tape	6 hours	12 hours

Rewind time 2½ minutes either direction (850 ft.).

Power Supply. 200-250 Volts (50 cycles), 60 watts power consumption.

Audio Output Power. 3 watts.

Loudspeaker. High sensitivity 7" x 3½" permanent magnet elliptical.

Cabinet. In two-tone blue simulated leather with chromium fittings. Size: 13½" wide, 12" deep, 6½" high. Weight: 19 lbs. complete.

Sockets. Microphone input (on deck cover), Radio input, Pickup input, Output to radio or amplifier, External Loudspeaker (internal loudspeaker automatically muted), Accessories — providing power for various accessories including transistor-operated units.

It's got other talents, too! This tape recorder is a twin set and can be used in partnership with the Ferguson 3006 record player, acting as an extension amplifier/loudspeaker for the playing of stereo records.

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By K. R. Wicks

BIAS IN TAPE RECORDING

Part Four—Fitting Variable Bias

CONSIDERING the importance of having the correct bias for a given tape, a surprisingly small percentage of commercial tape recorders have a control to adjust the bias level.

Bias oscillator circuits vary from machine to machine, but in most cases there is a fixed capacitor, probably in the range 50 to 200 pF, connected to one side of the oscillator coil, or to a tapping on it. With the machine in the *record* condition, bias current is fed through this capacitor to the record head (see **fig. 1**).

There are two main reasons why the bias level in a tape recorder may be incorrect. Firstly, the *exact* value of bias-feed capacitor required will probably not be available, the nearest 'preferred value' being used instead. This preferred value may be slightly different from its nominal value, so that the actual value of capacitance is sufficiently removed from the required value to give a bad quality recording due to under— or over—biasing.

The second reason for incorrect bias level may be that the recorder was designed with another type of tape in mind. The tape coating characteristics dictate the optimum bias level, and these characteristics vary from tape to tape, so that the correct level for one tape may not be suitable for another.

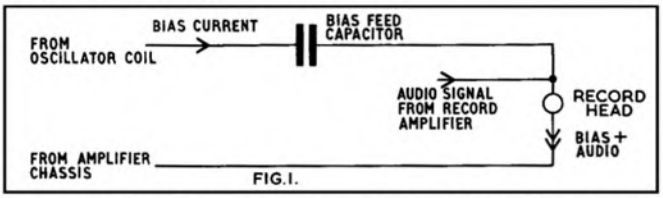


Fig. 1. *This shows the usual arrangement for combining the bias and audio signals (The record-playback switching has omitted for simplicity.*

The simplest method of making the bias level adjustable is to fit a variable capacitor in place of the fixed component. A reasonable rule to apply is to use a variable component of about twice the value of the original capacitor. Taking as an example the *Mullard* Type C tape pre-amplifier, a bias feed capacitor of 56 pF is fitted when the unit is to be used with *Collaro* (*Magnavox*) tape heads. On such an amplifier, the 56 pF capacitor was removed, and a 100 pF compression trimmer wired in its place. The trimmer was mounted on the rear of the amplifier, care being taken to ensure that it was insulated from chassis. The wiring was kept short to prevent the relatively high level output from the oscillator interfering with other parts of the circuit. (It has been known for the oscillator output to induce a voltage in the record-level indicator circuit, causing erratic readings, so if the two wires have to be over (say) a couple of inches long, it would be a good idea to twist them tightly together to reduce the possibility of this happening —but this will add even more capacity, so be careful.)

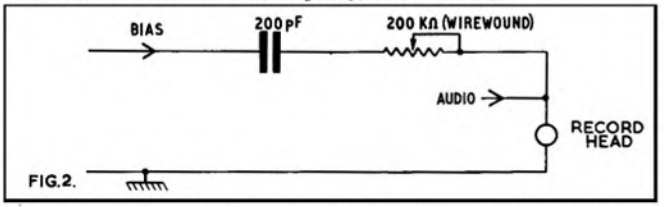


Fig. 2. *An adjust-bias circuit successfully employed by the author on a Mullard Type C tape pre-amplifier.*

The 100 pF trimmer worked very well in the circuit described, giving ample adjustment of the bias level.

One disadvantage of using a trimmer is that after altering its value, it is virtually impossible to reset it to the original value without going through the setting-up procedure (which will be described later). A better system would be one where, to set the bias level for a given tape, a knob is set to one of a number of pre-determined positions on a scale. A tuning condenser of suitable value could be used, but this is a relatively large component, which would have to be insulated from the chassis.

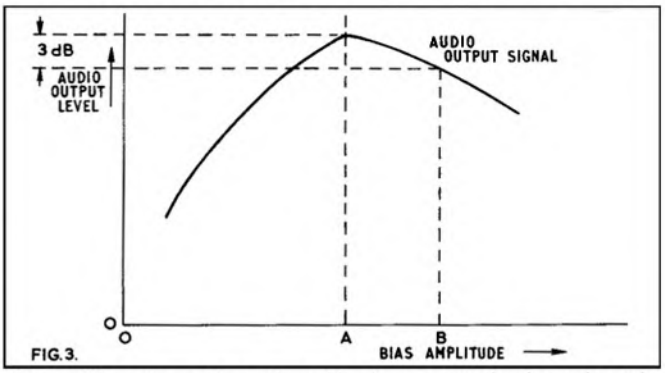


Fig. 3. *The optimum bias setting taking into account signal-to-noise ratio and distortion should be determined aurally. The best setting will normally be found somewhere between A and B; i.e. a slightly higher bias level than that giving maximum recorded signal level.*

The best solution to the problem is to use a variable *resistor* to adjust the bias level. First, the original fixed capacitor should be replaced by another, three or four times as large. In series with the new capacitor, a wire-wound potentiometer of resistance 200 K-ohms is then fitted (see **fig. 2**).

For many tape recorders, this combination of C and R will give a very satisfactory means of adjusting the bias level, but it should be realized that a certain amount of experimenting may be required before the best results are obtained. The potentiometer can be mounted directly on the rear of the chassis, and a pointer-type knob affixed.

A simple method of finding the optimum bias level is as follows: Fix a scale beneath the pointer, then make (say) twelve test recordings, at different bias settings; the ideal signal to record would be tone, preferably about 1 Kc/s. The recorded level will be found to alter with different bias settings in the manner shown by the graph (**fig. 3**).

The setting which gives maximum recorded level will not necessarily be the optimum bias setting, but *will* be very near to it. Exact setting can be found by recording some high quality music; if the bias level is slightly low the recording may sound rather harsh and distorted, whereas with the bias level too high a woolly quality may result due to attentuation of recorded level at high frequencies.

The above setting-up procedure is for those who possess tape recorders with combined record-playback amplifiers. Anyone with a separate playback amplifier can, of course, adjust the bias level, and listen to the recorded material a fraction of a second later, which will considerably simplify the setting-up procedure.

Once the best setting for one particular brand of tape has been found, the scale reading should be noted for future reference. Very occasionally, it may be found that two samples of the same type of tape require different bias settings. The probable reason is that the oxide coating is thinner on one of the samples due to the tape having been used a great deal (some of the oxide rubs off on to the capstan and the tape guides whenever the tape passes through the machine). Since the thickness of the coating is one of the factors determining the optimum bias setting, some slight variation might therefore be expected between different reels of the same variety of tape. This is of academic, rather than practical interest, the difference in bias level required generally being negligible.

Next month, methods of fade-erasing, and superimposing will be discussed.

A STUDIO QUALITY AUDIO MIXER

By D. P. Robinson——————Part I

IT is hoped in the course of some four articles to show the many stages in the design and construction of a sound mixer of a very high quality. The final version is suitable for the small studio, and for the amateur who does much recording. A feature of the design is that—being planned on a modular basis—any of the 'building bricks' can be used independently of the whole design, when they would form a sound foundation for a simpler unit. Thus, while the articles will describe the complete mixer, any section which is suited to a particular need can be abstracted in the full confidence that it will work as well as the full design.

Complex Planning Procedure

The planning of a studio sound mixer is a slow project, since of necessity the device is fairly complex. Many hours spent with paper and pencil sketching block diagrams and 'logic circuits' will be repaid by the ease of operation of the completed unit. With so many different functions to perform it is most important to position all the controls in such a way that they fall naturally to hand, and that they are separated into groups so that it is almost impossible to select the wrong control even in low ambient light, or, more important, under the strain of that sudden crisis which always seems to arrive. Here colour-coding is of real value, together with position.

