AUGUST 1964 TWO SHILLINGS

tape recorder

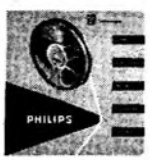
CONSTRUCTING A RECORD - PLAYBACK AMPLIFIER
BATTERY PORTABLE SURVEY — FIDELITY PLAYMASTER REVIEW

www.americanradiohistory.com

PHILIPS TAPE

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

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



FINE PRODUCTS FROM PHILIPS—THE FRIEND OF THE FAMILY

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

www.americanradiohistory.com

EVER READY HIGH POWER MEANS 4 TIMES MORE RECORDING PER BATTERY

This is the Ever Ready HP2 battery, one of the revolutionary new range of High Power batteries. At current drains of 300 mA in tape-recorders the HP2 has a working life over 4 times as long as that of the standard U2. HP batteries are extending the life and so the use of many types of battery-powered equipment from toys to photo-flash in the same way Get full details from The Ever Ready Co (GB) Ltd., Hercules Place, Holloway, London N7. Telephone: ARChway 3030

EVER READY

for longer life!

www.americanradiohistory.com

no other portable
tape recorder
so versatile
see and hear it
at our LONDON
SHOWROOM

UHER 4000 REPORT-S

PRICE
93
GUINEAS
Inc. microphone
and L.P. Tape

Two tracks to international standard ▪ reel size: up to 5" ▪ four tape speeds: 7½ ips, 3¾ ips, 1⅞ ips, 15/16 ips ▪ frequency response (± 3 db): 40-20,000 cps at 7½ ips, 40-17,000 cps at 3¾ ips, 40-10,000 cps at 1⅞ ips, 40-4,500 cps at 15/16 ips ▪ contrast ratio: 55db ▪ wow and flutter: ± 0.15% at 7½ ips (audible frequencies only) ▪ output power: 1 watt (push-pull power stage) ▪ power supply: five flashlight cells (1.5 volts each) or "dryfit" storage battery model Z 211 or model UHER Z 111 mains-operated power unit and battery charger or an automobile battery via automobile adaptor cable ▪ inputs: Micro 0.1 mV at approx. 2kΩ; Radio 1 mV at 47kΩ; Phono 25 mV at 1 meghohm ▪ outputs: 2 volts at 4 ohms: 1 volt at 15kΩ ▪ operating time: intermittent operation of approx. 12 hrs: continuous operation and intermittent operation respectively from the "dryfit" storage battery —approx. 10 hrs. ▪ dimensions approximately: 11" x 8" x 3" ▪ weight without batteries approximately 6lbs.

Ask your dealer to demonstrate the UHER 4000 REPORT-S. If you do not see this amazing Portable tape recorder displayed in your area, write for illustrated leaflet and further information to:

BOSCH LIMITED Domestic Appliance Division
205 Gt. Portland Street, London W.1 Tel: LANgham 1809

www.americanradiohistory.com

tape recorder

INCORPORATING 'SOUND AND CINE'

Editor - - - - - - - - - - **MILES HENSLOW**

Technical Editor - - - - - - - - **John Crabbe**

Advertisement Manager - - - - - - **Robin Wells**

Editorial and Advertising Offices

Link House, Dingwall Avenue, Croydon, Surrey

Telephone - - - - - - - **MUNicipal 2599 (12 lines)**

© *Link House Publications Ltd.*, 1964. *All rights reserved.*

AUGUST 1964 · VOLUME 6 · NUMBER 7

CONTENTS

EDITORIAL

WHEN comparing mains recorders within a fixed price range one comes to the conclusion that good value is being given for money. Whatever criticisms of excessive hum or narrow frequency range are levelled at the less-expensive recorders, they are counteracted, in most cases, when the price of the pure hardware is taken into account. Even without labour costs it is a miraculous achievement when a mains tape recorder of reasonable performance can be bought for under £30.

In the past decade the pound has crept steadily down in value and in nearly all fields of commerce prices have risen without an increase in quality. But the tape recorder has grown closer to the pocket of the man-in-the-street as prices have *fallen*. Mass production is one reason for this price decline; the unselfish attitude of the average manufacturer is another, for he could frequently ask a higher price.

But try listening to a few *battery* recorders and it becomes immediately obvious that price is no criterion by which to judge quality. When a recorder costing little more than £25 outperforms another in the £40 region something is obviously very wrong.

With the mains recorder there are inevitably exaggerated figures in the maker's specification. Such exaggerations are sometimes stretched in the battery field, however, a little too far. Claims of "truly high-fidelity" can be compared with the washing-powder being "whiter than white", but a false frequency response indicates either that the manufacturer is incapable of measuring a specification (which is most unlikely) or that he is knowingly misleading potential customers. If the washing-powder manufacturer says his product contains *GL* 70 you can rest assured that he speaks the truth—whether or not what he says is relevant to washing.

Discovering that the recorder with wow and flutter figures "better than 0.15%" is fluctuating audibly, and then comparing it with the excellent transport system of a "1% peak-to-peak" machine which is almost half the price but sounds much better, indicates that the manufacturer or distributor is not aiming his literature at those who have learnt to read between the lines.

National characteristics become very evident in the battery recorders exported by many countries. While Japanese, British, German and Dutch professional and semi-professional equipment are almost indistinguishable in quality and value, the cheaper products from the same sources are far from comparable.

The really cheap Japanese portables, thousands of which are now sold at between £5 and £20, have for many consumers cast a slur on Japanese equipment in general. This is far from fair, yet there is *not one* British battery recorder within the medium £30 to £50 range with which the more expensive imported models can be compared. German and Dutch recorders fill in this mysterious gap with a wide selection of battery equipment.

In an attempt to assist in the difficult choice of a battery addition to the domestic recording set-up we publish this month a survey of portable recorders. All the models shown are currently in production and should, with the obvious possible exception of the *Nagra* range, be obtainable from any reputable dealer. Again, however, we face the problem of the unreliable specification, for which reason we give the dates of relevant reviews and trials published in the past.

It cannot be too strongly stressed that no specification, no review or recommendation should be treated as more than a guide. A comparative demonstration from a dealer can show up the practical *merits* of the various recorders he has in stock; but the *bad* features will not be discovered unless the prospective buyer tries the machine for himself. Look for the badly fitting hub, the loud *clicking* noise that occurs when it is held upside-down, the loose or inconveniently placed controls—and above all, the background hiss and motor interference.

Distortion, if present on playback through the inbuilt speaker, may be overlooked provided you have a good second machine, and if the tapes play well on another recorder. The dealer should be quite prepared to use one of his mains machines for a playback demonstration, if one is requested. If distortion is very apparent when tapes are played in this way you should seriously reconsider your purchase.

But whatever model is decided on, the usefulness and versatility of the better battery portables can add a great deal to the enjoyment of tape recording as a hobby. Thanks to the transistor, the tape recorder need no longer be significantly more cumbersome than a good camera, and practically *everyone* uses a camera.

SUBSCRIPTION RATES

Annual subscription rates to *Tape Recorder* and its associated magazine *Hi-Fi News* are each 30s. in the U.K. and 32s. 6d. overseas (U.S.A. $4.50) from Link House Publications Ltd., Dingwall Avenue, Croydon, Surrey. These include free copies of the indexes.

COVER PICTURE

BBC outdoor recording staff often find themselves working in precarious positions. An EMI L2 battery portable is being used here to tape an interview some 25 storeys above ground level. (Readers may notice the Festival Hall in the background.)

The L2 was recently superseded by the transistorised *RE*321, listed in the survey of battery recorders on page 276.

www.americanradiohistory.com

LOEWE OPTA

Hi-Fi Tape Recorders

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

47 GNS.

NOW ADD SOUND TO YOUR SLIDE PROJECTOR!

OPTACORD 414 DIA

As the OPTACORD 414, with built-in Synchronisation with Automatic Slide Projector.

57 GNS.

THREE-IN-ONE · MAINS · BATTERIES · CAR BATTERIES

Ask our Representative to call, or see the complete range in our Showrooms.

HIGHGATE ACOUSTICS

Telephone: MUSeum 2901/6

71/73, GT. PORTLAND STREET, LONDON, W.1

Approved Loewe-Opta Stockists

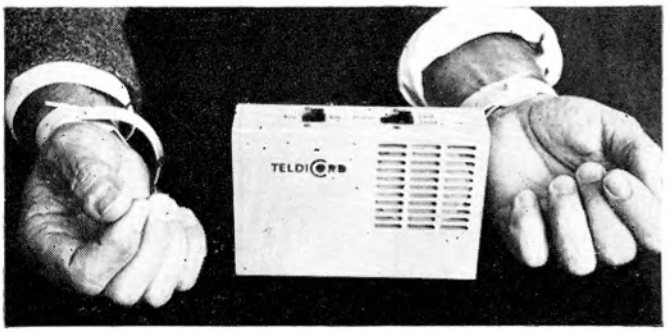
Alexanders, Holburn St., Aberdeen	Bristol & Cardiff Tape Recorder Centres	Gilbert Pianos Ltd., 37 Southchurch Rd., Southend	Joplings Ltd., John St., Sunderland	Piercy's, 63 Lupus St., S.W.1	G. H. Steel, 141 St. Georges Rd., Glasgow
J. J. Allen Ltd., The Quadrant, Bournemouth	A. Brown & Son Ltd., 24/28 George St., Hull	Grimes Ltd., Kings St., Wigan, Lancs.	Kendal Milne & Co., Deansgate, Manchester 3	Rackhams Ltd., Corporation St., Birmingham 2	Tape Recorder Centre, 82 High Holborn, W.C.1
Arding & Hobbs Ltd., Clapham Junction, S.W.11	Brown, Muff's Bradford 1	Guildhall Tape Recorders, 33 Guildhall St., Folkestone	John King Ltd., East St., Brighton	Recording Machines Ltd., 119 Victoria St., S.W.1	Tape Recorder Centre, 30 Kings Cross St., Halifax
Audiocraft, 20 Kettering Rd., Northampton	Camera Thorpe, 6/8 Osmaston Rd., Derby	J. E. Hargreaves Ltd., 1 Railway Rd., Blackburn	R. S. Kitchen Ltd., 22 King Edward St., Leeds 1	Tom Reekie Ltd., 10 Bridge St., Stafford	J. H. Tate & Co. Ltd., 45 Crowtree Rd., Sunderland
Barkers Ltd., 31 Oxford Rd., Worthing	Campkins Audio, 21 Harkett St., Cambridge	Harveys, High St., Guildford, Surrey	Lancashire Hi-Fi Ltd., Tape Centre, 8 Deansgate, Manchester 3	REW Earlsfield, 266 Upper Tooting Rd., S.W.17	Tele-Sales & Service Ltd., 9 Alexandria Drive, St. Annes, Lancs.
Barretts of Canterbury	Chelsea Record Centre, 203 Kings Rd., S.W.3	Hamilton Electronics, 35 London Rd., Southampton	Leech & Haig Ltd., 112 London Rd., Oxford	Ryland Huntley, 15 Old Bond St., Bath	Teletape, 33 Edgware Road, W.2
Battys (Rhyl) Ltd., Rhyl (Tel. 2621)	Chiesmans Ltd., Lewisham, S.E.23	J. Harris, 231 Baker St., N.W.1	Massey's, 121/3, High Rd., Chiswick, W.4	Selfridges Ltd., Oxford St., W.1	The Recorder Co., 188 West End Lane, N.W.6
James Beattie Ltd., Radio Department, Wolverhampton	City & Essex Tape Recorder Centres, 228 Bishopsgate, E.C.2	House & Son Ltd., Blake St., York	James McKenzie Ltd., Grange Rd. West, Birkenhead	Sheen Tape Recorder Centre, 8 Station Parade, Sheen, S.W.14	Turners Photographic Ltd., 9 The Walk, Ipswich
Bon Marche, Northgate St., Gloucester	Courtney Davies, 12 Station Road, Harpenden	Howard Tape Recorders, 218 High St., Bromley, Kent	Misons, Hi-Fi Specialists, Citadel Row, Carlisle	Sheffield High Fidelity, 10 West St., Sheffield 1	University Audio, 1 Peas Hill, Cambridge
Leonard Booth, 35 South St., Eastbourne	Croasdales (Nelson) Ltd., 41 & 58 Every St. Nelson, Lancs.	R.H.O. Hills Ltd., Bank Hey St., Blackpool	Nicholsons Ltd., High St., Bromley Kent	J. Smith & Sons, 184 The Rock, Bury, Lancs.	Lloyd & Keyworth, 26 Downing St., Farnham
Bourne Radio, 4 Albert Rd., Bournemouth	Dingles, Royal Parade, City Centre, Plymouth	Imhofs Ltd., New Oxford St., W.C.2	Olympic Electronics, 40 Queensway, W.2.	Stanwood Radio Ltd., (All Branches)	Bristol Hi-Fi, 28 Upper Maudling St., Bristol
LOEWE OPTA	Francis of Streatham, 169 Streatham High St., S.W.16	Jones & Higgins, 1-41 Rye Lane, Peckham, S.E.15	Paish & Co., 130 Union St., Torquay	Sport & Radio, 26/29 Aldwich Rd., Bognor Regis	J. W. Mansfield, 18 Liverpool Rd., Worthing

www.americanradiohistory.com

world of tape

INSTANT HEARTBEAT

DESIGNED for industrial use, the transistorised *Teldicord* is an invaluable addition to the first-aid kit. After a serious accident, such as an electric shock, the heartbeat occasionally falls below the level which can be detected from a pulse. In such cases the unit, which weighs 13 oz., is connected to the patient's wrists or ankles, through which electrodes relay faint heart currents to be reproduced as audible whistles.



The heart-monitor can also be applied in hospitals, both in the operating theatre and to observe a resting patient's condition from a remote point.

Manufacturer : Teldix Luftfahrt—Ausrustings G.M.B.H., 69 Heidelburg, Postfach 1730, W. Germany.

CELESTION SPEAKER DEMONSTRATION

NO admission tickets are required for the series of demonstrations, open to trade and public, at the Rembrandt Hotel, Thurloe Place, London, S.W.7, on the following dates : Friday, 28th August and 4th September, from 12 noon to 9 p.m. ; Saturday, 29th August and 5th September, 10 a.m. to 9 p.m. The demonstration is intended to be held in various towns throughout Britain, details of which are not yet available.

Studio Series 12in. speakers will be on show, models CX1512 and CX2012 of which became available in the third week of July.

Manufacturer : Rola Celestion Ltd., Ferry Works, Thames Ditton, Surrey.

MASS RECORDING SESSION

MORE than 12,000 reels of magnetic tape and 150 recorders have been donated to the *Boy Scouts of America* organisation by the 3M Company. Arrangements for the grant were concluded at the annual meeting of 1,500 adult Scout-leaders at Cleveland on May 22nd. The recorders, Wollensak mono and stereophonic models, were used at the Sixth National Scout Jamboree between the 17th and 23rd July in a "remarkable and massive new operation in electronic journalism".

The equipment served as the recording media for some 2,000 Scouts who prepared news tapes from the Jamboree for 3,000 commercial radio stations throughout the country.

Each day the scouts, representing broadcasting stations in their home-district, taped observations on the activities of different groups.

The seven-inch reels of tape donated, each capable of three hours recording time, were used in the production of a single report for each scout region represented in the event. Other tapes were used to record the speeches of various personalities expected to attend the Jamboree. A number of musical events were also scheduled to provide material for recording.

Tape recorders were located throughout the 28-acre site with which representatives from 3M's Revere-Wollensak and Magnetic Tape divisions trained adults and scouts in the operation of equipment and supplied information on microphone and general recording technique under varying conditions of recording.

MICROKIT CONFUSION ENDS

ALL enquiries regarding the *Microkit* condensor microphone should now be addressed to : **Nusound Recording Co., 93 Mortimer Street, London, W.1. (Museum 1219.)**

TELCAN DEMONSTRATED TO TRADE

ELECTRICAL dealers in the Midlands were invited to attend a demonstration of a domestic video tape recorder recently. Prototype recorders were operated with 19 and 23in. receivers and the technical and commercial aspects of sales and distribution were discussed. Orders were placed for the production model which, despite the news release published in April, is still not available.

Manufacturer : Telcan Ltd. (Nottingham Electronic Valve Co.), Main Street, East Bridgford, Notts.

FAIRCHILD DOMESTIC VIDEO RECORDER

INTENDED to retail at less than £200, a television recorder was shown recently in New York. The Fairchild Corporation are the second of several manufacturers, including 3M, Sony, CBS and Ampex, to develop such equipment, which uses 11in. spools of ¼in. tape.

Audio and video signals are multiplexed on to a single track running at 120 i/s. This track occupies half the width of the tape and is automatically transferred to the other half at the end of the reel. Stationary tape heads, less than 1 micron in width, and fifty silicon transistors combine to give a reasonably well defined picture although the accompanying sound is said to leave something to be desired. Head life is in the order of 1,500 hours and replacements would cost about £5 each.

TAPE RECORDER AND H.F.N. BINDERS

READERS who keep past copies of *Tape Recorder* and/or our sister magazine *Hi-Fi News* will find it very much more convenient to store them in binders specially made for the job. Twelve issues plus an index may be housed with ease and kept neatly on the bookshelf. Binders for Vols. 5 and 6 of *TR* and Vols. 7, 8 and 9 of *HFN* are available at 15s. each, including postage.

NEXT MONTH

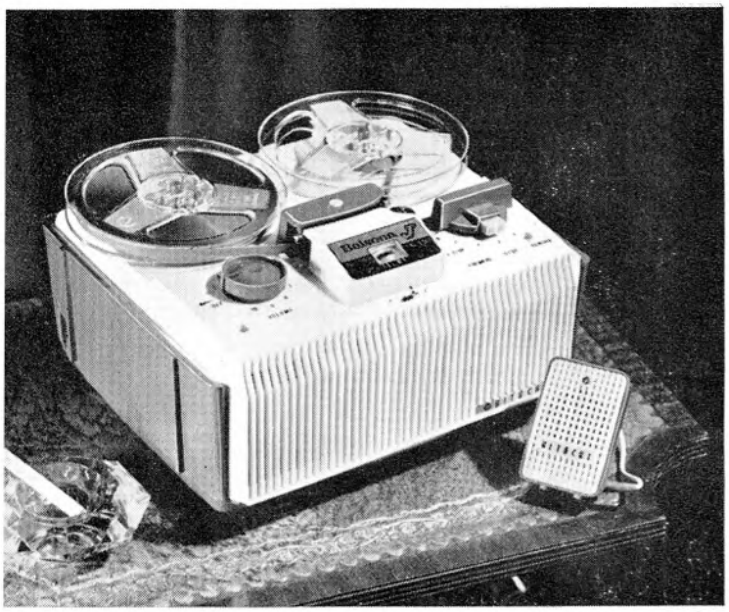
THE September issue of the *Tape Recorder* will be on sale Friday, August 28th. In this number John Berridge will describe a rival to *Telcan*, Roy Russell will help you entertain friends with a short tape play, and John Gaselee will discuss the ins and outs of tape recorder insurance. Peter Turner will relate a nostalgic incident in the Forest of Dean and David Kirk will subject another battery portable to a field trial.

www.americanradiohistory.com

HITACHI

TAPE RECORDERS

HAVE A NAME FOR BEAUTIFUL SOUND



Hitachi tape recorders are called BELSONA, which means 'beautiful sound'. It's a name they well deserve, for true sound fidelity, fullness of tone and volume. And because Hitachi are one of Japan's leading electronics manufacturers, technical features and quality of finish are unsurpassed.

BELSONA TRA 500 29 gns

Superb compact mains operated model, suitcase style. Has unique 'Automatic Recording Level Control'. 2 recording speeds, double track, Hi-Fi sound reproduction. Up to 3 hrs recording with Hitachi 5" l.p. tape. Attachment for direct recording from radio, stereo or T.V. Operates on convenient 'one-band' control system. All accessories.

BELSONA TRQ 399 35 gns

Transistorized luxury portable, which incorporates many 'standard model' features. It has 2 recording speeds, double track, 3 inch recording tape, fast 4 minute winding and rewinding, dimensions approximately 9" x 3½" x 6". Complete with case and many accessories.

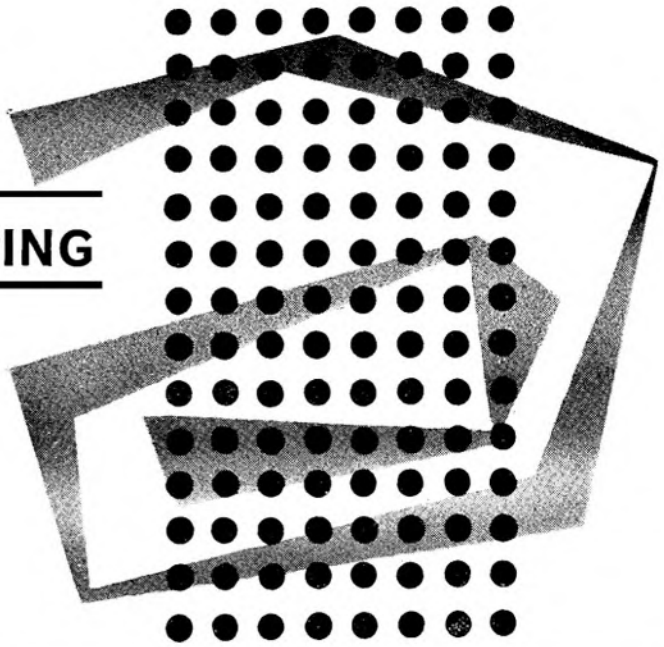
Also available BELSONA TRA 722 2-speed mains operated 42 guineas.

For full details please consult your dealer and in case of difficulty contact:
Lee Products (G.B.) Ltd.,
10/18 Clifton Street, London E.C.2. Telephone: BIShopsgate 6711
(Distributors for U.K.)

Hitachi, Ltd.
Tokyo Japan

www.americanradiohistory.com

TOWARDS BETTER TAPING



PART FIVE MICROPHONE IMPEDANCE AND SENSITIVITY

BY GORDON J. KING

LAST month we dealt with the principles of microphones; we investigated impedance, matching and output voltage. There are, however, additional factors that the amateur tape recordist should have in mind when purchasing or substituting a microphone. Two of these are *frequency response* and *directivity*, the latter sometimes called *pick-up pattern* or *polar diagram*.

Looking first at frequency response, we find that this is related to the magnitude of signal output voltage generated by the microphone due to sound pressure of equal intensity over a range of eight or nine octaves, depending upon the type and quality of the microphone. That is, a response from about 32 c/s up to approximately 8 Kc/s to give the eighth octave or up to 16 Kc/s to give the ninth octave. Note here that the first octave of 16 to 32 c/s is rarely covered with the type of microphone in which we are interested. This octave is responsible for the fundamentals produced, for instance, by large organs, but it is not essential for the high quality reproduction of serious music.

The ninth octave (as we are considering them—the tenth when the first octave is taken into account) from about 8 Kc/s to 16 Kc/s, again, is only fully embraced by the most expensive of microphones. This octave contributes to the 'sparkle' of the reproduction, but above about 12 Kc/s the human auditory response tends to degenerate with age, so sounds above that frequency may not be too important—music-wise—to all. Indeed, a response from about 80 c/s up to about 10 Kc/s can provide sounds of very high musical value, as long as the response does not cut off sharply at the extremes of the spectrum.

The frequency response of a microphone may be expressed in figures or in terms of a curve. The *Acos Mic* 39 dynamic microphone, for example, is said to have a response from 80 c/s to 10 Kc/s +3dB and approximately 10dB down at 50 c/s and 15 Kc/s.

For practical purposes, this means that the microphone can be considered as producing an output voltage which is essentially constant at all frequencies from 80 c/s to 10 Kc/s. The +3dB bit means that the output voltage over the range may vary up or down by a ratio of about 1.4 to 1 (the decibel giving the voltage ratio, as may be found from decibel tables—see also Part 4). Outside the 80 c/s to 10 Kc/s range there is a fall in output voltage, and at both 50 c/s and 15 Kc/s the voltage has dropped by a ratio of about 3.2 to 1 (e.g., 10dB voltage ratio).

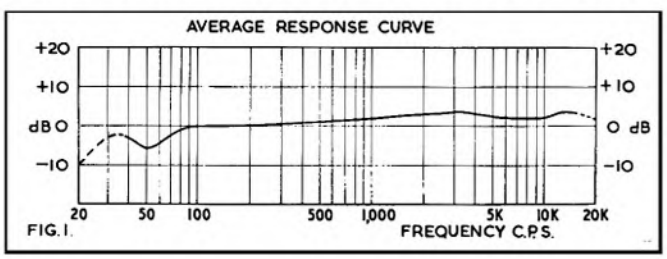


FIG. 1.

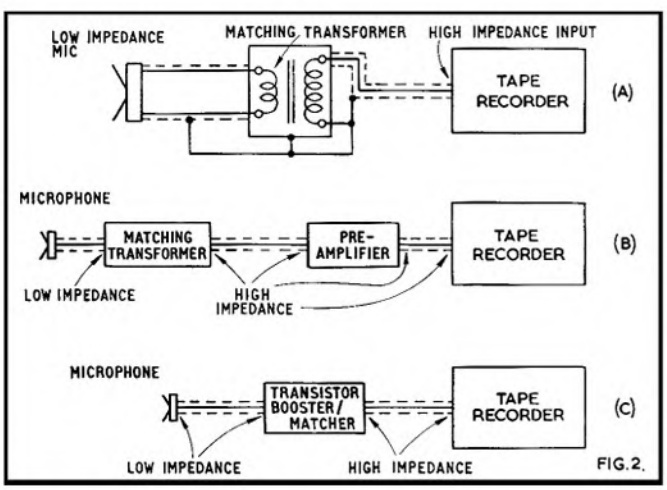


FIG. 2.

