OCTOBER 1968 2/6d

tape recorder

BASTIN'S ORCHESTRA (A PRACTICAL GUIDE TO MAKING MULTI-TRACK MUSIC)

AKAI 1710W REVIEW

A BUDGET PEAK PROGRAMME METER

ADDING A DIVIDER TO THE MINIATURE ORGAN

AMERICA TOMORROW

THE RANK NIVICO VIDEO TAPE RECORDER

FREE

We're giving away 10,000 of these 5¾″ self threading reels. Each one's worth 9/10d.
All you need to do to get this: fill in the coupon and send it off with the front-end Tartan slip from your purchase of any reel of 'Scotch' Magnetic Tape of 4″ diameter or larger—we'll send you your reel by return. So long as we've got one to send.
We've only 10,000. So hurry!

*Automatic wind-on. Just lay tape in hub of spool. The reel then threads itself. *No loose ends.
*Cuts down tape handling *Maximum tape protection *Fastest known method of threading reel.

3M COMPANY

To: Mr. R. Perkins, 3M Company Limited,
3M House, Wigmore Street, London, W1A 1ET.

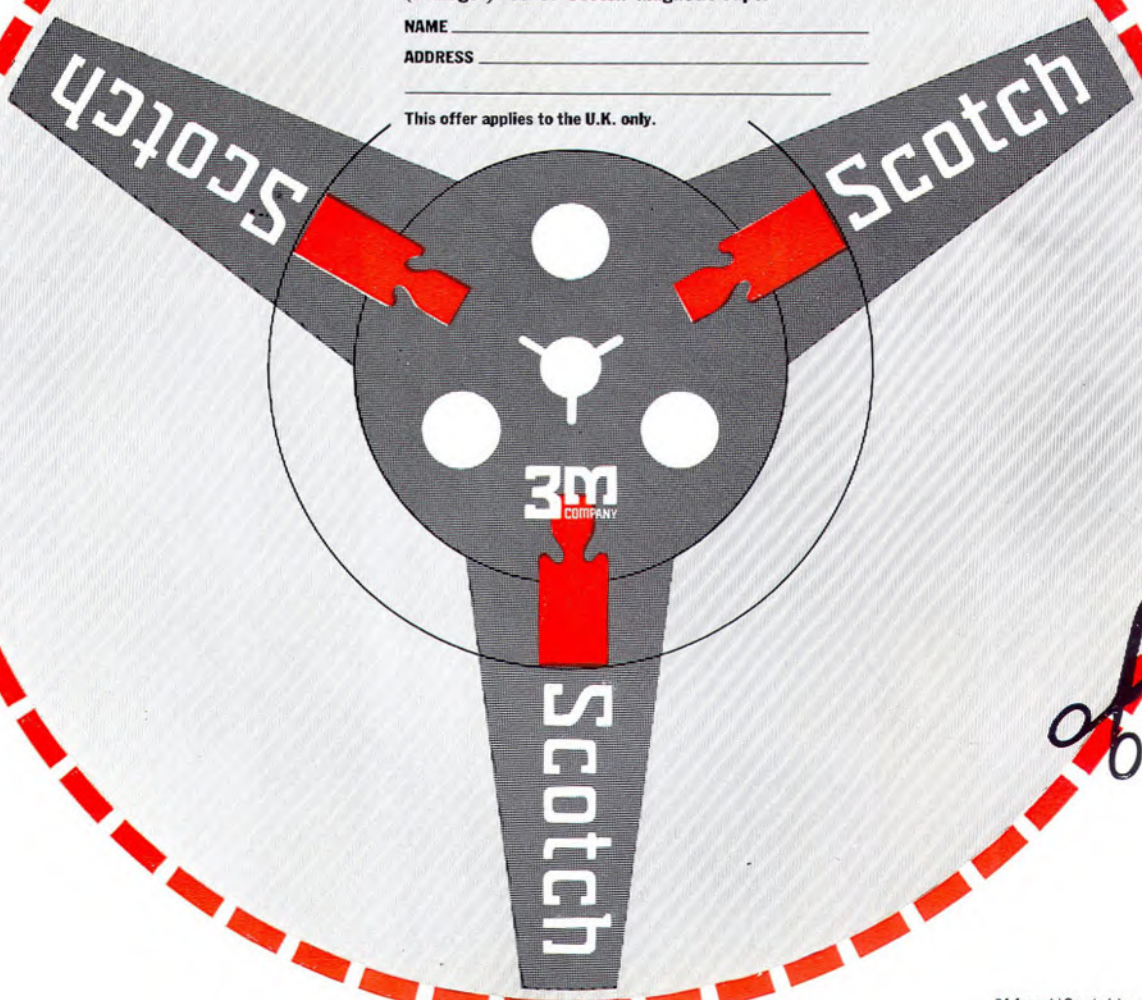
Please send me a free 5¾″ self threading reel.
I enclose the front-end Tartan slip from a 4″
(or larger) reel of 'Scotch' Magnetic Tape.

NAME _____

ADDRESS _____

_____

This offer applies to the U.K. only.



3M and 'Scotch' are trademarks.

NuSound

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TAPE RECORDER AND HI-FI CENTRES

EVERY LEADING MAKE AVAILABLE

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Stockists of: Akai, Ampex, Arena, Armstrong, B. & O., Brenell, Dynatron, EMI, Elizabethan, Ferguson, Ferrograph, Garrard, Goldring, Goodmans, Grundig, H.M.V., Hacker, Kef, Leak, Loewe-Opta, National, NuSound, Ortofon, Philips, Quad, Reps, Rogers, Sanyo, Sony, Stereosound, Tandberg, Telefunken, Thorens, Truvox, Uher, Van Der Molen, Vortexion, Wharfedale, Wyndsor, etc.

Every make and model of Tape Recorder and Hi-Fi Unit is available for **immediate demonstration** by our specialist staff who will be delighted to assist you in selecting equipment to suit your individual requirements. **Only from NuSound** can you benefit from all these invaluable features—**the most comprehensive range** of equipment on display in the country, **expert staff, free** technical advice, **immediate demonstration** of any model and the **finest** after sales servicing available.

WE OPERATE A PERSONAL EXPORT SCHEME
SAVING UP TO 20% ON LIST PRICE

SEE THIS EQUIPMENT

Tandberg SPECIALISTS

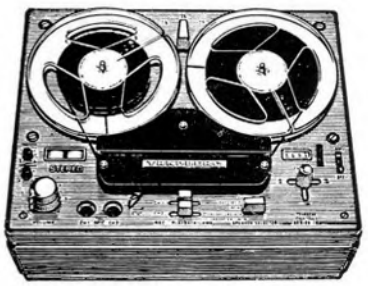
See, hear and compare the complete range of Tandberg Stereo and Mono Tape Recorders. Our experienced staff are able to give expert advice and also demonstrate the many outstanding features of this wonderful range of equipment.

MODEL 1241

4-track, 3 speed stereo recorder. A few still available at our special price of ONLY

105 GNS.

(List price £126)



MODEL 64X

4 track stereo tape unit with pre-amp. **138 gns.**

SERIES 15

2 or 4 track, 3 speed, 10 watts mono recorder **from 69½gns.**

NuSound TAPE RECORDER CENTRES

WEST END	**82 HIGH HOLBORN, W.C.1. Tel. 01-242 7401** (200 yds. Kingsway—Half-day Saturday)
CITY	**228 BISHOPSGATE, E.C.2. Tel. 01-247 2609** (Opp. Liverpool St. Stn.—Closed Sat. Open Sun. 10-2)
E. LONDON	**2 MARYLAND STATION, E.15. Tel. 01-543 5879** (Adjacent Maryland Point Stn.—Half-day Thursday)
N.W. LONDON	**360 KILBURN HIGH RD, N.W.6. Tel. 01-624 1656** (Opp. Kilburn Tube Stn.—Half-day Thursday)

TAPE AND HI-FI CENTRES

N. LONDON	**242/4 PENTONVILLE RD., N.1. Tel. 01-837 8200** (200 yds. Kings Cross Stn.—Half-day Thursday)
ILFORD/ESSEX	**85-100 ILFORD LANE, PIONEER MARKET. Tel. 01-478 2291** (200 yds. Ilford Stn.—Half-day Thur)
S.E. & KENT	**36 LEWISHAM HIGH ST, S.E.13. Tel. 01-852 2399** (Opposite Chiesmans — Half-day Thursday)

At every NuSound showroom you'll find a wonderfully comprehensive range of equipment backed by over 13 years' experience in this ever growing and highly specialised field—in which the **NuSound** reputation is "second to none".

Four NuSound Centres are devoted exclusively to Tape Recorders and Accessories and the other **three NuSound centres** specialise in both High Fidelity Equipment and Tape Recorders.

Visit any NuSound Centre and you'll be certain of 100% Service and Satisfaction.

BRITAIN'S LARGEST TAPE & HI-FI SPECIALISTS

Ferrograph quality Ferrograph reliability Ferrograph fidelity plus a unique combination of 30 features

Ferrograph New Generation Series 7

Available in Mono, and in Stereo with and without end amplifiers; with 30 features which market research has proved you, the user, want. Prices from £135 inc. P.T. Features include:

1. **All silicon solid-state electronics with FET input stages and wide input overload margins.**

2. **Vertical or horizontal operation.**

3. **Unit construction: The 3 individual units i.e. tape deck, power unit and amplifier complex are mounted on a single frame easily removable from cabinet for service or installation in other cabinets or racks.**

4. **3 motors (no belts). 3 tape speeds.**

5. **Variable speed spooling control for easy indexing and editing.**

6. **Electrical deck operation allowing presetting for time-switch starting without need for machine to be previously powered.**

7. **Provision for instantaneous stop/start by electrical remote control.**

8. **Single lever-knob deck operation with pause position.**

9. **Independent press-to-record button for safety and to permit click-free recordings and insertions.**

10. **8½" reel capacity.**

11. **Endless loop cassette facility.**

12. **Internal loud speakers (2) – 1 each channel on stereo, 2 phased on mono.**

13. **4 digit, one-press re-set, gear-driven index counter.**

14. **2 inputs per channel with independent mixing (ability to mix 4 inputs into one channel on stereo machine).**

15. **Signal level meter for each channel operative on playback as well as record.**

16. **Tape/original switching through to output stages.**

17. **Re-record facility on stereo models for multi-play, echo effects etc., without external connections.**

18. **Meters switchable to read 100 kHz bias and erase supply with accessible preset adjustment.**

19. **Three outputs per channel i.e. (1) line out – level response. (2) line out – after tone controls. (3) power output – 8-15 ohms.**

20. **Power output 10W per channel.**

21. **Independent tone controls giving full lift and cut to both bass and treble each channel.**

22. **Retractable carrying handle permitting carrying by one or two persons.**

Ideal for rack mounting

Grey vinyl case

Elegant hardwood case

Listen for yourself

To *know* the Ferrograph New Generation Series 7 you must look at it, listen to it, for yourself. You will find New Generation instruments soon in stock at many of the best tape-recording and Hi-Fi specialists in the country, including the following:

Ferrograph stockists

London Dealers
Telesonic Ltd.,
92 *Tottenham Court Rd.*,
London, W.1.
Larg's of Holborn Ltd.,
76/77 *High Holborn*,
London, W.C.1.
Nusound,
82 *High Holborn*,
London, W.C.1.
Nusound,
228 *Bishopsgate*,
London, E.C.2.
Nusound,
360 *Kilburn High Road*,
London, N.W.6.
Nusound,
36 *Lewisham High Street*,
London, S.E.13.
Francis of Streatham,
169-171 *Streatham High Road, London, S.W.16.*
Hampstead High Fidelity Ltd.,
91 *Heath Street*,
London, N.W.3.
The Recorder Company,
188 *West End Lane*,
London, N.W.6.
C. C. Goodwin Ltd.,
7 *The Broadway*,
London, N.22.
Nusound,
2 *Maryland Point Station, Stratford*,
London E.15.
Studio Tapes Ltd.,
199 *Hoe Street*,
Walthamstow, E.17.