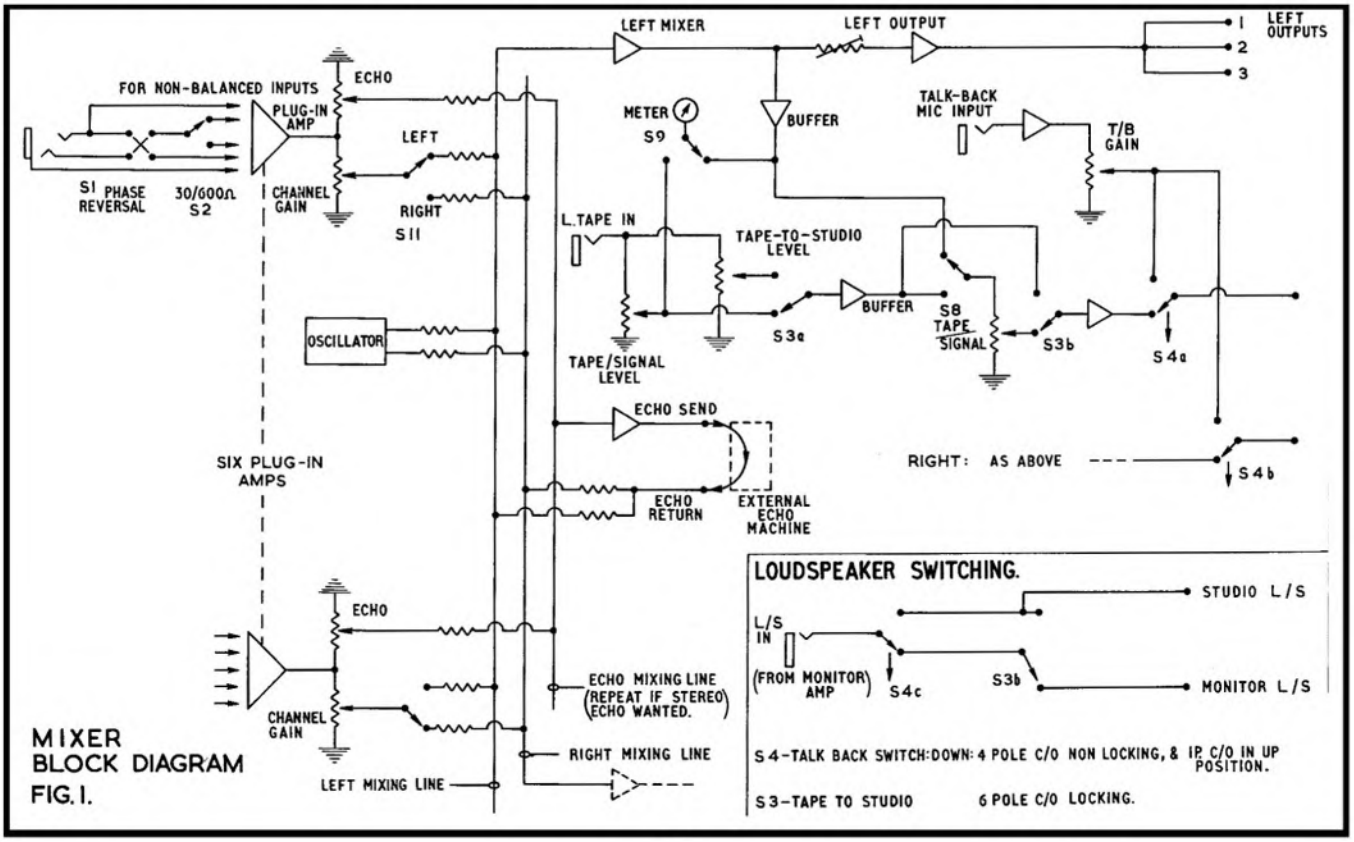
One design requirement was that the mixer had to be portable, so that for recording away from the studio, in churches and halls for example, the whole equipment could be transported easily. This means that transistors are used throughout, not that there was any doubt of this even if portability was not important. Nowadays the cost of transistors is lower than the equivalent valve and there are the well-known advantages of freedom from hum and microphony. The circuits are more reliable, and the ones to be described give better results than the equivalent valve circuits in all respects. In general, two types of transistors are used, both of which are cheap and easily obtainable. A mains power pack will be described, which is fully stabilised and can be used as a bench power supply in many cases if required. If necessary, the mixer can be operated from a battery supply, since the consumption is low.

At this stage the logic-diagram was drawn, and the final version is shown in **fig. 1.** This in fact is the sixth attempt, and shows that it is easier to experiment on paper than with the actual hardware, when change becomes difficult if not impossible! It was felt that six channels would be sufficient for the use contemplated by the author, although the design will accommodate twice this number at least. For monophonic use all six channels are available, while for stereophonic work the system was designed for two stereo pairs, and two monophonic injection microphones. These latter injection—or spot—channels can be fed in varying amounts to both outputs by means of a control known as a 'pan-pot', to enable the sound to be placed at any position in the stereo image plane, although if the sound it is picking up is also picked up to any extent by the main stereo pair, then it is most important that the pan channel is located in the same aural position to prevent image wandering. (A most interesting discussion on stereo microphone techniques is given in a BBC Monograph, No. 35.)

The Block Diagram

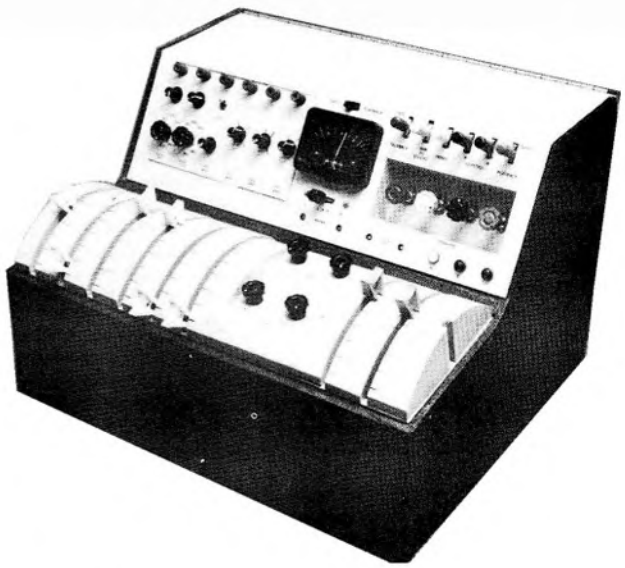
Referring to the block diagram, it will be seen that the output from the six pre-amplifiers can be switched to either left or right channels; this is to allow the faders for a stereo pair always to be adjacent to one another. The mixing amplifiers follow, and then an output amplifier to each channel. There are comprehensive facilities for monitoring the outgoing signal, and the replay signal from the tape recorder if it is fitted with a separate replay head. This replay signal can also be switched to the studio to play back to the artists. Talkback facilities are also incorporated.

Each recording session demands a different set of equipment, and there are two ways of overcoming this problem. In a fixed installation, or in a professional arrangement, all sources are processed to make the actual mixer stage see the same signal from each. Thus the signal from



MIXER BLOCK DIAGRAM FIG. 1.

A STUDIO QUALITY AUDIO MIXER



a microphone is simply amplified, while that from a tuner might be attenuated, and that from the pick-up both equalised and amplified. The amateur is often using a wide variety of other people's equipment, each with a different output, and to cater for all these it was decided to make the pre-amplifiers 'pluggable', and to design as many different types as was required. In this way the full versatility and portability of the mixer is preserved. So far, units have been constructed to suit standard microphones, either 30 or 600 ohm, condenser microphone or line input, and a high input impedance module to accept the output from valve gear which might have an output impedance of 100 K or so. In the near future a gramophone equaliser will be built. This shows the advantages of the plug-in system: the basic mixer is never outmoded because of other equipment changes, and any non-standard piece of gear can be accommodated into the system merely by building a new unit to plug in the space provided in the mixer.

A Second Feature

After the pre-amplifiers, the signal passes to the fader bank, and here the photograph shows the second important feature in the design. It was decided to have the six separate channels, and a master for each output, which is a total of eight attenuators. If knobs are used on rotary or conventional potentiometers, they should be large so that simultaneous operation of several channels is relatively easily performed. With practice, a rolling motion between fingers will allow about three faders to be operated by each hand. However, for small size this is not satisfactory, since eight large knobs will occupy a large amount of panel space, and this is clearly unacceptable. The solution was to use

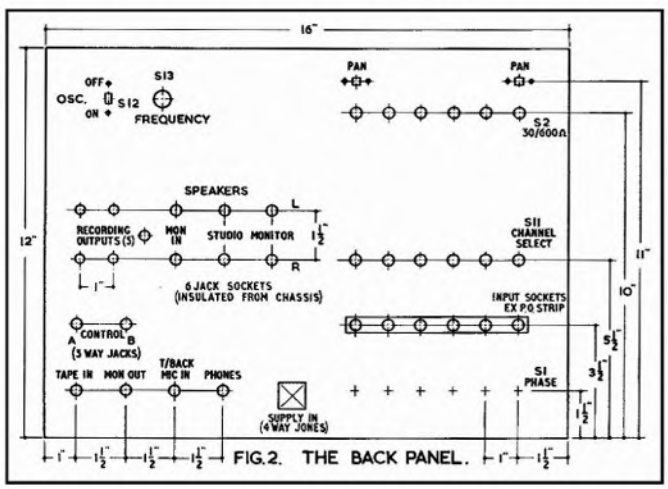


FIG.2. THE BACK PANEL.

quadrant faders, which occupy about 1½ in. of space lengthwise, but still retain a large travel for accurate level setting, and matching in stereo. It is also easy to use several at once, since each requires only one finger. In practice it has been found very easy to control stereo microphones on adjacent channels, and this is to be preferred to ganged channels.

Investigation of the price of commercial studio-type quadrant faders was brought to a rapid halt once the price was quoted—over £10 each—when it was decided to manufacture them from easily obtainable materials. The basis of the assembly, which will be fully described and drawn at a later stage, was a pair of gear wheels and an ordinary carbon potentiometer, which together give a very smooth reliable control, at a fraction of the purchased article's price.

The signal passes to the mixer amplifiers as previously mentioned and then is brought back to the fader bank to the main gain controls, which are grouped together at one end of the bank under the right-hand. At this point the monitoring takes place, and is designed so that any change to the monitor controls will have no effect on the output signal which is being recorded; as well, these controls are recessed into a small panel to prevent accidental movement. An amplifier similar to the output amplifier is used to amplify the signal so that any (external) power amplifier can be used for monitoring. The output from this power amplifier is brought back to the mixer so that it may be switched to the monitor speaker normally, but for talkback, and playback to the studio, a loudspeaker in the studio is put on to the amplifier output.

The monitor side is completed by the metering arrangements which in the prototype were based on a peak programme meter. In the author's opinion this is the only method of monitoring the peak signal to be considered, since it gives an extremely precise reading at all times, and is not upset by transients or particular types of music in the manner of a VU meter. The only disadvantage is that the meter movement is specially made, and is therefore a little more expensive than the conventional variety. Readers of *Tape Recorder* will remember a series by Graham Balmain which began in August 1962, describing the advantages in greater detail, and also discussing some typical valve circuitry. The transistor circuit will be discussed fully in a later article, and at the same time a simple but not-so-effective VU-type will be included.

There are two further circuits in the mixer which should be briefly touched upon at this stage. The first is a simple oscillator which can be switched to four spot frequencies of 1, 10 12, and 15 K/cs, which are very useful for aligning the recorder used in the system—head alignment and bias setting for example—and to set-up the outputs to be identical in level for stereo use. If many different types of tape

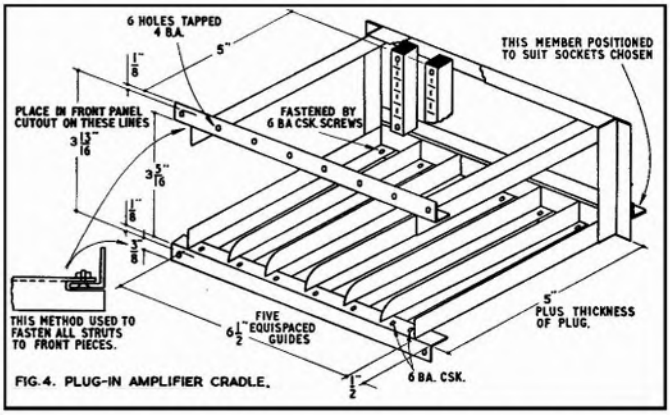


FIG.4. PLUG-IN AMPLIFIER CRADLE.

are used it is often a good idea to record 30 seconds or so of peak level of 1 Kc/s at the start of any important tape which might later be copied or used as the master tape in the cutting of a record, for use in the initial setting-up of the other apparatus. The second circuit is a flasher system which is arranged to operate a red panel light in the event of a fault or danger condition; in this case it is operated by the oscillator, by the talkback switch, and the tape-to-studio switch, since in all these cases a signal other than the required would be recorded. The flashing

(*Continued on page* 198)

A STUDIO MIXER—(*Continued*)

light gives a more compulsive indication than the simple red light.