This microphone, then, like many others of a similar kind, is capable of responding to most of the important musical frequencies and the tail-off either side of the range is gradual, meaning that the response even to the higher frequencies is not deleted completely.

Fig. 1 shows how the frequency response may be expressed in the form of a curve. Here the frequency (in logarithmic order) is plotted horizontally against the relative output (in decibels) vertically. The most linear part of the curve extends from about 80 c/s to 15 Kc/s, and, in fact, the microphone to which this curve relates (the Grampian *DP*4 dynamic), is said to have a frequency response from 50 c/s to 15 Kc/s. The curve shows, however, that the response is about 6dB (2-to-1 voltage ratio) down at 50 c/s. The curve also shows (by the broken lines) that the response gradually tails off at the extremes of the range. The relative "0dB" corresponds to the curve at about 100 c/s. At 300 c/s there occurs a slight rise of a decibel or so up to about 4 Kc/s when the response tends to fall a little. This, of course, is not serious, and the overall effect is often better pictured by the amateur diagrammatically, as shown, rather than by figures. The statistics issued by microphone manufacturers now often include response curves of this kind.

The response at **fig. 1** could be correctly expressed as being substantially flat over the working frequency range. Perfect flatness of response comes only with costly, studio quality, microphones, but a few rises and falls have virtually no effect on amateur recordings. Excessive variation, of course, is to be avoided if good quality work is proposed.

Unfortunately, it usually follows that a microphone with a very good and flat response has low sensitivity, and can rarely be used direct with the popular type of recorder. The microphone signal needs first to be boosted by passing it through a small, flat-response pre-amplifier before being fed to the recorder microphone input socket, but then the output impedance of the amplifier should match the microphone channel input impedance, the microphone also having to be matched to the pre-amplifier input, of course.

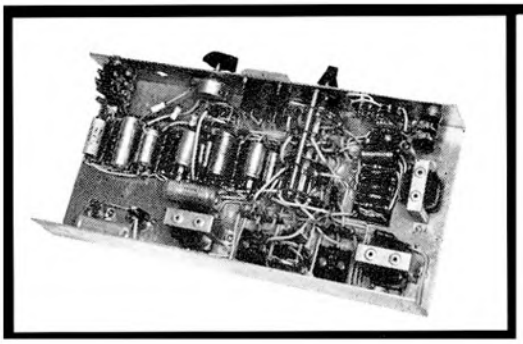
Microphone boosters or pre-amplifiers are available commercially. The Reslo GE1, for instance, employs a transistor amplifier circuit and, apart from giving a boost to the microphone signal, it serves as a matching device so that low and medium impedance microphones may be coupled direct to a high impedance tape recorder input without the need for a matching transformer (see later).

We have seen that the sensitivity and the response of microphones

(*continued on page* 269)

www.americanradiohistory.com

A TRANSISTOR TAPE AMPLIFIER



PART ONE

THE RECORDING CIRCUIT

BY S. WELLDON

THE use of transistors in tape-recorders can produce results comparing favourably with thermionic valve equipment. Probably the biggest single advantage in using transistors in this type of equipment is the relative ease with which a high gain amplifier can be constructed without adhering to a precise circuit layout or using elaborate screening precautions to minimise unwanted feedback loops and hum pick-up. Freedom from microphony is another important advantage, particularly where space is limited and components are mounted close to the tape deck motors.

The record/playback amplifier described here was originally designed for use with a medium-impedance half-track R/P head having a low DC resistance, enabling a low-impedance current-operated input stage to be used. Typical heads are those on the standard *Brenell*, *Collaro* Transcriptor (now *Magnavox*) and *Truvox* decks. A fall-off in bass response is obtained with heads having a lower inductance-to-resistance ratio, but extra equalisation can be added to compensate for this and in practice the circuit will work satisfactorily with a wide variety of heads.

It is initially described here suitably modified for use with the BSR single-speed *Monardeck* TD2 tape deck, fitted with the standard 600mH half-track R/P head (gap width 0.0002in.), and a low-impedance erase head. The circuit may be thought to be rather elaborate for a simple deck of this type, but it is easy to build and the combination is capable of excellent performance. The simple addition of a speed-change equalising switch (to be described later) makes it suitable for both the new BSR TD10 and the Magnavox *Studio* three-speed decks, as well as those mentioned earlier.

The recording sensitivity is adequate for most signal sources, and simple networks allow for ready adjustment of equalising on both record and playback. The recording head is driven in the conventional manner via a high resistance, hence the performance of the amplifier is independent of head characteristics. The circuit also includes a 60Kc/s push-pull oscillator which will erase the most heavily recorded tape.

The amplifier is designed to operate from a 12V supply, the total power consumption being 3¾W on record and 2½W on playback (at full output). A suitable power supply is also described.

The circuit of the complete amplifier is shown in **fig. 1.** Five transistors are used in the *recording* amplifier, the head being driven by an autotransformer T.1. Component values are given on the circuit, apart from the inductors and transformers which will be detailed in a table next month.

In the first stage a low-noise transistor (Tr.1) is biased at an emitter current of 450μA which, together with the use of high-stability resistors, results in a good signal-to-noise ratio. The first two stages (Tr.1, Tr.2) form a directly-coupled feedback pair, used as a linear amplifier on record and as an equalising amplifier on playback.

Treble-boost networks are placed between the third and fourth stages (Tr.3, Tr. 4), both of which have some undecoupled emitter resistance to provide local negative feedback.

On record the fourth and fifth stage (Tr.4, Tr.5) are directly coupled. On playback the fourth stage becomes the driver for the 1W audio output stage, Tr.5 then being switched out of circuit. Two matched GET116 transistors (Tr.6, Tr.7) are used in the output stage, and these operate on record as the 60Kc/s erase and bias oscillator.

The overall response shown in **fig. 2** (curve 'b') will normally be obtained with an HF bias current of 250-300μA. The response shown is within 3dB of the 1Kc/s level, from 60c/s to 7½Kc/s.

At this point it will be easier to examine the amplifier in greater detail by considering the recording and playback requirements and arrangements separately.

It is usual to drive the record head via a high resistance to provide a substantially constant current signal-source. This tends to reduce equalising problems and minimises variations in performance due to the spread of head characteristics, as well as allowing the tape to be magnetically 'loaded' equally well over the required frequency range.

The peak recording level is an arbitrary value, usually such that the amount of 3rd harmonic distortion introduced by the curvature of the tape transfer-characteristic is not more than 2 or 3%. The level at which this occurs varies with the HF bias current, as shown in **fig. 3** (curve 'a'). The bias current also controls the tape *sensitivity* (**fig. 3,** curve 'b'), in addition to which tape drop-outs are reduced as the bias is increased. Since the optimum values of bias current for these various factors do not coincide, the selected recording conditions are the result of a compromise between high sensitivity and a reasonable recording level relatively free from drop-outs.

From the measured characteristics of the BSR head used with *Scotch* 150 tape, a *bias* current of 270μA and a peak *recording* current of 60μA were chosen, these conditions giving not more than 2% of 3rd harmonic distortion on a 400c/s sine-wave signal. (N.B. Early models of the Monardeck used a lower impedance head, requiring a bias current of about 800μA.)

In order to maintain a high signal-to-noise ratio on the tape it is desirable to record at a level such that transients may exceed this arbitrary peak recording value. Therefore the amplifier should be capable of handling signals somewhat in excess of the normal peak, because any overloading of the amplifier results in severe clipping of the waveform, whereas the tape distortion tends to increase in proportion to the signal level.

Treble-boost is required to overcome both head and tape losses, which are dependent not only on the HF bias current, but also on the head structure, the magnetic tape, and the degree of contact between the oxide coating and the head. With so many variables it is an advantage to use a simple LC resonant circuit that can be readily adjusted to give the desired response.

For optimum low-noise performance the major part of this boost is applied on record. This again requires that the amplifier be capable of handling signals in excess of the normal peak recording level so as to avoid severe distortion on transients.

Referring to **fig. 1,** which shows the amplifier switched to record, the first stage has an input resistance of 250 ohms, a signal level of 20μV at 1Kc/s being required for 60μA of recording current. This is adequate sensitivity for most domestic low-impedance microphones which can therefore be coupled directly into the amplifier. Higher input levels are accommodated by attenuating networks. For example,

(*continued on page* 269)

www.americanradiohistory.com

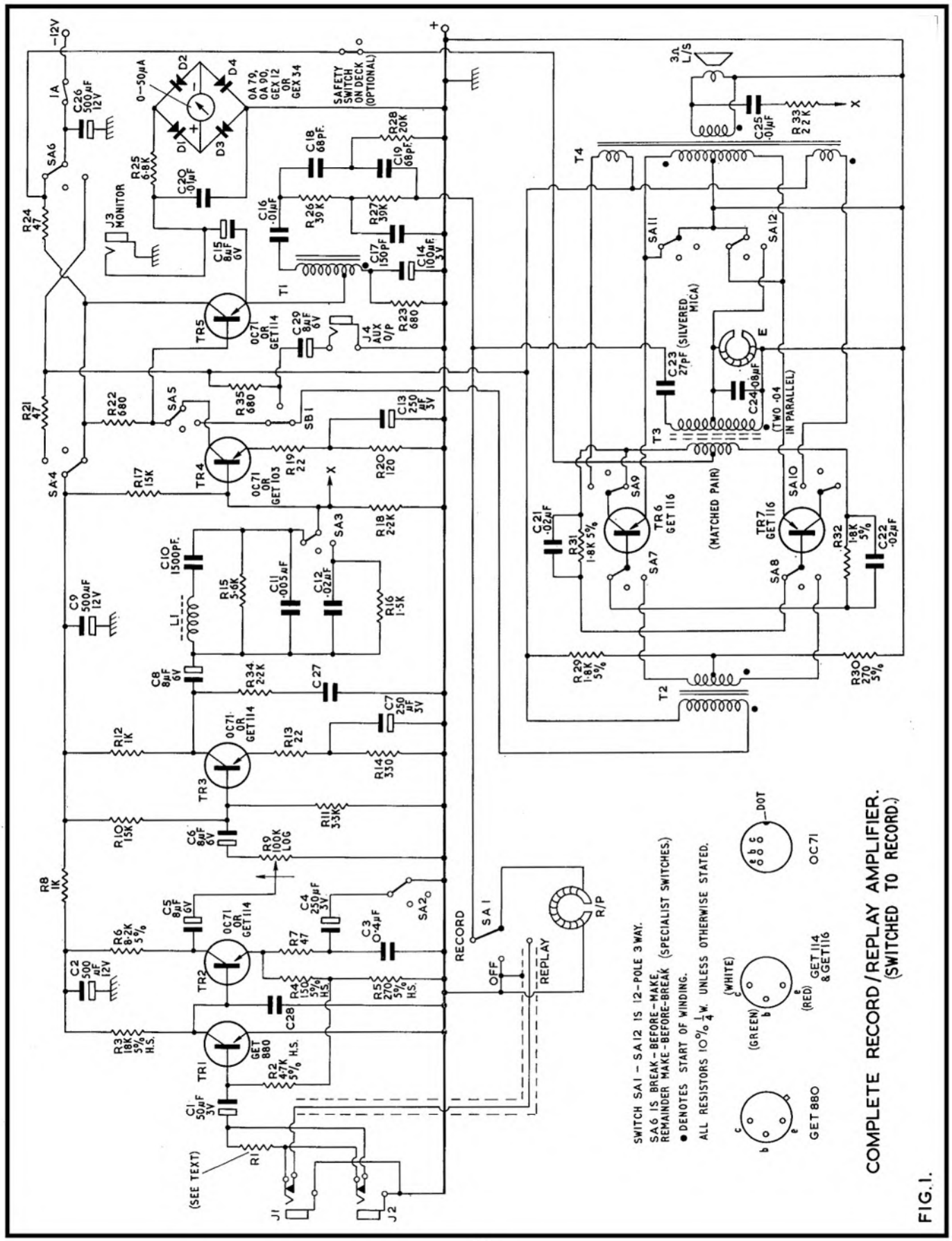


FIG. 1.

www.americanradiohistory.com

Here's something really NEW in tape recording:

CARTRIDGE LOADING

—exclusive feature of the brilliant new

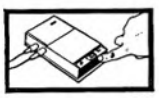
PHILIPS BATTERY POCKET TAPE RECORDER

EL3300

Just check these revolutionary features:

The easiest tape system in the world—cartridge loading.

Forget about troublesome spools and tape threading—simply clip in the one-piece cartridge for instant use—get 30 minutes recording per side.



The simplest operation—controlled by one push-button.

Single control gives playback, record (with interlocking safety button), fast wind and fast re-wind. No drain on batteries except when recorder is actually operating.

The most versatile microphone—use it any one of three ways.

Sensitive, omni-directional "stick" type microphone can be held in hand, clipped in pocket or stood on plastic stand.

The most useful extra control—remote stop-start.

Remote control switch on microphone starts and stops recorder—detaches from microphone for separate use.

Battery operation for instant use—anywhere, any time.

Five small batteries last about 20 hours. Indicator needle shows recording modulation level and battery strength.

Real Leather carrying case—always ready for action.

Carrying case gives easy access to recorder controls. Tape is visible through special window. Case has space for accessory stowage.

The first really new tape recorder for years

25 gns COMPLETE

ANOTHER BRILLIANT DEVELOPMENT BY **PHILIPS** – the friend of the family

(PTR001 4B)

www.americanradiohistory.com

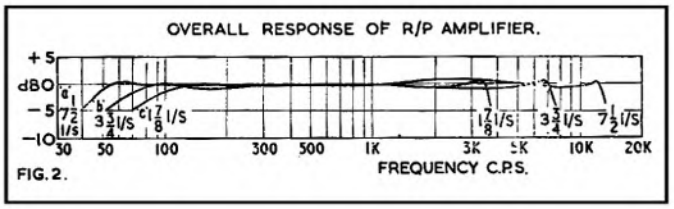


FIG. 2.

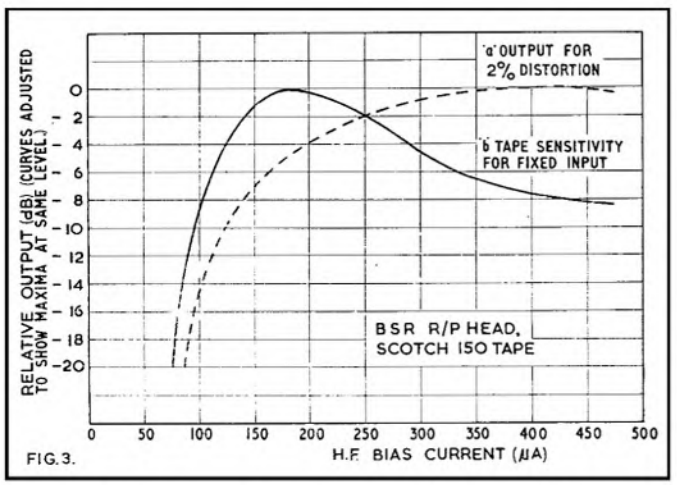


FIG. 3.

if R1 is 1 Meg., as may be necessary for loading a crystal pickup, an input of 80 mV will give the peak recording level. The signal applied to the base of the first transistor should not exceed 500μV (i.e. 2V into 1 Meg.) to avoid overloading the stage.

Treble-boost is provided by a series-tuned LC circuit between Tr.3 and Tr.4. The inductor L1 can be wound on any good-quality ferrite pot-core assembly that gives a high circuit Q together with good magnetic screening. The shunt resistor R.15 determines the amount of boost.

The fifth stage is an emitter-follower which provides excellent damping for the head transformer and makes the performance of the amplifier independent of the head characteristics and the monitoring and recording level indicator circuits.

The maximum signal available at the emitter of Tr. 5 is about 3.5V RMS. The transformer has a turns ratio of 1 : 8, hence the maximum output voltage is about 28V RMS. The head is connected to the transformer via a twin-T filter which provides the constant current source and also reduces the amount of HF bias circulating in the amplifier. The AF impedance of the filter is 80K, so that the maximum recording current available before clipping occurs is about 300μA. A signal voltage of 5V RMS across T.1 secondary corresponds to the 60μA level. The total harmonic distortion of the amplifier is typically less than 0.2% at this level, and less than 3% at maximum output.

The frequency response of the amplifier, measured at T.1 secondary, is shown in **fig. 4** ('b').

One problem arising in the design of a transistor tape-recorder is the provision of an efficient erase system. The erase power should be sufficient to saturate the tape so that over-modulated tapes may be adequately cleaned.

Generally, from 1 to 3W of erase power and 20 to 50mV of bias power are needed, depending on the heads, the oscillator frequency and the tape coercivity. For audio equipment the oscillator frequency is usually between 30 and 100Kc/s, requiring a medium-power transistor with a cut-off frequency of about 1 Mc/s.

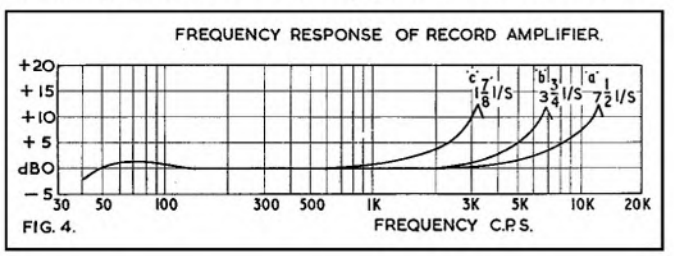


FIG. 4.

The oscillator shown in **fig. 1** uses two matched GET 116 transistors (Tr.6 and Tr.7) in a class-B push-pull arrangement. The power delivered to the load is about 2W at 60 Kc/s and is substantially independent of both transistor current gain and ambient temperature variations.

The DC operating bias and positive feedback to the transistors are maintained by two identical RC networks R.31/C.21 and R.32/C.22. The tuned transformer T.3 is wound on a high-efficiency ferrite pot-core assembly, the turns ratio reflecting a load of 30 ohms to each collector. The circuit is tuned by C.24, the value of which is determined by the type of erase head used, the Q of the transformer and the loading of the HF bias circuit. The output terminals of the oscillator should not be short-circuited during operation since this would give rise to a very large collector current and damage the transistors. In practice it is advisable to include a fuse in the DC supply line as a protection against a shorted load.

Next month we shall continue this discussion on the oscillator circuit, consider the playback amplifier performance, and go on to constructional and testing aspects and power supply.

TOWARDS BETTER TAPING — CONTINUED

are very much related. Flatness of response costs more than sensitivity, and if both are wanted, then it is usually necessary to employ a microphone of low sensitivity and flat response and boost the signal prior to its application to the tape recorder input.

The crystal microphone is probably one of the most sensitive, though not necessarily of flat response. The ceramic microphone has a smaller sensitivity and, in some cases, a better response than the crystal. Dynamic (moving-coil) microphones usually have an even smaller output or sensitivity, and many of the more expensive versions boast an excellent response. The sensitivity of the variable-reluctance type is about the same as, or a little above, the sensitivity of the moving-coil. Ribbon or velocity microphones have a very small sensitivity though very good response characteristics. The condenser microphone has probably the smallest sensitivity of all, and in studio versions a head or pre-amplifier is required to step up the small signal voltage to a usable level, while at the same time dropping the impedance so that the signal may be carried through a conventional lead to the equipment ; but this type of microphone can hardly be considered in isolation from its pre-amplifier. However, the condenser type has extremely good frequency characteristics and remarkable treble response. Indeed, it can be designed to respond to frequencies above hearing (supersonic).

We now come back again to impedance. In the high impedance family we have the crystal, ceramic and condenser microphones, while in the low impedance counterpart we have the variable reluctance (also available in high and medium impedance versions), the dynamic and the ribbon microphones.

Many amateur tape recordists have been very disappointed with the results on connecting a relatively costly microphone in place of the inexpensive one supplied with the recorder. In many cases examined by the author, poor quality and low output have been caused by the use of a microphone of too low a sensitivity and of incorrect impedance.

As we have seen, the better the frequency response of a microphone, the lower its sensitivity (generally speaking). This often means that by connecting such a microphone to a tape recorder which is designed essentially to take a signal from a high output crystal microphone sufficient pick-up is not possible even with the RECORD LEVEL control set to maximum. The trouble here is often aggravated by the new microphone being of medium or low impedance and the tape recorder input being of high impedance to suit the crystal microphone with which the recorder was supplied.

The solution to such a problem lies in the use of a low-to-high impedance matching transformer between the microphone and the recorder input with, where necessary, a pre-amplifier interposed in the circuit to boost the signal. Alternatively, a transistor booster/matcher (e.g., transistorized 'coupler') can be used between the microphone and the tape recorder input. The three conditions are illustrated at **(a)**, **(b)** and **(c)** in **fig. 2**, and we shall return to this next month before going on to mixers and polar diagrams.

www.americanradiohistory.com

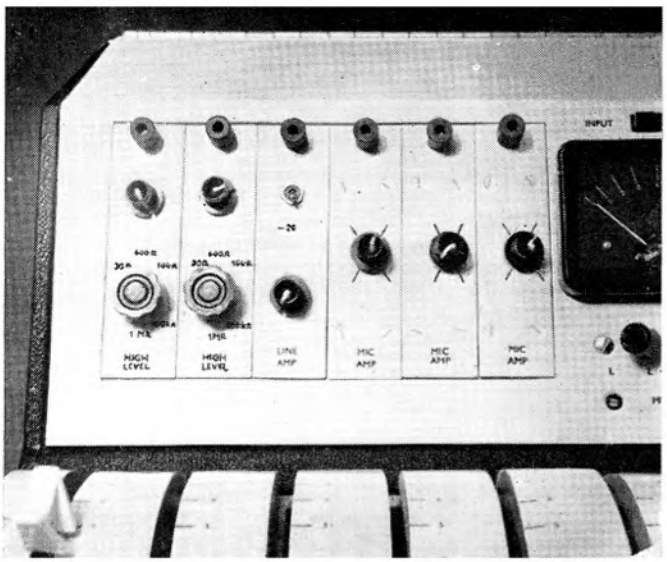
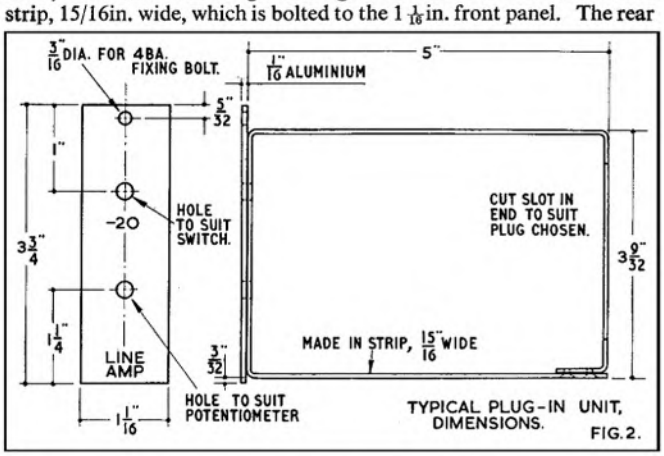


Fig. 1. *The module amplifier rack.*

A STUDIO QUALITY MIXER

BY now keen readers will have built the power supply and framework of the mixer, so this month's article makes a start on the electronics. The main path of the signal, from microphone input to tape recorder output, will be described, leaving the monitoring circuits and programme meters for next month. All the circuits are fully transistorised, and this enables full use to be made of small block circuits, and in particular the use of plug-in modules for matching the mixer to different sources. Three such modules will be described, although there is almost no limit to the number that can be conceived for other applications.

The modules are identical in overall dimensions, and differ externally only in the front panel. **Fig. 1** shows the appearance of a nest of amplifiers ; the dimensions are given in **fig. 2.** The units are made from one strip, 15/16in. wide, which is bolted to the 1 $\frac{1}{16}$in. front panel. The rear



is cut to take the multiway plug chosen. Details are given for the line amplifier, and in this case the front panel can be held neatly to the chassis by the fixing nuts of the two controls. Units with one or no controls will use nuts and bolts for this purpose. Some care should be taken on the construction of the chassis, since the ease with which the units can be plugged in and out will depend on the accuracy.

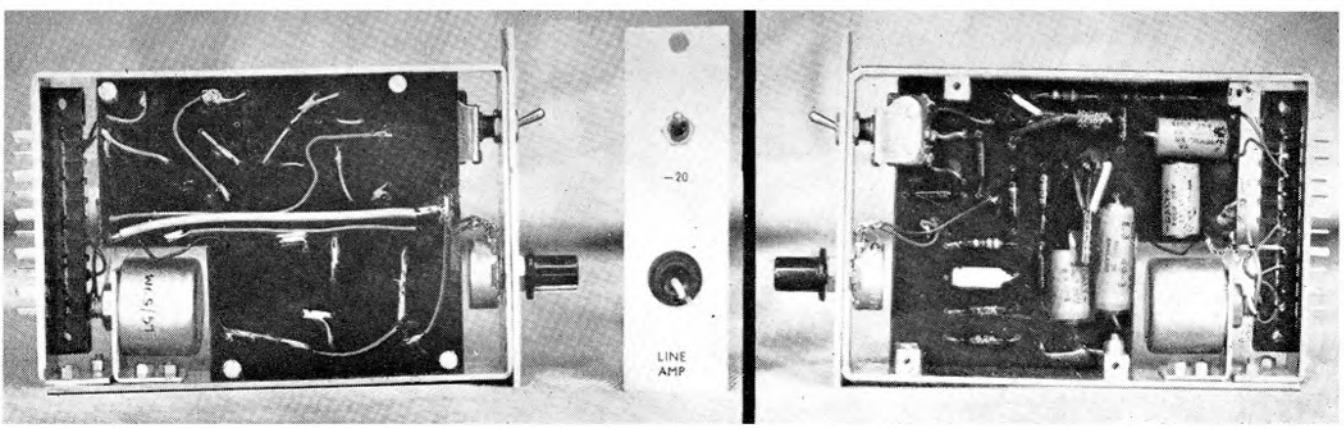
The actual components are mounted on Paxolin board, which is held in position by bolting it to the bottom of four aluminium pillars which are in turn fastened to the chassis frame. A metal plate is then bolted to the top of the pillars to provide shielding between units, and to protect the components when the unit is removed from the mixer. The photograph, **fig. 3,** shows the completed unit with this metal top-plate removed.