Aberdeen
Aberdeen Sound Centre
25a *Belmont Street.*
C. Bruce Miller,
51 *George Street.*
Aberdeen Radio Ltd.,
9 *Hadden Street.*

Barnsley
Geoffrey Barnard,
3 *Pitt Street.*

Barnstaple
O. Nicklin & Son Ltd.,
The Square.

Bath
C. Milsom & Son Ltd.,
Northgate.

Birkenhead
James McKenzie Ltd.,
Grange Road.

Birmingham
C.H. (High-Fidelity) Ltd.,
167/169 *Bromsgrove St.*,
Birmingham 5.
Chas. H. Young Ltd.,
170 *Corporation Street.*
Griffin Radio Ltd.,
94 *Bristol Street*,
Birmingham 5.

Blackburn
Holdings of Blackburn Ltd.,
39-41 *Mincing Lane.*

Blackpool
F. Benfell Ltd.,
17 *Cheapside.*

Bolton
Harker & Howarth (Music) Ltd.,
Goodwin Street,
Bolton, Lancs.

Bournemouth
Tape Recorders (Bournemouth) Ltd.,
874 *Old Christchurch Rd.*,
Boscombe, Bournemouth.

Brighton
John King Films Ltd.,
71 *East Street.*
Avery's Ltd.,
77 *St. James's Street.*
Lanes Radio Ltd.,
11 *Gardiner Street.*

Bristol
Tape Recorder and Hi-Fi Centres Ltd.,
Stokes Croft.
Sound Selection Ltd.,
361-363 *Gloucester Road*,
Bristol 7.

Bromley
Bromley Sound,
22 *Letchworth Drive.*

Bury
John Smith & Son (The Rock) Ltd.,
184 *The Rock*,
Bury, Lancs.

Cambridge
University Audio,
1-2 *Peas Hill.*
K.P. Cameras Ltd.,
12a *Kings Parade.*

Canterbury
Canterbury Hi-Fi,
St. Dunstan Street.

Cardiff
Sound Film Services Ltd.
(Cinema Liaison Ltd.),
27 *Charles Street.*

Carlisle
Misons,
Citadel Road.

Coventry
Coventry Tape Recorder Services,
33 *King William Street.*
R.E.S. Ltd.,
13 *City Arcade.*

Crewe
J. H. Charlesworth (Crewe) Ltd.,
28 *Hightown*,
Crewe, Cheshire.

Darlington
Geoffrey A. Williams & Son Ltd.,
Blackwell Gate.

Derby
Victor Buckland Ltd.,
41-49 *London Road.*

Doncaster
Tom Jaques Ltd.,
16 *Wood Street*,
Doncaster, Yorks.

Edinburgh
J. Nicolson (Hi-Fi Corner) Ltd.,
1 *Haddington Place*,
Edinburgh 7.

Epping
Chew and Osborne Ltd.,
148 *High Street.*

Exeter
Electrosure Ltd.,
162-163 *Fore Street.*

Farnham
Lloyd & Keyworth Ltd.,
26-27 *Downing Street*,
Farnham, Surrey.

Gerrards Cross
Edric Films Ltd.,
34-36 *Oak End Way*,
Gerrards Cross, Bucks.

Gillingham
E. Hadaway,
Watling Street.

Glasgow
McCormacks (Music) Ltd.,
33 *Bath Street*,
Glasgow, C.2.

Goodmayes
Unique Radio Ltd.,
6 *The Facade*,
Goodmayes, Essex.

Gravesend
Bennett & Brown Ltd.,
50, 60b *and* 60c
Wrotham Road,
Gravesend, Kent.

Great Yarmouth
Norfolk Radio,
12 *Broad Row*,
Great Yarmouth.

Guildford
P.J. Equipments,
21 *Onslow Street.*

Huddersfield
J. Wood & Son Ltd.,
67 *New Street*,
Huddersfield, Yorks.

Ilford
Nusound,
87-100 *Pioneer Market*,
Ilford Lane,
Ilford, Essex.

Kirkcaldy
Caithness Brothers,
270 *High Street.*

Leamington Spa
W. M. Tysons,
41 *Russell Street*,
Leamington Spa, Warks.

Leeds
Becketts Film Services Ltd.,
The Headrow,
Leeds 1, Yorks.

Leicester
United Film Services,
7 *Kings Street.*
Tape Recorder Centre,
72a *Church Gate.*

Linton
H. S. W. Speechley & Co.,
49 *High Street*,
Linton, Cambs.

Liverpool
Beaver Radio (Liverpool) Ltd.,
60 *Whitechapel*,
Liverpool, Lancs.

Luton
Coventry Radio Ltd.,
189 *Dunstable Road*,
Luton, Beds.

Maidstone
Sloman & Pettit,
Pudding Lane.

Manchester
Lancs Hi-Fi Ltd.,
8 *Deansgate*,
Manchester 3.
Godleys Radio & T.V. Ltd.,
Shude Hill.

Mansfield
Syd Booth,
11 *Queens Street.*

Middlesbrough
McKenna & Brown Ltd.,
122 *Linthorpe Road*,
Middlesbrough, Yorks.

Newcastle-upon-Tyne
Turners (Newcastle-upon-Tyne) Ltd.,
Camera House, Pink Lane.
J. G. Windows Ltd.,
1-7 *Central Arcade.*

Northampton
Audiocraft Ltd.,
Abington Square.

Nottingham
Petes Electronics Ltd.,
165 *Arkwright Street.*

Nuneaton
Taylors Pianos Ltd.,
119 *Abbey Street.*

Oxford
L. Westwood Ltd.,
George Street.

Plymouth
A. E. Ford Ltd.,
84 *Cornwall Street.*

Portsmouth
H. R. Knight,
71 *Tangier Road.*

Redcar
McKenna & Brown Ltd.,
135 *High Street*,
Redcar, Yorks.

Rugby
Berwick Hi-Fi Centre,
5 *Sheeps Street*,
Rugby, Yorks.

Salisbury
Suttons Hi-Fi Centre Ltd.,
50 *Blue Boar Row*,
Salisbury, Wilts.

Skegness
Norman Throp Ltd.,
68 *Lumley Road*,
Skegness, Lincs.

Sheffield
Sheffield Photo Co. Ltd.,
6 *Norfolk Row*,
Fargate.

Shrewsbury
Avon Hi-Fi Ltd.,
13 *Wyle Cop*
Shrewsbury, Salop.

Southampton
Hamiltons Ltd.,
35 *London Road.*

Southport
Wayfarers Radio Ltd.,
Burton Arcade.

Stafford
Tom Reekie Ltd.,
10 *Bridge Street.*

St. Helens
Harold Stott Ltd.,
18 *Westfield Street*,
St. Helens, Lancs.

Stoke-on-Trent
Wilsons Radio Ltd.,
30-32 *Liverpool Road*,
Stoke-on-Trent, Staffs.

Stockport
W. J. & M. Bayliss Ltd.,
611 *Gorton Road*,
Reddish, Stockport.

Swansea
W. J. Holt Ltd.,
Picton Arcade.

Teddington
Daytronics Ltd.,
119a *High Street*,
Teddington Lock, Middx.

Truro
John Fry Ltd.,
Hi-Fi Centre,
6 *Cathedral Lane*,
Truro, Cornwall.

Winchester
Southern Recorder Service.
34 *St. George's Street.*

Woking
D. W. Hughes & Sons Ltd.,
5 *Central Buildings*,
Chobham Road.

Worcester
Johnson's Sound Service,
Sidbury.

Wilmslow
Transistor Centre,
Green Lane,
Wilmslow, Cheshire.

Worthing
Bowers & Wilkins Ltd.,
1 *Beckett Buildings*,
Littlehampton, Worthing.

If none of these is near enough to you, in case of difficulty, or for free literature, send us the coupon, or give us a ring on WATerloo 1981.

FERROGRAPH

To The Ferrograph Co Ltd
Ferrograph House
84 Blackfriars Road London SE1
Please send me a free brochure on the Ferrograph New Generation Series 7

NAME .....
ADDRESS .....
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IMMEDIATE DELIVERY!

K. J. ENTERPRISES

EVERYTHING AUDIO!

BRITAIN'S PREMIER MAIL-ORDER RECORDING TAPE SPECIALISTS

IMMEDIATE 24 HOUR SERVICE ON ADVERTISED LINES

FULL CASH REFUND GUARANTEED — SEND TODAY AND SAVE!

BRANDED TAPES

20% OFF

BASF - EMI - GRUNDIG PHILIPS - SCOTCH - AGFA

Brand New, Fully Guaranteed and in normal manufacturer's pack.

	LIST PRICE	OUR PRICE
STANDARD PLAY		
5" 600' }	22/2	18/-
5¾" 900' } Except Agfa	29/5	24/-
7" 1200' }	36/7	29/6
LONG PLAY		
3" 210' Not Scotch	9/3	7/6
3" 300' Scotch only	9/7	7/9
4" 450'	14/9	12/-
4½" 600' BASF, Agfa only	22/-	18/-
*5" 900'	29/2	23/9
*5¾" 1200'	36/5	29/6
*7" 1800'	51/7	41/9
8½" 2400' BASF, Scotch only	74/-	59/6
10" 3280' Agfa only	85/9	68/9
10" 3600' BASF only	96/6	77/6
10½" 4200' Agfa, BASF only	113/6	91/6
SCOTCH DYNARANGE (L/P)		
5" 900'	32/8	26/3
5¾" 1200'	41/-	33/-
7" 1800'	58/1	46/6
8½" 2400' (Metal Reel)	84/3	67/6
BASF PES.35 L/P Low Noise		
5" 900'	36/10	29/9
5¾" 1200'	45/6	35/6
7" 1800'	63/-	50/9
10" 3600'	115/-	91/-

	LIST PRICE	OUR PRICE
DOUBLE PLAY		
3" 300' Not Scotch	14/3	11/6
3" 400' Scotch only	16/7	13/6
4" 600'	26/-	21/-
4½" 900' Agfa, BASF only	31/-	25/-
5" 1200'	43/2	35/-
*5¾" 1800'	56/11	46/-
*7" 2400'	79/-	63/6
10" 4600' Agfa only	140/9	112/9
TRIPLE PLAY		
3" 450' Not Scotch	22/3	18/-
3" 600' Scotch only	24/10	19/9
4" 900'	40/-	32/3
*4½" 1200' Agfa, BASF only	50/-	40/3
5" 1800' Not Scotch	67/2	54/-
5¾" 2400' } Agfa, BASF	91/4	73/6
7" 3600' } only	116/6	93/6
QUADRUPLE PLAY		
3" 600' }	37/-	29/6
3½" 800' } Kodak only	46/3	37/-
4" 1200' }	64/6	51/6
COMPACT CASSETTES		
C.60	17/6	14/3
C.90	25/-	20/3
C.120	33/6	27/-

GRUNDIG TAPE AVAILABLE ONLY WHERE MARKED WITH ASTERISK

Post and Packing 2/6 — ORDERS OVER £3 POST FREE

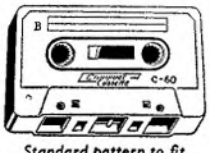
FERROGRAPH TAPE

Brand New. Fully guaranteed and in normal manufacturer's pack.