The first step in the construction is the metalwork and wood sides for the case to contain the electronics. The prototype used 16 SWG aluminium for the back and front of the mixer, and wood covered in rexine for the remainder of the basic structure. With low impedance transistor circuitry, there is no need to have extensive screening in the mixer, and the wiring—with one exception—is in single conductor bell flex, which simplifies the work involved. The front panel is hinged at the back so that the inside is readily accessible for maintenance and wiring. **Fig. 2** shows the back of the mixer. It was decided at an early stage to use jack plugs throughout as the standard, with the three-contact version for stereo (two signal and earth) but since many people use two separate leads, provision was also made for this. In addition, each recording amplifier has five independent outputs so that more than one machine can be safely driven, since shorting any output makes no difference to the other outputs.

Switches on Front Panel

S3	Tape-to-Studio	Key	2 Position	6p c/o	locking
S4	(a) Cue Studio	Key	3 Position	up: 1p make	non 1.
	(b) Talkback	Key	2 Position	down: 4p c/o	non 1.
S5	Mono/Stereo	Key	2 Position	3p c/o	locking
S6, S7	For controlling other gear, i.e. recorder stop/start	Key	2 Position	1p c/o	locking
S8	Tape Signal Select	Key	2 Position	4p c/o	locking
S9	Meter Tape Signal Select	Slider	2 Position	2p c/o	locking
S10	Meter Select Channel A / Both / Channel B	Key	3 Position	2p 3 way	locking

Switches on Rear Panel

S1	Phase reversed	Toggle	2 Position	2p c/o	locking (6 off)
S2	30/600 ohms select (mic. only)	Toggle	2 Position	2p c/o	locking (6 off)
S11	Channel select	Toggle	2 Position	2p c/o	locking (6 off)
S12	Oscillator on/off	—	2 Position	1p make	locking
S13	Frequency select	Rotary	—	2p 4 way	—
S14	Pan channel 1	Slider	—	2p c/o	locking
S15	Pan channel 6	Slider	—	2p c/o	locking

The major dimensions of the front panel are given in **fig. 3,** and are identical with the prototype except that provision has been made for separate feeds for echo purposes. For recording popular music echo is almost mandatory, and the control for each channel gives the echo mixture an easily adjustable level to a separate mixing amplifier, and then to an external echo machine which can be any of the many available on the market at varying prices. The meter cut-out is for the *Turner* Type 702, and these dimensions must be modified to suit any other meter that is contemplated. The large cut-out on the left-hand side is for the plug-in units, and here again can be modified to suit other requirements. The author's units are $1\frac{1}{16}$ x $3\frac{1}{4}$ in., and used *Painton* miniature ten-way plugs, with the sockets in the framework. These were a little expensive at about 15s. a pair, but have proved entirely reliable and can be recommended. There are other types, such as the *McMurdo* red range, on the general market at about half the cost, but may be wider so that other dimensions may have to be used if this plug is adopted. Any connector with six or more ways is suitable.

The runners for the plug-in units were made from angle pieces of aluminium, shaped to suit, and the sockets are mounted on a framework made from the same material. Dimensions here are given for the prototype. The framework is held together with 6 BA nuts and bolts, although if a material other than aluminium is used, then the holes could be tapped to save using nuts (**fig. 4**).

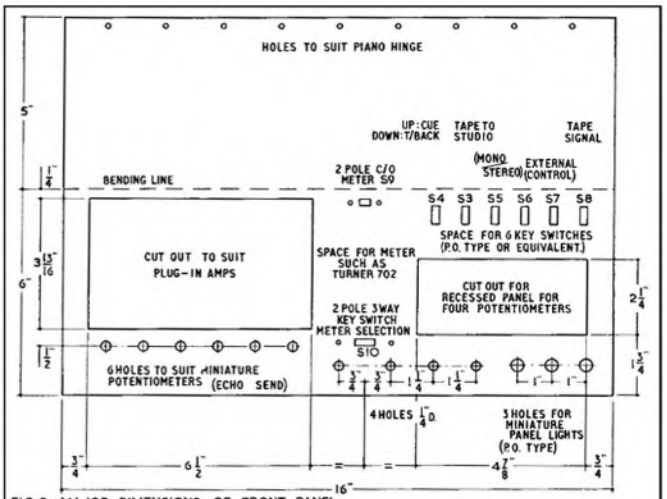


FIG. 3. MAJOR DIMENSIONS OF FRONT PANEL.

The recessed panel is made as a box in aluminium sheet, and is bolted to the rear of the cut-out. To finish this off, fibreglass is pasted over the join and the whole smoothed off with a file when dry.

Next Month . . .

This finishes the construction of the framework, and next month will see the full details of the construction of the fader bank, and a start on the electronics with the design and building of the mains power pack so that the testing of the other units can be carried out easily.

TWO SIDES OF THE COUNTER

IN DEFENCE OF THE DEALER

By H. W. Hellyer

AT a recent meeting of service managers, some wag came out with the chestnut: "If it were not for the customers, we'd all be happy." No matter what your reaction to this, as a customer or potential customer of the radio dealer, or tape recorder salesman, there is a hint of wry truth in it when heard from the other side of the counter. 99% of a dealer's customers are normal, average, tolerant and tolerable beings. But the odd one seems determined to make up for all the rest. He invokes the flames of wrath and retribution on the dealer's greying head for every little thing that goes wrong. He—or more likely she—sees the man behind the counter as a target for every complaint in the consumer's calendar.

The point seems to be, just how far is the dealer really to blame when things do not suit the purchaser, and what can be done about it? Take the case of guarantees. Every reputable maker gives a guarantee with his goods. For the equipment that interests us, this is generally 12 months, overall, with a subsidiary guarantee of three months by valve makers. But this guarantee simply says that failure of the goods under normal conditions of use will be made good. Faulty parts will be replaced free of charge *by the maker*.

Note that last phrase. It is not the dealer who is giving the guarantee, but the maker. When the goods are returned to the dealer for repair, he has to spend time locating the faults, and postage in sending back the goods, for which he can quite legitimately make a charge. He cannot recoup this from the makers, but many dealers consider it worth their while, for the sake of continued goodwill, to make no charge for such repairs. He allows for this virtual loss in his budgeting—and in a normal radio dealer's service department this can represent quite a considerable drain on his profits.

We, as customers, have no right to demand a free job. Neither is the dealer obliged, in law, to accept such a repair job. He would certainly be very reluctant to take on repairs of goods he did not sell himself. In fact, many dealers will only repair goods under guarantee, or under their own maintenance scheme. It is not for us to rail at them for operating a business their own way. For this reason, it is always advisable, when purchasing a piece of equipment as complex (and vulnerable) as a tape recorder, to ensure that an after-sales-service is provided.

What about this business of 'chucking the goods back' at the retailer when they go wrong soon after being bought? What right have we to demand a refund? The answer is—*none at all*.

Under the Sale Of Goods Act, 1893, where a buyer "expressly or by implication makes it known to the seller the particular purposes for which the goods are required, so as to show that he relies on the seller's skill or judgement, and the goods are of a description which it is in the course of the seller's business to supply, there is an implied condition that the goods are reasonably fit for the purpose." Which, being interpreted, means that so long as you did not tell the dealer you wanted to use the tape recorder as a foundation stone or a bed-warmer, it is presumed you bought it for making and replaying tape records. If it goes up in smoke when you get it home, you have to prove, at your own expense, that it was not suitable for its true purpose when you handed over your cash. The implication is obvious—don't buy a pig in a poke.

This leads us to another small point that has bothered some readers who have bought second-hand goods. What if they are stolen? Well, the law does not protect you. Under Section 18 of the Act, Rule 4, everything depends on the terms of contract between original seller and buyer. So, for example, if a dealer gets his goods from a wholesaler on a Sale or Return basis, then 'Welshes' on his settlement with the wholesaler, the latter can descend upon you to claim his goods, even though you paid the dealer cash and have a receipt. And it is then up to you to claim against the dealer—which is too bad if he is the sort of fly-by-night that sometimes appears in the market place with so-called 'bargains'. Buy second-hand machines from *reputable* dealers, such as those that advertise in these pages.

Mind you, the same thing applies from the other side of the counter. If a dealer is stupid enough to trust us with goods on a verbal sale-or-return basis and we then pawn the goods, he can get them back from Uncle but we have made off with the cash. Which is one reason why the dealer is very chary about letting goods go out on approval—and can you blame him?

So what about this problem of choice, I hear you say? Well, we have very few rights. We can demand a demonstration, but cannot object if it is refused, except to take our custom elsewhere, which is our ultimate weapon. But we cannot demand that a machine be sold at any particular price, not even for that marked on the ticket (I am not referring now to the bone of contention, rpm). Neither can we demand *that* particular machine, in the front of his nicely dressed window. We have no right in law.

We are on very different ground when it comes to the description of the goods on the price ticket or label. The Merchandise Marks Act of 1887 and the Act of 1953 which brought things more up-to-date make quite a few stringent provisions about this. The bugbear of a 'false trade description' has caught many manufacturers and dealers. It is a very definite offence to sell goods with a false trade-mark or description, and penalties are severe—up to £100 for the first offence and £250 subsequently.

Returning to that matter of goods left for repair, it is necessary to clear up another small point. How long can they be kept, and what if we refuse to pay? As to how long—that is really a matter of common sense. If the dealer has to wait for replacement parts, through no fault of his own, we can hardly blame him. If he is simply blaming the manufacturer for his own tardiness, the only answer is to nag, and nag, and nag (as a practising engineer, I may say that we very quickly get rid of repairs that bring a nagging customer round our necks). And if it is a question of withholding payment of hire-purchase, you should really read the small print of your agreement, where you will usually find that you can withhold only so long as you pay the whole sum of arrears when the goods are collected. But this depends on the Company.