The first circuit requirement was for an amplifier which would accept an input signal of zero level, or 775 mV, for use in matching to a programme line or standard sound distribution system. The input must be balanced and isolated from earth, which means a transformer has to be used. If the amplifier can be designed to accept a slightly smaller signal as well, it can be used for high-output microphones such as the capacitor variety which usually have a built-in pre-amplifier to match the capsule and to raise the very low output signal-level to something more manageable. **Fig. 4** shows the feedback amplifier that was designed to accept a signal of +2 dB without distortion in the maximum gain position, and +22 dB in the normal or line position.

The input can be either 60 or 600 ohms, selected by a switch at the rear of the mixer, and is balanced to earth by the capacitance in the windings ; the input sockets are arranged so that if an unbalanced line is used, one side is automatically earthed. The secondary of the transformer passes either direct to the base of the first transistor or via a 10:1 attenuator, and is amplified in the first stage which has some local feedback from the undecoupled part of the emitter resistor. The first transistor should be of the low-noise type, such as the AC107 or GET106, for best results. Tr.2 forms another amplifying stage, again with some local feedback, and with a 'bootstrap' input arrangement to raise the overall gain of the amplifier before loop feedback is applied. The junction of R10 and 11 is a suitable point from which to stabilise the DC conditions, and C5 is added to decouple the chain.

The AC output is taken from the collector of the second transistor, and at the same time variable feedback is applied to the first stage by C2 and VR1, which raises the input impedance so that the transformer is correctly loaded by R1 and R2 only. VR1 appears as a front panel control, and is used to preset roughly the amount of gain required so that the quadrant faders, which are the main controls per channel, are

Fig. 3. (*below*). *Three views of the completed input amplifier modules showing Paxolin mounting boards, and "poor man's printed circuit".*



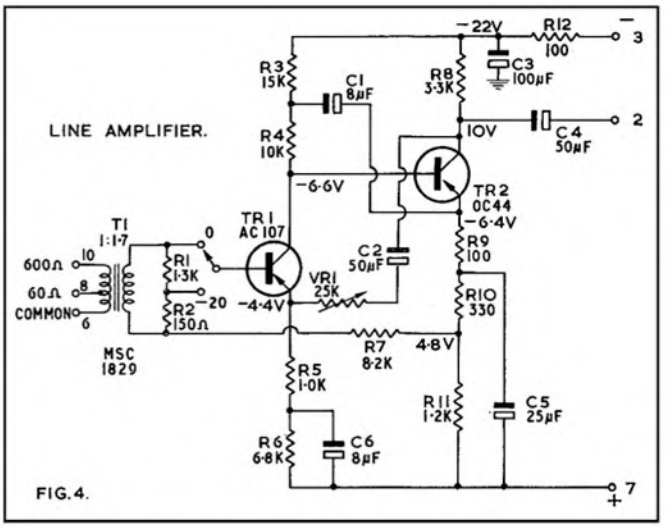
www.americanradiohistory.com

all approximately in the same position ; this makes for easier mixing.

The prototype circuit was constructed on Paxolin board, drilled to take the component wires which were then bent over to form the wiring on the other sides. This forms a neat reliable assembly—a 'poor man's printed circuit'. However, the design is very suitable for full printing, and **fig. 5** shows the two sides of such a board. There are kits on the market for making printed circuits, and one of these would be suitable for this circuit and the others to be described.

The most important amplifier in the complete mixer is undoubtedly that for the microphone. This has to accept in one extreme a very low signal from a quiet passage in a recording, and provide an amplified signal without significantly increasing the noise level, and at other times it must be capable of accepting a large signal without overloading. The design of such a stage is difficult and is not to be undertaken without much time for experiment. The circuit shown in **fig. 6** is one solution, which has been developed by the Designs Department of the BBC ; the author is indebted to the Corporation for their permission to publish the circuit and its details. At the time of writing it represents one of the best microphone amplifiers in production, and is fully described, together with the theoretical and practical considerations which lead to the final design, in the BBC *Engineering Monograph No.* 46 (The Application of Transistors to Sound Broadcasting), which also includes several other interesting circuits ; this is a most useful publication for the audio engineer.

The noise figure for the amplifier is typically 3 dB, which means that the noise at the output terminals is 3 dB greater than, or about 1.4 times, the noise from the thermal movement of electrons (Johnson noise) in a resistor of the same value as the input impedance, followed by a noiseless amplifier of the same gain ; or put another way, this is an excellent amplifier ! This noise figure is better than most existing valve circuits. For a 600 ohm resistor the inherent noise is about



commonest types met in high quality work. Other types will require a different input transformer. Two transistors are used in a feedback amplifier with both DC and AC feedback for stability and to determine correctly the input impedance which is essential for low-noise operation. The first transistor is set at the optimum collector-emitter voltage, and collector current, and is DC-coupled into the next stage. The emitter of the second transistor is in a long chain of resistances which are used in the feedback circuits. R11 is in the DC path, and the AC feedback is both shunt (R1, C2) and series (C4). The transformer is included in the loop ; it is manufactured by *Fortiphone Ltd.*, type No. MSC 1829, and is the same type as is used in the line amplifier described earlier.

The output from this stage passes to a variable 30 dB attenuator which is mounted on the front panel, and then to an output stage which has a controlled gain of some 17 dB with feedback from the undecoupled part of the emitter resistance. The output is taken from the collector and passes eventually to the channel fader in the rack at the front of the mixer.

The remaining plug-in module to be described at present is the high input impedance stage. The main use of this is to match to the output from valve equipment such as tape recorders and pre-amplifiers. It can also be used to match to crystal pickups if necessary, but this is not recommended since the input impedance is only 1.5 Meg., which means there will be a loss of 6 dB at about 60 c/s with the average cartridge. This may or may not be a disadvantage ; the author has recently been engaged in copying old 78 rpm records on to tape, and the low frequency cut-off was a help in removing the large amount of rumble and hum on the originals.

The circuit, shown in **fig. 7,** is conventional, and is basically a two-stage cascaded emitter-follower. Without extra feedback this gives an input impedance of just under a megohm at low frequencies ; the bootstrap arrangement with C3 raises this to 1.5 M, but only at low

(*continued overleaf*)

A STUDIO QUALITY MIXER

BY D. P. ROBINSON **PART 3**

THE INPUT AMPLIFIERS

0.5 mV, or —127 dB ; the amplifier makes this appear as —124 dB, which means that extremely small signals from microphones can be handled successfully.

At the other end of the scale, an input level of —25 dB can be accepted before the onset of serious distortion, and this represents a very loud noise for most microphones, almost at the threshold of pain. For louder situations a pad can be used on the input, or the line amplifier used, if by then the microphone output itself is still undistorted. Such a situation has not yet arisen with the prototype, but it is theoretically possible !

The amplifier input is transformer-fed to provide both a balanced input and also facilities for 600 or 60 ohm microphones, the two

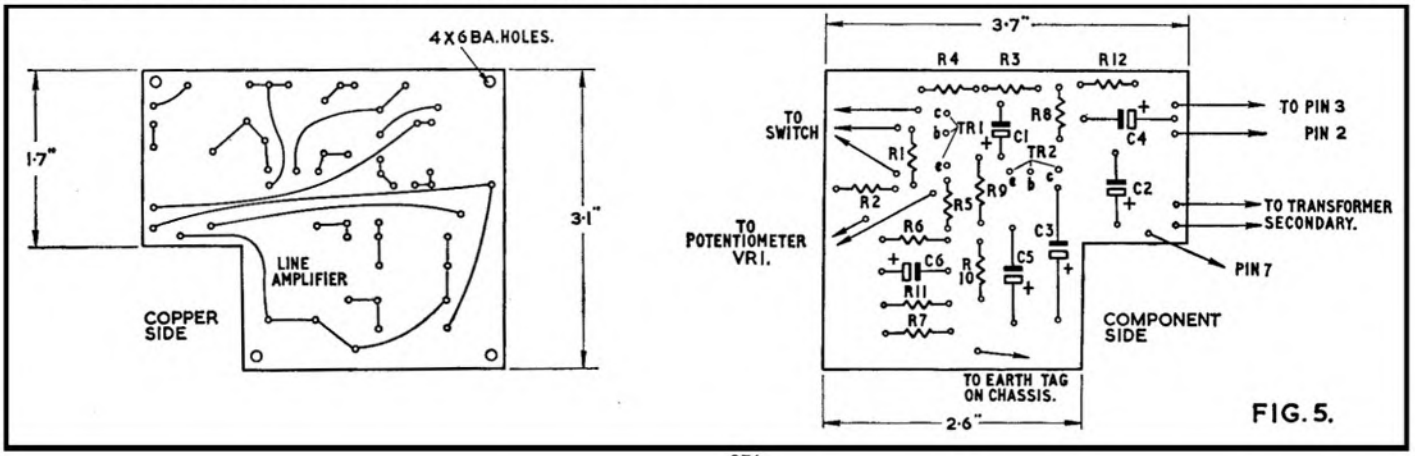
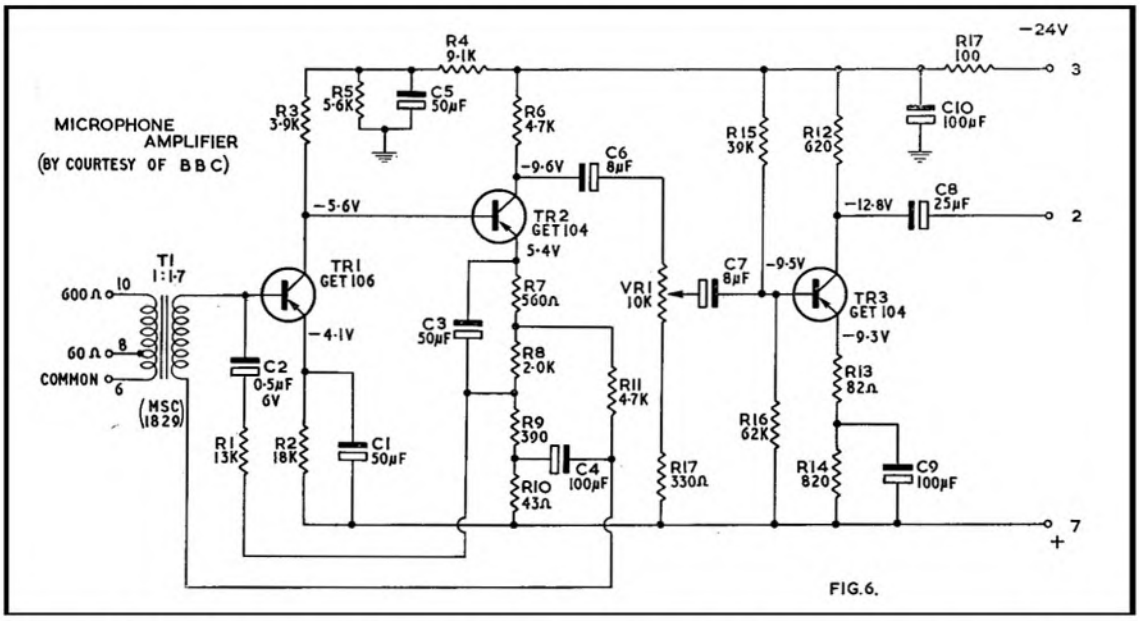


FIG. 5.

www.americanradiohistory.com

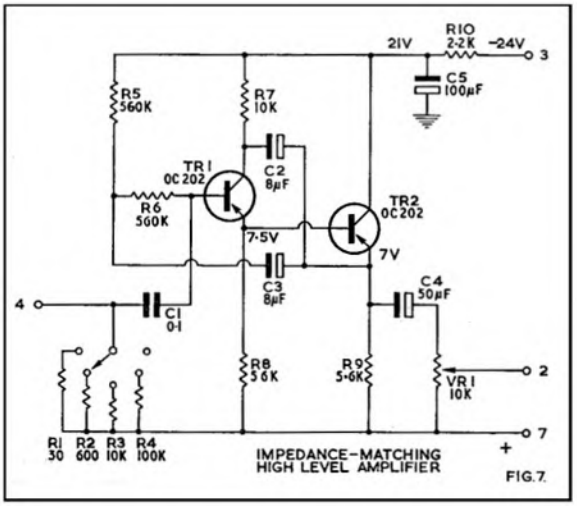
frequencies where the capacitive effects in the transistor are not important. To maintain the impedance throughout the audio band collector feedback is used with R7 and C2. The front panel control is used to switch in a range of matching resistors so that if the source contains an output transformer of some sort (which must be correctly matched to obtain the correct frequency response) the right terminating resistance can be added simply. Most of the time this facility is not used, but it is worth including for that one most important time. The input is taken to a different pin from those used for the transformer stages, and does not pass through the phase-reversal switch, since it would then be possible to short out the input signal in one position of this switch. **Fig. 8** shows this wiring in more detail ; it is also shown in the block diagram which appeared in the first article in this series. **Fig. 8** also shows the connections for the 'pan' control ; the prototype has this feature on two channels. By this method a soloist or injection microphone can be positioned electrically to appear anywhere on the stage, or made to move around for special effects. VR1 is a double potentiometer, one half with the usual log-law, and the other antilog. These must be wired in reverse to achieve the correct characteristic, which is that moving the control from the central position should decrease the amplitude of the signal to one channel while leaving the other output substantially constant. This produces a very smooth and accurate positioning control.

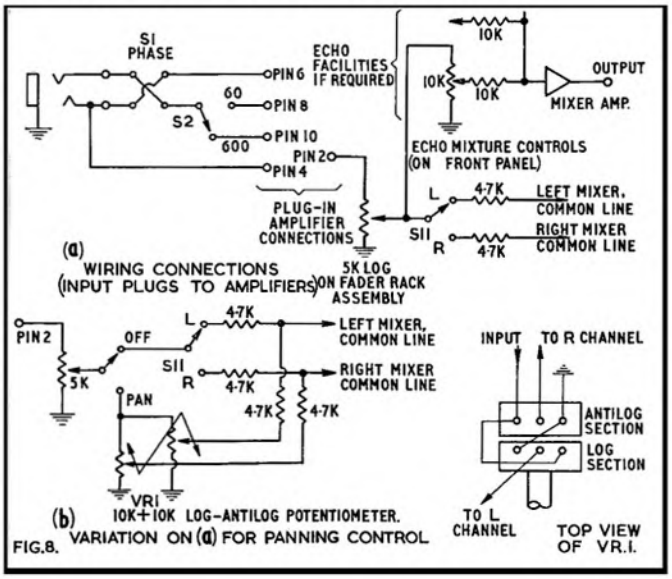
Also in this diagram are the connections that must be made in order to provide full echo facilities in the mixer. A separate volume control, labelled 'echo mixture', is used to take a fraction of the output signal of each plug-in unit, after it has passed through the main channel gain control. This is passed to a mixing stage, identical with that used in the normal channel (to be described next month), where it is mixed with signals from all the other channels in any desired proportions. This output is then passed from the mixer to an external echo machine.



This can be of any type commercially available, such as the metal plate, coiled spring or tape machine. If a quiet reverberant room is available this makes an excellent echo chamber. The output from the device is returned and fed into the main channel faders with the other sources. Echo is shown in mono only ; for stereo the system is similar, but the second side of S11 (2p co) is used to switch the echo feed to two separate echo mixers in an identical manner as the main signal is switched.

A few key pieces of information were omitted from last month's description of the power supply : mains transformer is type MTA3, diodes for the main bridge are type XU612, and, most important, the OC 28 transistor must be mounted on *at least* 6 sq. in. of aluminium. All these components are obtainable from Henry's Radio. Part 4 will commence with details of the common mixer amplifier.





www.americanradiohistory.com

book reviews

MAGNETIC TAPE RECORDING. By H. G. M. Spratt, 382 pages, 203 illustrations. Price 63s. Published by *Temple Press Books Ltd.*, 42 Russell Square, London, W.C.1.

THIS second edition of what is now a standard book on tape recording will gladden the hearts of those whose first (like mine) is falling to pieces, and give many new readers, I hope, a clear, detailed, readable and commonsense insight into what a magnetic recording system contains, how it is put together and how it works.

After a short historical survey, the twelve main chapters cover: Principles of Magnetism, Sound Reproduction and Electro-Acoustics (short, this, and strictly relevant to the subject), Principles of Magnetic Recording, Tape Manufacture, Tape Testing, Tape Recording Machines, Recording and Reproducing Machines for Music and Speech, Testing of Machines, Applications of Magnetic Recording, Present Trends and New Developments and Recording Standardisation.

*Parts of BS*1568:1960, "Magnetic Tape Sound Recording and Reproduction", dealing with frequency characteristics and the dimensions of tapes and spools, are reproduced in one Appendix. Two others contain notes on "Abnormal Climatic Effects" and "The Basic Electrical Design of the Reproducing Head" respectively. Practical recording is not covered—it's not that kind of book. Nor will readers find any collected hints on keeping tape recorders in good condition, although the "Testing of Machines" chapter may open their eyes a bit; and the one on "Tape Testing", come to that.

What they will find is a comprehensive up-to-date and factual account of almost all functional aspects of magnetic recording, tape, heads, machines and applications, with the emphasis on audio techniques but with much interesting fringe stuff on new recording methods, TV recording, data storage, etc.

MUCH NEW MATERIAL

A lot of new material has been added in this edition, and some of the old rewritten and expanded, all with great attendance to detail and care to preserve the flow of the text and the logical arrangement.

In particular, the section on ferrites, heads, new recording methods, AC biasing, and the many references to transistor techniques, will interest those who like to keep abreast of developments in audio work. Severe critics of the tape manufacturers will perhaps think again when they meet statements like " . . . no controversy associated with magnetic recording is more baseless than the prejudice against the spliced reel"; or—" . . . the additional production cost of fitting them (leaders) is quite out of proportion . . . Their inclusion is a bane which no manufacturer will suffer gladly"; or when they read about the choice of materials and complicated production process necessary for a high-quality magnetic tape.

There are the odd mistakes, of course. For instance (pages 49 and 128) the lowest tape base thickness in common use is 0.0005 in. not 0.0007 in., and the coating thickness may have to be considerably less (on triple-play tape) than the 0.0003in. quoted as a minimum. Orientation of particles in the coating (page 143) should cause less than ¼dB directional difference in sensitivity, not 2dB, and it is as necessary for the manufacturer to bulk-erase unoriented tape as oriented (page 150) before packing. Again, on my pet subject of level meters (page 232), no recordist would tolerate a recording channel in which the recording gain has to be set so that "the pointer just kicks perceptibly on loud passages".

But these are trivial things which most tape enthusiasts will recognise on sight and ignore because the text as a whole is so good. All the relatively small amount of mathematics is paraphrased, so that one can understand and enjoy the text fully without it, although in fact it's no more advanced than what one did in sixth forms (or *does*, if you're in one). A new clearer type-face on good paper makes for less tiring reading than in the first edition, and the layout, diagrams and photographs are excellent and to the point. The index is perhaps not as full as one might like for reference use, but it's an easy book to get to know and almost anything you can think of on the subject can be found quickly enough. I can unreservedly recommend 'Spratt' as the best buy of its kind available at the moment. **G.C.B.**

TAPE RECORDING AND HI-FI. By R. Douglas Brown, 159 pages, 8 line illustrations, 32 half-tones. Price 5s. Published by *Arco Publications*, 9 Grape Street, London, W.C.2. **TAPE RECORDING AND HI-FI.** By Frederick Oughton, 128 pages, 14 line illustrations, 23 half-tones. Price 5s. Published by *Collins Nutshell Books*, 144 Cathedral Street, Glasgow, C.4.

TWO books, written by different authors and produced by separate publishers, with identical titles. Good enough reason for a combined review!

Douglas Brown's book is far from new. First published as an Arco 'Handybook' in 1961, it was re-introduced recently as a paperback. It is larger and thicker than Frederick Oughton's equivalent, of the same price, which was first published a couple of months ago.

Mr. Oughton's version begins poorly with a blatant misuse of 'Print-through', in the context of poor erasure of previous recordings. A rather jerky style of writing in these first few pages quickly gives way to descriptions of imaginative recording techniques. The chapter on "Candids and Tapespondence" is well written and contains much useful information.

The book is unpretentiously levelled at the complete tyro—so much, however, that a half-track recording is diagrammatically illustrated by three equidistant parallel lines. This is, perhaps, over-simplifying the relevant and interesting point of erase-scanning being wider than recorded tracks.

A possible source of confusion, frequently found in books of this nature, shows itself in a tape-length-playing-time chart. This is calculated for double-track playing times, although no such reference is given to that effect.

Pages 51 onwards concern themselves with hi-fi, though elementary information on the cleaning and servicing of recorders is given in the last chapter. The book closes with a postscript on copyright which is, in fact, out of date according to Mr. Brown's work published three years previously. Consequently much of the information given is misleading.

A prospective sound enthusiast reading Brown's 'Handybook' is thrown deep into a mono-stereo-cost debate in the first chapter. The author, perhaps unfairly, sides strongly with the "good-mono-rather-than-indifferent-stereo" sect, possibly at the expense of frightening his readers to the pursuance of another hobby.

Nevertheless, a much more factual and intelligent style is presented by the paper-back. Illustrations are clear though not drawn as if intended for moronic readers. Considerable emphasis is placed on the suitability of the tape recorder as a creative instrument, rather than an off-shoot of the hi-fi world, with interesting suggestions for do-it-yourself *musique concrète*. Mr. Oughton's book seems of doubtful value at any price. Mr. Brown's version gets my 5s.

D.K.

RADIO AND ELECTRONIC HOBBIES. By F. C. Judd, 159 pages, 8 line illustrations, 19 half-tones. Price £1 1s. Published by *Museum Press Ltd.*, 26 Old Brompton Road, London, S.W.7.

ALTHOUGH covering a very wide range of topics, this book should prove extremely interesting to the home-experimenter and constructor. Hi-fi, amateur radio and remote control of models, to name just three completely different subjects, are dealt with fully in a simple, practical way. Several fascinating circuits are shown, including a very simple oscilloscope and several audio signal generators. The latter form part of a comprehensive chapter on electronic music and *musique concrète*.

Twelve pages of text and line illustrations are given to un-diluted tape-recording, covering basic principles of tape-transport, tracking and microphone anatomy. Frequency correction is quite well covered, although the function of bias is only sparsely described.

The reader's enthusiasm is whetted by a short section on *Chromasonics*, a system of converting sound into vision. Considering this is a field in which Mr. Judd has made several original developments, much too little space is given.

Not ideally suited to the prospective recordist searching for information on his hobby, but highly recommended as a mine of information for the experimenter wishing to leave audio at a tangent.

D.K.

www.americanradiohistory.com

• Hi-Fi Equipment • Speaker Systems • Radios • Educational • Amateur Gear • Test Instruments •


TA-IS

TO ALL MUSIC LOVERS AND HI-FI ENTHUSIASTS

No electronic or soldering experience is necessary *to build any Heathkit model: our simple, well illustrated manual guides you step by step.* **A FREE CATALOGUE of the full range,** *and detailed specifications of any item, will be gladly sent on request without obligation on your part.*

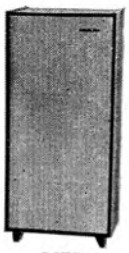
TAPE AMPLIFIER UNITS
Models TA-IM and TA-IS
The monophonic version (TA-IM) can be modified to the stereo version (TA-IS) by modification kit (TA-IC). Special features include the provision of a bias level control, easy-to-read thermometer-type recording level indicators; large printed circuit boards. Both models have identical presentation. TA-IM **£19.18.0** kit
TA-IS **£25.10.0** kit TA-IC **£6.15.0** kit
TA-IM **£28.18.0** Assembled
TA-IS **£35.18.0** Assembled


D-93

TRUVOX D93 TAPE DECKS
Standard. High-quality stereo tape decks. D93/2 ¼-track for highest fidelity **£36.15.0**
With TA-IM **£52.18.0**
With TA-IS **£58.10.0**
D93/4, ¼-track, for most economical use of tape. **£36.15.0.** With TA-IS **£58.10.0**

MONO CONTROL UNIT. Model UMC-1.
Designed to operate with our model MA-12 or any amplifier requiring 0.25 V or less for full output. Suitable for cabinet mounting or free standing. Size 10" × 7" × 4". **£8.12.6** kit
£13.12.6 Assembled


UMC-1


MFS

"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.

"COTSWOLD" STANDARD SPEAKER SYSTEM
This is an acoustically designed enclosure 26in. × 23in. × 14in. housing a 12in. bass speaker with 2in. speech coil, elliptical mid-range speaker and a pressure unit to cover the full frequency range of 30-20,000 c/s. Capable of doing justice to the finest programme source. Delivered complete with speakers, cross-over unit, level control, grille cloth, etc. Either Model **£23.4.0** kit
£30.15.0 (Assembled in the white)

"OXFORD" TRANSISTOR RADIO Model UXR-2. Luxury solid leather case, full long and medium wave coverage. Printed circuit facilitates assembly. 7" × 4". high-flux speaker. Send for full details.
£14.18.0 incl. P.T.