	LIST PRICE	ONE	THREE	SIX
BN7 1200' on 7" reel (Dynarange)	50/-	40/-	117/6	230/-
BN8 1800' on 8½" reel (Dynarange)	71/-	57/-	168/-	330/-
BL7 1800' on 7" reel (Dynarange)	70/-	56/-	165/-	324/-
BL8 2400' on 8½" reel (Dynarange)	90/-	72/-	213/-	420/-

Post and Packing 2/6 — ORDERS OVER £3 POST FREE

SPECIAL OFFER COMPACT CASSETTES



Standard pattern to fit Philips, Stella, Elizabethan, Dansette, Sanyo, etc.

MC.60 AND MC.90 at half price!

Compact Cassettes with 60 and 90 minutes playing time. Brand New and packed in normal plastic library box. Available at this exceptional price.

MC.60		MC.90	
1 for	10/6	1 for	14/-
3 for	30/-	3 for	40/6
6 for	55/6	6 for	78/-
12 for	105/-	12 for	150/-

Post and Packing 2/6 — *Orders over £3 Post Free*

BASF TAPE—30% OFF!

A 'Special Offer' of the world-famous BASF Magnetic Recording Tape. Guaranteed Brand New, Polythene sealed, and supplied in Plain White Boxes.

TYPE	DESCRIPTION	LIST PRICE	ONE	THREE	SIX
LGS.35	900' Long Play on 5" Reel	29/1	19/6	57/-	111/-
LGS.35	1200' Long Play on 5¾" Reel	36/4	24/6	71/-	137/-
LGS.35	1800' Long Play on 7" Reel	51/6	35/-	102/-	198/-
LGS.26	1800' Double Play on 5¾" Reel	56/4	38/6	112/6	219/-
LGS.26	2400' Double Play on 7" Reel	79/-	55/-	162/-	318/-

Post and Packing 2/6 — ORDERS OVER £3 POST FREE

KODAK TAPE—30% OFF

Brand New, fully guaranteed and in normal manufacturer's pack. Superb quality polyester base tape for top performance. Complete with Full leader and stop Foil.

TYPE	DESCRIPTION	LIST PRICE	ONE	THREE	SIX
P.150/12	1200' Long Play on 5¾" reel	35/6	25/6	75/-	144/-
P.150/18	1800' Long Play on 7" reel	55/-	37/6	111/-	216/-
P.200/16	1650' Double Play on 5¾" reel	57/9	40/6	120/-	234/-

Post and Packing 2/6 — ORDERS OVER £3 POST FREE

AMPEX TAPE

Brand New. Fully Guaranteed, and in normal manufacturer's pack.

301 SERIES AUDIO TAPE (Mylar Base)

TYPE	DESCRIPTION	ONE	THREE	SIX
331-13	600' Standard Play 5" reel	16/6	48/-	93/-
331-15	1200' Standard Play 7" reel	27/6	81/-	156/-
341-13	900' Long Play 5" reel	19/6	57/-	111/-
341-15	1800' Long Play 7" reel	32/6	96/-	186/-
351-13	1200' Double Play 5" reel	31/6	93/-	180/-
351-15	2400' Double Play 7" reel	54/-	159/-	312/-

304 SERIES "LOW NOISE" AUDIO TAPE (Mylar Base)

344-13	900' Long Play 5" reel	24/6	72/-	140/-
344-15	1800' Long Play 7" reel	42/6	124/6	243/-

'600' SERIES PROFESSIONAL AUDIO TAPE (Mylar Base)

641-13	900' Long Play on 5" reel	23/-	67/6	129/-
641-15	1800' Long Play on 7" reel	39/6	115/6	225/-
651-13	1200' Double Play on 5" reel	34/6	101/-	196/-
651-15	2400' Double Play on 7" reel	60/-	177/-	348/-

Post and Packing 2/6 — ORDERS OVER £3 POST FREE

N.B.—Other types and sizes available including the inexpensive "White Box" series

PHILIPS

NOW FROM K J THE FULL RANGE OF

MUSICASSETTES

AVAILABLE BY RETURN POST

SEND FOR FREE CATALOGUE

TRIPLE PLAY TAPE – 40% OFF!

A large purchase from two world-renowned manufacturers enables us to make this unique near half-price offer. Brand new, fully guaranteed, premium grade Polyester Base Tape with FULL LEADER and stopfoil. In original maker's boxes and polythene wrapped at these EXCEPTIONALLY LOW PRICES.

	LIST PRICE	ONE	THREE	SIX
450' on 3" reel Gevasonor	22/-	14/-	40/6	78/-
600' on 3" reel Gevasonor	27/6	17/6	51/-	99/-
900' on 4" reel Gevasonor	39/-	24/6	72/-	140/-
1800' on 5" reel Gevasonor	66/-	41/6	122/-	238/-
2400' on 5¾" reel Zonal	90/-	55/6	165/-	324/-

Post and Packing 2/6 — ORDERS OVER £3 POST FREE

20% off all Grundig and Philips Equipment

SEND FOR LISTS OF OTHER TAPE AND HI-FI BARGAINS

K. J. ENTERPRISES, (Dept. TR), 17 THE BRIDGE, WEALDSTONE, MIDDLESEX (OPPOSITE HARROW & WEALDSTONE STATION)

01-427 0395 (CLOSED P.M. SAT.) — REFUND GUARANTEE

FREE

Our New Illustrated catalogue sent entirely free on request. Britain's most specialized comprehensive range of recording tape and accessories. 20,000 reels always in stock with reductions ranging up to 50%.

MORE FANTASTIC BARGAINS FROM K.J. ENTERPRISES

WE SAVE YOU MONEY!

SPECIAL CLEARANCE SALE

All Brand New, Guaranteed and Boxed in Manufacturers Carton

	Quantity	List Price	Our Price	Carr.
GRUNDIG TK.120 Tape Recorder	2	£33.2.10	£21.17.6	10/-
GRUNDIG TK.125 Tape Recorder	3	£50.9.6	£33.3.6	10/-
GRUNDIG TK.6L Tape Recorder	2	£76.13.0	£61.7.0	10/-
GRUNDIG Transonette 60A Transistor Radio	3	£17.17.0	£10.19.6	6/-
GRUNDIG Satellit 5000 Transistor Radio ...	1	£128.18.9	£105.10.0	15/-
PHILIPS 3572 (4304) Tape Recorder	6	£33.2.10	£21.17.6	10/-
PHILIPS 3575 Stereo Tape Recorder	2	£101.19.4	£69.0.0	15/-
PHILIPS 4408 Stereo Tape Recorder	3	£133.16.8	£89.0.0	20/
PHILIPS 3302 Portable Cassette Tape Recorder	6	£31.10.0	£24.3.0	7/6
PHILIPS 2600 Car Cassette Player	6	£26.7.1	£18.0.0	7/6
ELIZABETHAN LZ.612 Cassette Tape Recorder (In Teak Cabinet)	2	£47.5.0	£30.0.0	Collection only.
ARMSTRONG 223 AM/FM Tuner with Case ...	1	£34.19.0	£28.0.0	7/6
ARMSTRONG Case only for 224 Tuner ...	1	£3.10.0	£2.15.0	5/-
GARRARD A70 MkII Turntable	2	£23.0.0.	£14.0.0.	10/-
EAGLE SMX 52 Stereo Tuner Amplifier (5 x 5 watts)	1	£53.0.0	£42.0.0	10/-
EAGLE SA.100 Stereo Amplifier (5 x 5 watts)	3	£21.10.0	£16.4.0	6/-
EAGLE VTA.40 Stereo Transistor Amplifier (10 x 10 watts)	3	£44.10.0	£32.0.0	7/6

Phonoband Stereo Pre-Recorded Tapes at Pre-Budget Prices — Send for Free List of Titles Available.

Available Only While Stocks Last — SEND NOW.

SPEAKERS GALORE!

SAVE £6.10.0 on the SONOTONE SOLENT

The fabulous bookshelf speaker system designed and manufactured by Plessey, one of the country's largest electronics groups. Acoustically designed two-speaker system with crossover network.

ORIGINALLY SOLD FOR £18.0.0

NOW OFFERED AT £11-10-0d

CARRIAGE 10/- EXTRA PER UNIT

THIS OFFER REMAINS OPEN ONLY WHILE STOCKS LAST!

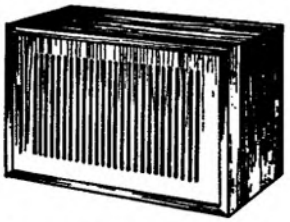
WHAT THE REVIEWERS SAID:

"Recommended without reservation for this category of Loudspeaker." David Phillips & Donald Aldous.

"Sonotone 'Solent' deserves to reach a wide public." John Borwick.

"A worthy member of the Hi-Fi family." R. L. West.

Technical Specification:
Cabinet Size 14" x 9" x 8½".
Woofer 6½", 10,000 Gauss, 1" pole.
Tweeter 3½" Acoustically loaded.
Frequency response 40—20,000 cps.
Power Handling 12 watts.
Impedance 8—15 Ohms.
Scandinavian style finish.



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K. J. ENTERPRISES (Dept. TR)
17 THE BRIDGE, WEALDSTONE, MIDDX.
Tel: 01-427 0395

3 superb NEW microphones added to the RESLO range

- ★ **Introduced at the A.P.A.E. March Exhibition and London Audio Fair 1968.**
- ★ **Developed to give the finer acoustical performance required today.**
- ★ **Reslo quality, reliability and precision engineering guaranteed.**
- ★ **British made.**

MPD 2

An inexpensive small omni-directional microphone for hand held use, weighing 2½oz. only. Frequency response: 200 c/s to 15 Kc/s ± 4dB ref. 1 Kc/s. Sensitivity: 58dB below 1V/dyne/cm² (High impedance)

RECOMMENDED RETAIL PRICE, complete with 18' of directly connected screened cable: Low impedance—

MPD 2/L (40 ohms)... ... ... **£5.10.0**

High impedance—MPD 2/H (50K ohms) **£6.10.0**

See us at the NORTHERN AUDIO FAIR SEPT. 20-22 HOTEL MAJESTIC, HARROGATE

SL1

High quality omni-directional slim line dynamic microphone for hand, or stand, use. Complete with remote universal selector unit, with bass reduction, impedance selector and phasing switches, input/output sockets and 30' of screened cable in presentation case.

Frequency response: 40 c/s to 17 Kc/s ± 3dB, ref. 1 Kc/s.

Sensitivity: (L-Z) 89dB below 1V/dyne/cm²

Recommended Retail Price: £29.10.0

Available October

UD1

An improved uni-directional high output hand, or stand, dynamic microphone (supercardioid) incorporating an internal anti-pop filter. Supplied in black presentation case and with 18' of directly screened cable. Frequency response: -10dB at 100 c/s and -4dB at 15 Kc/s ref. 1 K/cs. Well maintained over the range 100 c/s to 16 Kc/s. Sensitivity: (Hi-Z) 58dB below 1V/dyne/cm².

Recommended Retail Price:

UD1/L (50 or 600 ohms) **£19.10.0**

UD1/M (200-300 ohms) **£19.5.0**

UD1/H (High Impedance only)... ... **£19.10.0**

Reslo also manufacture a complete range of public address amplifiers, loudspeakers and the famous Chapman range of Hi Fi radio tuners.