A repair should really be accompanied by a detailed invoice, otherwise you have no grounds for a claim against the dealer. Many times the dealer has the annoying experience of an item being returned, maybe months later, with the remark: "It's just the same as it was before". Very often the fault is quite different, and again, the dealer may not give any kind of repair warranty. Any such will be stated on his invoice, and would generally cover replacement of parts within a limited period.

If you do not claim your repaired goods, and the dealer has notified you that they are ready, he can give you notice that he is going to sell them, after 12 months, under the Disposal of Uncollected Goods Act, 1952. He can then sell them to recoup his repair losses—but there is a lot of complicated procedure, many sub-paragraphs of conditions, and he would much rather you paid up and collected.

A final point: what if Sonny Jim buys a Super Special Hi-Fi rig on credit, and you refuse to pay? Well, the Sale of Goods Act, 1893, still stands on this point. We are deemed infants till we are 21, and the contract is not binding except for *Necessaries*, as they are termed. Although under Section 42 of the National Assistance Act, 1948, a parent is under a statutory obligation to maintain his child, he is *not* liable for the child's debts. Which is why the dealer requires your signature on Johnny's order—so don't knock the poor chap, he's only trying to make a living. He wants you to buy—and he wants you to be satisfied and come again.

THE REPAIR-MAN COMETH

By David Kinglake

HAVE you noticed how machinery always seems to have a will of its own? I mean, a sort of vindictiveness, a process of being stubborn just when some extra effort is needed. For example the telephone which insists on connecting you with someone-or-other's conversation about performing Chimpanzees just when you've a raging toothache and urgently need the dentist, or the alarm clock which you knew you'd switched off that rouses you from your slumbers on your first morning off for a month.

Television sets, too, have these little traits; ours certainly has. A week or two back our set developed a peculiar morse-like interference over a short period—occurring, of course, right in the middle of our

(*Continued on page* 200)

REPAIR MAN COMETH—(*Continued*)

favourite programmes. This eventually became so distracting that I telephoned the Rental Company and, explaining this phenomenon in great detail, requested their immediate attention.

The engineer arrived that evening. After I had explained again exactly what he could expect to happen, he switched on, and of course we got perfect reception. Not a trace of disturbance; not an iota of interference; it might have been the manufacturer's model demonstration set for all the wrong it would do. I need not describe my embarrassment. After all the Hoo-Ha I'd created, all I could demonstrate was Pinky and Perky, and I'm sure the engineer went away convinced that we were under some kind of delusion. But perhaps we had seen the last of the fault.

Oh, no. Half an hour later—yes, that's right—*Beeeeeeeeep!* Even the cat woke up and spat at it. "Get the man back," said my wife, by now pretty fed up with the whole business; but it was too late then. "Anyway," I said, "How do we know it wouldn't stop playing up if he did come?"

Then my wife had an idea, rather on the basis of "Set a thief to catch a thief"—which is where the tape recorder comes in. "Couldn't you record that noise or something, dear" she said, "then we could prove that it happens, and demonstrate what it sounds like."

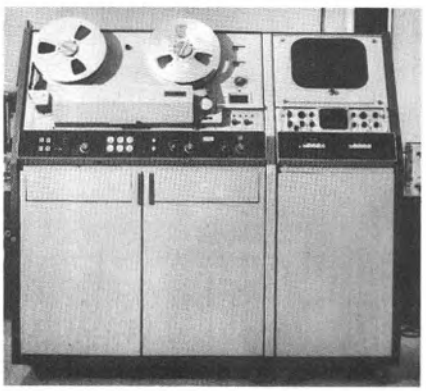
It should have been obvious from the start; I might have guessed that set would make a fool of me when it came to the pinch. So out came the recorder, and with an inward shudder I hung the microphone in front of the loudspeaker and provided myself with several yards of Squealing Coronation Street.

I was surprised to find that the set and the recorder weren't in cahoots, or I'm sure the recorder would have gone on strike in sympathy (although I did discover afterwards that I'd recorded over a tape I particularly did not want to touch), and I ended up with a very explicit recording. A call the next day brought a somewhat sceptical engineer to our door, but a few seconds of that recording soon changed his ideas, and I'm pleased to report a very successful conclusion to our operation.

After all, these little problems can soon be cured with the application of technical know-how and imagination, and . . . what's that dear? . . . Eh? *Your* idea . . . well, yes but . . . Wives! They always want to muscle in.

TAPE, RECORDERS & ACCESSORIES

FIRST DETAILS OF NEW PRODUCTS



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AMPEX VR2000

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Colour TV Recorder

COLOUR television recording of higher quality than ever previously obtainable is made possible by the *Ampex VR2000*, just released in this country. Making its debut in Chicago last month, orders have already been received from the BBC who requested six units.

A substantial improvement in signal-to-noise ratio is said to be the main breakthrough incorporated in the new recorder. This is claimed as 46 dB, compared with the earlier maximum of 42 dB. Provision is made for lowering the ratio to enable interchange of tapes with other recorders. It is claimed that the quality is so high that copies of tapes made on a VR2000 can be dubbed three times before the picture quality becomes comparable with standard master video recordings.

Available in 525 line 60 c/s, and 625 line 50 c/s versions, the recorder features Ampex *Mk. 4* video heads with rotary transformers and integral nuvistor pre-amplifiers. Bandwidth, referenced to 100 Kc/s, is ± 1 dB for the following: Domestic 'low-band': 4·2 Mc/s —3 dB. Domestic 'high-band': 4·5 Mc/s —3 dB. International 'low-band': 5·0 Mc/s —3 dB. International 'high-band': 6·0 Mc/s —3 dB. **Manufacturer: Ampex (Great Britain) Limited, 72 Berkeley Avenue, Reading, Berkshire.**

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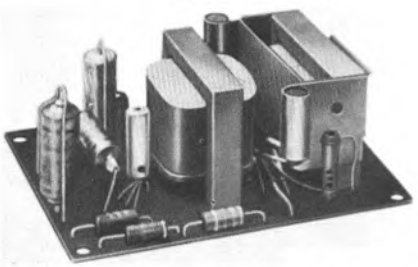

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T.S.L.

TRANSISTOR

AMPLIFIER

★

THE *Audio Heart* transistor amplifier, recently announced by T.S.L., has a wide range of applications in the field of amateur tape set-ups. With a claimed frequency response of 60 c/s to 16 K/cs ± 3 dB, it has a push-pull output of 1W. Retailing at £2 19s. 6d. (or in kit form, £2 12s. 6d.), the amplifier measures 3 x 2·2 x 1·2 in. high and is powered from a 6V DC supply. **Distributor: Technical Supplies Limited, Hudson House, 63 Goldhawk Road, London, W.12.**

* * *

SELACHRON ELAPSED TIME INDICATOR

FITTING into a standard fuse-holder, the *Selachron* can be connected across a suitable electrical supply within a tape recorder to show the total time the unit has been used. This is only one of many possible uses to which the time-recorder can be put. Several versions are available, for operation on AC or DC supplies. **Manufacturer: Industrial Instruments Limited, Stanley Road, Bromley, Kent.**

Drive Belt Sets

DRIVE belt sets for the following recorders and decks can now be obtained from Tape Recorder Maintenance. At prices varying between 2s. 6d. and £1, the sets are, where necessary, complete with indicator belts.

Grundig: TK1, TK5, TK8, TK9, TK12, TK14, TK18, TK20, TK23, TK24, TK25, TK30, TK35, TK40, TK41, TK46, TK55, TK60, TM45, TM60, TK720, TK819, TK830, TM819A, 500L, 700L, 700C, Cub.
Telefunken: 65S, 65X, 75, 75/15, 76, 77, 85, 95, 96, 97, 98.
B.S.R.: TD1, TD2.
Walter: 303 Deluxe, 404, 505.
Korting: All models.
Minivox: All models.
Philips, Cossor, Stella: EL3515, EL3527, EL3536, EL3538, EL3541, EL3542, EL8105, EL8107, CR1601, CR1602, AG8108, AG8109, ST450, ST451, ST454, ST455.

Distributor: Tape Recorder Maintenance Limited, 323 Kennington Road, London, S.E.11.

* * *

★

ROBUK RK44

★

Colour-Coded Tapes

A NEW series of audio recording tapes, specified for use in education and industry, has been introduced by *Ampex*. Using 1·5 mil (long play) du-Pont Mylar base, a new heavy-duty oxide coating is said to resist wear and consequent drop-out.

A pressure-sensitive binding is supplied, on which the subject-matter of the enclosed tape can be written. Coloured reels form the basis of the coding system, utilising red, green, blue, orange, violet and yellow spools. **Manufacturer: Ampex (Great Britain) Limited, 72 Berkeley Avenue, Reading, Berkshire.**

* * *

Robuk RK44

WITH a maximum playing time of 25½ hours on a 7-in. reel of triple-play tape, the new *Robuk RK44* is a ¼-track version of the RK3 and sells at £40 19s. With a claimed frequency response of 60 c/s to 14 Kc/s and 60 c/s to 7 Kc/s ± 3 dB at 7½ and 3¾ i/s respectively, and 60 c/s to 3·5 Kc/s at 1⅞ i/s, the recorder has a signal-to-noise ratio better than 40 dB. **Manufacturer: Robuk Electrical Industries Ltd., 559-561 Holloway Road, London, N.19.**

● *You're Guaranteed a Better Deal*

When you PART EXCHANGE Your TAPE RECORDER with R·E·W

A friendly welcome awaits you at our bright showroom extension. Here you will find a lavish array of equipment at every price level . . . make your choice for immediate delivery or if you cannot visit us, the fast and friendly R.E.W. Mail Order Service makes it easy for you to enjoy the professional results only possible with an advanced Tape Recorder Get in touch with us now. We have thousands of satisfied customers and a reputation for generous part exchange, reliability and specialist service.

300 MACHINES ON DISPLAY!

Call, see, hear and choose the Tape Recorder you've always wanted from one of the biggest ranges anywhere. Just about every model—for off-the-shelf delivery. An unrivalled stock of leading makes of new and used machines at unbeatable bargain prices—30% -60% reductions on original prices! Make a point of asking for our Special Bargain List.

MACHINE OF THE MONTH

TRUVOX R92 (2-TRACK) OR R94 (4-TRACK) 69 GNS.

An instrument for the enthusiast who wants professional performance and top reliability. Inc. microphone, tape and spool. 3 Speeds, automatic stop, High Fidelity Sound, 7 in. spools. High Frequency Response.
Terms: £7.9.0 deposit and 12 monthly payments of £5.8.4.