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
£15.18.0 Assembled

COLLARO "STUDIO" TAPE DECK. Operating speeds: 1⅞in., 3¾in. and 7½in. p.s. Wow and flutter not greater than 0.15% at 7½in. p.s. **£17.10.0**
With TA-IM **£31.5.6**

Heathkit
DAYSTROM

Save Money and enjoy yourself building these Heathkit models

NO SPECIAL EQUIPMENT OR PREVIOUS EXPERIENCE NECESSARY TO BUILD ANY HEATHKIT MODEL

STEREO CONTROL UNIT Model USC.1

Push-button selection, accurately matched ganged controls to — 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
£26.10.0 Assembled

GARRARD AUTO/RECORD PLAYER Model AT-6. 4-speed stereo and mono unit, manual or automatic record selection, Ronette 105 cartridge. **£13.12.1**
With Decca Deram cartridge **£14.6.1**

GOLDRING-LENCO TRANSCRIPTION RECORD PLAYER Model G.L.58. Fitted with the G.60 pick-up arm it has infinitely variable speed adjustment between 33⅓ and 80 r.p.m. and four fixed speeds. 3½lb. turntable to reduce rumble "wow" and "flutter". With Ronette 105. **£20.1.3**

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


MALVERN

HI-FI EQUIPMENT CABINETS
A range of over a dozen equipment cabinets is now available to meet differing needs of enthusiasts. Designed for maximum operating convenience or for where room space is an over-riding consideration, this range includes kits, ready assembled cabinets or assembled and fully furnished cabinets, and has at least one model to meet your requirements. Why not send for full details?
Prices from **£7.7.0**—**£33.12.0**

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 TI **£4.13.6** incl. P.T.) IF Amplifier (AFM-AI **£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 AMPLIFER 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-33H. De luxe version of S-33 with many refinements. Ideal for use with Decca Deram pick-up. **£15.17.6** kit
£21.7.6 Assembled

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. **£30.10.0** Assembled **£22.10.0** kit

AUDIO SINE SQUARE WAVE GENERATOR AO-1U. Covers 20 c/s—150 kc/s in four ranges. Choice of sine or square waves, the latter up to 50 k/cs. **£21.5.0** Assembled **£14.15.0** kit

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. **£17.2.11**

HI-FI STEREO 18 WATT AMPLIFIER Model S-99. Within its power rating, this is the finest stereo amplifier available, regardless of price. Printed circuit board construction; ganged controls. U/L push-pull output. 0.2% distn. at 9 W/chal. **£27.19.6** kit
£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.
£11.15.0 Assembled **£7.9.6** kit

ELECTRONIC WORKSHOP KIT, Model EW-1
The ideal present for youngsters. Will make over 20 exciting experiments, including Transistor Radios, Intercoms, Burglar Alarm. Electric Eye, etc. No soldering. 72-page well illustrated instruction manual. Two-colour Club badge given free with every kit. Total price **£7.13.6** incl. P.T.

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**

A WHOLE RANGE OF PACKAGED DEALS (INCLUDING "CONNOISSEUR CRAFTSMAN" TURNTABLE and DECCA fiss PICK-UP) NOW AVAILABLE TO SAVE YOU FURTHER MONEY.

All prices include free delivery in U.K. Deferred terms available on orders over £10

JUST POST THIS COUPON FOR FURTHER INFORMATION

Without obligation please send me TICK HERE

★ **HEATHKIT FREE BRITISH CATALOGUE . . .** ☐

FULL DETAILS OF MODEL(S)

Kindly write below in BLOCK CAPITALS

NAME .....

ADDRESS .....

..... HT8..

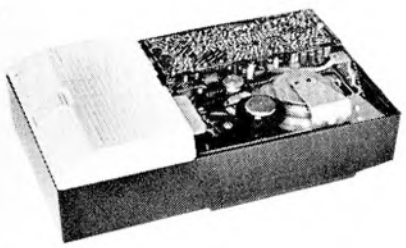
WE SHALL BE EXHIBITING at the TELEVISION AND RADIO SHOW, Earls Court, LONDON, August 26th—September 5th, 1964, STAND 32, 11 a.m.—9 p.m. AND LOOK FORWARD TO SEEING YOU.

DAYSTROM LTD. DEPT. H8 GLOUCESTER, ENGLAND
(A subsidiary of Weston Instruments Group) manufacturers of
THE LARGEST-SELLING ELECTRONIC KITS IN THE WORLD

www.americanradiohistory.com

field trials

OF BATTERY PORTABLES



A rear view of the 'works' showing printed circuitry and sizable capstan.

NUMBER TWO PHILIPS EL3300 BY DAVID KIRK

PHILIPS recently took a step into the unknown with the announcement of a battery portable recorder using cartridges in place of spools. Previous attempts to popularise the cartridge in this country have always failed, though this may have been due to poor promotion.

All relevant accessories are included in the cost price—a leather carrying-case, cartridge, microphone with battery on/off switch, and recording lead.

The recorder's minute size is camouflaged, to some extent, by the carrying-case, which also provides storage space for a few accessories. 'Pocket-size' is *almost* the word, although a raincoat pocket bulges visibly on the machine's intrusion.

Having purchased the batteries, five 1.5V leakproof cells giving some twenty hours playing time, they were inserted into the appropriate compartment, access to which is gained through a spring-loaded clip. Diagrammatic outlines of the cells, imprinted on leather battery cradles, ensure—in a foolproof manner—the correct combination of polarities.

My first attempts at serious recording took place in an empty railway carriage somewhere between Croydon and London Bridge. Microphone and remote on/off switch were extracted from the case and inserted into two DIN sockets. Plastic clips, thoughtfully included by the manufacturer, held the two leads together, preventing the awkward tangle that so often occurs at inconvenient moments.

A description of the surrounding scenery, spoken less than two inches from the microphone, was then begun. Background sounds were so loud that I could hardly hear myself speak, and would have been grateful for the provision of a headphone monitor-while-recording facility which, contrary to a remark by a Philips representative at the EL3300's press-demonstration, would *not* have required extensive and expensive modification to the case and layout. Only a small number of the two DIN socket pins are used on this machine and the 'modification' would be in the form of two wires taken from some convenient point in the recording amplifier to the pre-amp output socket.

As it happened, recording balance proved almost perfect on replay later in the evening. Over-sibilance was non-existent even though some of the recording had been made speaking directly at, and not across, the microphone diaphragm. Distortion, hiss and electrical motor interference were entirely absent, hidden perhaps by the sound of the train.

Holding a microphone outside a carriage window is no way to record railway sounds, but the EL3300 reproduced wheel-clatter in this way without any noticeable wind effects whatsoever. Considering the speed of the train this was a very good performance.

The full range of notes taped from a piano showed up two faults in the reproducing system. Not surprisingly, considering the small size (2½in.) of the speaker, bass reproduction was lacking. Middle-range sounds, however, gave rise to considerable distortion caused by vibration of the plastic cabinet. In an attempt to eliminate this, everything from clasping the machine tightly between the hands to extracting various sections of the casing was tried, without much success. Wow and flutter were almost inaudible on playback of that most telling instrument, but when the machine was supported from the shoulders, rather than on a table, speed fluctuation became noticeable. Lurching railway trains could not prove damaging to speech, however.

Light music reproduced quite well through the internal speaker, although the cabinet vibration still proved slightly annoying; but on connection to an external amplifier and speaker, the results proved magnificent for such a slow speed, narrow track and low price. The piano recordings, played back in this fashion, also showed an impressive rise in quality. In this case bass reproduction was emphasised considerably more than the middle and high frequencies; this was corrected by moderate use of a tone control. With the absence of box vibration it was possible to discern just how clear the recordings were.

Sufficient voltage was obtainable from the pre-amp output to load fully the high-level input of a mains recorder, and I have no hesitation in recommending the EL3300 as an inexpensive 'second machine' for the dubbing of speech and light music.

Background hiss, although this is virtually a '¼-track' recorder, is, in common with motor noise, only very slightly louder than on the Philips *EL*3586. With the latter recorder (my own) on hand during the Field Trial I spent long periods trying vainly to distinguish between the comparative qualities of the two machines. Unfortunately (from my point of view—but obviously not from the manufacturer's) I could find nothing to suggest any great difference in quality. Which brings me to the inevitable conclusion.

The EL3300 has one great advantage over the EL3586: it is little heavier than an average-sized camera—sufficiently light to forget that one is carrying it. After an unforgettable nightmare tour of Glasgow carrying 10lb. of EL3586 (made all the worse by the fact it was never used) there seems only one major reason for not selling it to buy an EL3300, the difference in quality being, as I said, hardly discernible. This reason lies in the latter machine's use of cartridges. I do not have a great collection of cartridges, whereas my stocks of tape (mainly un-used 'cheap' brands) have to be seen to be believed. A Philips cartridge retails at 19s. 6d. and gives sixty minutes playing time.

Perhaps the right line of approach to the cassette-spool problem is that put forward recently by a friend. He already owned a *Stella* version of the EL3586 but has decided to buy an EL3300, not to

(*continued on page* 286)

MANUFACTURER'S SPECIFICATION:

Speed: 1⅞ i/s; **Wow and Flutter:** 1% peak-to-peak: **Frequency Response:** 120 c/s to 6 Kc/s ±3dB; **Playing Time;** One hour on cartridge-loading 3/20in. triple-play, ¼-track. **Microphone:** Moving-coil, fitted with clothing clasp, detachable table stand and remote on/off switch. **Dimensions:** Cabinet—7¾ x 4½ x 2¼in. Carrying-case—8¾ x 6½ x 2½in. **Weight:** 4lb. including batteries. **Battery Complement:** Five 1.5V cells. **Signal-to-Noise:** 40dB. **Inputs:** Microphone: 0.3mV at 2K; high level: 200mV at 2K with *EL*3768/03 connecting lead. **Output:** 0.5V at 20K from pre-amp. 250mW to 2½in. speaker. **Price:** £26 5s. **Manufacturer: Philips Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2.**

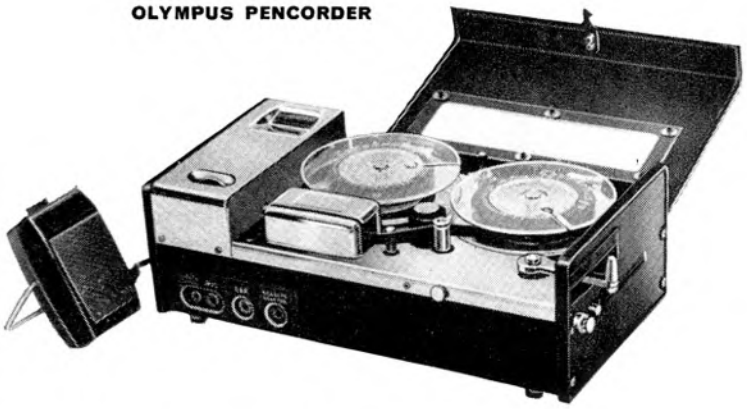
www.americanradiohistory.com

SURVEY

"WE recently checked a recorder," reads the *Nagra* 3 Test Report, "which was accidentally dropped into the Amazon and suffered very little from its ducking." Considering the weight of the machine, over 20lb., it is surprising it was ever retrieved from the river-bed, though a charmed-life may well be included in the price —£317.

But are you in fact looking for a waterproof recorder? Probably this aspect of a specification will not hold a very wide interest—in which case you can expect to pay just a little less for its absence.

OLYMPUS PENCORDER



PHILIPS EL3586

SURVEY OF BATTERY PORTABLES

Similarly, if the machine is required for serious recording of tapes to be replayed elsewhere, look for the model with a monitor-only replay and a top quality recording system. This will generally indicate that a greater proportion of the cost price has been devoted to achieving something which is not already possible with your mains recorder.

Should the portable be required for entertainment where mains power supplies are not available, such equipment is also listed below. The *Stuzzi Disc-Corder*, despite its poorly chosen name, would compete very favourably with the most carefully-chosen of such combinations obtainable at £62.

The *Uher* 4000 range offers all 'mod. cons.', with the exception of the Light, Home and Third, for little over £100. Its performance, as illustrated in a fairly recent review, equals that of some even higher priced mains machines. Outdoor stereophonic recording facilities must surely be unique to this model.

Telefunken brought hi-fi replay quality to the battery field, as any visitor to their Audio Fair demonstrations will confirm. No such pretentions are made, however, by the *Philips EL*3586 and its *Stella* and *Cossor* equivalents. Their straightforward facilities for good quality recording and quite reasonable monitoring are difficult to equal at £26 5s. It is not possible to include *all* battery-operated recording equipment in this survey, due, among other things, to the indefinable margin between recorder and dictaphone. The latter term is often applied to a poor quality tape recorder but, as in the case of the *Fi-Cord* 101, some dictaphones are so good that they become known as tape recorders.

* * *

COSSOR CR 1621. TAPE SPEED : 1⅞ i/s. SPOOL CAPACITY : 4¼in. BATTERY COMPLEMENT : Six 1.5V cells. BATTERY LIFE : 40 hours. FREQUENCY RESPONSE : 80 c/s to 8 Kc/s ±3dB. SIGNAL-TO-NOISE : 40dB. OUTPUT POWER : 500mW. LOUDSPEAKER : 4in. LEVEL INDICATOR Meter. WOW AND FLUTTER : 1% peak-to-peak. DIMENSIONS : 12⅛ x 9 x 4⅛in. WEIGHT : 8lb. with batteries. MISCELLANEOUS : Fast Wind and Rewind. Tone Control. ACCESSORIES : Mains convertor. Remote

TELEFUNKEN M300

GRUNDIG TK6

www.americanradiohistory.com

SURVEY

on/off switch. Shoulder-case. PRICE (including moving-coil microphone, tape and recording lead) : £27 6s.
Manufacturer : Cossor Radio and Television Co. Ltd., 233 Tottenham Court Road, London, W.1.

* * *

DANSETTE CADET. TAPE SPEEDS : 3¾ and 1⅞ i/s. SPOOL CAPACITY : 4¼in. BATTERY COMPLEMENT : Six 1.5V cells. LEVEL INDICATOR : Valve. WOW AND FLUTTER : 0.2%. DIMENSIONS : 11⅛ x 5⅝ x 12in. WEIGHT : 10lb. MISCELLANEOUS : Fast wind and rewind. Tone Control. Incorporating Garrard Battery Tape Deck. ACCESSORIES : Microphone, recording lead and tape—supplied. PRICE : £27 6s.
Manufacturer : Dansette Products Ltd., 112-116 Old Street, London, E.C.1.
● **Field Trial :** June 1964.

FI-CORD 202 (LEFT)

Q-CORD 203 (RIGHT)

* * *

EMI RE 321. TAPE SPEED : 7½ i/s. SPOOL CAPACITY : 5in. BATTERY COMPLEMENT : Eight 1.5V cells. FREQUENCY RESPONSE : 60 c/s to 10 Kc/s to CCIR recording characteristic. SIGNAL-TO-NOISE : 44dB unweighted. OUTPUT : Phones/Line, max +8dBm. LEVEL INDICATOR : Meter. WOW AND FLUTTER : 0.25% RMS. DIMENSIONS : 14½ x 8 x 16¾in. WEIGHT : 17½lb. MISCELLANEOUS : Full-track recording and playback (70mW through monitor speaker). PRICE £124.
Manufacturer : EMI Electronics Ltd., Hayes, Middlesex.
● **Review :** November 1961.

STUZZI DISC-CORDER

* * *

FI-CORD 101. TAPE SPEED : 1⅞ i/s. SPOOL CAPACITY : 3in. BATTERY COMPLEMENT : Two Mallory ZM9. BATTERY LIFE : 20 hours. DIMENSIONS : 6⅜ x 3¼ x 1⅝in. WEIGHT : 1lb. 11oz. MISCELLANEOUS : Automatic Volume Control. Fast forward and rewind. ACCESSORIES : Stethoscope Earphones, Electronic Foot Switch, Transcribing Amplifier, Case, etc. PRICE £55 13s.
Manufacturers : Fi-Cord International, 40a Dover Street, London, W.1.

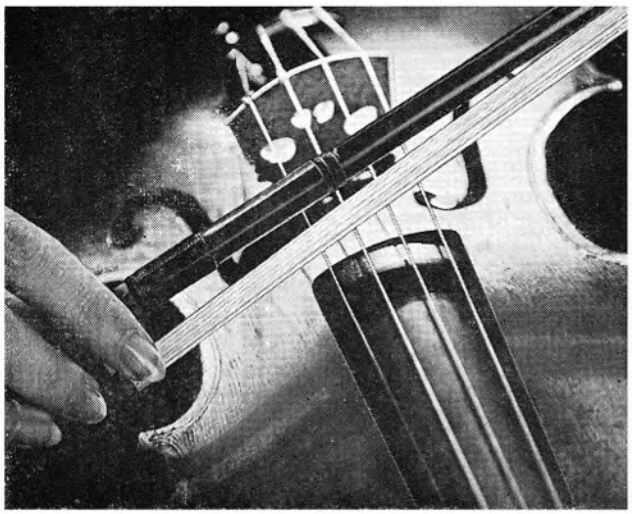
OPTACORD 414

FI-CORD 202. TAPE SPEEDS : 7½ and 3¾ i/s. SPOOL CAPACITY : 4¼in. BATTERY COMPLEMENT : Mercury Cells. BATTERY LIFE : Motors—20 hours at 7½ and 30 hours at 3¾ i/s. Electronic—60 hours. FREQUENCY RESPONSE : 50 c/s to 12 Kc/s ±3dB. LEVEL INDICATOR : Meter. WOW AND FLUTTER : 0.3% RMS. DIMENSIONS : 9 x 6½ x 4½in. WEIGHT : 6¾lb. with batteries. MISCELLANEOUS : Fast wind and rewind. Remote control socket. ACCESSORIES : Carrying case, mains unit, rechargeable batteries. PRICE (with tape and batteries) : £69 6s.
Manufacturer : As above.

(*continued on page* 279)

www.americanradiohistory.com

IN A WORLD OF SOUND



... the most important contribution to the development of recording equipment has been made

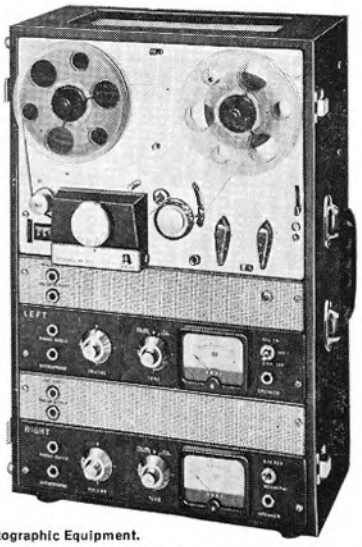
AKAI M7

4-TRACK TAPE RECORDER

THE WORLD'S FIRST 'X'—FIELD TAPE RECORDER

Sound . . . sheer quality of vivid **AKAI** sound. From the lucid treble notes of the piano to the brave and brassy blare of the trumpet, **AKAI** tape recorders will faithfully reproduce your favourite sound time and time again—at your command.

AKAI Model M-7. 4 track, 3 speed, full stereo or monaural, twin amplifiers, cross - field recording head, total output 12 watts, V.U. meters. Complete with microphones and accessories **£139.13.0.**



AKAI Model 345. 4 track, 2 speed, full stereo or monaural, fully automatic operation, protected circuit, automatic re-play device, total output 20 watts, V.U. meters, remote control. Basic price **£208.19.0.** Remote control **£6.10.0**

AKAI Model 707. 2 track, 2 speed monaural, V.U. Meter, single touch speed control, automatic shut-off device. Total output 6 watts, Complete with microphone, recording tape, empty reel, reel caps, service cables, and full instructions. **£88.4.0**

AKAI Model 903. 2 track, 2 speed monaural with mixing facilities, V.U. meter, monitoring switch, Instant Stop device, supplied complete with microphone. Reel of tape, spare reel, reel caps, 50 cycle adaptor and splicing tape. **£84.0.0**

Twin speaker systems are available for all AKAI machines and range from the SS 50 at £31.10.0 through the SS 55 at £37.10.0 and the SS 70 at £38.17.0 to the SS 100 at £43.14.0 and a full range of accessories are available for all models.

If the Akai M-7 is not yet at your usual dealer, write for literature and detailed information to:—

PULLIN OPTICAL COMPANY LIMITED, U.K. Marketing Organisation for the World's Finest Photographic Equipment.

Ellis House, Aintree Road, Perivale, Greenford, Middlesex. Tel: ALPerton 1541/7 Visit our London Showrooms at 93-97 New Cavendish Street, W.1.

FRANCIS OF STREATHAM

IN STOCK NOW—THE NEW B & O STEREOMASTER

A superlative instrument—105 gns.

*Brenell Stereo STB I	£120
*Brenell Mk. V Model M	88 gns.
*Brenell Mk. V Series 2	69 gns.
Cossor 4 Tr. 1604 2 sp.	39 gns.
Cossor 4 Tr. 1605 4 sp.	62 gns.
Elizabethan 'Popular'	23 gns.
Elizabethan LZ29	38 gns.
Elizabethan 9Z	27 gns.
*Ferrograph 422 or 424	110 gns.
*Ferrograph Series 5	85 gns.
Fidelity Major	35 gns.
Fidelity Playmaster 2 Tr.	20 gns.
Fidelity Playmaster 4 Tr.	23 gns.
Grundig TK14	35 gns.
Grundig TK18 'Magic Ear'	39 gns.
Grundig TK23 4 Tr.	45 gns.
Grundig TK40 4 Tr.	75 gns.
Grundig TK41 2 Tr.	75 gns.
*Grundig TK46 4 Tr. St.	99 gns.
Philips 4 Tr. 3541/H	42 gns.
Philips 4 Tr. 3549	62 gns.
Philips 4 Tr. Stereo 3534	92 gns.
Philips 3548 4 Tr. 2sp.	39 gns.
*Reflectograph 'A' ½ Tr.	105 gns.
*Revox T36	124 gns.
Robuk	36 gns.
*Saba Stereo	95 gns.
Siemens Stereo 14 4 Tr	69 gns
*Simon SP5	93 gns.
Sony 200	79 gns.
Sony 500	106 gns.
Stella 458 4 Tr.	39 gns.
Stella 459 4 Tr.	62 gns.
*Tandberg Mono 92	69 gns.
*Tandberg Series 6	110 gns.
*Tandberg Series 7	93 gns.
Telefunken 55	43 gns.
*Telefunken 85 de luxe	83 gns.
*Telefunken 96 4 Tr.	69 gns.
*Telefunken 97 ½ Tr. Stereo	95 gns.
*Telefunken 98 ½ Tr. St.	95 gns.
Telefunken 300	59 gns.
*Vortexion WVA	£93.13.0
*Vortexion WVB	£110.3.0
*Vortexion CBL Stereo	£160.0.0
Wyndsor Trident	33 gns.

TRUVOX

R.92 2 Tr. Recorder	69 gns.
R.94 4 Tr. Recorder	69 gns.
*PD.93 (2 Tr.) or PD.95 (4 Tr.) Deck and Pre-Amp	59 gns.
*PD.97 (2 Tr.) or PD.99 (4Tr.) Stereo (Deck and Pre-Amp)	79 gns.

BATTERY PORTABLES

Grundig TK6	65 gns.
Cossor 1621	26 gns.
Philips 3586	25 gns.
Loewe Opta 414 (Mains/Battery/Car)	47 gns.
*Butoba	59gns.
*Fi-Cord 202	66 gns.
Philips Battery Portable EL3300	25 gns.
Stella 471	26 gns.
Stuzzi Memo-Cord	25 gns.
Uher 4000S	93 gns.
Sanyo	36 gns.

**Microphone extra*

MAINS POWER PACKS

Philips, Stella or Cossor	£5.12.0
Butoba	11 gns.
Fi-cord	£7.10.0
Uher 4000	16 gns.

Tape Decks by Brenell, Wright & Weaire.

Tape to disc and copy service.

LEADING STOCKISTS OF EQUIPMENT FOR

TAPE and HI-FI

... and NO EXTRA FOR CREDIT TERMS

★ **Minimum Deposit**

★ **No Interest or Service Charges on H.P. up to 18 months**

★ **Free Service during Guarantee Period**

● **MICROPHONES, MIXERS, ETC.**

Grampian Reflector	£6.15.0
Grampian Ribbon	£11.10.0
Grampian DP/4 Dynamic	£8.0.0
Simon 'Cadenza' Ribbon	£10.10.0
Reslo Pencil Dynamic	10 gns.
Reslo Ribbon	£10.2.0
AKG Stereo D.77A	£15.10.0
AKG D.19C	£17.10.0
TSL 3 Channel Mixer	£2.7.6
TSL 3ch. Transistor Mixer Eagle Mixer	£2.19.6
Grundig Mixer Stereo	18 gns.
AKG K 50 Headphones	£7.10.0
Philips Pre-amp	£6.10.0

Also in stock microphones by ACOS, FILM INDUSTRIES, TELEFUNKEN, Beyer, etc.

All WALGAIN PRODUCTS

● **TAPES & ACCESSORIES**

Standard, Long, Double, Triple Play in all sizes by all leading makers.

● **DELUXERS BY WEARITE, WALGAIN**

● *Pre-recorded Tapes by Columbia, H.M.V. and all E.M.I. Labels, Saga, Tutor-tape, etc.*

Bib, Bond and E.M.I. splicers. Matching transformers. Plugs, sockets, etc.

Prices subject to alteration as announced by manufacturers.

● **STANDS OF ALL TYPES**

HI-FI DEPT.