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SPRING GARDENS, LONDON RD., ROMFORD, ESSEX.

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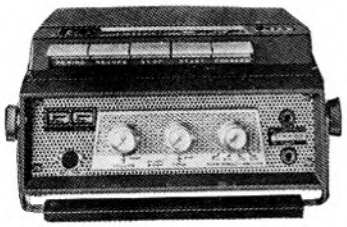
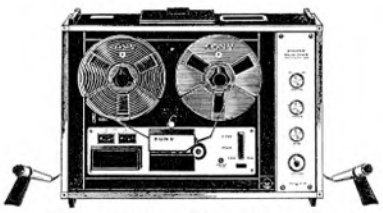
Tel.: **Romford** 61926 (3 lines). Telex: 25356



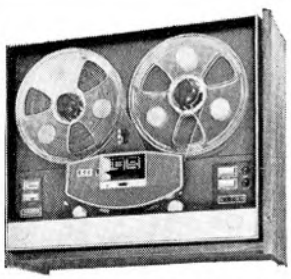
Akai X-IV Stereo Batt./Mains Tape Recorder. List price £169 7 11

Our price 129 gns.



Sony 260 Stereo Tape Recorder
List price £116 5 2

Our price £95.



Ampex 753 Stereo Tape Unit
List price £117 16 8

Our price 91 gns.

Akai 1710W Stereo Tape Recorder
List price £109 17 3

Our price £89 10 0

Don't miss this opportunity to choose from the biggest anywhere stock at pre-Budget prices !

Large stocks secured before the budget enable us to offer a wide selection still at pre-Budget prices, **but even our big stocks can't last for ever.** Make the most of the wide choice, come in and see them for yourself or write for lists now.

H.P. Terms available. Your deposit will be one third of our price, add one-tenth to the balance and divide by 12 for monthly payments.

The equipment shown here represents only a small selection from the wide range of superb machines we have available for immediate delivery.

SEND FOR LISTS NOW!

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(opposite Astoria Cinema)

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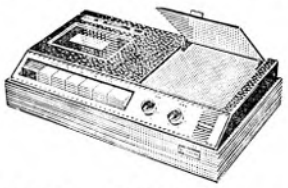


SAVE OVER £13

Magnificent Philips EL 3310 Mains-operated cassette tape recorder. 2-track, high-quality, slim-line model. List price £41 2 10; R.E.W's special price only 26 gns. or on interest free terms £9 2 0 deposit and 12 monthly payments of £1 10 4.

BUY NOW WHILE STOCKS LAST AT THIS PRICE !

Ferrograph 632 Stereo Tape Recorder
List price £163 3 9

Our price 126 gns.
Also model 634 at 132 gns. (list £170 18 0)

PHILIPS TAPE RECORDERS

Available at Pre-Budget Prices!

EL3302 Cassette Portable, current price £31.10.0 **OUR PRICE 23 gns.**

EL3312 Stereo Cassette, current price £66.19.0 **OUR PRICE 55 gns.** (includes 2 speakers).

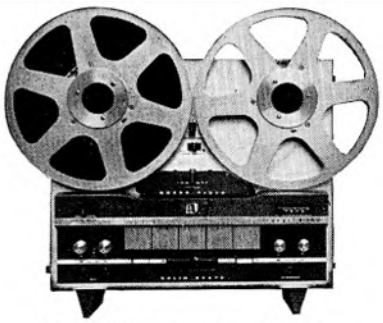
N4304 Mains 2-Track, current price £33.2.10 **OUR PRICE 26 gns.**

EL3303 de-luxe Cassette tape recorder, current price £37.5.9 **OUR PRICE 29 gns.**

N4306 Mains 4-Track, current price £56.1.8 **OUR PRICE 44 gns.**

EL3575 Stereo 4-Track, current price £101.19.4 **OUR PRICE 80 gns.**

N4408 Stereo Prof., current price £133.5.0 **OUR PRICE 105 gns.**



Akai X-300 Stereo Tape Recorder
List price £263 18 3

Our price 195 gns.

SANYO PORTABLES put you in the world class

Sanyo MR 120

Well styled mains/battery tape recorder giving an undistorted output of 1.8W. Frequency range 70-8000 c/s at $3\frac{3}{4}$ ips. 70-4000 c/s at $1\frac{7}{8}$ ips. Two track. Automatic level control or meter control. Tone control. Push buttons for easy operation. Remote control on microphone. AC bias, DC erasing. Ext. speaker socket. Radio input socket. This compact recorder measures $11\frac{1}{2}$" x 8" x 4" and weighs 8 lbs. Batteries 6 x U2. The 4" elliptical speaker gives a faithful reproduction.

Recommended selling price **£49.19.6.**

Even if you've a roomful of fixed hi-fi in your home, you'll still be impressed with the performance of these special SANYO portable radios and tape recorders. Everything about them is designed to give the highest possible performance within a reasonable compass of size and price.

For further information write to:

Sales Manager, Marubeni-Iida Co. Ltd, 164 Clapham Park Road, London SW4.

SANYO reliability is built in

Ferguson make 'more for

Model 3232

LOOK! a Ferguson stereo recorder with track transfer and 2nd channel monitoring.

This sophisticated 3-speed ¼-track Stereo Tape Recorder is packed with special features – much more than you could expect for the money. It has 7" reels and accommodates standard pre-recorded tapes. Employing all transistor circuits it is, in effect, two recorders and replay amplifiers independently controllable and integrated to provide stereophonic recording and reproduction. Housed in an attractive teak veneered cabinet with transparent lid.

• Twin all transistor amplifiers • 3 speeds, 7" spools play up to 17 hours on double play tape (mono) • Automatic end of tape stops • Clutched dual concentric controls • Input mixing facilities • Latching pause control • Calibrated meter record indicators • Monitoring while recording on built-in speakers • Track transfer on mono • Second channel monitoring • Comprehensive input and output sockets • Suitable extension loudspeaker available • Supplied complete with two dynamic microphones, reel of tape (1200'), take-up spool and connecting leads.

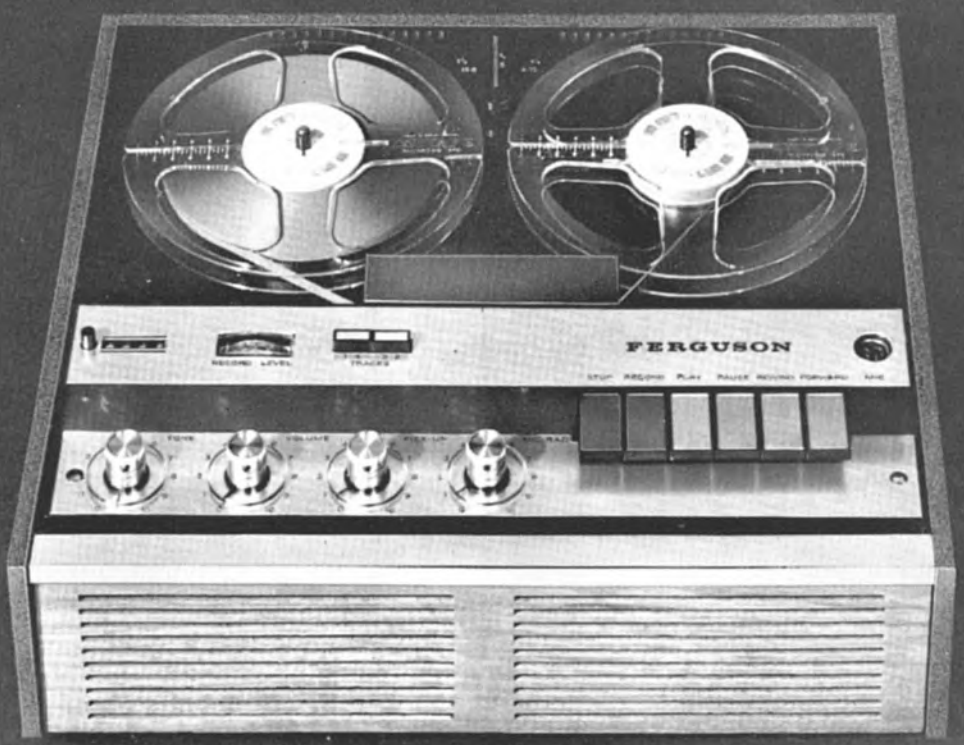
Model 3232–**£91.13s.**

LOOK! a Ferguson mono tape recorder with 3 speeds and input mixing.

Outstanding value is offered by this 3-speed 4-track mono Tape Recorder. With 3-Watts audio output on speech and music, interlocking controls that prevent accidental 'wiping' of tapes, a metal foil operated automatic stop and a solenoid operated remote pause control. The unit incorporates a new symmetrical motor with low hum field and extensive signal head shielding reduces mains hum to minimum. The cabinet is attractively veneered in teak with a transparent lid.

Model 3216–**£64.19s.**

your money' tape recorders



Model 3238

LOOK! a new Ferguson portable tape recorder.

A 3-speed, 4-track Tape Recorder with 7" spools, presented in black leathercloth with a teak-veneered loudspeaker grille. A removable cover at the rear provides access to input and output sockets, storage space for mains lead and microphone, etc.

• Four tracks, 3 speeds, 7" spools play up to 17 hours on double play tape • Automatic end of tape stop • Input mixing controls • Remote control from microphone • Latching pause control • Double track replay • Monitoring while recording • Meter record level indicator • 4-digit, push-button position indicator • Graduated dials on rotary controls • Tape editing index • Comprehensive input and output sockets • Powered socket for accessories • Microphone with remote control switch • 1200 ft LP tape, take-up spool and connecting lead included.

Model 3238 - **£58.11s.**

A wide range of accessories are available for all Ferguson Tape Recorders.