OPTIONAL INSURANCE at nominal rates against unemployment, sickness or accident during term of H.P. agreement!

You're guaranteed maximum satisfaction with the **R.E.W.**

"PLUS FIVE" SERVICE

- **Generous part exchange allowances.**
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LOWEST DEPOSITS

CASH FOR YOUR TAPE RECORDER or HI-FI.
Highest cash offers for good equipment . . get in touch today!

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Take your pick from our wide range and have any machine you want for 10% deposit, balance twelve months and no interest charged. (18-24 months H.P. terms also available.)
Home demonstrations in the London area gladly arranged. By return enquiry service. Agents for all makes.

Bargain Basement!

We have an unrivalled stock of leading makes of new and used machines at unbeatable bargain prices—30%–60% reductions on original prices! Make a point of asking for our Special Bargain List.

Hi Fi CENTRE Tape recorders

R·E·W (Earlsfield) Ltd.

Mail Order Department
266/268 (TR) Upper Tooting Road, London, S.W.17.
Telephone: BALham 9174-5

How fast is Speed ?

Among the many factors taken into consideration by Tandberg engineers when designing semi-professional tape recorders are Tape running speed and maximum reel size.

It is now more than ten years since Tandberg demonstrated their ability to produce a standard of performance at 7½ i.p.s. better than that previously achieved by many expensive 15 i.p.s. tape recorders. Since that time the completely dedicated Tandberg tape recorder research team have progressed from one outstanding development to another.

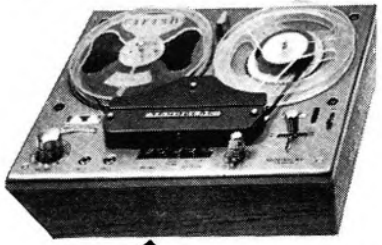
With a speed of 15 i.p.s., and before the advent of modern Long Play tapes, a 10½" reel was essential. The modern Tandberg Series 6 or 7 use 7" reels and with L.P. tape will play 45 minutes at 7½ i.p.s. or 1½ hours at 3¾ i.p.s. uninterrupted. This has enabled Tandberg to produce semi-professional tape recorders weighing only 25 to 28 lbs. and measuring 15¾" x 11¾" overall.

Due to their modest dimensions and absence of overhanging reels, Tandberg Series 6 and Series 7 have therefore established themselves as first choice for inclusion in permanent Hi-Fi installations.

With final reference to Tape Speed as related to performance we quote :—

"At 7½ neither he nor the reviewer could distinguish the tape from the original. At 3¾, the two could be barely distinguished. The reviewer made his differentiation largely on the basis of slightly higher background noise when the tape was played". (Tandberg 64 reviewed in AUDIO March 1963).

"Even at the lowest tape speed of 1⅞ i/s it needs a sharp ear and a really good performance source to be sure, every time, whether you are listening via tape or directly". (A. Tutchings reviewing Series 6 (2-track) in The Tape Recorder).

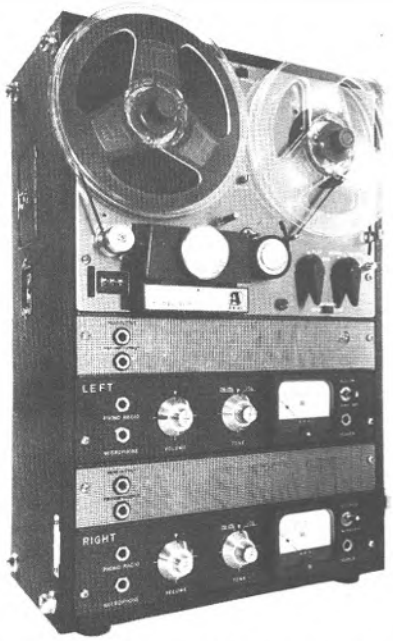


Write for details of Tandberg Series 6 & 7 Tape Recorders and 28 page booklet of Technical Reviews.

Tandberg

ELSTONE ELECTRONICS LIMITED
Edward St., Templar St., Leeds 2. Tel : Leeds 35111 (7 lines)

EQUIPMENT REVIEWED



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AKAI MODEL M-7 STEREO RECORDER

★

Manufacturer's specification: Frequency response: 30 c/s-23 Kc/s at 7½ i/s, 40 c/s-20 Kc/s at 3¾ i/s, 40 c/s-13 Kc/s at 1⅞ i/s. Measured with 3M (Scotch) recording tapes 111A, 150 and 200. **Signal-to-noise:** 40 dB below recorded 0 level signal. **Wow and flutter:** less than 0·06% at 7½ i/s, less than 0·10% at 3¾ i/s, less than 0·13% at 1⅞ i/s. **Equalisation:** correct equalisation of tapes recorded to NARTB curve. **Channel separation:** better than 80 dB at 1 Kc/s −3 VU. **Distortion:** within 3% at 1 Kc/s 0 VU (total harmonic). **Heads:** in-line ¼-track stereo/mono record-play, ¼-track trail-less recording bias heads. All functions are controllable by a single head switch having positions for: ¼-track stereo, 1-4 track mono, 3-2 track mono, 2-track stereo (playback only). **Recording system:** cross-field recording based on the new theory of trail-less recording bias system. In-line 4-track stereo and 4-track mono recording. **Motor:** hysteresis synchronous, 2-speed motor, 3,000-1,500 rpm at 50 c/s, 3,600-1,800 rpm at 60 c/s. Capacitor start, dynamically balanced. **Tape speed:** 7½, 3¾ and 1⅞ i/s (15 i/s with accessory capstan and pinch wheel). **Recording time:** 4-track stereo 1,200 ft. tape 4 hrs, 2 hrs. and 1 hr. for tape speeds of 1⅞, 3¾ and 7½ i/s. 4-track mono: 8 hrs, 4 hrs. and 2 hrs. for 1,200 ft. tape at the three tape speeds. **Power output:** 6W max. on each channel, total 12W. **Tubes used:** 2-EF86, 2-12AX7, 2-6BQ5, 2-6X4 and 1-6RA5. **Fast forward and rewind time:** 75 seconds for either operation using 1,200 ft. tape at 60 c/s (90 secs. at 50 c/s). **Power requirements:** 100 VA. **Weight:** 47·3 lbs. **Dimensions:** 20 1/10 in. high, 13¾ in. wide and 8 9/10 in. deep. **Price** (with 1⅞ i/s stereo demonstration tape, matched pair of wide range dynamic microphones, radio cables, 5 in. reel with tape, empty 5 in. reel, rubber caps for reels and accessories case): £139 13s. **Distributed by The Pullin Optical Co. Ltd., Ellis House, Aintree Road, Perivale, Greenford, Middlesex.**

* * *

THIS recorder was supplied with a pair of Model *SS-70* wide-range stereo loudspeakers so that it was possible to listen immediately to the 1⅞ i/s ¼-track stereo demonstration tape supplied with each machine.

I must say the demonstration was extremely impressive, particularly as the label on the tape announces that "The stereophonic sounds recorded on this demonstration tape were actually recorded by this machine at 1·875 i/s". Speech and music were crisp and clean and the stereo effect was excellent. Really careful listening showed a slight background noise and a just perceptible lack of extreme high note response. Wow and flutter seemed to be remarkably low as judged by a simple listening test.

The novel feature of this recorder is the 'cross field trail-less bias' recording system and I am going to digress for a moment or two to explain what it is all about.

It is well known that the recorded high note response depends to a very large extent on the sharpness of the decay of the bias field at the trailing edge of the gap. A high bias gives very low distortion, as

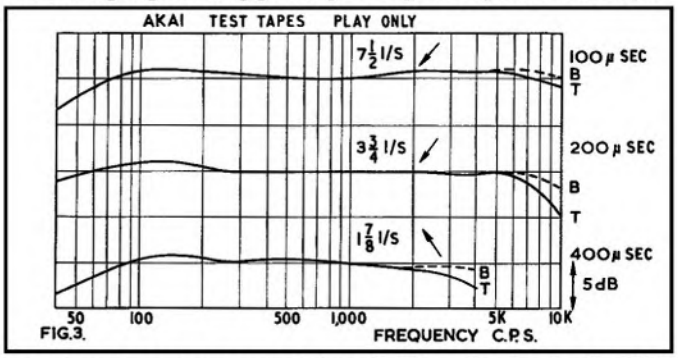


FIG.3.

the bias field penetrates to the full depth of the oxide, but the bias field dies away gradually on either side of the gap so that oxide particles, properly magnetised within the gap, are partly erased as they pass through this diminishing field so that short wavelengths, comparable to the dimensions of the fringing flux, are most affected leading to a lack of high note response which has to be made good by extra high frequency pre-emphasis in the recording process. See **fig. 1A.**

A lower bias together with a narrow recording gap tends to prevent this effect but short wavelengths are only recorded on the extreme surface of the tape and the full depth of the oxide layer is not used at medium and high frequencies. Such recordings are unstable and can be affected by very weak fields, or the high frequencies may literally be 'rubbed off' the tape surface by normal wear and tear. See **fig. 1B.**

Many years ago the *Armour Research Foundation* in America

(*Continued on page* 205)