● **STEREO AND MONO AMPLIFIERS—**
Quad HMV Pye Rogers
Leak Armstrong Tripletone
Scott B & O Chapman Eagle

● **TUNERS**
Quad Rogers Pye H.M.V.
Leak Armstrong Chapman
B & O Tripletone

● **LOUDSPEAKERS**
Quad Pye Rogers W.B. Kef
WharfedaleGoodmansTannoy
Lowther Mordaunt Leak
Lockwood Elac Eagle Kelly

● **MOTORS, PICKUPS**

Garrard	Tannoy EMI
Goldring	Lenco Shure
Connoisseur	Decca Stereo
Decca Deram	Pickering
Philips	Ronette
Ortofon	B & O
Acos	SME Mk. II
Thorens	ADC BSR

All types of Diamond and Sapphire styli, stereo and mono. Microlifts, Garrard, Goldring and Acos Pressure Gauges. Disc Preener. Acos Dust Bug. Cabinets by Record Housing and G.K.D.

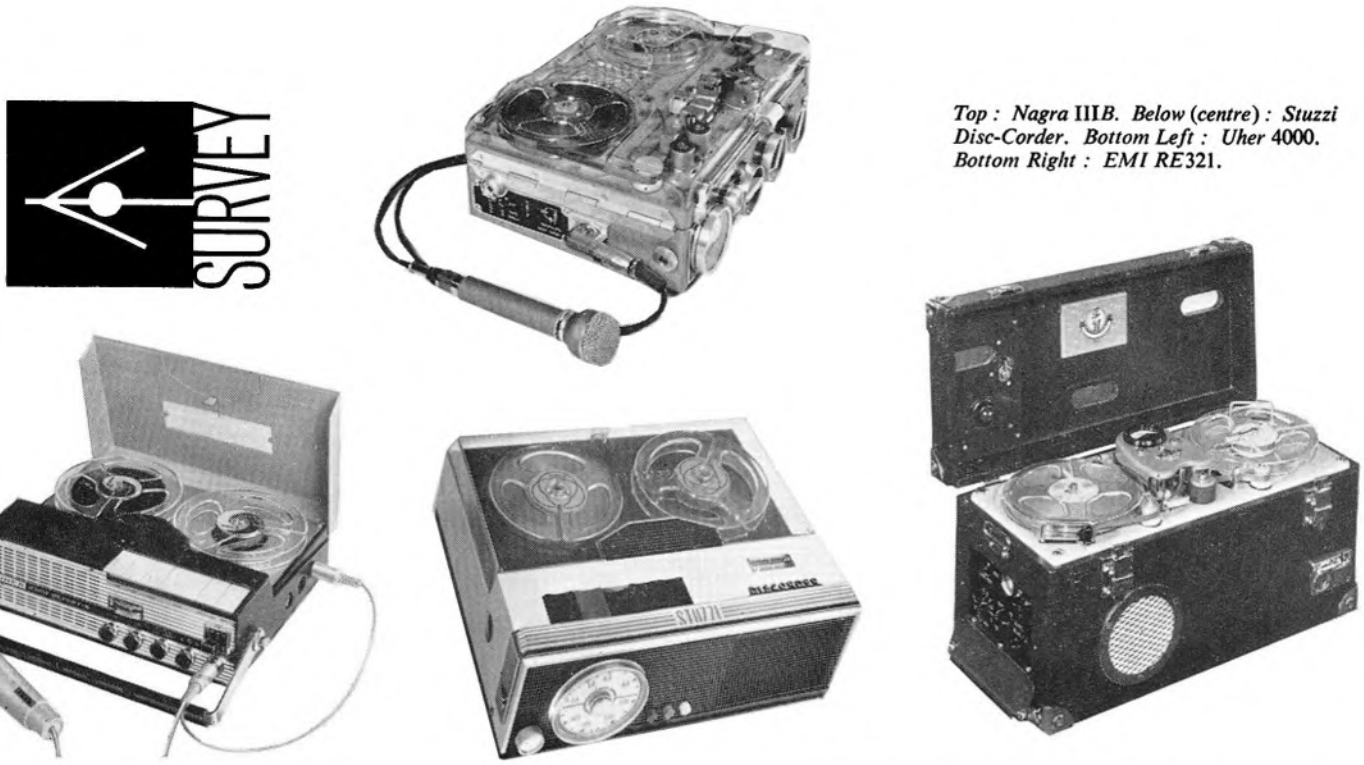
169-173 STREATHAM HIGH ROAD, LONDON, S.W.16

Between St. Leonard's Church and Streatham Station

STReatham 0466/0192

Please note this is our only address

www.americanradiohistory.com



Top : Nagra III*B. Below (centre) : Stuzzi Disc-Corder. Bottom Left : Uher* 4000. *Bottom Right : EMI RE*321.

SURVEY OF BATTERY PORTABLES — CONTINUED

GRUNDIG TK6. TAPE SPEED : 3¾ and 1⅞ i/s. SPOOL CAPACITY : 4¼in. BATTERY COMPLEMENT : Six 1.5V cells and mains. BATTERY LIFE : 20 hours. FREQUENCY RANGE : 50c/s to 13Kc/s. LEVEL INDICATOR : Meter. WOW AND FLUTTER : ±0.2%. DIMENSIONS : 12¼ x 9½ x 5¼in. WEIGHT : 13½lb.
Price : £68 5s.
Manufacturer : Grundig (Great Britain) Ltd., Newlands Park, Sydenham, London, S.E.26.
● **Review :** May 1964.

* * *

HITACHI TRQ399. TAPE SPEEDS : 3¾ and 1⅞ i/s. SPOOL CAPACITY : 3in. BATTERY COMPLEMENT : Four 1.5V cells. BATTERY LIFE : 15 hours. FREQUENCY RANGE : 150 c/s to 7 Kc/s. OUTPUT POWER : 500mW. LOUDSPEAKER SIZE : 4 x 2¾in. elliptical. DIMENSIONS : 8⅞ x 3⅜ x 6⅛in. WEIGHT : 4½lb. LEVEL INDICATOR : Meter. MISCELLANEOUS : Supplied with leather case, tape, moving-coil microphone, earpiece, splicing tape, recording leads and polishing cloth. ACCESSORIES : AC Adapter, price 6 gns. PRICE : £36 5s.
Distributor : Lee Products (G.B.) Ltd., 10-18 Clifton Street, London, E.C.2.

* * *

LOEWA-OPTA 414. TAPE SPEED : 3¾ i/s. SPOOL CAPACITY 9 4¼in. POWER SUPPLY : AC 40 to 60c/s, 110 to 220V. 6V car battery. Five 1.5V cells. BATTERY LIFE : 20 hours. FREQUENCY RANGE : 50 c/s to 10 Kc/s. SIGNAL-TO-NOISE : 45dB. OUTPUT POWER: 1W. LOUDSPEAKER: 3 x 6in. elliptical. LEVEL INDICATOR : Meter. WOW AND FLUTTER : 0.13% RMS. DIMENSIONS : 15½ x 9¼ x 4½in. WEIGHT : 9lb. MISCELLANEOUS: Fast wind and rewind. Accessories. Choice of microphones. PRICE : £49 7s.
Distributor : Highgate Acoustics, 71-73 Portland Street, London, W.1.
● **Review :** June 1963.

* * *

NAGRA 111B. TAPE SPEEDS : 15, 7½ and 3¾ i/s. SPOOL CAPACITY : 7in. BATTERY COMPLEMENT : Twelve 1.5V cells. BATTERY LIFE : 20 hours. (70 hours with alkaline accumulators). FREQUENCY Response : 40 c/s to 18 Kc/s ±1.5dB. SIGNAL-TO-NOISE : 51dB at at 15 i/s. LEVEL INDICATOR : Meter. WOW AND FLUTTER : 0.08 RMS. DIMENSIONS : 8¾ x 12½ x 4¼ in. WEIGHT : 20lb. 12oz. including batteries. MISCELLANEOUS : Optional automatic volume control, separate record, replay and erase heads, servo-operated direct-drive motor. Remote control. Stroboscopic speed indicator. Three-channel mixing. ACCESSORIES : Various. PRICE : £317 including duty.
Distributor : Livingstone Laboratories Ltd., 31 Camden Road, London, N.W.1.
● **Review :** September 1963.

NAGRA 111P. Details as for 111B, but an additional head for film lip-synchronisation. PRICE : £361 including duty.
Distributor : As above.

* * *

OLYMPUS PENCORDER F. TAPE SPEEDS : 3¾ and 1⅞ i/s. SPOOL CAPACITY : 3½in. BATTERY COMPLEMENT : Six 1.5V cells. BATTERY LIFE : 12 hours. FREQUENCY RANGE : 200 c/s to 5 Kc/s. SIGNAL-TO-NOISE : 35dB. OUTPUT POWER : 200mW. LOUDSPEAKER: 4in. elliptical. LEVEL INDICATOR : Meter. DIMENSIONS : 5¼ x 9⅝ x 3¼in. MISCELLANEOUS : Remote on/off switch on microphone. Fast wind and rewind. ACCESSORIES : Leather case (£3 3s.) PRICE (including microphone, earphone, tape and recording lead) : £35 14s.
Distributor : Pullin Optical Co. Ltd., Ellis House, Aintree Road, Perivale, Greenford, Middlesex.

* * *

PHILIPS EL3300 : TAPE SPEED : 1⅞ i/s. BATTERY COMPLEMENT : Five 1.5V cells. BATTERY LIFE : 20 hours. FREQUENCY RESPONSE : 120 c/s to 6 Kc/s ±3dB. SIGNAL-TO-NOISE : 40dB. OUTPUT POWER : 250mW. LOUDSPEAKER : 2½in. LEVEL INDICATOR : Meter. WOW AND FLUTTER : 1% peak-to-peak. DIMENSIONS : 7¾ x 4½ x 2¼in. MISCELLANEOUS : Cartridges of 3/20in. triple-play tape in place of spools. ACCESSORIES : Mains unit, headphones. PRICE : (including moving-coil microphone, cartridge, and remote on/off switch) : £26 5s.
Manufacturer : Philips Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.1.
● **Field Trial** on page 275.

PHILIPS EL3586. TAPE SPEED : 1⅞ i/s. SPOOL CAPACITY : 4¼in. BATTERY COMPLEMENT : Six 1.5V cells. BATTERY LIFE : 40 hours. FREQUENCY RESPONSE : 80 c/s to 8 Kc/s ±3dB. SIGNAL-TO-NOISE : 1% peak-to-peak. DIMENSIONS : 11⅛ x 7¾ x 3⅞in. WEIGHT : 8lb. with batteries. MISCELLANEOUS : Fast wind and rewind. Tone control. ACCESSORIES : Mains convertor, remote on/off switch, shoulder case. PRICE : £25 6s.
Manufacturer : As above.

* * *

Q-CORD R.119K. TAPE SPEED : 3¾ i/s. SPOOL CAPACITY : 4¼in. BATTERY COMPLEMENT : Four 1.5V cells. FREQUENCY RANGE : 60 c/s to 10 Kc/s. LEVEL INDICATOR : DM70 valve. WOW AND FLUTTER : 0.50%. DIMENSIONS : 9¼ x 4 x 9¾ins. WEIGHT: 6lb. including batteries.

(*continued on page* 281)

www.americanradiohistory.com

THE RECORDER CO.

for best machines on advantageous terms

	Deposit £ s. d.	12 Monthly Payments £ s. d.	Cash Price Gns.
4-TRACK STEREO/MONAURAL			
Revox Model 736 ...	13 4 0	9 15 0	124
Ferrograph 424 ...	11 12 0	8 13 2	110
Sony TC 500 ...	11 9 0	8 11 8	109
Grundig TK 46 ...	10 12 0	7 15 7	99
Telefunken 97 ...	10 0 0	7 9 7	95
Siemens Mod. 12 ...	8 0 0	5 17 11	75
Philips EL3534 ...	9 16 0	7 4 8	92
Sony TC 200 ...	8 19 0	6 3 4	79
2-TRACK STEREO/MONAURAL			
Revox Model 736 ...	13 4 0	10 11 8	124
Brenell STB 1 ...	12 0 0	9 0 0	120
Ferrograph 422 ...	11 12 0	8 13 2	110
Telefunken 98 ...	10 0 0	7 9 7	95
MAINS 2-TRACK			
Brenell 5 Type "M"	9 5 0	6 18 7	88
Ferrograph 5A/N ...	8 19 0	6 13 10	85
Telefunken 85 ...	8 15 0	6 10 8	83
Grundig TK 41 ...	8 0 0	5 17 11	75
Brenell 5/2 (Meter)	7 15 6	5 16 7	74
Brenell 5/2 ...	7 5 0	5 8 8	69
Truvox 92	7 5 0	5 8 8	69
Reps R10 Mk. 2 ...	6 4 0	4 12 11	59
Telefunken 95 ...	6 4 0	4 12 11	59
Grundig TK 18 ...	4 2 0	3 1 5	39
Grundig TK 14 ...	3 13 6	2 15 2	35
Wyndsor Trident ...	3 10 0	2 11 11	33
Ferguson 3206 ...	2 16 6	2 0 10	26

H.P. also over 18 and 24 months

	Deposit £ s. d.	12 Monthly Payments £ s. d.	Cash Price Gns.
MAINS 4-TRACK			
Grundig TK 40 ...	8 19 0	6 3 4	79
Reps R10 Mk. 2 ...	7 5 0	5 8 8	69
Truvox R94 ...	7 5 0	5 8 8	69
Philips EL3549 ...	6 12 0	4 17 6	62
Grundig TK 23 ...	4 15 0	3 10 10	45
Philips EL3541/H ...	4 12 0	3 5 10	42
Elizabethan LZ29 ...	4 0 0	2 19 10	38
Philips EL3541 ...	3 15 8	2 16 9	36
Fidelity Major de luxe	3 13 6	2 15 2	35
Ferguson 3204 ...	3 10 0	2 11 11	33
Philips "Star Maker"	2 16 9	2 2 7	27
BATTERY			
Uher 4000S ...	9 16 0	7 6 5	93
Ficord 202	7 0 0	5 3 10	66
Grundig TK6 ...	6 17 0	2 5 4	65
Butoba MT 5 ...	6 4 0	4 12 11	59
Telefunken 300 ...	6 4 0	4 12 11	59
Stuzzi Magnette ...	6 4 0	4 12 11	59
Optacord 414 Bat/Mns	4 19 0	3 14 0	47
Philips EL3586 ...	2 12 6	1 19 5	25

"THIS IS IT !"
PHILIPS EL3300 POCKET TAPE RECORDER
The 'Snap-in' Cartridge Loading
Twin-Track, playing time 30 minutes per track. 1⅞ i.p.s. Remote control switch on microphone (detaches for separate use). Modulation Meter and Battery strength Indicator. Size 7½" x 4½" x 2¼". Complete with Grained Leather Carrying Case 25 gns. Deposit £2.15.0, 12 monthly payments £1.19.2.

Open Saturday 6 p.m., Friday 6.30 p.m.

If unable to call, write for brochure, or send deposit now for quick delivery or telephone SWI 4977 for FREE HOME DEMONSTRATION

FREE DELIVERY
PART EXCHANGE

THE RECORDER CO.

(DEPT. R) 188, WEST END LANE, WEST HAMPSTEAD, LONDON, N.W.6
Telephone: **SWI 4977**

H.P. INTEREST FREE

Whatever the time —Wherever you are —you're completely independent with the NEW—

UHER 4000 S

Price **93** gns.

Ever-ready leather carrying case—9 gns. extra

4 speeds, 7½, 3¾, 1⅞ and ⅞ i.p.s. Reel size up to 5". Push button controls. Remote Control. Combined Record level/Battery Meter Indicator. Operated from rechargeable 'Dryfit' storage Battery, or 5 U2 batteries, or Mains operated Power Unit. Complete with Dynamic Remote Control Microphone and 5" Tape.

We will be pleased to demonstrate this fine model or send full details.

Agents for : **Ferrograph, Vortexion, Reflectograph, Tandberg, Sony, Goodmans, etc.**

'Q'-CORD

QUALITY	COMPACT	OBJECTIVE	RELIABLE	DUALTRACK

60-10,000c/s ±3db. sig./noise 38db. Heads by BOGEN Push Pull Osc. AC erase.

10 x 10 x 4. 5 lbs.

3¾ I.P.S. Constant speed 4½ inch spools. 2 hrs. play. Operate in any position.

Buhler motor. Finest components. West German made.

No pr. pad on record head. Replay pre. rec tapes. Ideal for dubbing. Inputs for mike, radio outputs for amp. & spkr.

Powered from Mains/Battery/Car Battery/ 6v or 12v /Also for 203 6v. accumulator.

"Complete with dynamic mike, spool, radio lead, cct. diagram, batteries etc."

203 - **34** Gns. R119K - **33** Gns.

Write for full details

C. Braddock Limited

266 Waterloo Road, Blackpool.
Telephone: 45049

DO NOT MISS THIS OFFER

TO PROVE THE EXCELLENT QUALITY OF THIS MACHINE WHEN USED AS A STATIC RECORDER AT HOME. WE OFFER TO ALL PURCHASERS OF THE "Q"-CORD, DURING AUGUST A FREE MAINS UNIT (WORTH £5-5-0) WITH EACH MACHINE

DO NOT MISS THIS UNIQUE OPPORTUNITY

www.americanradiohistory.com

MISCELLANEOUS: Fast rewind. PRICE : £34 13s.
Distributor : C. Braddock Ltd., The Tape Recorder Centre (Blackpool) Ltd., 266 Waterloo Road, Blackpool, Lancs.
● **Review :** November 1963.

* * *

Q-CORD 203. Details as above. DIMENSIONS : 10 x 4 x 10in. PRICE : £35 14s.

* * *

SHARP TRC-1004. TAPE SPEED : 1⅞ i/s. SPOOL CAPACITY : Non-standard, approximately 3in. diameter. BATTERY COMPLEMENT : Four 1.5V cells. BATTERY LIFE : Four hours. FREQUENCY RESPONSE : 200 c/s to 3 Kc/s ±3dB. LOUDSPEAKER : 3 x 2½ elliptical. DIMENSIONS : 3¾ x 5⅛ x 2⅛in. INDICATOR : Meter. MISCELLANEOUS : Supplied with detachable playback amplifier and speaker. ACCESSORIES : Earpiece, moving-coil microphone, splicing tape, recording leads and standard-spool holder—included in price. AC Adapter available. PRICE : £37 16s.
Distributor : Wholesale Supplies (Swinton) Ltd., 16-18 Worsley Road, Swinton, Manchester.

* * *

STELLA ST471. Stella equivalent of Cossor CR1621 but dissimilar colour schemes. PRICE : £27 6s.
Manufacturer : Stella Radio and Television Co. Ltd., Astra House, 121-3 Shaftesbury Avenue, London, W.C.2.

* * *

STUZZI DISC-CORDER. TAPE SPEED : 1⅞ i/s. SPOOL CAPACITY : 4½in. FREQUENCY RANGE : 60 c/s to 8 Kc/s. SIGNAL-TO-NOISE : 40dB. OUTPUT POWER : 400mW. LOUDSPEAKER : 4in. LEVEL INDICATOR : Meter. DIMENSIONS : 10 x 9 x 3½in. WEIGHT : 7lb. excluding batteries. MISCELLANEOUS : Also plays 45 rpm discs and incorporates 190 to 580 metre radio. Internal recording facilities. ACCESSORIES : Shoulder case, microphone, mains unit/extension speaker. PRICE : £61 19s. 6d.
Distributor : Recording Devices Ltd., 44 Southern Row, Kensington, London, W.10.

TELEFUNKEN M300. TAPE SPEED : 3¾ i/s. SPOOL CAPACITY : 5in. BATTERY COMPLEMENT : Five 1.5V cells. FREQUENCY RANGE : 40 c/s to 14 Kc/s. SIGNAL-TO-NOISE : 50dB. OUTPUT POWER : 1W. LOUDSPEAKER : 4 x 2¾in. elliptical. LEVEL INDICATOR : Meter. WOW AND FLUTTER : ±2%. DIMENSIONS : 10⅜ x 10⅛ x 3in. WEIGHT : 7lb. MISCELLANEOUS : Fast wind and rewind. ACCESSORIES : Mains unit and rechargeable battery. Microphone with built-in modulation level meter and control. Carrying case. PRICE : £61 19s. 6d
Distributor : Welmex Corporation, Lonsdale Chambers, 27 Chancery Lane, London, W.C..2

* * *

TRANSICORDER TR - 100. TAPE SPEEDS : 3¾ and 1⅞ i/s. SPOOL CAPACITY : 3½in. BATTERY COMPLEMENT : Six 1.5V cells. FREQUENCY RANGE : 150 c/s to 7 Kc/s. LEVEL INDICATOR : Meter. WOW AND FLUTTER : 0.3% DIMENSIONS : 7¾ x 3⅞in. WEIGHT : 4lb. PRICE : £51 9s.
Distributor : Fonadek (Branson) Ltd., Vivian Road, Harborne, Birmingham 17.

* * *

UHER 4000 REPORT-S. TAPE SPEEDS : 7½, 3¾, 1⅞, 15/16 i/s. SPOOL CAPACITY : 5in. BATTERY COMPLEMENT : Five 1.5V cells. BATTERY LIFE : 12 hours. FREQUENCY RESPONSE : 40 c/s to 20 Kc/s ±3dB. SIGNAL-TO-NOISE : 55dB. LEVEL INDICATOR : Meter (Optional Illumination). WOW AND FLUTTER : ±0.15%. DIMENSIONS : 10½ x 8½ x 3¾in. WEIGHT : 9lb. MISCELLANEOUS : ½-track mono. PRICE : £97 13s.
Distributor : Bosch Ltd., 205 Great Portland Street, London, W.1.
● **Review :** September 1962.

UHER 4002. Twin track stereo version of 4000S. Details as above. PRICE : £115 10s.

UHER 4004. Quarter-track version of 4002. Details as above. PRICE : £115 10s.
● **Review :** May 1963.

OUR READERS WRITE . . .

. . . about the 570

From : B. R. J. Plumtree, 20 Newburgh Road, Acton, London, W.3.

DEAR SIR, H.C's problems with the *Reflectograph* 570 and its variable-speed deck arise because : (1) Playing tape, there is no back torque on this model—the left hand motor is fed *not* with reduced voltage AC but with rectified DC and relies on eddy-current-breaking when tape in motion to give smooth back-tension over a wide range of speed (three to eight i/s). There is no tension in stationary tape, as the DC gives rise to no turning moment in either direction.

(2) The power resistor will be found at the rear of the deck, between the spools, just under the motor plate, and is usually green-vitreous in colour.

(3) Tape tension also depends on the sliding drag of the running tape between the three heads and their pressure pads. Some later models have stainless pins instead of the green felt pads (a method widely praised in the newer model for good 'wrap round' heads). However, neither type gives any help with stationary tape and in the indeterminate pause setting which H.C. mentions, creepage is easier with pins than pads.

(4) There is no slipping clutch (see answer page 169) on any specimen through my hands in four years of servicing Models 400, 500, 570 or 102—only a brake shoe which is lifted by the quite slight movement of tape controls. Very precise adjustment of the brake rods and pinch-wheel cam, etc., is needed to give the pause facility, as the original makers, Messrs. Rudman Darlington, intended only the provision of fast motor run-up until the right-hand level should be fully engaged to right—see manual.

(5) Speed variation from full to empty spool, also wow and flutter, are difficult to cure on these machines without brackets and stays to prevent shuddering of motor and cone assembly.

(6) If H.C. has any other queries I would be glad to assist.

Yours faithfully.

. . . about a Reader's Problem

From : Reps (Tape Recorders) Ltd., 118 Park Road North, South Acton, London, W.3.

DEAR SIR, We were interested to read a letter in your April issue from a Colchester reader who has harmonic trouble with his *R.*10 tape recorder. As manufacturers of this machine, and in a spirit of helpfulness, we have the following comments to make :

Slight out-of-balance voltage readings on both anodes of the bias oscillator do not necessarily indicate harmonic content in the wave-form. The frequency of oscillation is 65 Kc/s, so as two triodes are used (ECC82) the distortion would be basically second, which is cancelled by push-pull operation. Now if both sections of the ECC82 were incorrectly balanced by, for example, different self-capacity across each half of the oscillator coil, 65+130 Kc/s would appear in the bias and erase wave-form. This, in practice, means a residual DC component is recorded on the tape, which generally takes the form of rumble more noticeable at the higher speeds. Therefore, the harmonic content of the oscillator will not cause this additional spurious tone.

We would venture to suggest that the 9 Kc/s tone was recorded at full modulation level instead of at —20dB below, and due to the rising record characteristics, this signal will overload the recording channel and the fourth or fifth harmonic would beat with 65 Kc/s to produce this audible note. This effect is common with all magnetic recording systems, more so at the slower speeds. As the energy content of most sounds is very low at 9 Kc/s as compared with 1 Kc/s this effect is generally of no consequence.

Yours faithfully.

Editor's Note *Again and again we are gratified by the prompt response of readers to their fellows in distress. The letter from Mr. Plumtree. in quick reply to H.C. demonstrates this, while the one from Reps Ltd. shows that not all manufacturers lock themselves in ivory towers.*

www.americanradiohistory.com

Quality Magnetic Recording Tapes

TO SUIT EVERY BUDGET...

- for professional studio use
- for homes, schools, churches

UNCONDITIONALLY GUARANTEED

Irish makes a quality tape for every purpose for both the amateur and professional. **Irish** is the only **premium-quality** tape at a **standard price.** The exclusive **Irish** Ferro-Sheen process prevents shedding of abrasive oxide . . . assures reduced head and tape wear, superior sound quality. Every **Irish** tape is 100% unconditionally guaranteed!

FREE—"Signature Tape" binding with every 5", 5¾" and 7" reel. "Signature Tape" makes identification of tapes easy . . . makes a handsome binding which can be stored on shelves or bookcases . . . gives added protection to recordings . . . gives tape box extra strength.