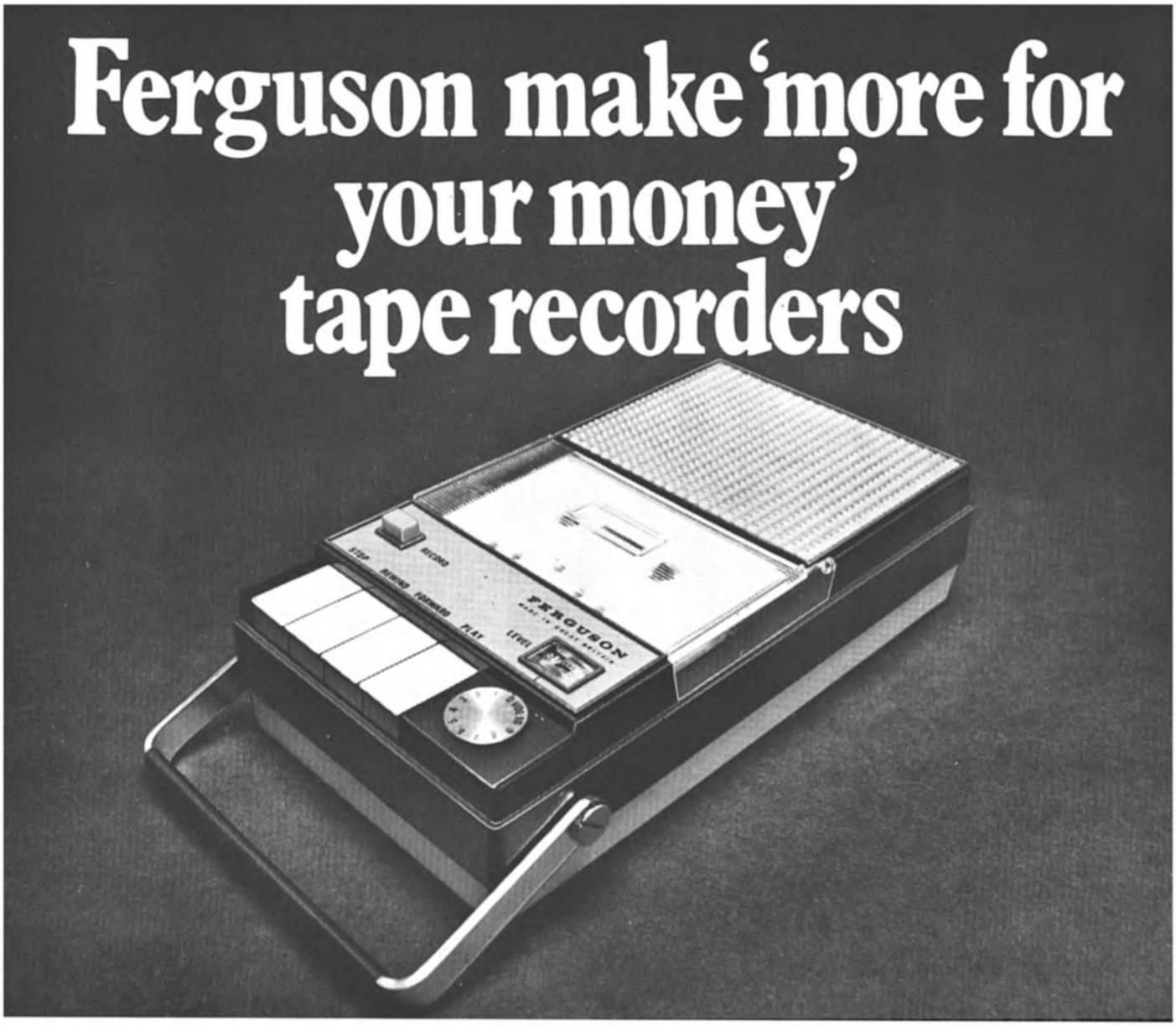
To: British Radio Corporation Ltd.
284 Southbury Road, Enfield, Middlesex
Please send me your free full-colour fact-filled leaflets about Ferguson Tape Recorders.

Name_____
BLOCK CAPITALS PLEASE
Address_____

THORN British Radio Corporation is a member of The Thorn Group T.21.

Fine! It's a FERGUSON

Ferguson make 'more for your money' tape recorders



LOOK! a superb compact Ferguson Cassette Recorder

This Ferguson Cassette Recorder is the enthusiasts sketch-book and enables you to pick up material for transfer later to the tapes in your library. It is housed in a cabinet moulded from high impact material in black, contrasted with light grey and has a silver coloured metal grille. This machine is battery powered utilising the new instant loading 'Compact Cassette'. It may also be used to reproduce 'Musicassette' pre-recorded tapes monophonically. It has simple piano type keys for tape motion control and a dynamic microphone with remote stop/start control. It is powered by 5 HP 11 type cells and a socket is provided for external power supply. The dimensions of this recorder are: Length 8⅞", width 5", depth 2⅛" and it weighs only 3¾ lbs.

Model 3236 **£26.14s.**

- *Moulded black cabinet with light grey contrast and silver coloured metal grille.*
- *Ideal for indoor and outdoor use and as a dictating machine.*
- *Simple piano keys for tape motion control.*
- *Dynamic microphone with remote stop/start control.*
- *The instant loading 'Compact Cassette' of tape provided, plays for one hour.*
- *Meter level and battery condition indicator.*
- *Will reproduce 'Musicassettes'.*
- *Operates on five HP 11 batteries or external power supply.*
- *Comprehensive input/output socket.*
- *Supplied complete with remote control microphone, cassette of tape, radio connecting lead and muting plug.*

Fine! It's a FERGUSON

THORN British Radio Corporation is a Member of The Thorn Group.

tape recorder

OCTOBER 1968 VOLUME 10 NUMBER 10

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SOUND AND CINE

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COVER PICTURE

Video tape recording, the hobby of the future. This opinion, shared by many of today's audio recording enthusiasts, has been taken up by the Kensington department store *Harrods*. An £890 Philips VTR, a £230 camera, a £120 monitor, a £19 microphone, a £20 tape, and you're away.

SUBSCRIPTION RATES

Annual subscription rates to *Tape Recorder* and its associated journal *Hi-Fi News* are 36s. and 41s. respectively. Overseas subscriptions are 38s. 6d. (U.S.A. $4.60) for *Tape Recorder* and 42s. 6d. (U.S.A. $5.10) for *Hi-Fi News*, from Link House Publications Ltd., Dingwall Avenue, Croydon CR9 2TA.

Tape Recorder is published on the 14th of the preceding month unless that date falls on a Sunday, when it appears on the Saturday.

LAST MONTH IN this column we aired our opinion that cassettes had failed to present a practical alternative to conventional magnetic tape. This situation appears also to apply in the United States, where competition between rival cassette systems has reached the chaotic level long ago predicted by pessimistic pundits. As Edward Tatnall Canby points out on page 467, little if any of the cassette and cartridge equipment now marketed in the States is actually manufactured there. A good sign, we feel, for the American audio industry has never been interested in toys.

A great profusion of elaborate semi-domestic tape recorders is produced by American companies, either in the *USA* itself or under licence in the Far East, though very few find their way to the *UK*. Ampex have sold here for years but who else manages to cross the Atlantic? Crown International are represented here, obscurely, and then there's that other firm in Salisbury, memory fails, no reference in yearbooks—obscure indeed. The list of little-known or unknown American recorder manufacturers seems endless — Schafer, Scully, *MRC* and Gauss are major producers in their own land but not generally known here. Price, we suppose, is the reason for the Great American Non-Invasion. Even before devaluation and the budget, imports from the *USA* were uncompetitively priced against Anglo-European wares, whether recorders, organs, cars or anything else. The Japanese have found a profitable demand for £250+ domestic tape recorders in Britain so perhaps it is mere apathy that precludes American manufacturers from capitalising on this nation's philanthropists. We were intrigued to learn of an American corporation turning down as "too small" an order (Japanese) for a fleet of aircraft. The beginning of the end?

Referring to a not-so-recent review, H. W. Hellyer emphasises again, on page 454, that praiseworthy performance of a new tape recorder is no guide whatever to long term reliability. Aware that the Family Mind still regards £30 as a fair starting point for a mains tape recorder, manufacturers will inevitably whittle down their cheapest models to absorb purchase tax. Philips are the experts at this game and Telefunken have lately made brave efforts in the same direction. The temptation to reduce motor power, make components lighter and tensions slacker, is creating a situation where a bad splice—once the cause of 'mere' wow—will now bring the tape to an absolute halt. Philips and Telefunken recognise the danger and do not yet suffer it but other manufacturers have been less careful. Badly slit tape, arguing with indented guides, can slow even the fat Papst in a Revox *736*.

Battery recorders are similarly prone to transport failure when subjected to splices —good, bad or indifferent—or to cheap tape. Current conservation is the main reason for low-power drives in portable recorders, which is why the better models are consistently heavy on batteries. A major danger with portable power which we managed to overlook until, while absent on holiday, it happened to us, is that of corrosion. The term 'leakproof' *should not* be taken seriously but the physical isolation of battery compartment from recorder-proper *should*. Many plastics currently in use are acid-proof to a high degree, though electrical contacts and springs are not. Total isolation from mechanism and circuitry is within the capabilities of any designer but, in our experience, the battery compartment seems often to be treated as an after-thought.

This comment, like most of those raised in our field trials, is aimed at the *designer* rather than the user. Operating convenience, facilities, even robustness, are not so important in themselves to justify one recorder against another. Recording quality is the main criterion upon which a purchase should be judged. If this is poor, no other factor will redeem a machine. What criticism remains should be thrown at whoever will be responsible for the *Mark Two*.

FEATURE ARTICLES

REGULAR ITEMS

EQUIPMENT REVIEWS

EMITAPE is not just the finest recording tape backed by the world's largest recording company....

EMITAPE is also *completely* British manufactured.

EMI's exacting quality control ensures that you get perfect, clean recording results every time – there are four grades of Emitape in five reel sizes to suit all recording requirements.
And you have the satisfaction of knowing you're backing Britain by buying an all-British manufactured recording tape.
Don't buy any tape – buy EMITAPE

EMI

An EMI group product
EMI TAPE LIMITED, HAYES, MIDDLESEX, ENGLAND

ANOTHER YEAR OF HI-FI

LATEST edition of Imhofs' annual catalogue *This Year of Hi-Fi* is now available at 2s. 6d. The 1968/69 publication has been entirely revised and contains an up-to-date list of post-budget tape recorder prices. Headphones, microphones, amplifiers, loudspeakers, equipment cabinets, tuners, pickups, turntables and even television receivers are listed, with illustrations and specifications. This is the first occasion that Imhofs have felt the need to charge for their catalogue but a £1 voucher is included, valid on any purchase over £20. Copies are obtainable from **Imhofs, 112-116 New Oxford Street, London W.C.1.** There is no charge to overseas readers.

FERROGRAPH CHANGES

FORMER Deputy Director of Engineering at the BBC, M. J. L. Pulling, has been appointed Chairman of the Ferrograph Company Ltd. in succession to R. W. Merrick. Mr. Merrick remains a member of the Ferrograph Board as Director in charge of Commercial Affairs. Ferrograph recently became a wholly-owned subsidiary of Wilmot Breeden (Holdings) Ltd.

DOWN AGAIN

PRICES of Bang and Olufsen tape recorders have been reduced by Technomark, bringing overall post-budget increases into closer line with their competitors. The *2000K*, £131 5s. before and £177 10s. after the budget, is now £155 10s. Model *2000T*, originally £135 9s. and later £183 15s., is now £162. First marketed at £101 17s., the *1500* rose to £134 15s. but is now £122 10s. Lastly, the £72 9s. *1100K* falls from its recent £98 to £85. The price reductions took effect during July.

BATRIC '68

FOLLOWING last year's successful event, the British Amateur Tape Recording Contest will follow a similar pattern for 1968/69, with seven entry classes and the possibility, for any competitor, of producing the 'tape of the year'. The categories are: *Speech and Drama*, *Documentary*, *Music*, *Reportage*, *Technical Experiment*, *Schools* and *Home Sweet Home*, this last being a 'set subject' for those who prefer the challenge of a given idea. Closing date for the event will be 31st January 1969, results to be announced and prizes presented at next year's Audio Festival and Fair in London. Entry forms are available from this office or from the Secretary, *33 Fairlawnes, Maldon Road, Wallington, Surrey*.

The Contest's organising committee comprises Cyril Rex-Hassan (Audio Fair organiser) as Chairman, Brenda Marriott (Grundig) as Vice-Chairman and Hon. Treasurer, John Bradley (FBTRC) as Secretary, with Donald Aldous (Audio Record Review), John Borwick (The Gramophone), Douglas Brown (Tape Recording Magazine), John Crabbe (Tape Recorder and Hi-Fi News) and F. C. Judd. Preliminary judging of entries under category headings will be the responsibility of this committee, with final selection of the *Tape of the Year* from the section winners to be made by a team of celebrities, as in 1967/68.