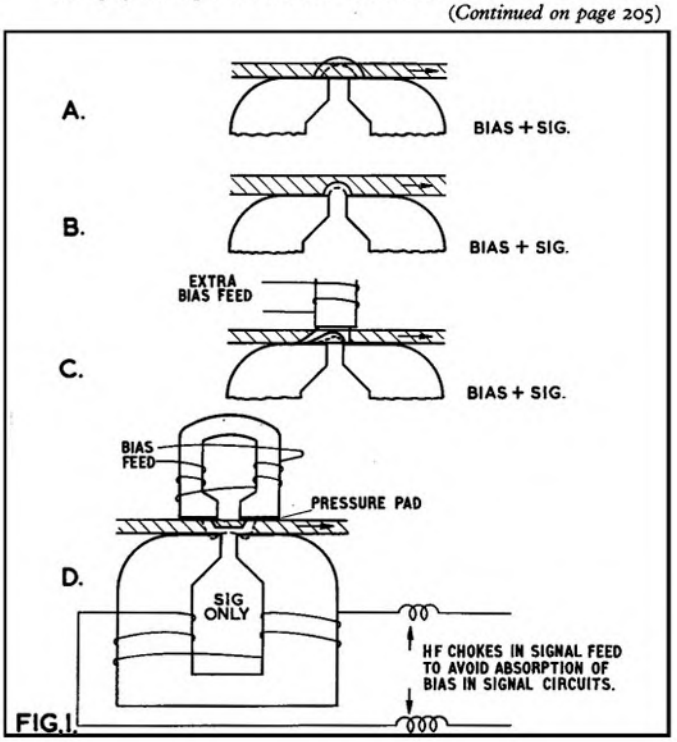
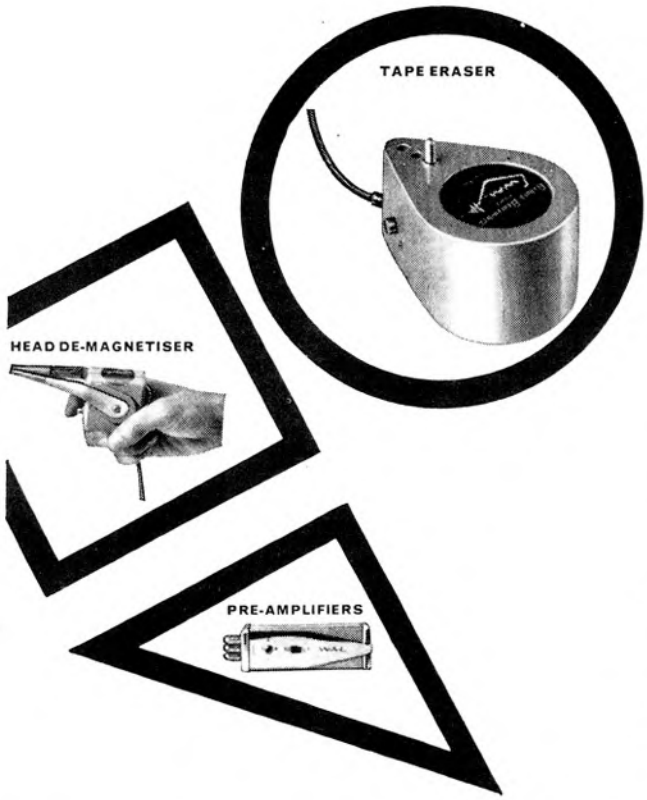


FIG.1.



Three basic essentials for the recording enthusiast

Tape Eraser

Erases both sides of a 7" tape reel in 30 seconds and positively removes even the very low frequency portions of a recording. Use the WAL Tape Eraser, the only way to ensure an *absolutely* clean tape—quicker and better. Mains operated. Also erases sound from 16 mm. film, 10" aluminium reels. Professionally designed for professional recording engineers. £6.18.6.

Head De-magnetiser

De-magnetises tape heads quickly and simply. Also for pin-point erasing on striped film and tape recordings—removes local unwanted noises without detriment. Has nylon-cushioned twin probes with a concentrated demagnetising field in the 1/8" gap between the arms. Pistol grip. A.C. mains. Professionally designed for professional recording engineers. £2.10.0.

Pre-amplifiers

WAL pre-amps are made for every purpose. Fully transistorised, battery-operated, give high gain, completely hum-free. Laboratory built and fully tested. Professionally designed for professional recording engineers. Ask for details of WAL-GAIN Mono £5.10.0. STEREO WAL-GAIN £7.10.0. and the superb WAL HI-GAIN with built-in switched equalisation for monitoring, dubbing etc. etc. £7.16.0.

WAL

Free leaflets available on these professional aids to perfection . . . please write:

ELSTONE ELECTRONICS Ltd

Edward Street, Templar Street, Leeds 2.

Alive to every sound

Like the ears of this wary fox, the Grampian DP4 microphone is sensitive to an extremely wide range of sounds. With its uniform frequency response from 50 to 15,000 c/s, the reliable, medium-priced DP4 will greatly improve the standard of your recordings.

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patented a system where a single pole carrying bias flux was placed on the opposite side of the tape to the normal recording head which was also biased in the normal way. The phasing of the bias flux in head and pole resulted in added leakage flux on the leading edge of the gap and some cancellation of the fringing flux on the trailing edge. See **fig. 1C.**

The new system uses a two-pole head on the opposite side of the tape and this supplies all the bias flux; the recording head coils are not supplied with bias current at all. Nevertheless bias flux is relayed into the core of the record head by simple induction from the extra biasing head. The interaction between the direct and relayed bias flux cancels most of the leakage flux and gives a uniform horizontal bias field through the full depth of the oxide layer with a sharp cut in bias flux on either side of the gap. See **fig. 1D.**

In this machine the extra head is spring-loaded against the back of the tape and is faced with fabric so that it acts as a pressure pad also during recording. As the machine is switched off the head is first lifted well away from the record head proper, so that the flux in the tape and record head dies away gradually, and then, at the full extent of its travel the bias current is switched off. This completely de-gausses the record-play head at the end of each recording sequence and ensures that playback is as quiet as possible.

Wow and Flutter

Fig. 2 shows the fluttergrams for the three speeds, but, as the $3\frac{3}{4}$ i/s tape speed is available at two motor speeds, four sets of pen recordings were prepared.

With the capstan sleeve fitted and with the motor speed at 'high' the tape is transported at $7\frac{1}{2}$ i/s. Total RMS wow and flutter remained

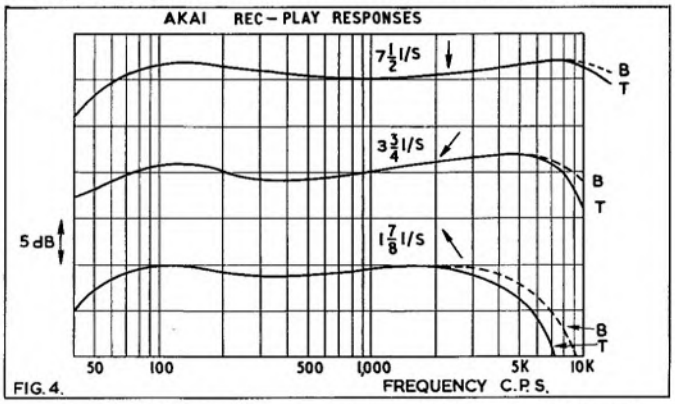


FIG. 4.

at 0·08% and the short-term speed imperfections are fairly random with no 'build-up' of wow or flutter as the recorded and playback components come in and out of step with each other.

With the motor speed still at 'high' and with the capstan sleeve removed the tape speed is $3\frac{3}{4}$ i/s. The top trace shows traces of 50 c/s flutter from the motor rotation frequency of 3,000 rpm with an RMS meter reading of 0·15%. The lower trace shows a period of partial cancellation where the playback flutter was momentarily out of phase with the recorded flutter; the RMS reading at this time was 0·12%.

With the motor on 'low' and the capstan sleeve fitted the total flutter reading was between 0·15% and 0·1% with traces of 25 c/s flutter at the motor speed of 1,500 rpm.

Finally, with the motor on 'low' and the capstan sleeve removed the total RMS reading remained fairly steady at 0·2% to 0·22% with the 25 c/s flutter from the motor more obvious due to the reduced smoothing of the lower speed flywheel. At no time was there any sign of wow at capstan frequency, which shows that the capstan, sleeve, flywheel and belt are all true to fine limits.

Test tapes were played at all speeds and both tracks to give the responses of **fig. 3.** As the tone control was continuously variable it was set at each speed to give the most level response and the position is shown by the arrow on each curve. The bottom head had a slightly finer gap giving the more level dotted responses.

The surface induction time-constant of each test tape is shown against each response. Thus tapes recorded to CCIR recommendations would play level with the tone controls set in the positions shown.

Hum and noise with no tape running was 30 to 33 dB below test tape level; the hum content changed by 3 dB when the motor speed

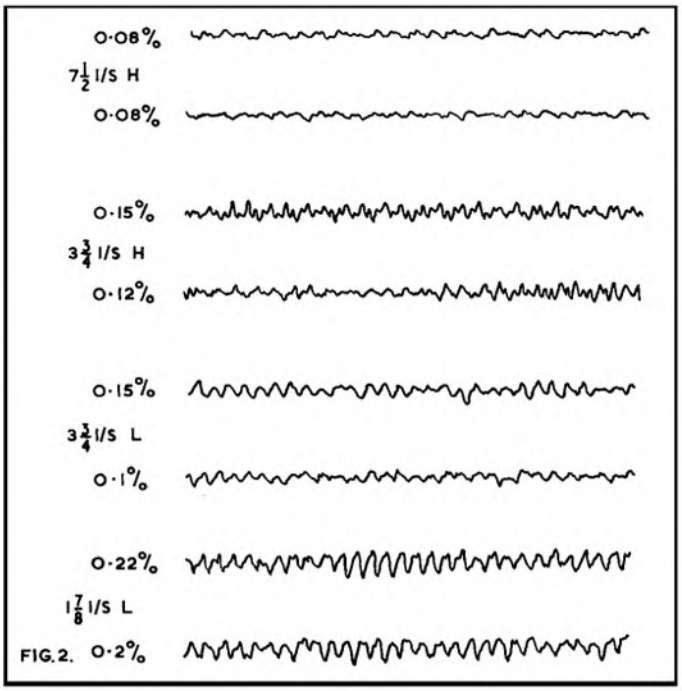


FIG. 2.

was changed, being worst at the higher speed where the hum field radiated by the motor increased slightly.

Record-Play Responses

Fig. 4 shows the overall record replay responses at the three speeds and it will be seen that they are very similar to those provided by the test tapes. The tone control position at the highest speed of $7\frac{1}{2}$ i/s is slightly different to that for the test tape and confirms that the recording characteristic is close to the NARTB 50 μS characteristic.

Test-tape level was recorded at −6 dB on the VU meter, but waveform distortion was evident on recordings made with the VU meter reading above 0 dB, namely 6 dB above test-tape level. After several tests it was found that the culprit was the Japanese tape supplied with the recorder. Any of the tapes mentioned in the specification, indeed any other tape I tried, recorded +12 dB on test-tape level without any sign of waveform distortion. To prove that it was not an isolated dud reel of tape I made test recordings on an unused portion of the demonstration tape with exactly the same result; overload at only 6 dB above test-tape level!

Frequency response on other tapes was almost identical, proving that bias is optimum for lowest distortion. Thus the signal-hum ratio is 36 dB on the tape supplied with the recorder and 42 dB on normal tapes.