Recording Tape
Series #190
Standard
1½ mil acetate
Long Playing
1 mil acetate
1 mil Mylar*
Double Play tensilized
½ mil Mylar*

Professional Tapes
Series #200
Standard
1½ mil acetate, 1½ mil Mylar*
Long Playing
1 mil acetate
1 mil Mylar*
Double Play tensilized
½ mil Mylar*

*Dupont Registered Name

Shamrock
Recording Tape
EXPERIMENTAL, AMATEUR AND HOBBY TAPES

Here's the low-cost economy tape for all non-critical uses. Available in 5" x 7" reels with plastic or Mylar film backing in 1 mil, .5 mil, and 1.5 mil thickness.

Available in Shamrock box shown, or in a plain white box for your own imprint.

UNITED STEREO TAPES Division of Ampex
A complete line of four-track pre-recorded tapes. Write for complete catalog.

Write for complete Catalog Specifications and Prices.

MORHAN
EXPORTING CORPORATION
458 Broadway, New York 13, N. Y.

REPS R10 MkII VERSION

AN IMPROVED MODEL IS NOW AVAILABLE MAINTAINING A HIGH STANDARD OF PERFORMANCE

Exclusive professional type idler wheel for reliability and reduced wow.

D.C heating on pre-amp valves.

Modified Magnavox Studio deck with improved wow/flutter.

Bogen micro-gap two or four track heads fitted.

10 watts nominal R.M.S. Rating.

Calibrated Bass and Treble controls

Mic. Gram/radio inputs, separate controls for mixing.

$7\frac{1}{2}$ i.p.s. 40—15,000 C.P.S. ± 1dB 100μS
$3\frac{3}{4}$ i.p.s. 40—10,000 C.P.S. ± 2dB 200μS } to C.C.I.R.
$1\frac{7}{8}$ i.p.s. 50— 5,000 C.P.S. ± 3dB 400μS

5 ECC83. 2 EL84. 1 ECC82. 2 Contact Rectifiers.

Pre-amp Signal/Noise > —55dB at all speeds.

Fully illustrated literature available on request to—

2 Track **59 gns.**
4 Track **69 gns.**

REPS (TAPE RECORDERS) LTD.
118 Park Road North, South Acton, London, W.3
Phone: Acorn 4141

www.americanradiohistory.com

tape reviews

THE D minor 'double' concerto by Bach has probably been heard more often as a double harpsicord concerto in the key of C minor. This is Bach's own transcription from the older version for violin and oboe. It is the older version that we have here and, in my view, it is the more attractive of the two.

All the concertos on this tape are by 'pre-classical' composers, and the soloists are rather less in the limelight than in concertos by later composers such as Mozart, or later still, Beethoven and Brahms. So anyone buying this tape expecting to hear Menuhin or Goosens play long cadenzas with lush romanticism will be disappointed. Style, elegance, beauty-of-line and phrase are the key-notes here, with much interchange between soloists and the small orchestra.

In the Bach concerto I felt that Menuhin subjects himself to the playing of Goosens, particularly in the slow movement where the soloists are prominent. I wished for more assertion from the violin during the beautiful counterpoint between the two instruments. However, this is a small point, for it is splendid playing of fine music.

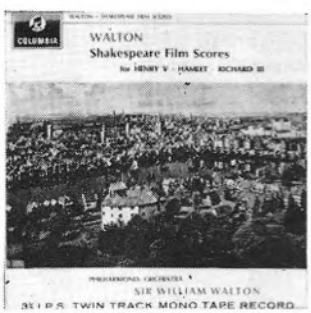
The Vivaldi concerto is music of a lighter, more delicate character. It requires great sensitiveness and feeling for style to make the most

BACH, VIVALDI, HANDEL CONCERTOS. Concerto in D minor (J. S. Bach), Menuhin—violin, Goossens—oboe. Concerto in B minor Op. 3 No. 10 (Vivaldi), Menuhin, Masters, Goren and Humphreys—violins, Simpson—cello obligato. Oboe Concertos No. 1 in B flat major, No. 3 in G minor (Handel), Goossens—oboe. Bath Festival Chamber Orchestra. **HMV TA-ALP 1949,** 3¾ i/s mono twin-track, 35s.

of it. This I felt was lacking in this performance. The notes were all there within their phrases and the tempos well judged, but those extra tiny points of accent were somehow missing.

The Handel oboe concertos are made of good, basic stuff, and Goosens with the Bath Festival Chamber Orchestra cruises through them easily, dropping points of piquancy on the way. The orchestra has a lot to say here, and in places rather drowns the oboe.

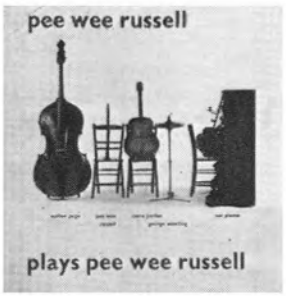
The recording quality is free from serious defects, though the string tone sounds rather lifeless on wide-range equipment. A harpsichord is sometimes dimly heard, but its presence is not acknowledged in the list of performers on the box, though the cello obbligato player is.—**G.G.**



SHAKESPEARE FILM SCORES, Sir William Walton. Music from Richard III, Hamlet and Henry V. Philharmonia Orchestra conducted by composer. **Columbia TA-33CX 1883,** 3¾ i/s mono twin-track, 35s.

EVEN though this music is written as film scores, it makes pleasant listening without the tableaux to go with it. It is all very easy on the ear; noble marches, majestic fanfares, tender love songs and stirring charge and battle music are arranged in the form of two orchestral suites, the result being a well balanced programme.

Sir William Walton and the Philharmonia Orchestra give an appropriately theatrical and technically polished account of the music. The recording quality is clean, but the frequency range is restricted. The 'thinness' of the recorded sound is very noticeable when played through wide-range equipment, though less so when played through the tape recorder's internal speaker.—**G.G.**



PEE WEE RUSSELL. Eight pieces played by Pee Wee Russell (clarinet), Nat Pierce (piano), Steve Jordan (guitar), Walter Page (bass), George Wettling (drums), **World Record Club TT 308,** 3¾ i/s mono twin-track, 29s.

THE croaking, cracked, thin-toned clarinet of Pee Wee Russell is a product of Chicago-Dixieland jazz, but whereas many of his old associates from the thirties have been unable to escape the narrowing confines of this style, Pee Wee has long since shown his ability to play with mainstream and even modern groups.

He now appears with this tape among those few jazz musicians who have made a successful recording backed only by a rhythm section, which in itself is a mark of an outstanding instrumentalist. Of course, the backing is provided by four very good jazzmen in the persons of George Wettling (drums), Nat Pierce (piano), Walter Page (bass), and Steve Jordan (guitar).

The best items are *Exactly Like You*, and two numbers credited to Pee Wee: *Muskogee Blues*, and *Pee Wee's Song*. But why, oh why, did we have to have *Somewhere Over The Rainbow?* It doesn't even rate as good background music, let alone jazz.

Nat Pierce gives very good support throughout and his solos are excellent, especially on *Pee Wee's Song*, which is reminiscent of Teddy Wilson.—**T.F.**

HIGHLIGHTS FROM TOSCA, Puccini. Maria Callas (soprano), Guiseppe Di Stefano (tenor), Tito Gobbi (baritone), Angelo Mercuriali (tenor), Dario Caselli (bass), Melchiorre Luise (baritone). Orchestra and Chorus of La Scala Opera House, Milan, conducted by Victor De Sabata. **Columbia TA-33CX 1893,** 3¾ i/s mono twin-track, 35s.

THE story of Tosca is a tale of love, jealousy, betrayal, abuse of power, physical torture, murder and suicide told to a background of the Napleonic wars, so it is not surprising that a selection of highlights from it should be at a high level of emotional intensity. Maria Callas's range of expression is renowned, and the selections on this tape record demonstrate them to the full, from tenderness and passion in the love duets to violent hate in her dispatching of Scarpia. Stefano's voice I find rather less convincing in the part of Cavardossi, Tosca's lover, but Tito Gobbi is splendid as the villain Scarpia.

The quality of the recorded sound is very good, and the voices are well balanced with the orchestra. In all, this is a warmly recommended issue, it should give pleasure to many.—**G.G.**

www.americanradiohistory.com

How flat is Flat ?

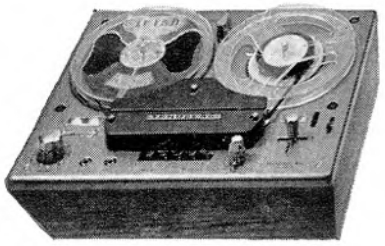
So often do we read in tape recorder specifications "Frequency Response Flat 40 to 16,000 cycles", a statement completely valueless unless qualified by the upper and lower limits of deviation, in decibels, throughout the frequency range.

While the "Replay Amplifier" specification is worthy of note, it is the overall "Record/Play" response which is most important, for record and replay heads, and their associated circuits, are all involved. In a Stero Machine, careful attention should also be paid to ensure that both channels meet the specification and are matched. Only in tape recorders designed up to a specification rather than down to a price may a manufacturer safely refer to a FLAT response curve.

Tandberg Series 6 and Series 7 tape recorders meet an overall Record/Play frequency response specification of 40 cycles to 16,000 cycles at a speed of 7½ i.p.s., *plus or minus 2 decibels throughout the entire range.* Factory trained engineers, in our own works, verify that *every* Tandberg Tape Recorder meets this specification before the machine is despatched to a Tandberg Dealer.

In conclusion we quote from a review in AMATEUR CINE WORLD, JULY 18/1963 :—

"The Manufacturer's specification for an overall frequency response of 40 to 16,000 c.p.s. ± 2 d.b. at 7½ in. per sec. was easily exceeded with a high grade tape. In fact our laboratory tests revealed that it is possible to record and replay a frequency of 25 c.p.s., as well as approx. 19,000 c.p.s. In other words, the Tandberg will handle the entire useful audio spectrum."



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)

TAPE RECORDER COVERS

Smart waterproof cover to give complete protection to your tape recorder. Made from rubberised canvas in navy, wine, tan, grey and bottle green with white contrasting pipings, reinforced base, handy zip microphone pocket and name panel.

Grundig	TK.1	49/6
,,	TK.5	55/-
,,	TK.6	67/6
,,	TK.8	63/-
,,	TK.14 & 23 & 18	59/6
,,	TK.20 ...	52/6
,,	TK.24... ...	55/-
,,	TK.25... ...	55/-
,,	TK.30... ...	60/-
,,	TK.35... ...	63/-
,,	TK.40 & 41 ...	66/-
,,	TK.46... ...	82/-
,,	TK.55... ...	63/-*
,,	TK.60... ...	75/-*
,,	TK.830/3D ...	63/-
,,	Cub	35/-*
Telefunken	85	65/-
,,	75/15 & 76K	55/-
,,	95	69/6
Philips	8108	57/6
,,	8109	63/-
,,	3534	87/-
,,	3459	79/6
Philips	EL3538	63/-
,,	EL3542	63/-
,,	EL3536	70/-
,,	EL3515	57/6
,,	EL3541/15 ...	57/6
,,	3541H	72/-
,,	Starmaker ...	66/-
Cossor	1602	57/6
,,	1601	63/-
,,	1604	79/-
,,	1605	84/-
Stella	ST455	63/-
,,	ST454	57/6
,,	ST458	79/-
,,	ST459	84/-
Saba	... ...	63/-
Elizabethan	FT.1 ...	66/-
,,	FT.3 ...	75/-
,,	LZ29 ...	75/-
Fi-Cord	1A	52/6
Fidelity	Argyle	55/-*
Clarion	(with strap) ...	52/6
Brenell	Mk.5	77/-
,,	3 star	69/-
Truvox	R92 and 94 ...	99/-
Robuk	RK.3	67/6
Ferrograph	... ...	88/-
Sony	521	90/-
Revox	... ...	84/-
Optacord	414 + 412 ...	63/-

*Without pocket.

A. BROWN & SONS LTD.

24-28 GEORGE STREET, HULL. TEL. : 25413, 25412

COMPLETE "SLEEPOMATIC" UNIT FOR ONLY £20

Comprising transistorised tape machine, auto time-switch, microphone, batteries, and under-pillow speaker.

INTERESTING FREE BOOKLET

and details of our range of tapes, discs and equipment gladly sent on receipt of postcard.

(We are the pioneers of Automated Sleep-learning in Gt. Britain)

EDUCATIONAL RECORDINGS LIMITED

(Dept. TR) 21 Bishops Close, Church Lane, London, E.17

BRAND NEW 100% TESTED RECORDING TAPES

MANUFACTURED BY FAMOUS BRITISH FIRM

Fitted Leaders and Stop fails. All boxed and suitable for 2 or 4 track recorders at any speed.

Our guarantee is in writing with all orders (it has never ever been requested)

	Size	Length	P.V.C. Crayterm	P.V.C. Polytray
STANDARD PLAY ...	3"	150'	2/6	2/3
	5"	600'	9/-	8/-
	5½"	900'	11/6	10/-
	7"	1200'	16/-	12/-
LONG PLAY	3"	225'	3/-	2/9
	4"	450'	6/-	5/6
	5"	900'	11/6	10/-
	5½"	1200'	16/-	12/-
	7"	1800'	23/-	15/6
DOUBLE PLAY ...	3"	400'	6/-	5/-
	4"	600'	8/6	8/-
	5"	1200'	21/-	14/6
	5½"	1800'	24/-	19/-
	7"	2400'	39/-	24/-
EMPTY SPOOLS ...	3" 9d	5" 2/-	5½" 2/3	7" 2/6

Post and Packing 1/- per spool, 4 or more post free.

The above tapes are only available at these prices from:

N. WALKER, 28 Linkscroft Ave., Ashford, Middx. Tel: Ashford 53020

www.americanradiohistory.com

THE *Model* 262 has much in common with the 101, mechanically, and with the 103, electrically. Rather more austere in appearance, and with a different control knob layout, the 262 retains the familiar Sony features : the capstan and pinch wheel 'out in the open', and the overlapping spools.

In fact, these features make for a versatile machine, for this compact (15 x 7 x 11in.) tape recorder takes 7in. spools, is two speed (7½, 3¾ i/s), has a digital tape position indicator and a magic-eye modulation level indicator. The amplifier is valve-operated, with a 12AT7 two-stage amplifier, 6BM8 triode amplifier plus pentode output, the latter doubling as oscillator during recording, a 6DA5 modulation level indicator and 6X4 rectifier. The consumption is 70W, and inputs are either 100, 110, 117 or 220V, 50 or 60 c/s.

To dismantle, first remove the volume control, tone control, function selector and tape speed selector knobs. These are secured with set screws. The FAST FORWARD control knob pulls off, and the PAUSE control knob likewise. The head cover is a push-fit. The top panel is secured by three Phillips headed screws. After taking all the top gear off, turn the machine over, remove the two securing screws on the sides of the handle, take out the two screws for the rubber feet on the loudspeaker side, and a single screw at the base centre, when the cabinet can be lifted away.

Most of the servicing detail has been dealt with in the previous article, but the following notes may be regarded as complementary, and are also applicable to other machines in this range.

First, lubrication. In general, a thin oil is quite suitable for the faster rotating parts, such as the motor spindles of tape recorders ; sewing machine oil is best to avoid the drag that heavier oils can cause when the motor is cold. Oiling should only be necessary after about 1,000 hours running, and one or two drops at the vital points are sufficient. If the base of the motor is inspected, a small hole will be found near the spindle, where the oil-can nozzle can be inserted. The fan may have to be removed to obtain access to the top hole, and the bottom hole needs extra care, the motor being turned by hand until the oil has run into the bearing, to avoid its being thrown off and possibly getting on rubber drive surfaces—a distinct possibility on these machines, where several rubber-tyred wheels are employed.

Dynamo oil, or heavy-medium viscosity oil, is more suitable for the pinch and idler wheel bearings, and the spool carrier spindles. On these machines, the drive capstan has a felt ring beneath the top portion over which the tape runs ; this should be oiled and allowed to run-in before tape is loaded, and with the pinch wheel temporarily held off. A felt ring is also to be found beneath the retaining screw of the pinch wheel. Great care must be taken to avoid the oil seeping to the rubber roller. Even greater care is needed when oiling idler wheels. The rubber tyres are fairly wide, and the central boss is held by the upper washer and circlip. It may be easier in some cases to remove this last item, withdraw the idler wheel, wipe the spindle clean and merely lubricate with an oily rag before refitting the wheel. Spool spindles also have an upper retaining screw and oil can be injected at the top of the spindle quite easily. These points need oiling a little more frequently than motor bearings—every 500 hours of running time is a good general rule.

Next general point, before pressing on, is the wiring colour code that is adopted by the Sony designers. My personal reaction to colour coding of cables is : don't trust it unless you are quite certain of your details. Production bods have a habit of making modifications in the light of exigencies. Different makers use different codes : there is no common rule, not even for the products of one factory. Nevertheless, I quote below the wiring colour code as used on the 262 and other machines in this range, with the proviso that this be used as a *guide* rather than an infallible *rule :*

White : A.C. wiring, or the secondary of the output transformer. *Blue :* heater wiring. *Green :* cathode circuits. *Yellow :* grid circuits. *Orange :* screen grid circuits. *Red :* anode circuits. *Brown :* HT wiring. *Black :* chassis or earth.

The Sony 272 has a different action again, and the general mechanical layout is shown in **fig. 1.** Key selection of the various functions is used, and the speed change is push-button operated. There is a transistorised input stage, a diode pentode valve (6AV6) used for signal level indicator rectifier plus AF amplifier, and a separate 6AR5 pentode used as output and oscillator valve.

Dismantling is a simple operation, much as outlined above, except for the way the top panel is removed. This has to be lifted from the rear then slid forward to clear the keys and edge-type controls. The main cabinet lifts straight upwards after the top, side and feet-securing screws, and the handle retainers, have been removed.

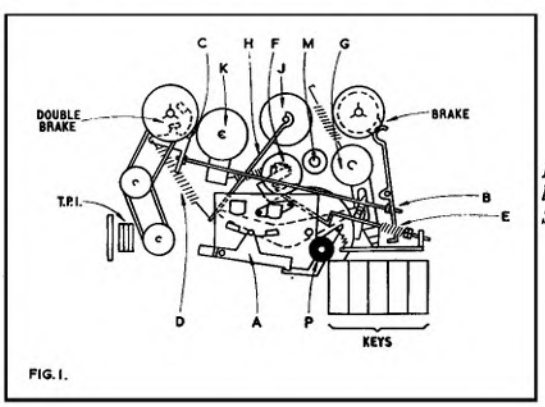


FIG. 1.

Mechanical layout of Sony 272

TAPE RECORDER SERVICE

NO. 32 — THE SONY RANGE

CONTINUED BY H. W. HELLYER

Pivoted, spring-loaded latch-plates beneath the keys (**fig. 1**) engage levers and rods to perform the functions. The pinch roller P is mounted on an arm with counter-spring, and selection of PLAY allows this arm to travel inwards, releasing the lock of arm A, which has a spring at its left hand end. Inward movement actuates the pressure pad engagement system. In **fig. 1,** this is not shown in detail. It consists of a raised tongue and hinged pad plates, and is characteristic of Sony machines. Space permitting, greater detail will be shown in the next article, which will cover the 464 and later machines. The special advantage of this system is that a wide clearance is gained for tape loading, head cleaning, etc. This is a point that might well be considered by designers of some other machines. From the servicing aspect, apart from checking the palette plate action, beneath the keys, and ensuring that spring tensions are adequate for a clean return to neutral in all cases, there is little to bother us. The throw of the lever which the PLAY key operates is perhaps the most important test. Check that, with the machine disconnected from its power supply, actuation gives an inward pressure such as to allow a pull on the tape at the right of the head system to turn the flywheel smoothly. Note that a release of pressure pad tension, by holding off the head plates with the point of a pencil, should not make any significant difference to the pulling force required.

Reference to **fig. 1** shows that the brakes are coupled by a rod running across the deck, and locknutted for exact length (and thus, engaging action). The important thing is to set the right-hand brake first by engaging STOP and setting the block for correct pressure. If

(continued overleaf)

www.americanradiohistory.com

● *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

SONY T.C. 500

Full stereo facilities with independent recording and playback amplifiers, providing professional mixing facilities. Manual cueing, digital tape counter, instant stop, automatic tape lifter. Instantaneous selection of 7½/3¾ ips. Response—30-18000 cps at 7½ ips. Harmonic—distortion—less than 2% a 3 db below rated output. Detachable speakers for stereo separation.

106 gns *including microphones and accessories.*

TERMS: £11.6.0 deposit and 12 monthly payments of £8.6.8.

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

"PLUS FIVE" SERVICE

- Generous part exchange allowances.
- No interest terms—lowest deposits.
- Off-the-shelf delivery from the biggest range under one roof.
- Free servicing and free delivery.
- Optional personal insurance.

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

OPTIONAL INSURANCE at nominal rates against unemployment, sickness or accident during term of H.P. agreement. Premium 6d. in the £—gives cover over two years.

INTEREST FREE TERMS

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.)

Bargain Basement?

We have an unrivalled stock 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.

Home demonstrations in the London area gladly arranged. By return enquiry service. Agents for all makes.

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

there is no alternative, release the transverse rod at point **B.**

It will be noted that the push-rod actuates a double brake, based on the pivoted bracket **C.** First setting is the locknut of the push-rod, and second the tension of spring **D.** The double brake is provided for clean action both on forward movement, to prevent spillage but also correct any tape 'pull' when pausing or inching, and also to ensure a clean stop action after fast rewind. The brake should clear the drum by about a millimetre if the STOP key is pressed lightly.

Flywheel drive is rather complicated. When the FORWARD key is depressed, the coupling rod **E** causes the coupled brackets to swivel, engaging the drive wheel **F** with one step on the motor pulley and simultaneously with the flywheel. At the same time, the idler **G** is drawn to the smaller step on the pulley and engages the clutch drum of the right-hand spool carrier. Points to check are the stop plate fitted at the return end of the latter bracket, the spring tension, the guide pieces beside the idler spindle, the felt pads and the bottom washers of the right-hand turntable.

Similarly, the speed change depends on the setting of this common bracket, and the play of the lower part on the spring support should be checked.

Rewind action is dual idler drive. When the appropriate key is pressed, the large pivoted lever shown dotted in **fig. 1** draws the rod **H** forwards, causing the idler **J** to engage with the motor pulley and the other idler **K.** This, in turn, engages the left-hand spool and drives it. A return spring is fitted for neutralising, and the bracket is loosely pivoted. FAST FORWARD drive is direct. The only points to look for are distortion of the coupling rod, lack of return spring tension, and the usual faults, such as binding circlips, distorted angle brackets, etc. The retaining screws of the pivot points should be noted, as looseness here can cause all manner of strange faults.

Two other things to note are the leaf switches used both for muting between functions and for equalising, and the setting of the modulation level indicator. The first point is straightforward, depending on the mechanical setting of the switch mounting and blades ; the second point requires a valve voltmeter (VVM) and signal generator to be done properly. Although many readers will not have those instruments readily accessible, a short description of the method may give a guide to empirical adjustments.

First, switch to RECORD. Connect the valve voltmeter to the white lead, tag 4 of the strip approximately central below chassis. (Near the hum-bucking coil.) There is a mica trimmer nearby. This should be adjusted for minimum reading.

Next, connect the VVM to tag 3, the red lead, and adjust the 200K preset resistor near the oscillator transformer for a 30V, RMS reading. This sets the bias. From there we can check the recording level by connecting the VVM via a 0.1 mF paper capacitor to the top of the variable slider on the printed panel. With the volume control fully advanced, feed in a 1 Kc/s signal, adjusting the volume control to obtain a 3.8V reading on the VVM when a 0.77 mV input at 1 Kc/s is applied to the microphone input. The slider potentiometer on the printed circuit board can then be adjusted for correct indication on the 6RE13 magic eye, which is when the beam just closes.

replace, but to go along with the Stella. He suggested that the two machines had different things to offer, the EL3300 being a really portable machine, and the Stella a good general-purpose recorder, independent of mains supply.

Summarising, then, it is clear from the styling and publicity leaflets of the EL3300, that it is aimed as much at the general market as the domestic tape enthusiast. With sufficient advertising in the right quarters, beatle haircuts and transistor radios might well give way to the craze of carrying (and perhaps even *using*) battery tape recorders—which might not be a bad thing for the recording world in the long run.

The EL3300 makes a superb job of recording, taking into account its slow speed. Any serious user would do well to leave his 'remote-control' switch at home—or even sell that accessory if he wishes to preserve the recorder's good wow performance (it does not disengage the pinch wheel) ; but the light weight and considerate design make a valuable contribution to the evolution of tape recording. I forecast attempts at imitation by other firms within the next couple of years.

www.americanradiohistory.com

NEW PRODUCTS NEW PRODUCTS NEW PRODUCTS

SABA TK230-S

THE latest recorder from *Saba* is the ¼-track stereo TK230-S. It is equipped with two speeds, 7½ and 3¾ i/s, claimed wow and flutter figures for which are ±0.15% and ±0.25% respectively. Full playback facilities are included, with two 6 x 3¾in. elliptical speakers located within the cabinet. Extension speakers may be connected when required.

Transistorised input stages allow mixing of microphone (0.1mV. at 200 ohms), radio (10mV. at 100K) and pickup (200mV. at 1 Meg.). The remaining circuitry is valve.

Remote control, using a pedal switch, time switch or slide synchroniser, is optional. A variety of accessories are available, including a connecting lead for inter-track transcription, mono and stereo microphones, microphone stands and extension cables. The Saba *Regiemixer* retails at 18 gns. and uses sliding controls. Output power is 10W with frequency ranges of 40c/s to 20Kc/s at 7½ i/s and 40 c/s to 15Kc/s at 3¾ i/s.