CREATIVE RECORDING AT HIGHBURY

A SERIES of 12 practical classes concerning Creative Tape Recording commences on Thursday 26th September at the *William Tyndale School, Upper Street, London N.1.* Recording from audio equipment, the merits of different microphones, servicing, script-writing, sound effects, making and recording music, interviewing, mixing, and the application of ancillary equipment will be among an ambitious programme set by Mr. T. Devereux. Classes are from 7 to 9 p.m., weekly, the course fee being 17s. 6d. Further details may be obtained by contacting **Highbury Manor Adult Education Institute (01-837-2583), Starcross School, Risinghill Street, London N.1.**

TEAC DISTRIBUTION

FORMERLY represented by C. E. Hammond, the Japanese Teac Corporation have appointed *B. H. Morris & Co. (Radio) Ltd., 84-88 Nelson Street, London E.1 (01-790-4824)* as their UK distributors. The Morris company is closely linked with the Tottenham Court Road retailer Laskys but will be operating through various audio dealers.

LONDON MICROPHONES

MICROPHONES and accessories produced by the London Microphone Co. are now available through the STC company *Electroniques, Edinburgh Way, Harlow, Essex (Tel. Harlow 26777)*. Existing distribution arrangements will continue. Electroniques have also been appointed to handle Kangol *Timac* time switches.

NEW NAGRA AT THE IBC

THE long awaited *Nagra 4* professional battery recorder will appear for the first time before the European public at the *Grosvenor House Hotel, London W.1*, on September 9th. The *International Broadcasting Convention* continues there until Friday 13th. Smaller, lighter, more versatile, and technically superior to the existing *Nagra 3*, the new recorder operates at 38, 19 and 9.5 cm/s with ±0.04% wow and flutter (to DIN 45 507) at the fastest speed. A tachometer system is again employed to achieve 0.1% speed stability between —4°F and +160°F (standard model). The capstan is now located between end bearings. Several protection circuits are incorporated to guard against motor overload and accidental shorts. The AGC now derives its control voltage from two sources, the first with a short time constant to follow transients and the second to ensure natural decay; the two function simultaneously.

A "new recording process" is employed to reduce distortion, 0.8± being claimed at =4dB recording level (1 kHz). Signal-to-noise ratio is 73 dB (*Scotch 202*). A more powerful low-distortion oscillator is fitted, bias level being adjustable through a screwdriver preset. The new dimensions: 11 lb. 9 oz., 31.8 x 22.3 x 10.8 cm.

A fully operational 1,300 sq. ft. colour television studio will be exhibited by EMI, manned by Thames Television. Central feature will be the improved *2001* four-tube separate luminance camera. A new video tape will be demonstrated though no surprises are expected in the way of audio recorders—the *BTR4* and *L4* will be on show.

Another exhibitor, Daystrom, will display their range of *Heathkit* test instruments.

THIS ENGLAND SOUND

FOG sirens on the Thames, the sound of the Lowestoft herring market, clogs on a cobbled Lancashire street, the bells of a village church, windmills clanking, London's rush hour, snippets of regional conversation: examples of recordings required by the publisher of *This England* for potential inclusion on an LP gramophone record. Well equipped amateurs and professionals are invited to submit tapes of this nature with supporting information from which a linking narration could be prepared. Accepted recordings will be paid for. The project is being organised by **R. C. F. Faiers, Editor, This England, Barclays Bank Chambers, Victoria Street, Grimsby, Lincolnshire.**

FIRST BULGARIAN PORTABLE

BULGARIA'S first transistor domestic tape recorder, the Rilaphone *MK-10*, will be in production before the end of 1968. Developed by the *Designing Institute of Radio Electronics*, Sofia, in conjunction with the French *Remap* company, the *MK-10* operates at 9.5 cm/s, ¼-track. The 35.5 x 26.5 x 13.8 cm cabinet is of wood, total weight being some 16 lb. (8.5 Kg.). Power is from 220 or 110 v supplies.

SABA SERVICING

SERVICE agents have been appointed to handle equipment marketed in the UK by Saba, of West Germany. Gregg Radio Ltd. will operate from *11 Alexandra Road, Hemel Hempstead, Hertfordshire (Tel. Hemel Hempstead 3915)*. London clients may alternatively contact the company's head office at *88-98 College Road, Harrow, Middlesex (Tel. Harrow 4556)*.

NEXT MONTH

A VARIABLE SPEED tape drive will be described for constructors in our November issue, to be published on Monday 14th October. Designed by F. C. Judd, it provides a variable-frequency power supply to suit synchronous and hysteresis synchronous capstan motors. The stereo Ferguson will be reviewed.

THE THEORY AND PRACTICE OF MAKING MULTI-TRACK MUSIC

BY PETER BASTIN

IT all started some years ago. The youngster, who was having his annual bath, had been listening all day to records of The Beatles. By bath-time, our heads were ringing with "yeahs", wild drumming, and other sounds associated with four kids plugged in to a power point. I went into my studio. I gazed at the electric guitar which we had bought for his lordship's last birthday (funny thing, he didn't really want to play; just stand and pose). I got an idea.

If, I said, I play this thing into a recorder then feed it into another recorder and add a bit more, it may be interesting. I hooked the thing up and played something about a shark having pretty teeth dear. I then went back to zero with the tape and hooked the recorder and the guitar to the other recorder. I strummed some discordant chords and played the whole thing back. The balance was appalling but there seemed to be some merit in what I was doing. I tried it again but this time, instead of playing chords, made drumming noises with my mouth. The result was very much better, so I added a bass by playing the bass string of the guitar. This was absolutely splendid and I ran shrieking through the house saying listen, listen to this marvellous bit of work. My wife looked as if the cooker had blown up and the youngster was so upset that he started to wash himself. And that was it. From then on this multi-track music has possessed me. My wife regards it as worse than an addiction to Pot and our son pretends not to notice. I suppose it is an addiction although, in my loftier moments, I regard it as a vocation or something.

I should hate to hear that first effort now. It must surely have been crude beyond belief for the simple reason that progress of any kind inevitably brings improvement. Anyway, I suppose I must have known at the time that it wasn't quite as good as it might be, for I devoted as much of my spare time as I could to improving it. And this article is an account of that progress—although some people may have an alternative word for it.

The first improvement necessary was the production of some form of basic rhythm. All multi-track music is subject to one great disadvantage—repeated dubbings play the very devil with quality and it is clearly desirable to reduce the number of tracks for that very reason. However, when I first started this lark, I was not very bright on the subject of dubbings and the first few recordings, done in tremendous zeal and enthusiasm, were dreadful in quality. I had produced a tape loop of a fairly reasonable fast rhythm, made by a zish-zish mouth noise simulating drums. I then added about four tracks of music. Consequently, the finished result was an excellent recording of the last track and an almost unintelligible mush of the first two. This was food for thought and, of course, led me to consider quality with a great deal more respect.

As time went on, I added more instruments to the set-up and, at the moment, I have an electric guitar, a glockenspiel (a sort of miniature vibraphone), a trumpet, an ocarina, a tambor, a recorder (which I can't play) and a miniature electronic organ. All these were acquired for the simple purpose of variation of tone colour. I found that the electric guitar was the most convenient of all instruments because of its ability to feed directly into the recorder instead of having to worry about extraneous noises filtering into a microphone. All my early tunes were basically guitar pieces; at first, rather dead-sounding which led to purchase, at bargain price, a reverberation unit. As a matter of interest, this thing broke and I took it in for repair four years ago. It still isn't back, but the dealer let me have another one *pro tem* which has now been part-exchanged for another! This present unit works on a revolving drum principle, the heads being spaced round the drum. It is absolutely silent as opposed to the usual motor-driven loop and gives a clean reverberation, although it is a little temperamental sometimes on hum and odd crackles.

Having investigated and experimented with levels, leads and speeds, my recordings were beginning to sound a little more professional and I started to add the other instruments. The trumpet was not really added, for I have always had one; it's just that I was chicken about playing it. I did try, but the results were a little more suited to 9.45 p.m. outside the Queen's Head. The glockenspiel came next, I think, and this proved to be a worthwhile acquisition. However, before you belt out and buy one, remember that its high transient notes can be the very devil to record. If the glockenspiel is used without the damper, the sustained clear notes tend to jumble up if your microphone is not placed just right. I started off by using a ribbon microphone but I found that the gain from the microphone was insufficient without sticking it almost up against the keys, which resulted in a slightly distorted sound. I tried my Grampian microphones but they were quite unsuitable so I bought a low impedance Beyer *M69*. This was superb and I use it almost exclusively for the glockenspiel. The microphone is on a boom and suspended about 15 in. (38 cm) above the instrument for damped playing. For open playing (no damper) I lift the microphone to about 2 ft. 6 in. (76 cm). Playing the glockenspiel through the reverberation chamber is not very successful, for you tend to get too much ring-a-ding noise.

So I could now produce music on guitar and glockenspiel. These are my two main instruments, the trumpet and other instruments being used infrequently as 'front line' or lead instruments. In point of fact, the trumpet is rather an easy instrument to record, either muted or open, especially with the Beyer microphone. I nearly always use it through the reverberation unit to give character to the sound. The ocarina, with its rather flute-like tone, is sometimes difficult because of peaks created by the higher-frequency notes. The tambor imitates bongoes, timpani or snare-drum, according to the recording speed employed. The mini-organ is a bit of a story on its own. I had the idea of using an electronic organ but couldn't manage to steal the £300 or so necessary, so I decided to make one. I used a multivibrator, adding a vibrato unit and a transistorised amplifier. The whole thing was built into a 38 x 23 x 8 cm cabinet and is powered by a 9 v battery. It can play through its own 8 cm speaker or can be channelled through the reverberation unit into the recorder. The only drawback is that the keys are strips of metal and are activated by being pressed down against a contact. The contact is not always very positive and I never know whether I am going to get a note or not. It has tremendous power and is most effective if well-echoed. As it will not play chords, it functions entirely as a solo instrument.

I bought, for 7s. 6d., a sizzle cymbal from one of the youngster's friends and this, combined with tambor snare drum, tambor bongoes, and tambor timps, produces a lot of interesting rhythms. Bass is added by tuning down the bass string of the guitar and damping at the bridge. Loops can be prepared but, as I am the world's worst splicer of tape, the process of making rhythm loops—in itself very difficult—fills me with horror, rage and frustration. Nevertheless, I make the things. Rhythms which are too complex to loop, such as a complicated Latin American rhythm, are recorded on to a special "rhythms" tape. The only drawback with using a tape is that you have only a set period into which to get your

melody. A loop gives you endless time and you can start over and over again without having to do any rewinding. I have found that it is impracticable to add bass to the basic rhythms. The bass must follow the melody line and the rhythm as well, and the very telling four-in-a-bar emphasis cannot, of course, be pre-judged. This usually means that the bass track must be added after the melody has been stated.

Right, then, how do we go about it? Firstly, the rhythm has to be selected. This is played on Machine 1 into Machine 2 and the second-important instrument added. I say the second-important because, clearly, the most important instrument must be recorded last for quality's sake. So the premise is that the chords or broken accompaniment are recorded first. But this is not always possible. Nearly all my music is impromptu and I cannot add backing chords to something which does not yet exist. So I play my lead first. Where this happens, I only record a further two tracks—the figures and the bass, making three recordings in all, about as much as good quality will suffer. The glockenspiel always has to be recorded last as it will only accept being copied twice, and even then is rather borderline.