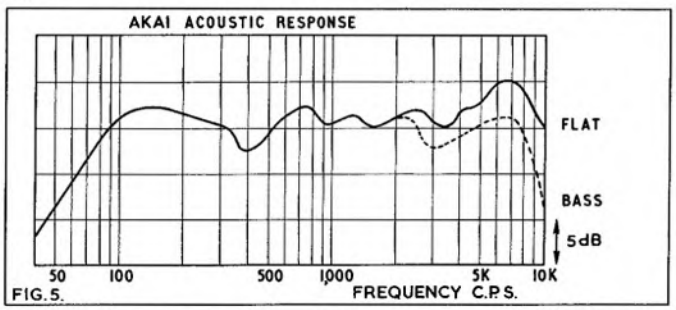


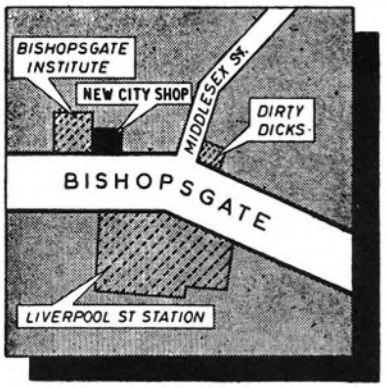
FIG. 5.

Signal-noise ratio, measured by passing the reproduced signal through a weighting network to simulate the ear's response, was 45 dB and 51 dB respectively.

Acoustic Response

The response and sensitivity of one of the Akai microphones was tested in a white-noise sound field to give the curve of **fig. 5.** The low note response is exceptionally smooth and level and the rising high note response with a slight peak at 3 Kc/s gives 'presence' to voice recordings without hardening music recordings to any appreciable extent.

(*Continued on page 207*)



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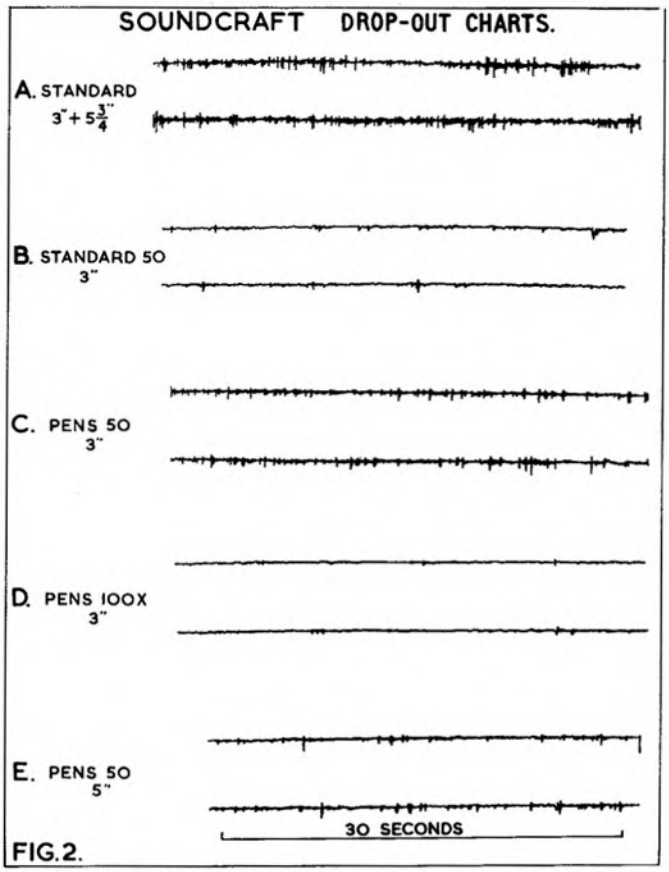

FIG.2.

One of the SS-70 stereo loudspeakers supplied with this recorder was tested by playing a 7½ i/s white-noise test-tape with the tone control set as in **fig. 3** and measuring the sound output on the speaker axis. A switch near the input jack of the speaker provides alternative responses 'flat' and 'bass' and these are shown in the response curve of **fig. 6.** It would seem that the switch simply attenuates the input to the tweeter section of the coaxial speaker unit on the 'bass' position to reduce the high note response slightly without in fact affecting the low note response at all.

The effect of the cross-field biasing system is not so very startling in terms of extended frequency response, but this is because the designers have chosen to use the new biasing technique to lower the distortion and intermodulation by-products rather than please the advertising copy-writer who nevertheless has gone to town on wild claims for very wide frequency responses—but by now we have almost come to disregard frequency response claims as we know full well that frequency response is almost exactly inversely proportional to price, and that no

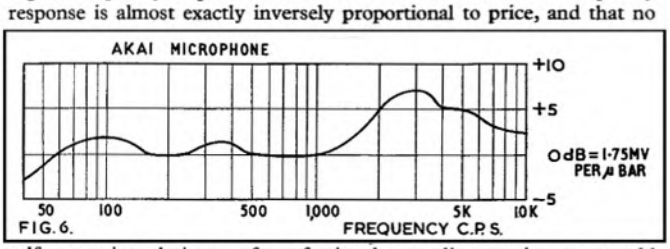

FIG. 6.

self-respecting designer of professional recording equipment would promise a level response above 10 Kc/s at 7½ i/s or 5 Kc/s at 3¾ i/s using orthodox recording methods. The fact that good 5 Kc/s response is available at 1⅞ i/s with low distortion and lack of exaggerated recording pre-emphasis is a measure of the success of this new system.

The low remanence tape supplied with the machine is probably the fault of the Sales Dept. as it is obvious from the specification that the technical design is based on good quality tape. No one can afford to throw away 6 dB in dynamic range, particularly on a 4-track machine, and this recorder is worthy of the very best quality tape.

Appearance and styling is severely functional, but every control is well placed and does its job efficiently. The machine is not sensitive to position; it can be laid on its back, placed at an angle, or stood upright with no change of performance. It is transportable rather than portable, but it is just possible for one man to stagger from his car to a recording session with a complete stereophonic recording and monitoring system. Standard P.O. type jacks are used for all input and output connections which include head output and pre-amplifier output as well as microphone and loudspeaker connections, so that it is most flexible in use and can be patched into other equipment as a moment's notice.

Comment

It is a recorder for the real enthusiast or semi-professional recordist rather than the domestic user and could form the nucleus of a hi-fi stereo system which only needs the addition of stereo pickup and transcription turntable and an FM tuner. In the not too distant future when stereo broadcasting arrives it should be possible to collect a wonderful library of stereo tapes: 7½ i/s for top quality serious music, 3¾ i/s for most other programmes, and 1⅞ i/s for background music to fill the house with pleasant unobtrusive sound. If the 1⅞ i/s music is half as good as that recorded on the demonstration tape, I, for one, would be quite content to leave the recorder on this speed for nine-tenths of its working life. **A. Tutchings**

SOUNDCRAFT MAGNETIC TAPE

TESTS are carried out at a tape speed of 7½ i/s on a machine fitted with a 0·1 in. width record head with a gap length of 0·0005 in. Bias for the reference tape is 3·75V. The level on the tape is monitored by a playback head with a pole width of 90 thou. and a gap length of 0·2 thou. Equalisation is adjusted so that the frequency response on the Standard play reference tape is within plus or minus 0·5 dB over the range 100 to 10,000 c/s (see top curve of **fig. 1**). Recording level and playback level are each set to read zero dB.

The tape under test is recorded at 500 c/s and the bias voltage is adjusted for maximum playback level at this frequency. The optimum bias voltage is noted at the right-hand end of each response curve. The playback level of the review tape is expressed in dB above or below the output of the reference tape. This figure is noted at the left-hand end of each response curve. The frequency response of the review tape is plotted over the range 100 c/s to 10 Kc/s. The 10 Kc/s test is continued for 1 minute. The tape is reversed and the response plotted again, any deviation in the high frequency response is plotted as a dotted response. Finally the 10 Kc/s 1 minute test is rectified and fed to a high-speed pen recorder to give some measure of the amplitude fluctuations at this frequency.

The Soundcraft tapes submitted for review consisted of four 3-in. tape mailer reels containing *Standard* (standard play tri-acetate), *Standard 50* (long play tri-acetate), *Plus 50* (long play mylar) and *Plus 100X* (double play mylar). Also two 5¾-in. reels of *Standard* and two 5-in. reels of *Plus 50*.

The graphs of **fig. 1** show the response curves, bias settings and sensitivity figures for these samples. The *Standard* samples, both 3-in. and 5¾-in. reels, showed identical response, bias and sensitivity figures. Sensitivity was standard, i.e. same as reference tape. Bias was nearly identical to reference at 3·8V against 3·75V. The high note response was very good for a standard play tape, indicating a high coercivity oxide and a good surface finish (it is usual for a double or extended play tape to show a rise in top-response due to the slightly thinner oxide layer and improved contact due to the limper base). There was a slight directional effect amounting to about 1 dB at 10 Kc/s.

Average Drop-Out

Fig. 2A shows a drop-out chart covering a period of one minute for the *Standard* samples. This is fairly typical of standard thickness acetate base which is relatively stiff, so that small surface imperfection can lift the whole tape away from the head for short periods. Remember, this test is done at 10 Kc/s where the wavelength on the tape is less

(*Continued on page* 208)

than a thousandth of an inch and where a spacing of only one-tenth of a thou. will drop the output by 6 dB.

The *Standard 50* long play tri-acetate base tape shows a further slight improvement in extreme high note response because of the decreased spacing loss due to the thinner base. This effect can also be seen in the drop-out chart of **fig. 2B.**

The mylar base long play tape *Plus 50* on the small reel shows less high note response and a recurrence of a regular drop-out pattern at high frequencies. This could be due to a small difference in the surface texture of the mylar base, or of the oxide layer itself (see later report on 5-in. reels of *Plus 50*).

The *Plus 100X* double play mylar-based tape shows good high note response and an almost complete absence of drop-outs over the whole test period of one minute. Here we seem to have a combination of thin limp base with a good surface, and an oxide layer which has no surface imperfections. Note that optimum bias is slightly high at 4V.

Finally we come to a pair of very interesting tape samples. The two 5-in. reels of *Plus 50* show an intermediate drop-out pattern: not as bad as **A** or **C**, and not quite as good as **B** or **D**. *But* the high note response is way up and stays up even when the bias is increased from the optimum of 3·2V to 4·0V. The only effect of increasing the bias is to drop the output by 2 dB at all frequencies. This is quite out of line with the behaviour of normal tapes where the slightest amount of over biasing sends the high note response tumbling down.