To prevent excessive tape wear and friction, spinning tape guides and a tape cleaner are incorporated, the latter functioning during rewind. Maximum spool size is 7in. and the cabinet dimensions are 16¼ x 14½ x 7½in. The retail price is £99 15s.

Distributor : Saba Electronics Ltd., Eden Grove, Holloway, London, N.7.

LAFAYETTE REDUCED PRICE OFFER

A SCHEME was introduced recently by *Leda Tapes* to provide clubs and associations with *Lafayette* tape at reduced prices. Minimum orders should be not less than £10, but should the tape prove unwanted within three months of its purchase, up to £10 worth will be taken back by *Leda* in exchange for its original value. More information is available from : **Leda Tapes, 12 Montague Road, Leytonstone, London, E.11.**

SCOTCH MAGNETIC TAPE VIEWER

BASED on the same principle as *Indicord*, a magnetic tape viewer has just been announced by 3M. It takes the form of a small disc, the overall size of which is approximately 1⅞in. diameter x ⅜in. deep. On one side is a glass window of 1⅛in. diameter through which the pattern is viewed. A dispersion of oxide lays in a film on the thin metal base of the disc and, when placed over a recorded tape, coagulates to form a picture of the recorded signal.

The device, known as *Magnetic Viewer* 600, is at present available only to the industry ; but for readers interested in seeing a similar effect, the distributor of Indicord is : **H. P. Freedman, 13 Talbot Road, Twickenham, Middlesex.**

3M TRIPLE-PLAY

SCOTCH triple-play has just been announced by 3M. Said to be the least expensive of its kind on the market, it retails at £1 4s. 9d. for 600ft., on 3in. reels, and £1 18s. 6d. for 900ft., on 4in. reels.

A black oxide coating, making this brand easily distinguishable from most other tapes, is described as a direct development from instrumentation and computor-tape coatings. **Manufacturer : 3M Co. Ltd., 3M House, Wigmore Street, London, W.1.**

MSS TRIPLE-PLAY

YET another brand of triple-play tape claimed to be the least expensive available is that introduced recently by MSS. Retail prices of the polyester-based tape are as follows : 600ft. on 3in. spool —£1 1s. 6d.; 900ft. on 4in. spool—£1 7s.; 1800ft. on 5in. spool—£2 11s.; 2400ft. on 5¾in. spool—£3 3s.; 3600ft. on 7in. spool—£4 19s.

Manufacturer : MSS Recording Co. Ltd., Poyle Trading Estate, Colnbrook, Slough, Bucks.

SPOOL ROTATION COUNTERS

SERIES 433 tape recorder rotation counters are fully listed in a folder now available from *English Numbering Machines*. Physical dimensions, direction of drive, colour and number of figures are included in the specifications.

Manufacturer : English Numbering Machines Ltd., Queensway, Enfield, Middlesex.

★

DANSETTE EMPRESS

★

USING the *BSR TD*10 three-speed tape deck, the Dansette *Empress* is a ¼-track recorder to retail at about £34. Facilities for straight-through amplification and mixing of microphone and radio inputs are included. The Empress has storage space for two 7in. spools and will play for a maximum of six hours with lid closed. A variety of two-tone cabinet colour schemes is available.

Manufacturer : Dansette Products Ltd., 112-116 Old Street, London, E.C.1.

www.americanradiohistory.com

Always in stock—
an unrivalled selection of

- **Tape Recorders**
- **Hi-Fi Equipment**
- **Tapes**
- **Microphones**

Free demonstrations—Honest opinion

COMPLETE STEREO TAPE RECORDERS (Four Track)

Sony TC 500—7½, 3¾ i.p.s.	£111 6 0
Sony TC 200—7½, 3¾ i.p.s.	82 19 0
Siemens Model 14 All transistor—7½, 3¾, 1⅞ i.p.s.	72 9 0
*Telefunken M97—7½, 3¾, 1⅞ i.p.s.	99 15 0
*Tandberg Series 7, 2 or 4 track. 7½, 3¾, 1⅞ i.p.s.	97 13 0
Philips EL 3534—7½, 3¾, 1⅞, 15/16 i.p.s.... ...	96 12 0
OUTSTANDING TWO-TRACK STEREO RECORDER. VORTEXION CB.L., SEPARATE RECORD/REPLAY HEADS. SEMI-PROFESSIONAL. ALL FACILITIES.	160 0 0

TAPE STEREO UNITS

*Ferrograph 422 U, 2 track—7½, 3¾ i.p.s. ...	£115 10 0
*Ferrograph 424 U, ¼T playback—7½, 3¾ i.p.s.	115 10 0
*Tandberg Series 6, 2 or 4 track—7½, 3¾, 1⅞ i.p.s.	115 10 0
Sony 464 one replay amplifier)—7½, 3¾ i.p.s.	67 4 0

FOUR TRACK MONO TAPE RECORDERS

*Telefunken M.96—7½, 3¾, 1⅞, i.p.s.... ...	£72 9 0
Philips EL.3549—7½, 3¾ 1⅞, 15/16 i.p.s.	65 2 0
Philips EL.3541—3¾ i.p.s. only	37 16 0
Philips EL.3541/H—3¾ i.p.s. only	44 2 0
Elizabethan LZ.29 (illustrated)—7½, 3¾, 1⅞ i.p.s.	39 18 0
Elizabethan Popular 400—3¾ i.p.s. only ...	26 5 0
Cossor 1604—3¾, 1⅞ i.p.s.	40 19 0

TWO TRACK MONO TAPE RECORDERS

*Vortexion WV.B. (3 head system)—7½, 3¾ i.p.s.	£110 3 0
*Vortexion WVA standard system—7½, 3¾ i.p.s.	93 13 0
*Ferrograph 5A/N (modernised)—7½, 3¾ i.p.s.	89 5 0
*Telefunken 85 "The Classic"—7½, 3¾ i.p.s.	87 3 0
*Telefunken 95—7½, 3¾, 1⅞ i.p.s.	61 19 0
Elizabethan Popular 200—3¾ i.p.s. only ...	24 3 0

ALSO AVAILABLE— BATTERY RECORDERS

*Butoba MT.5—3¾, 1⅞ i.p.s.	£61 19 0
Optacord 414 (inc. Mains)—3¾ i.p.s. only ...	49 7 0
Philips EL3586—1⅞ i.p.s. only	26 5 0
Stella ST 471—1⅞ i.p.s. only	27 6 0

*Microphones EXTRA.

HI-FI IN STOCK	TAPES
● Quad	● BASF
● Leak	● Telefunken
● SME	● Philips
● Garrard	● Scotch
● Rogers, etc., etc.	● EMI, etc., etc.

All types of Microphones.

For free delivery, competent demonstrations, good after sales service, and the best of Hire Purchase terms call at

THE TAPE RECORDER CENTRE

THE TAPE RECORDER CENTRE LIMITED
82 High Holborn, London, W.C.1

Open from 9 to 5.30 weekdays
Close 12.30 Saturdays

Telephone: CHAncery 7401

ELECTRONIC WORLD **FREE OFFERS**

NEW SUPER QUALITY TAPE IMPROVED at no increase of price.

SUPERIOR callendered oxide to make 'dropouts' even rarer than before. SUPERIOR new Triple Play, stronger and more stretch-free than most DP; all reel sizes 3" to 7". LEADER TAPE trailer and stopfoil on 4" to 7" spools, all grades. ALL REELS factory-sealed in polythene.

AT LEAST 40% CHEAPER.

than any other tape of comparable quality.

1 FREE SAMPLE LENGTH OF TAPE ON A 7" REEL

2 BUY ANY TAPE FROM OUR RANGE, AND GET A TAKE-UP SPOOL OF THE SAME SIZE — FREE

DE VILLIERS (Electronic World) LTD., 16B Strutton Ground, London, S.W.1

STANDARD PLAY (PVC Base)

3" / 150ft.	4 for 18/-	☐
,, ,,	48/- doz.	☐
4" / 300ft.	4 for 26/-	☐
5" / 600ft.	2 for 26/-	☐
5¾"/ 900ft.	16/-	☐
7" /1,200ft.	19/-	☐

LONG PLAY (Prestressed Polyester Base)

3" / 225ft.	4 for 22/-	☐
,, ,,	60/- doz.	☐
4" / 450ft.	2 for 21/-	☐
5" / 900ft.	2 for 35/-	☐
5¾"/1,200ft.	24/-	☐
7" /1,800ft.	31/-	☐

DOUBLE PLAY (Prestressed Polyester Base)

3" / 375ft.	2 for 20/-	☐
,, ,,	108/- doz.	☐
4" / 600ft.	2 for 30/-	☐
5" /1,200ft.	27/-	☐
5¾"/1,800ft.	35/-	☐
7" /2,400ft.	45/-	☐

TRIPLE PLAY (Prestressed Polyester Base)

3" / 475ft.	2 for 26/6	☐
,, ,,	150/- doz.	☐
3½"/ 650ft.	17/-	☐
4" / 900ft.	23/6	☐
5" /1,700ft.	40/-	☐
5¾"/2,300ft.	52/6	☐
7" /3,300ft.	80/-	☐

Please send Free Offer 1 ☐ Please send Free Offer 2 ☐

I enclose £ s. d. NAME.....

ADDRESS.....

.....

BLOCK CAPITALS PLEASE **CASH WITH ORDER**

POST FREE · SEND COUPON NOW—

EVERYBODY'S DOING IT

If you have children about to take their O levels, you know just what we mean. A headmaster, a careers master, a form master, a youth employment officer and your rich brother Joe, all have their pet theories about a career. If you care about your children's careers, you will want independent, accurate information about the nine hundred possibilities that exist. You will want to get PROSPECT for a year or so to help you and your children make up your own minds about what is best.

AUG.-SEPT. ISSUE OUT NOW
3/6

Published four times a year.

PROSPECT
A CAREERS GUIDE FOR YOUTH

To Subscription Department, PROSPECT, Link House, Dingwall Avenue, Croydon, Surrey. Please send me each issue of PROSPECT for ..... year/s for which I enclose remittance of £.....s.....d.

Name .....

Address .....

.....

SUBSCRIPTION RATES
1 year 15/- post paid (4 issues);
2 years 30/- post paid (8 issues).

www.americanradiohistory.com

FIDELITY PLAYMASTER

Manufacturer's Specification : Domestic ¼-track recorder. **Tape Speeds :** 1⅞, 3¾ and 7½ i/s. **Frequency Range :** 60 c/s to 15 Kc/s at 7½ i/s. **Spool Capacity :** 7in. **Amplifier Power :** 5W. **Signal-to-noise :** 50dB. **Wow and Flutter :** 0.15% at 7½, 0.25% at 3¾ and 0.35% at 1⅞ i/s. **Stereo Output Sensitivity :** 2mV at 1 Kc/s. **Price :** £36 15s. **Manufacturer : Fidelity Radio Ltd., 11-13 Blechynden Street, London, W.11.**

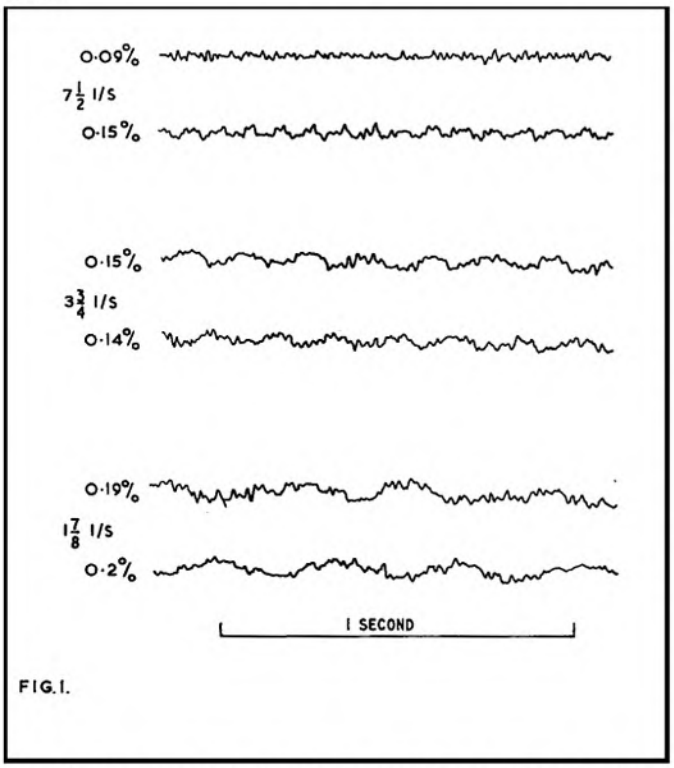


FIG. 1.

THIS new recorder in the £36 price bracket offers 'the lot'—three speeds, 7in. reels, meter record-level indicator, superimpose, stereo head outlet, separate bass and treble tone controls, radio-mic mixing, tape timing indicator, nicely styled cabinet of adequate size to prevent 'boxiness'. Plenty of storage space at rear compartment for mic., stand, mains and radio lead and any other accessories which belong to the recorder.

A separate output stage with independent gain control allows loudspeaker monitoring while recording, and this gain control becomes the treble tone control on playback. The bass tone control carries the mains 'on-off' switch. Rocker type push button switches select the track and control the superimpose facility. All tone and gain controls are of the edge-operated type and, although these are uncalibrated, there is no difficulty in deciding which way to turn them for a given effect ; movement to the right always *increases* the effect.

Phone type sockets are provided on the control panel for radiogram input, microphone input, extension loudspeaker input and stereo head output.

It was found essential to have a good earth connected to the green mains lead to reduce hum and hand capacity effects at the controls. The printed amplifier circuit is not screened in any way, and without an earth a very audible hum comes up each time the hand approaches a gain control. Even with an efficient earth, the polarity of the mains connection is important and should be selected for minimum hum. This must be done with the joystick tape motion control pushed forward, as the amplifier circuit is muted in the OFF position. Apart from this minor criticism the performance of the machine is excellent and the objective tests detailed below bear out my listening tests.

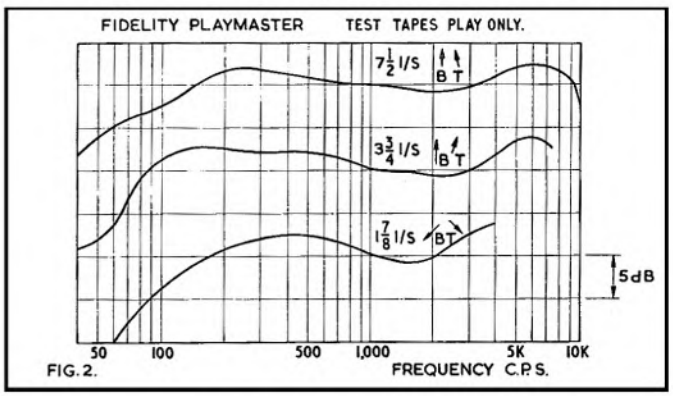


FIG. 2.

The fluttergrams of fig. 1 show that the RMS wow and flutter are well within the specification with very low level 50 c/s flutter from the 3,000 rpm motor, and wow at capstan rotation frequency at 12, 6 and 3 c/s respectively at the three tape speeds of 7½, 3¾ and 1⅞ i/s.

The capstan wow was just audible on a continuous pure tone, but could not be detected on speech or most types of light music. At 7½ i/s serious music of the most demanding type could be handled without any trace of speed imperfections.

Test tapes of 100, 200 and 400 μS time-constant were played and the output voltage measured across the internal speaker terminals (no amplifier output is provided) to give the responses of **fig. 2.** In each case the tone controls were set to give the most level response from the test tape. The tone control settings selected are indicated by arrows on each curve. It will be seen that at the two higher speeds the controls are in the midway position, and at the lowest speed the bass control is at minimum and the treble control at maximum.

Hum was only 25dB below test tape level with the recorder properly earthed and the mains polarity in the most favourable position.

Fig. 3 shows the overall record-replay responses. It will be seen

(*continued overleaf*)

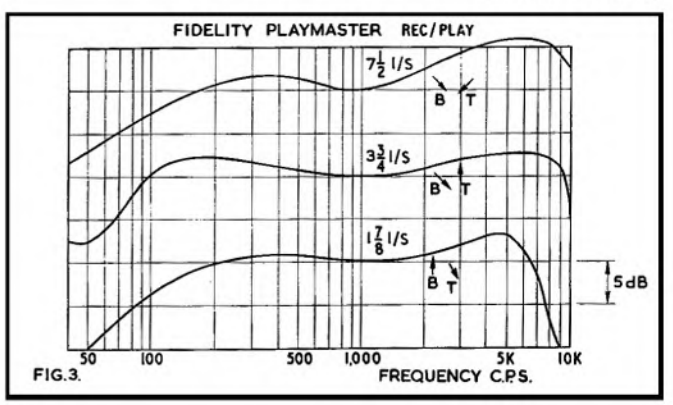
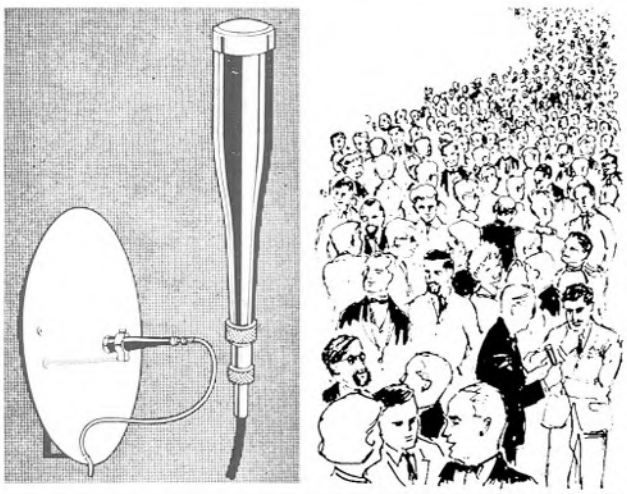


FIG. 3.

www.americanradiohistory.com

100,000 users can't be wrong!



One of the really outstanding microphones in the medium-price range, the **DP/4** is enjoying unparalleled success. Small wonder, for the **DP/4** is wonderfully reliable and sensitive to an extremely wide range of sounds. Uniform frequency response from 50 c/s to 15 kc/s. It is in world-wide use for high quality broadcasting, recording and public address both by the amateur and professional. The **Parabolic Reflector,** its natural partner, focuses a distant sound-source on to the microphone head, greatly amplifying it without loss of realism and without unwanted side-noises. Low impedance microphone, complete with connector and 18ft. screened lead, **£8.** Medium and high impedance models, **£9.** Parabolic Reflector, 2ft. dia. complete with microphone holder, **£6.5.0.**

Further details from your dealer or from :

Grampian SOUND EQUIPMENT
Integrity that you *hear*

GRAMPIAN REPRODUCERS LTD
Hanworth Trading Estate. Feltham, Middlesex
Feltham 2657

that generally the bass control has to be advanced and the treble control turned back compared to the test tape responses, indicating that the new CCIR recommendations of 70 and 140 μS have been adopted for the recording characteristic for 7½ i/s and 3¾ i/s, and that the 1⅞ i/s response is about 300 μS.

Test tape level was recorded at about quarter-scale meter reading, and peak recording level, at 12 dB above test tape level, was recorded without distortion with the meter needle at the centre of the red sector of the meter scale. Waveform distortion commenced with the meter needle just off the scale. Recorded programme tests showed that the

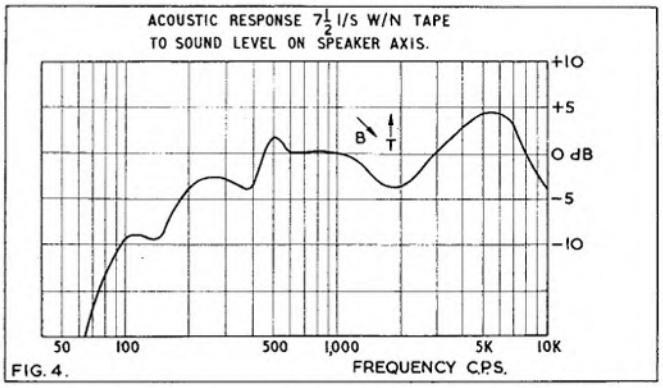


FIG. 4.

dynamics of the meter were satisfactory and that recordings made with the meter kicking into the red very occasionally used the dynamic range of the tape and recorder to the full.

Although the signal-hum ratio was slightly low at 37 dB, the signal-noise ratio, measured through a weighting network to approximate to the ear's response at low levels, was very satisfactory at 47 dB. This shows that bias and erase waveform is good and that first stage noise is low.

The overall acoustic response, including that of the speaker and the effect of the cabinet, was measured by playing a 7½ i/s white noise test tape with the tone controls in the position shown in **fig. 4.** Response is within limits of plus or minus 5 dB over the range 200 c/s-10 Kc/s with bass response reasonably maintained down to the speaker resonance at 100 c/s.

The microphone response was also measured in a white noise sound field to give the response shown in **fig. 5.** This is excellent for a cheap microphone and is an ideal choice for this particular recorder. Recorded voice quality is clean and crisp at all speeds and the 8ft. lead length

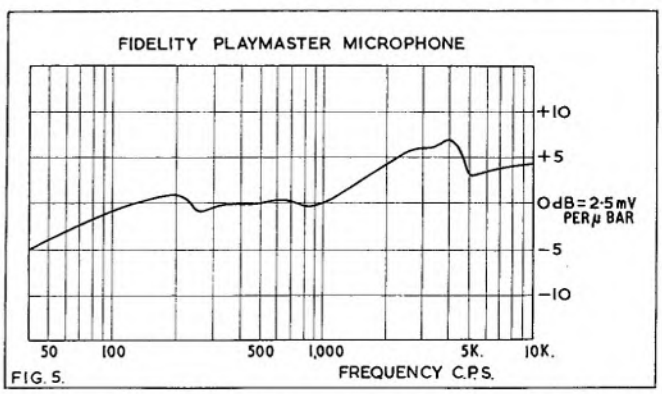


FIG. 5.

allows one to get well out of range of the very slight mechanical motor noise of the recorder.

A square foot of foil-coated paper under the plastic control panel and around the printed circuit would almost certainly eliminate most of the hum trouble mentioned above. It would be a worthwhile refinement as the rest of the design is excellent.

The size and weight of this machine is considerably more than that of the average medium priced recorder, but it pays off handsomely in appearance, tone quality and the very useful extra storage space provided. 7in. reels can be left in position with the lid closed, but despite this it is well balanced for carrying.—**A. Tutchings.**

www.americanradiohistory.com

READERS' PROBLEMS

Readers encountering trouble with their tape equipment are invited to write to the editorial office for advice, marking their envelopes "Readers' Problems —Tape". Replies will be sent by post and items of general interest may also be published in this column at a later date. This service does not, however, include requests for information about manufacturers' products when this is obviously obtainable from the makers themselves. Queries must be reasonably short and to the point, limited to one subject whenever possible. In no circumstances should such letters be confused with references to matters requiring attention from other departments at this address. We cannot undertake to answer readers' queries by telephone.

BALANCED CABLES

Dear Sir, Would you please inform me if there is any advantage in employing balanced-line over unbalanced-line when using low-impedance microphones.

Yours faithfully, **S.C.L., Birmingham 34**

The advantage of using balanced-line on inter-connections is that very much longer lines may be used before hum and noise become troublesome. There is a subsidiary advantage for certain kinds of work, that with the correct twin-core screened cable, the floating winding can be reversed, and there is not so much possibility of inadvertent setting-up of hum loops.

The disadvantage is extra cost. The practical point to be watched is an absolute preservation of balance. In practice, a poor joint on a balanced connection, resulting in imbalance, can be much more troublesome than the hum or noise pick-up with a much simpler two-connection input.

PRONOUNCED FLUTTER

Dear Sir, I have a very pronounced flutter on my Wyndsor Trident that occurs at 3¾ i/s when there is about ½ in. thickness of tape left on the feed spool. Easing this spool round by finger at this point seems to correct the fault. Could you put *your* finger on the fault by offering a cure in a more practical way !

Yours faithfully, **C.A.P., Stevenage**

You may have noticed from previous issues that the problem of smooth running of the Studio deck has exercised several correspondents. Your case seems rather different in that the flutter occurs when the feed spool is nearly empty. From this I would say that you may have a worn left-hand guide. These can be turned to present a fresh surface to the tape, and this is worth trying. But consider : the crux of the problem is the relative angle between tape and guide. If you run the tape over an auxiliary guide, temporarily, at a wider (less acute) angle, and the fault reduces, you may find it worthwhile to fit a guide at a point an inch or two to the left of the present one. But first check that the pinch pressure is adequate between roller and spindle, and that the pressure pads are not to blame.

HEAD DE-MAGNETISATION

Dear Sir, As a novice in tape recording I would appreciate information on the reason for de-magnetising heads on a recorder. How often, in terms of operating hours, should this procedure be carried out ? Does it apply to the recording head only, or should the erase head be treated in the same way ?