Multi-track music must be approached with caution. You must, in the first place, be a musician of sorts and you must, above all, have an ear for synchronisation. The whole art of multi-track music depends upon three basic factors—musicianship, perfect synchronisation and perfect balance. You have to be musician and recording engineer at the same time and this, sometimes, is no joke. A further factor to bear in mind is imagination. Multi-track music can be deadly dull if all it does is simulate a piano duet. To my mind, this sort of music should have a character all its own and some commercial discs which are released do nothing for me whatsoever: the material is merely an imitation of three or four people playing instruments. Technically excellent, of course, but somehow dead and lacking the brilliance of that veteran of multi-tracking Les Paul. But—and a very big but—considerable credit must go to the studio technicians behind the discs. For example, many commercial pop records are recorded track by track; the backing and rhythm are recorded first on Track 1, the lead instruments on Track 2, and the singers on Track 3 of a multi-channel machine. A dud track can thus be re-recorded without affecting any of the other tracks. The master recording, taken from a simultaneous playback of all three or more tracks could thus consist of a permutation of the best recordings on each of the separate tracks. As these machines take up to eight separate channels, running at 76 or 38 cm/s, you can see that quality is bound to win. Multiple dubbings just do not happen in the studios.

Some amateurs have been known to produce multi-track music on a four-track machine which records on one track while you listen to the other track. The term 'four track' applies only to the total number of tracks; I know of no non-professional machine which plays four tracks in one direction. I wish I did. The basic technical problems are associated with balance and freedom from hum and other noise. These must be ironed out before any serious work is started. It goes without saying that all equipment must be first class, heads clean and demagnetised. It is a good preliminary test to record something then play it back at above ordinary listening level. If you get a high noise level in the form of a hiss, try re-recording at a much higher gain. (You can very often exceed the 'distortion point' on the modulation meter without serious effects, especially if the 'over-modulated' signal is percussive. Pure musical notes should never be over-modulated.) Any excessive noise increases as the number of dubbings increase and if you dub more than four or five times the hiss becomes so apparent that the recording is ruined. I have had this problem with five-track recordings and I have often solved it by adding yet a further track of a rolling cymbal beat which swishes itself over the hiss. But this is a course not to be recommended for the simple reason that the addition of another track reduces the fidelity of the main material.

Choice of instrumentation is important. However, if the recording is to be of Uncle Charlie playing *Roll Out the Barrel* with himself on the piano, the problem is no problem. Whatever happens, it will be Uncle Charlie playing *Roll Out the Barrel;* a recording of a tune played on an instrument. If the material is to be character music—that is music with a difference—the choice of tone-colour is of paramount importance. If, for example, the brief is a piece of music for a thriller series, such as *Danger Man*, the music must be played or scored for an instrument or instruments which prepare the listener for what is to come. It's no good recording Uncle Charlie at the piano for *Danger Man*. The music must promise mystery and danger and the use of a highly-reverberated bass guitar might well do the track. Again, music for a lighthearted comedy could be provided by a frisky flute, a galloping glockenspiel or a pizzicato piano (not Uncle Charlie). On the other hand, unusual instruments can be used. An electric guitar, unamplified and played in chords close to a microphone, through an echo chamber and replayed at twice the recording speed, can produce quite an acceptable harpsichord. A guitar string attached to a microphone stand, tensioned and plucked, can produce a most satisfying thunking noise. A roll of toilet paper between hammers and strings on a piano, a child's piano, glasses filled with water, and a kazoo are all acceptable means to an end. I once recorded a piece against a rhythm loop employing only mouth noises—hisses, grunts, quacks, squirks, plops and clicks, together with an occasional clunk from a salad bowl. Recorded through an echo chamber and replayed at double speed, it is quite effective and rejoices in the name of *Sidney's Carburretor*. Anything is game in the multi-track business. You can, for example, record a single note at three separate speeds, chop out bits and stick them together and it's quite amazing what you get. Mind you, if you start on this lark, you will be cutting and glueing together bits of tape for a week, all to produce 90 seconds of queer stuff.

Procedure is the single most important thing in multi-tracking. You must decide upon the *effect* you want. In deciding that, you will almost certainly have decided upon your instrumentation because the two go together. Visualising the finished effect will help you to not only decide upon instrumentation but upon tempo. The only thing remaining in the project stage is arrangement. In this respect, you may either be a natural impromptu man who can make his arrangements as he goes along or you may be a purist who requires to score the material. Fortunately, I am an impromptu man although there are occasions when it is necessary to score the whole thing out. This is especially necessary if you are preparing a five or more track piece where it is essential that there are proper harmonies and/or descants. The score may be thoroughly musical or may be a diagrammatic thing which indicates starting, rest and closing sequences. The question to score or not to score rests with the performer; only he, as performer and engineer, can judge his capabilities in this direction. On the other hand, the piece may be a straight performance of a standard musical work, performed by one person on, say, piano, violin and cello. This clearly calls for a score and a great deal of attention to balance and acoustics. In point of fact, this sort of multi-tracking is a great deal easier than the sort of stuff I do, which calls for considerable concentration in the realms of composition, arrangement and recording technique. Multi-tracking of this latter nature calls for a great deal of experience in all branches of recording and I would respectfully suggest to all optimists in this direction that they should learn to walk before they run.

I am afraid that there is no easy formula to successful multi-tracking. It is all a matter of experience, imagination and skill, and if you are defective in any of these, do not attempt the 'creative' type of multi-track work until you have gained those skills. My advice to anyone interested in this most fascinating aspect of recording is to try multi-tracking a friend who can play one or more instruments: he will gain enormous experience in the field of balance and acoustics, especially if, after what he considers to be a spiffing recording, he listens to the piece recorded professionally by a group of musicians. The other type of multi-tracking—the creative kind—is a subject and technique all on its own and very little advice can be offered to the beginner except try, try, try again. It is, at the same time, an exciting, exhausting and sometimes frustrating art, but one worth pursuing. It also, I may add, costs money.

My wife, a self-confessed unmusical (but I *do* know what I like), offers excellent criticism when she is asked to lend an ear to one of my latest Things. She makes some comment which makes me as mad as hell, but she is always right. Or nearly always. I did a piece for television once. Took hours and when I played it to her she said "Ooh, there's a very sour note there". It was a poor little note, hidden away, an inoffensive little note that meant no harm to anyone, but she spotted it. I didn't eat any of her blasted cakes for two days after that. My son thinks that everything which does not appear on a Monkees or Hendrix disc missed the Ark. One must try to ignore the untutored remarks of one's family; after all, they do hear the stuff over and over again and what may sound like Ted Heath or the London Philharmonic to you sounds like Revolution Day at Whipsnade to them. Or so they say.

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A MINIATURE ELECTRONIC ORGAN

BY F. C. JUDD

PART TWO

THE first part of this article gave the full circuit and other details for the construction of a simple single note (monophonic—in the strictest non-audio sense) keyboard organ with a choice of four voices and vibrato. The addition of an octave divider which will reduce the pitch of the 2.5 octave range by one complete octave calls only for a two transistor bistable divider circuit and a suitable power supply. In addition, 'octave coupling' can be provided with a little extra circuitry. Octave coupling allows the divided frequency and the original to be played together thereby giving the effect of two notes in octave unison.

Before going on to describe the divider, some notes on the oscilloscope waveforms in the accompanying photographs may be of some use to those who are contemplating building the organ. **Fig. 1** shows the square-wave output from the master oscillator with an amplitude of approximately 1 v p-p. When this keying amplifier is triggered, a large pulse forms across L1 providing an output of approximately 8 v p-p which is sufficient to allow for the insertion losses of the tone forming networks and to drive the frequency divider circuit of **fig. 7** in this article. **Figs. 3, 4, 5** and **6** show the waveforms for the various voices. The amplitude at the output socket (from Vr38) via R26 and C17 will be averagely 500 mv except for the 'brass' voice signal which by itself is a spiked waveform and peaks to around 750 mv.

The **fig. 7** circuit is a typical bistable Eccles-Jordan arrangement and is similar to the familiar flip-flop circuit except that both sides are resistively cross coupled and both are stable. The circuit will therefore *not* oscillate by itself and will only change one stable state to another when a trigger pulse is applied. This makes it ideally suitable for frequency dividing and is commonly used in electronic organs for

(*continued on page 453*)

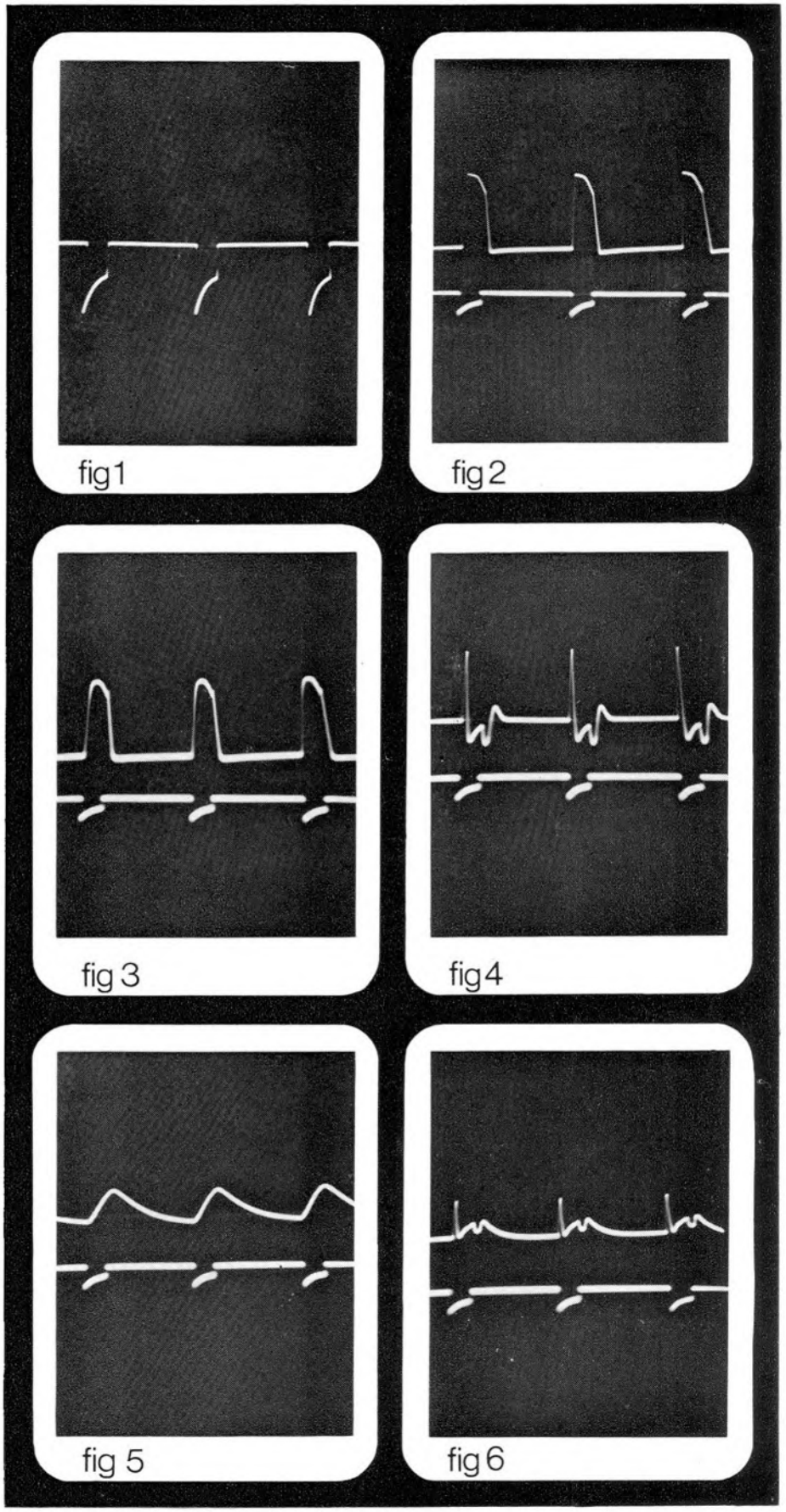

Fig. 1 Master oscillator output at junction of R14, R15 and C9 (fig. 1 of last month).