Mr. Silvant of Soundcraft Magnetics Ltd., who distributes Soundcraft tape in this country, assured me that all tapes should be coated with the standard *FA-4* oxide formulation, and that he has not been notified of any basic change in the tape coating. I have suggested that these two 'way out' samples be returned to the manufacturer to see if this performance can be maintained, and the reason for it

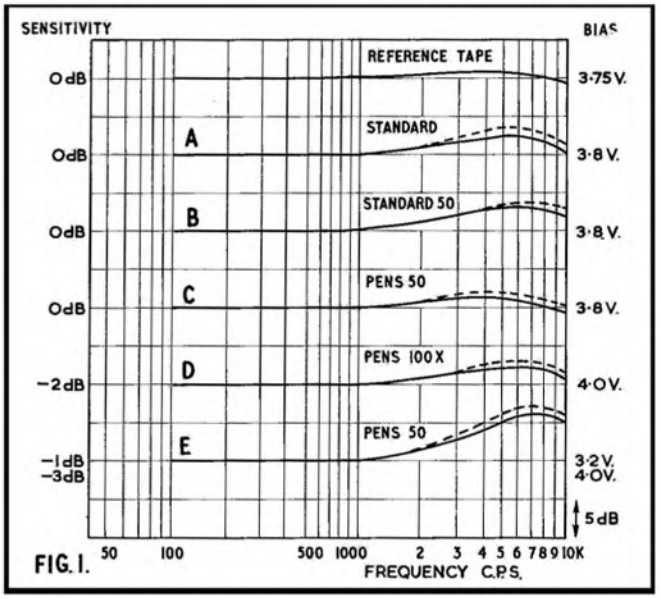

FIG. 1.

established. If so, we may look forward to a significant improvement in the short wavelength response of this tape so that extended frequency response at low tape speeds could be achieved with optimum bias for lower distortion and intermodulation.

Comment

This review underlines the sad fact that it is not difficult to devise tests which will show up the most subtle differences in the performance of magnetic recording tapes, but that the spread in characteristics within any one manufacturer's product may be comparable to that between different manufacturers. Thus, spot checks on random samples of tape from different sources may give a false picture of the average performance and consistency of any one manufacturer's output.

As a reviewer, I can only test the samples submitted to the best of my ability and hope that the occasional "flash in the pan" exception may point the way to better things. **A. Tutchings**

our readers write . . .

. . . about the Fair

From: F. Y. Darmoo, 60a Trevelyan Road, Tooting, London, S.W.17.

Dear Sir, For some time I had been looking forward to this year's Audio Fair, which I attended on Saturday 4th April, and I feel perhaps that one or two constructive criticisms would not be unwelcome if they would help to make the Fair even better than it is at present.

It seemed ludicrous to me to pack so many booths into such a small area thereby necessitating that the booths be extremely small and that the gangways between be very narrow. This, coupled with the size of the crowd, made it impossible to see or make enquiries about, all the equipment in which I was interested.

Although it was possible to play the tape recorders in the demonstration rooms, it was often a case of battling with two other tape recorders in the same room, making it impossible to hear any one clearly. I also noticed in one room that there was no attendant to explain or give information about any of the equipment, or to supervise the playing of the recorders.

In some rooms, however, demonstrations were being given and I was very amused when one demonstrator openly confessed he knew very little about working the equipment he was demonstrating. After his first mishap he spent his time crossing his fingers that he had pressed the right button. I am sure that you will agree that it would have been a much better idea to have had someone in charge who understood the equipment.

During one demonstration which I attended, no mention at all was made of the equipment being used, nor any information about it given. The stereophonic records which were played were introduced and not another word was said. This seemed to me to be a highly unsatisfactory demonstration.

Despite all this I did enjoy myself, and I shall look forward to next year's Fair hoping that it will prove to be even better than this year's. *Yours faithfully*

* * *

. . . more about the Fair

From: D. Ian Hodges, 'Dudmaston', Wainsford Road, Lymington, Hampshire.

Dear Sir, I went to the Audio Fair for the first time. I was amazed! Twenty-nine thousand four hundred and seventy-two other folk were there too—on every stand. What a crush, and everyone in a wet overcoat.

To whom should I apply to take charge of organising the next Fair? Here are a few suggestions meantime:

1 Charge at least 5s. entrance fee. This money would go a long way to paying for the Hotel, and would reduce the cost to the exhibitors. With lowered overheads the exhibitors would feel more inclined to extend the duration of the show, this would allow more people more time to see and hear it in greater comfort.

2 Streamline the flow of people through the demonstration rooms to avoid the jam of comers and goers at doorways. Most of these rooms had two doors but only one was in use. Allow those firms who from experience expect a lot of interest in their products to have bigger rooms.

3 Provide a cloakroom service. *Yours faithfully*

* * *

. . . about a Criticism of Policy

From: Bernard J. Lynn, Flat 3, 59 Palace Road, Tulse Hill, London, S.W.2.

Dear Sir, I feel I must reply to A. S. H. Hodges' criticism of *Tape Recorder*. I bought my first copy in 1961 after acquiring an old second-hand model that cost £16 16s. brand new. I played around with this for a while but reading your magazine made me realise that there was more to tape recording than just taping family voices and making inane remarks so I traded in the recorder for a Reps R10. I decided upon this model after reading its specification in the *Hi-Fi Year Book*. I had some trouble with the deck but found that even an absolute amateur like myself could quite easily service the unit with the aid of the February 1962 issue (Tape Recorder Service).

My first attempt at servicing was after much screwing up of courage but now I find no cause for worry and even repaired a friend's Philips with the aid of the magazine. I therefore think that I can honestly say your magazine does more for the amateur than the professional. *Yours faithfully*

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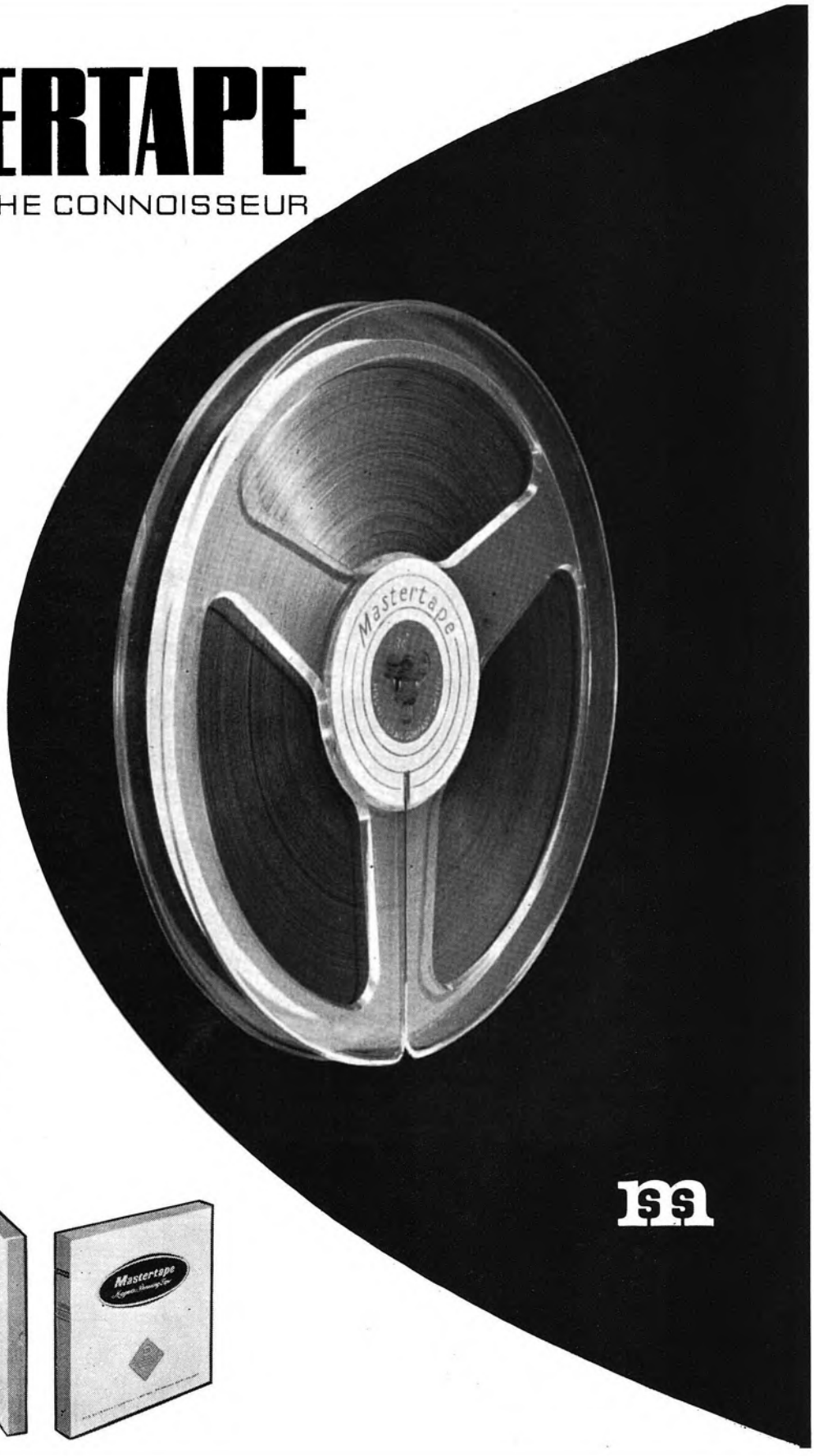

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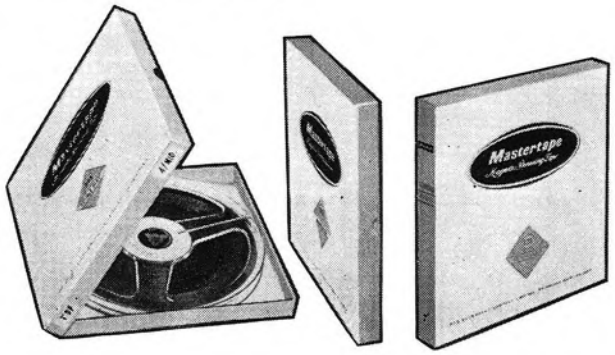

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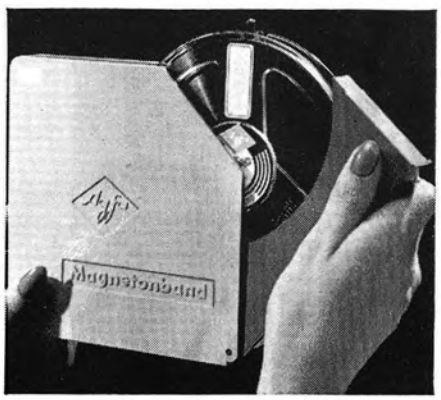

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