Yours faithfully, **T.S., Draycott**

The materials of which the record/playback and erase heads are made must be of high permeability. That is, they are easily magnetised, and just as easily de-magnetised. But although circuits are devised that cut magnetisation to a minimum, the residual magnetism has a gradual cumulative effect on all metal parts, even the most perfect material must have some remanence. Fortunately the process of 'flooding' the

(*continued overleaf*)

— YOUR TAPE DEALER —

London

Disc and Tape Reproducing Equipment and Tape Recorders by Leading Manufacturers
Custom Built Installations
All High Fidelity Requirements and Services Available
Estimates Free *Personal Service*
Custom High Fidelity
371 Green Lanes, Palmers Green, N.13 PALmers Green 5228

hHIFI FOR ALL LEADING AUDIO EQUIPMENT
call, write, or telephone
hampstead HIGH-FIDELITY
91a Heath Street, Hampstead, London N.W.3 Telephone HAMpstead 6377

LASKY'S RADIO
ALL LEADING MAKES IN STOCK
Cash or Easy Terms
LONDON'S FINEST SERVICE
207 EDGWARE ROAD, W.2
PAD 3271/2
152-153 FLEET STREET, E.C.4. FLE 2833
33 TOTTENHAM COURT ROAD, W.1. MUS 2605

★ PART EXCHANGES WELCOMED ★
★ ALL MAKES Hi-Fi and Tape Recorders supplied
★ PART EXCHANGES. Terms 12, 18 or 24 months
★ SONY Specialists. Full Range Stocked
★ GUARANTEED Recorder Repair Service
MAC'S CAMERA SHOPS LIMITED
250-252 KING STREET, HAMMERSMITH, LONDON, W.6
RIV 8581-2 Hours 9-6 Thursday 9-1

SHEEN TAPE RECORDER CENTRE
SPECIALISTS IN TAPE RECORDERS, ACCESSORIES, HI-FI EQUIPMENT
YOUR CENTRE FOR FRIENDLY HELP—SALES AND SERVICE
8 STATION PARADE, SHEEN LANE, SHEEN, LONDON, S.W.14
Showrooms *Open until 7 p.m.*
PROSPECT 0985
(Opposite Mortlake Station S.R.)

WIMBLEDON'S
TAPE RECORDER CENTRE
Agents for : FERROGRAPH, VORTEXION, SIMON, BRENELL, GRUNDIG, PHILIPS, COSSOR, ETC.
GET IT TAPED THE EXPERT WAY—By letting us install your apparatus
TEL-LEE-RADIO
LIBerty 4946 220 The Broadway, WIMBLEDON, S.W.19

Cheshire
STOCKPORT
FAIRBOTHAM & CO. LTD.
47 LOWER HILLGATE STO 4872
FERROGRAPH, REVOX, TANDBERG, BRENELL, SIMON, TRUVOX, SONY, PHILIPS, MAGNAVOX, GRUNDIG, TELEFUNKEN
All models on comparison demonstration
Evening demonstrations by appointment

Devon
PLYMOUTH
TOM MOLLAND LTD.
102 CORNWALL STREET Phone 69282
FERROGRAPH, REVOX, TANDBERG, SIEMENS, AKAI, UHER, SONY, B & O STEREOMASTER, FI-CORD, AND
The largest selection of Hi-Fi equipment in the West

www.americanradiohistory.com

— YOUR TAPE DEALER —

Gloucestershire

CHELTENHAM
MODERN RADIO (Cheltenham) LTD.
Service and Hi-Fi Dept. 40/42, St. James Street
Ferrograph, Revox, Telefunken and Truvox always in stock
TELEFUNKEN appointed Service Agent
Phone : **Cheltenham 21216/7**

Hampshire

BOURNEMOUTH
NATIONAL RADIO SUPPLIES
66 Holdenhurst Road
Bournemouth
Tape, Hi-Fi & components *Tel.* 25232

HAMILTON ELECTRONICS
HIGH FIDELITY AND TAPE RECORDER SPECIALISTS
35 LONDON ROAD
TEL. 28622 **SOUTHAMPTON**

Kent

ENGLAND'S BIGGEST T/R SPECIALISTS
HOWARD
218 HIGH ST.- BROMLEY - RAV. 4000

Lancashire

H. D. KIRK Stereolectrics LIMITED
Specialists in High Fidelity — *Phone: 23093*
150 HIGHER BRIDGE STREET **BOLTON**

MANCHESTER
LANCASHIRE HI-FI LIMITED
and now incorporating
The Tape Recorder Specialists
DIXONS ELECTRONIC (Sales and Service)
8 DEANSGATE (NEXT TO GROSVENOR HOTEL)

Leicestershire

LEICESTER
ALL YOUR HI FI REQUIREMENTS
Speakers by : H.M.V. QUAD LEAK ROGERS TANNOY MORDAUNT LOWTHER W.B. WHARFEDALE GOODMANS
Tape : FERROGRAPH REFLECTOGRAPH GRUNDIG SIMON BRENELL
Record Department : ALL LABELS-PARASTAT SERVICE
LEICESTER CO-OPERATIVE SOCIETY LIMITED, High Street, Leicester. **Tel. 20431**

Northamptonshire

PETERBOROUGH, NORTHANTS *Tel :* 5643/5644
CAMPKINS RECORD SHOP
RECORD TAPE AND HI-FI EQUIPMENT SPECIALISTS
NEW ADDRESS **15 LONG CAUSEWAY** LARGE STOCKS
(IN CITY CENTRE)

material with a strong alternating field is sufficient to return it to its random nature. The de-magnetiser does just this.

It is advisable to carry out the operation fairly frequently on some decks, whereas others rarely need it. Much depends on other factors, such as the circuitry in use, the depth of modulation, external fields, etc. A basis of no more than 100 *hours is a useful figure with many decks.*

The erase head should certainly be treated, as should other metal parts, including guide posts, tape pins, feelers, and capstan spindle. Take care not to apply a de-magnetising field for too long a period, or heating of the windings by induced magnetism, and hence current, can occur.

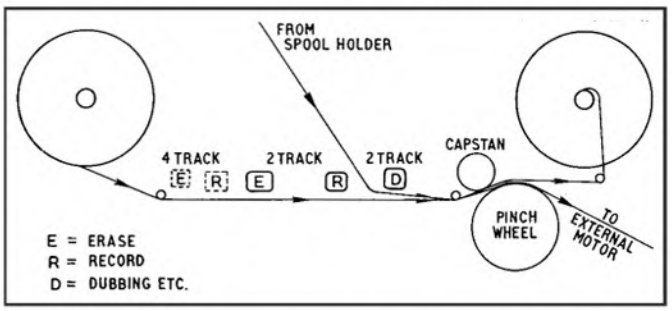
MODIFYING THE STUDIO DECK

Dear Sir, A short time ago I purchased a Magnavox Tape Deck and Martin Pre-amplifier kit. Having completed the pre-amp, and being delighted to find that it worked, I am writing to ask your advice on modifying the deck.

The first change I wish to make is to insert a switch between the oscillator coil and erase head, thus making superimposition possible. I would like to know what type of switch to use, and whether the length of wire matters. Secondly comes the problem of mixing. The makers of the pre-amp say this is easy ; one merely plugs in both microphone and 'direct' lead together. I have not yet been able to try this but after reading about mixing units and their like I feel that there must be more to it than Martin suggest. (I may say that I am not thinking of completing all the alterations about which I am enquiring all at one sitting, so to speak).

Thirdly, I am very keen to have facilities for some of the effects which are made possible by magnetic tape. I have in mind a second recording head, which can be fitted easily on to the Magnavox deck. I am hoping that, with suitable switching arrangements, I can use the second head for monitoring, providing echo, and possibly dubbing.

Yours faithfully, **M.H., Amersham**



Superimposition : it is necessary to provide an alternative load for the oscillator when disconnecting the erase head. A 1.5 *K resistor would be suitable, with a single-pole, double-throw switch to select either the erase head or the shunt resistor.*

Mixing of one microphone and one radio or pick-up input is possible with no further modification. The microphone input is amplified by an additional stage, in normal practice, but a balance is obtained by attenuation of the radio input by a potential divider network. If further simultaneous inputs are required, an external mixer would be necessary. This could be a 'passive' type, with matching and isolating resistive branches, or an 'active' type, with transistorised pre-amplifier and balanced gain controls. Unless a varied series of inputs is anticipated, it is better to use the existing facilities.

The use of a second head for monitoring will need a pre-amplifier circuit. Quite a simple device can be built for headphone monitoring. See Mr. Bartlett Still's previous articles on mixers for guidance. For echo and dubbing work, it is advisable to incorporate a separate amplifier circuit, to separate the channels and avoid complicated switching.

Although the capstan is powerful enough to propel two tapes, this is not the best method for obtaining a quality recording. Combining two- and four-track heads on the single deck is quite feasible, but the switching must also allow for the different impedance and recording currents of the heads—and this factor is the reason for different amplifier specifications.

www.americanradiohistory.com

CLASSIFIED ADVERTISEMENTS

Advertisements for this section must be pre-paid and accompanied by a postal order, money order, or cheque.

The rate is 6d. per word with a minimum charge of 7s. 6d. Box numbers may be used for an extra charge of 1s. 6d. The trade rate is 9d. per word, plus 2s. for a box number, conditions on application.

Send replies to box numbers c/o "Tape Recorder", Link House, Dingwall Avenue, Croydon, Surrey.

No responsibility will be accepted by the editor, the publishers, or the printers of **"Tape Recorder"** for the quality of any goods offered, bought, or exchanged through the medium of these columns, or for any failure in payment, etc., though the greatest care will be taken to ensure that only bona fide advertisements are accepted.

All advertisements for the September issue must arrive not later than August 5th.

PERSONAL

Disabled War Ex-Serviceman will undertake in own home, tape recording, monitoring, dubbing. Same day immediate return. Any speed 1⅞, 3¾ and 7½ i/s. Television or radio news monitoring, etc. All answered. S.A.E. please. Box No 366.

FOR SALE

Ferrograph 4AN, Reslo mike, floor, desk stands, ext. lead, c/case. Excellent condition £65—Love, 49 Alfred Road, Brentwood, Mddx.

Ferrograph Model 808 Stereo 3¾" x 7½". This machine is as brand new, cost £115, accept £70. Also stereo speaker outfit, 2 Davis full lined cabinets each containing 1 Goodmans Audiom 70 x 1 Kelly Ribbon, cost £90, accept £45. Phone : Putney 9950 after 8 p.m.

Grundig TK 46, Four Track, Mono/Stereo, with three speeds. Original cost £103-19-0. Excellent condition, only a few months old. First offer of £60 secures this very popular recorder. Box No. 370.

Tandberg 6-4, 2 mics, case, AKG phones, as new. Value £138. £80 o.n.o. Owen, 100 Windsor Road, Torquay.

Ferrograph 422U £65. Garrard 4.H.F. on base, £10, hardly used. Hurley, 52 Greswell Street, Fulham, S.W.6.

TRADE

Pre-recorded tapes. Unique complete catalogue listing all makes, mono, stereo, 7½ and 3¾ i/s including World Record Club tapes. Call for free copy or send 1s. mailing fee. Dept. T.R.3, Teletape Ltd., 33 Edgware Road, W.2. Phone : PAD 1942.

A Unique Buy ! Recording tape, top brand, 5¾in. 1200ft. 19s. 6d., 7in. 2400ft. D.P. 28s. 6d. P. and P. 1s. 6d. per spool. Bargains in all sizes. S.A.E. for list. E. C. Kingsley & Co., 132 Tottenham Court Road, London, W.1. Phone : EUSton 6500.

Speedy and Expert Tape Recorder and Hi-Fi repairs by England's leading Hi-Fi Specialists. Telesonic Ltd., 92 Tottenham Court Road, London, W.1. MUS 8177.

If quality matters consult Sound News Audio Supply for better terms. 60 page photographically illustrated Hi-Fi catalogue 4s. 6d. Part exchange, servicing. Your precious tapes transferred to unbreakable L-Ps by specialists. Specify requirements. 10 Clifford Street, London, W.1.

29/6 P & P 2/6

AUTOMATIC CONTROL over radio and/or tape recorder. Will switch ON/OFF or OFF/ON once every 24 hours at any manually pre-set time. Minimum time lapse 30 minutes. It has a current rating of 1 amp sufficient to carry radio and/or tape recorder. Complete with key and mounting bracket. Used but in perfect condition. Fully guaranteed. Also 5 amp model available 35/- pp 2/6

KINGSWOOD SUPPLIES (T.R.17), 4 Sale Place, London, W.2. PAD 8189

— YOUR TAPE DEALER —

Oxon

WESTWOOD'S of **OXFORD**

46 GEORGE STREET

PHONE: 47783

Staffordshire

Audio Electronics (Midlands) Ltd.

Specialists in Dictation Mcs., Tape Recorders, Inter Com., Tapes and Accessories

Full After Sales Service on all Equipment

PHILIPS, GRUNDIG, TRUVOX, UHER, ETC.

203 STAFFORD STREET, WALSALL Tel. : 21086

Surrey

FARNHAM, SURREY

The finest selection of Tape Recorders, Hi-Fi Equipment and quality Radiograms in the Provinces is awaiting you at:—

LLOYD & KEYWORTH LTD

26-27 Downing Street, Farnham, Surrey. *Telephone:* 5534

Comparative Demonstrations, Large stock of Cabinets and Pre-Recorded Tapes.

CROYDON'S TAPE RECORDER CENTRE

All leading makes in stock, Hi-Fi equipment, cabinets, etc.
Service agents for AKAI Tape Recorders

SPALDING ELECTRICAL LTD.,

352/354, Lower Addiscombe Road, CROYDON *ADDiscombe* 1231/2040

Sussex

WORTHING, SUSSEX

Stocking Ferrograph, Revox, Sony, Tandberg, Truvox, Philips, EMI, Luxor, etc., on fully comparative Demonstrations

BOWERS & WILKINS LTD.

1 Becket Bldgs., Littlehampton Road, Worthing 5142

Warwickshire

COVENTRY & DISTRICT CO-OPERATIVE SOCIETY LTD.

HIGH FIDELITY SOUND EQUIPMENT TASTEFULLY DISPLAYED FOR YOUR "BROWSE AROUND" ENJOYMENT

All leading makes : Amplifiers, Control Equipment, Loud-speakers, Cabinets, Tuners, Microphones, Tape Recorders and Ancillary Items in stock or quickly obtainable.

Coventry & District Co-operative Society Ltd., High Fidelity Sound Section, Electrical Dept., First Floor, Central Premises, Corporation Street, Coventry. Tel. Coventry 24031-10 lines

Wiltshire

SOUTHERN ENGLAND

HI-FI AND RECORD CENTRES

J. F. SUTTON

SALISBURY 18 QUEENS STREET — SOUTHAMPTON 421 SHIRLEY ROAD

Yorkshire

TAPE RECORDER CENTRE (HALIFAX)

Stock all the best Tape Recorders; Hi-Fi Equipment; Tape; L-P Records, etc.

DEMONSTRATIONS DAILY BY EXPERT STAFF
2 years FREE SERVICE ON NEW RECORDERS over £35

30 King Cross Street, Halifax. 'phone 66832

www.americanradiohistory.com

CLASSIFIED ADVERTISEMENTS

TRADE—*continued*

"Sleep Learning", the book essential for go-ahead people. Send 6s. 6d. to York House, Huddersfield.

Something Slipping ? . . . try Vita-Drive, an excellent rubber drive cleaner that definitely prevents slipping of Pinch Wheels, Intermediate Drives and Belts used in Tape Recorders and Record Changers. Used by Service Organizations throughout the world. Ask your Dealer for it or write us. A product of Friend's Mfg. Co., 614 Arch Street, Philadelphia, PA., U.S.A. 19106.

Sound Effects—Castle 45 r.p.m. discs, 8s. each or on tape 18s. 6d. each including postage and packing. Titles include : mixed effects, trains, animals, military parades, electronic music, bells and sirens, haunted house, etc. Send 3d. stamp for lists. Recorded Tuition Limited, 174 Maybank Road, South Woodford, London, E.18.

Pre-Sleep Study. Learn difficult lessons or parts or improve your mental powers while you sleep! Send now for price list of materials : including the perfect tape machine, time switch, pillow speaker, endless tape cassettes, pre-recorded tapes for learning or therapy, language courses, etc. Psychology Tapes Ltd., (TR) 16 Kings College Road, London, N.W.3. (PRI 3314).

Can you preset your recorder to give a fully warmed-up perfect recording of a chosen Radio Programme automatically in your absence, with complete freedom from "flats" ? If not you need one of our Symphony Tape Timers. Full details from N.R.S., 16 Kings College Road, London, N.W.3. PRI. 3314.

Lafayette Tape Cheaper ! Polyester Base 7″ 2,400ft. 22/6 ; 5¾″ 1,800ft. 19/6 ; 5″ 1,200ft. 13/6 ; 7″ 1,800ft. 18/6 ; 5″ 900ft. 10/6 ; 7″ 1,200ft. 11/6 ; 7″ 1,800ft. (Acetate) 14/6 p. & p. 1/6. Refund guarantee. S.A.E. list. LEDA TAPES, 12 Montague Road, London, E.11.

WANTED

Lee Electronics. The Tape Recorder and Hi-Fi Specialists wish to purchase good quality Tape and Hi-Fi Equipment for cash. 400 Edgware Road, W.2. Phone : PADdington 5521.

Highest cash prices offered for good quality Tape Recorders and Hi-Fi. See our ad. page 286 this issue. R.E.W., 266 Upper Tooting Road, London, S.W.17.

TAPE EXCHANGES

Tapesponding is fun. The Australian Tape Recordists Association puts you in contact with enthusiasts all over the world. For details write : Hon. Sec. P.O. Box 67, Eastwood, N.S.W., Australia.

STUDIO FACILITIES

Tape to Disc service, editing, and dubbing, all speeds. Studio available for musical groups. Outside recordings our speciality. Ilford Sound Recording Service, 63 Aintree Crescent, Barkingside, Ilford, Essex. Phone : CRE 8947 and GRA 5107. S.A.E. for list.

Rapid Recording Service, 78s and L.Ps. from your own tapes. (48-hour service.) Master Discs and pressings. Recording studio. Mobile recording van. Manufacturers of the Sleep-o-Matic Unit. Foreign language courses available for sleep-learning. Brochures and price lists on request from : Dept. T.R.21, Bishops Close, London, E.17.

Tape to Disc Recordings. Finest professional quality, 10in. L.P. 42s. (32 min.), 12in. L.P. 48s. (45 min.), 7in. E.P. 21s. 48-hour Postal Service. S.A.E. for leaflet to : Deroy Sound Service, 52 Hest Bank Lane, Hest Bank, Lancaster.

— YOUR TAPE DEALER —

North of the Border

Edinburgh's TAPE RECORDER specialist

Ferrograph—Grundig—Telefunken—Philips, etc.
W. G. Graham, Assoc. Brit. I.R.E.

Tape to Disc Recording Service

Agent for The Famous Heathkits.

Hi-Fi Corner
1 Haddington Place, EDINBURGH.
Phone WAV 7901

— TAPE TO DISC SERVICES —

The following are members of the Association of Professional Recording Studios who can be relied on to give satisfaction

MJB RECORDING & TRANSCRIPTION SERVICE

specialise in the production of microgroove records from Professional and Amateur recordings (Acetate copies ; Mono and Stereo pressings). Extended playing times achieved by controlled cutting techniques. Studio, Mobile, "Off the Air" and all recording services. Detailed booklet available.

7 HIGH STREET, MAIDENHEAD (Tel: 25630)

TAPE RECORDERS - AUDIO EQUIPMENT - DISC CUTTING STD & LP FROM TAPE - STUDIO FACILITIES - HIRE SERVICE - SALES - EXCHANGES

MAGNEGRAPH

1 Hanway Place, London, W.1. *Tel. : LAN 2156*

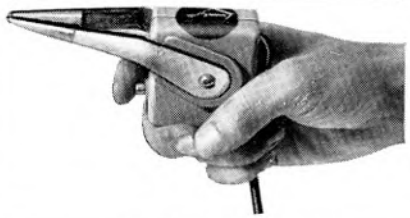
ADVERTISERS' INDEX

PLEASE MENTION THE *TAPE RECORDER* WHEN REPLYING TO ADVERTISEMENTS

Published by the proprietors, Link House Publications Limited, 10-12 South Crescent, Store Street, London, W.C.1, and printed by Arthurs Press Limited, Woodchester, Stroud, Glos., England.

www.americanradiohistory.com

Professional Performance



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.

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.

WAL

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.

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

ELSTONE ELECTRONICS LIMITED
Edward Street, Templar Street, Leeds 2.

SUMMER SALE !

OF UNSOLD STOCK

		Our Sale Price				Our Sale Price
ELIZABETHAN POPULAR 200 ...	£24 3 0	£18 3 0	GRUNDIG TK/41	£78 15 0	£58 15 0
ELIZABETHAN POPULAR 400 ...	£26 5 0	£20 5 0	SIEMENS 12	£78 15 0	£56 15 0
ELIZABETHAN LZ/27	£28 7 0	£20 7 0	LUXOR MP.423	£77 14 0	£55 14 0
FERGUSON 3206	£27 6 0	£22 6 0	LUXOR MP.424	£80 17 0	£56 17 0
WYNDSOR TRIDENT 2-T	£34 13 0	£26 13 0	GRUNDIG TK/40	£82 19 0	£60 19 0
WYNDSOR TRIDENT 4-T	£36 15 0	£28 15 0	SONY TC.200	£82 19 0	£62 19 0
CAROUSEL JUNIOR with AM Tuner	£39 18 0	£24 18 0	UHER 4000/S	£97 13 0	£82 13 0
STUZZI MEMOCORD with lapel mic.	£34 13 0	£26 13 0	SONY 801 Battery	£93 9 0	£64 9 0
PHILIPS EL.3541	£37 16 0	£30 16 0	SIMON SP/5	£97 13 0	£67 13 0
Q-CORD 203 with mains unit ...	£40 19 0	£28 19 0	TELEFUNKEN 97	£99 15 0	£69 15 0
ELIZABETHAN LZ/29	£39 18 0	£32 18 0	VORTEXION CBL	£160 0 0	£132 0 0
SONY TC.103	£66 3 0	£40 3 0	SONY TC.500	£114 9 0	£94 9 0
SIEMENS 10	£72 9 0	£51 9 0	SONY 600	£143 17 0	£108 17 0

All complete with Manufacturer's Guarantee Cards, etc. *H.P. terms possible.* *Write for Lists.*

Please indicate interests :

TAPE RECORDERS
Mono under £50
Mono over £50
Stereo

HI-FI
Amplifiers and Tuners
Speakers and enclosures
Turntables and Arms
Portable Radios and Grams

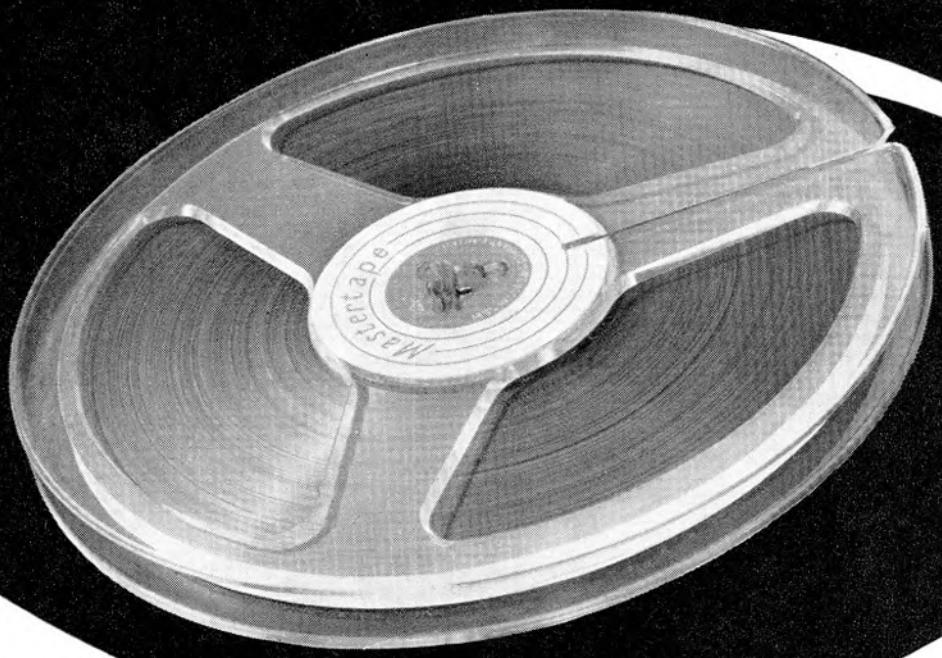
HOWARD

TAPE RECORDERS · HI-FI

218 HIGH ST. BROMLEY. KENT. RAV. 4000

www.americanradiohistory.com

*** Elizabethan, Fidelity, Wyndsor and other famous makers fit MASTERTAPE!**



MASTERTAPE

Nationally distributed by Vidor and available now at your local radio shop.

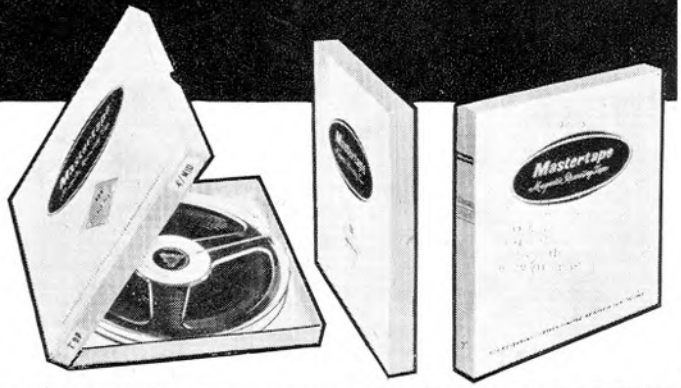
. . . . there is a Mastertape to suit your requirements. Just compare these prices for the most popular sizes: 5¾" 900 ft. Standard Play (P.V.C.) 20/-; 5¾" 1200 ft. Long Play (P.V.C.) 25/-; 7" 2400 ft. Double Play (Polyester) 55/- and our 10 minute Mini-Voice Letter at 2/8d. — the best quality and value in high grade recording tape!

** Always have a spare reel for that unexpected recording session!*

Manufactured in England by

M.S.S. RECORDING CO. LTD. Colnbrook, Slough, Bucks.

Tel: Colnbrook 2431 (8 lines)



www.americanradiohistory.com