Fig. 2 Lower trace shows waveform at base of Tr4. Upper trace is from collector.

Fig. 3 Upper trace shows output at Vr38 with reed switch closed. Lower is at the input to the keying amplifier.

Fig. 4 'Brass' waveform at Vr38.

Fig. 5 'Flute' waveform at Vr38.

Fig. 6 Mixture of 'flute' and 'brass'.

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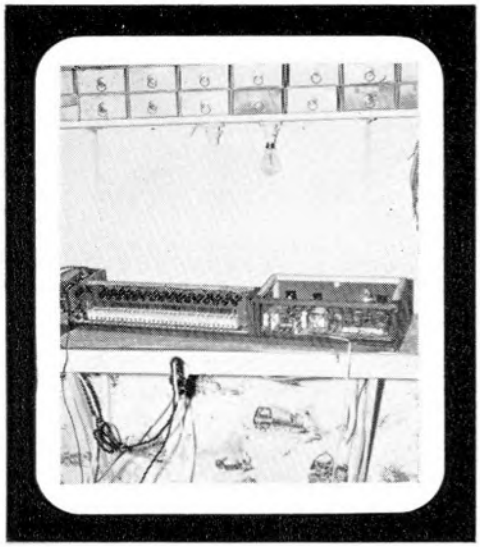


Fig. 9 Interior of completed organ with divider/coupler and its power supply.

this purpose. It requires two voltage supplies, one at 9 v negative with respect to earth and one at 1.5 and 2 v positive with respect to earth. A small separate power supply is therefore required. *This unit cannot be run from the existing power unit as described in Part 1* but could be run from batteries. The circuit for a suitable power unit is given in **fig. 8.**

Octave coupling is quite simple and involves mixing signals from the master oscillator at original frequency in the right proportion to those from the octave divider. The necessary mixing and switching network is included in **fig. 7** which also takes in the alteration to the original circuitry of fig. 1 last month. The output from Tr3, the keying transistor, is taken direct to the input of the divider via a change-over switch. The output from the divider is coupled directly to the tone forming network.

No alteration to the tone forming network has been thought worthwhile since the octave lower pitch now available, and the octave coupling, provides in itself the effect of more voices.

The power supply may present a little problem as I had difficulty in finding a transformer to provide 10 to 12 v plus a separate 3 v windings. Eventually a transformer with a 230 v primary and a 15 v secondary was stripped and rewound with two separate windings for the required voltages. The 9 v negative supply could of course be a duplicate of the one recommended for the original circuit and the 1.5 to 2 v supply could be obtained from a centre-tapped 6 v secondary (230 v mains to 6 v). Small mains transformers with a single 6 v secondary are available from component dealers such as *Henry's Radio, 303 Edgware Road, London W.2.* The components for the divider, with the exception of the Mullard transistors, can be obtained from *Electroniques (STC) Limited, Edinburgh Way, Harlow, Essex,* (see Part 1 regarding ordering from their catalogue). As before, the components for the divider can be assembled on Electroniques General Purpose Wiring Board made by Veroboard.

The divider board and its power supply could be housed in a compartment built beneath the original design or in an extension compartment as shown in Part 1. The actual internal layout of the version shown in Part 1 is shown here in **fig. 9.** The extra switches for the octave divider and coupling should, of course, be mounted along with the voice and vibrato switches on the front panel. The fairly long wires between the keying amplifier and the divider do not require screening but should not be run close to power supply transformers. In the writer's finished version, as in Part 1, a small 6 v transformer was also included to run a pilot lamp but make sure that leads carrying mains or other alternating voltages do not run near the circuit wiring of the organ.

In conclusion, this small monophonic organ has been used consistently as an 'extra voice' unit with a Lowrey Hilton two manual electronic organ for normal playing and for multi-track recording. It maintains its tuning well and, as the voices are pleasingly contrasting, it would also sound well with a piano. If it is desired to multi-track the various voices, there is no reason why a further divider should not be included to provide an additional bass voice.

FIG. 7 OCTAVE DIVIDER AND COUPLING CIRCUIT

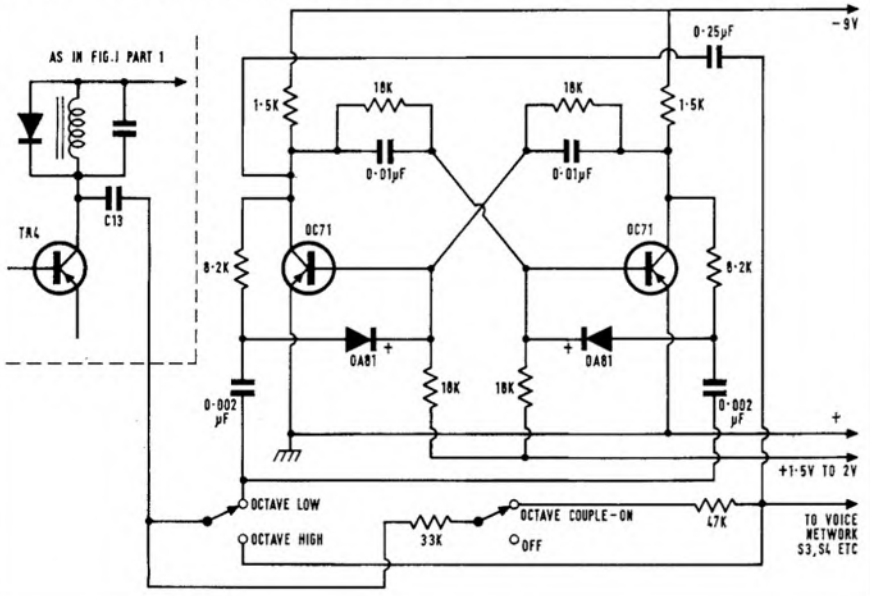
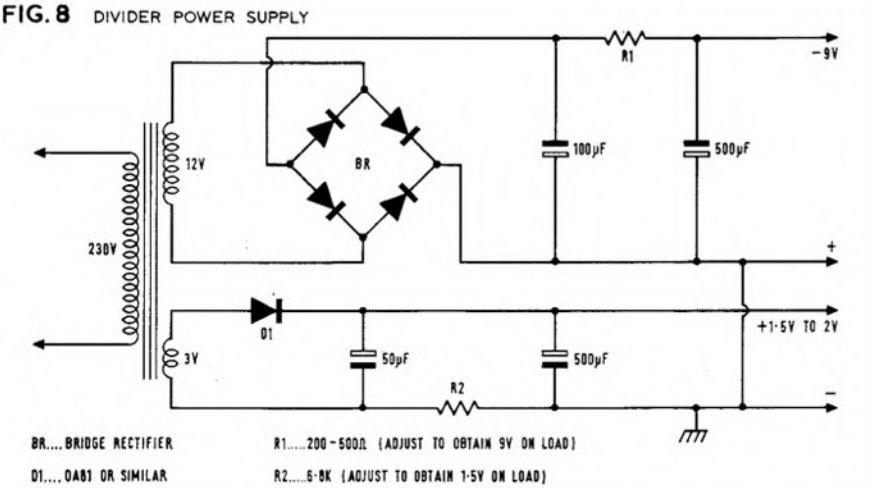
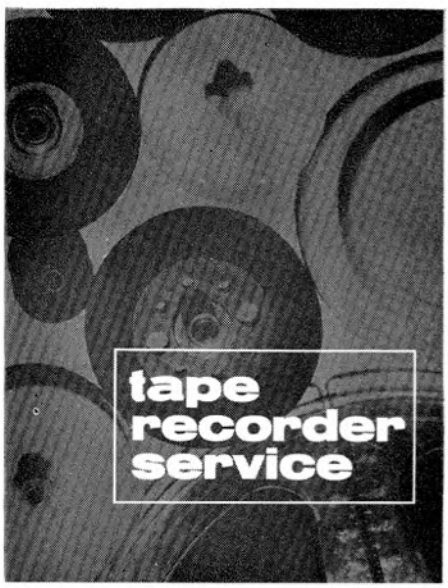


FIG. 8 DIVIDER POWER SUPPLY





GRUNDIG TK120, TK125, TK140 AND TK145

BY H. W. HELLYER

IN his August 1968 review, Mr. Tutchings dealt with the Grundig *TK145*, and stymied your humble contributor, who was halfway through collecting data towards this present look at the servicing aspect of the group of machines of which this is the final refinement. In saying that the *145* was ". . . a near perfect specimen of a good quality general purpose domestic recorder" our boffin spikes this critic's guns. If so perfect, why bother talking about service: surely it must never go wrong?

Well, let us exculpate ourselves by referring to Mr. T's qualifications "good quality . . . general purpose . . . domestic . . ."—what do they mean? In the terms of a copywriter, they mean about as much as the charming young German lady with the Telefunken *300* on the cover of the same issue. But used by one who can, when necessary, be a stern castigator, the words must mean that this is a machine worth its price and capable of fulfilling its specification. I'll go along with that.

I will not go along with the implied praise of the Easy-G control. Wild-west indeed! Any attempt to switch from function to function a bit rapidly is inclined to produce results of truly maverick effect.

This is not to say that the best test of a tape recorder is its misuse. Perhaps it admits a failing on my part—a prejudice against any control that has to go through one function to get to another. This is one of the prime complaints I have had against Akai machines, and one of the few drawbacks that one can legitimately level against Sony; happily overcome in the latest machine from this stable. The complaint arises from one's experience of breakdowns, many of which are incurred by sheer mishandling. Manufacturers will one day begin to understand that not all their products are to be used by hyper-capable enthusiasts.

Having said all this, I shall have to justify my remarks by dealing at greater length than usual with the mechanics of these machines, leaving the circuitry to speak for itself—which it can well do, being quite free of gimmicks and as reliable as is usual with Grundig electronics. In fact—let me tell you a story! I have recently returned from a weekend of pleasure-cum-business with a well-known Editor of a technical magazine. Having handled almost as many machines as some of us are able to in the course of business, he might have been expected to have built into his own studio-type cabinet the cream of the country's offerings (we all know how filthy rich these Editors are!). Consequently, I chipped him somewhat on discovering he relied upon a Grundig *TM45* for some quite elaborate taping. His reply was a classic: "Just so long as I can get all the technical information I want by return of post, or direct advice from someone who knows what he is talking about at the end of a telephone, plus the knowledge that accredited dealers really have been vetted for service facilities, plus willing and immediate factory service, I shall be happy to stick to my Grundig". Maybe if he reads Mr. Tutchings' review and this article, he may be constrained to give them a little more business by adding the *TK145* to his collection!

So, to spare Mr. Paul Spring's blushes, down to business. Of this group of four machines, the *TK120* and *TK140* are ½-track, the *TK125* and *TK145* four-track. The *TK120* and *TK140* are straightforward machines, and the '*5*' suffix appears to denote the extra facility of automatic recording, plus the synchronous function and trick recording that a ¼-track machine with auto-manual functions has as a matter of course. Our given circuit (**fig. 1**) is of the *TK145*, being the most complicated machine; but there is such a complete difference in practical circuitry between this model and the *TK120* that **fig. 2** becomes necessary to describe the original machine. I apologise for this method, but a desire to get at the mechanism makes such compression a necessity.

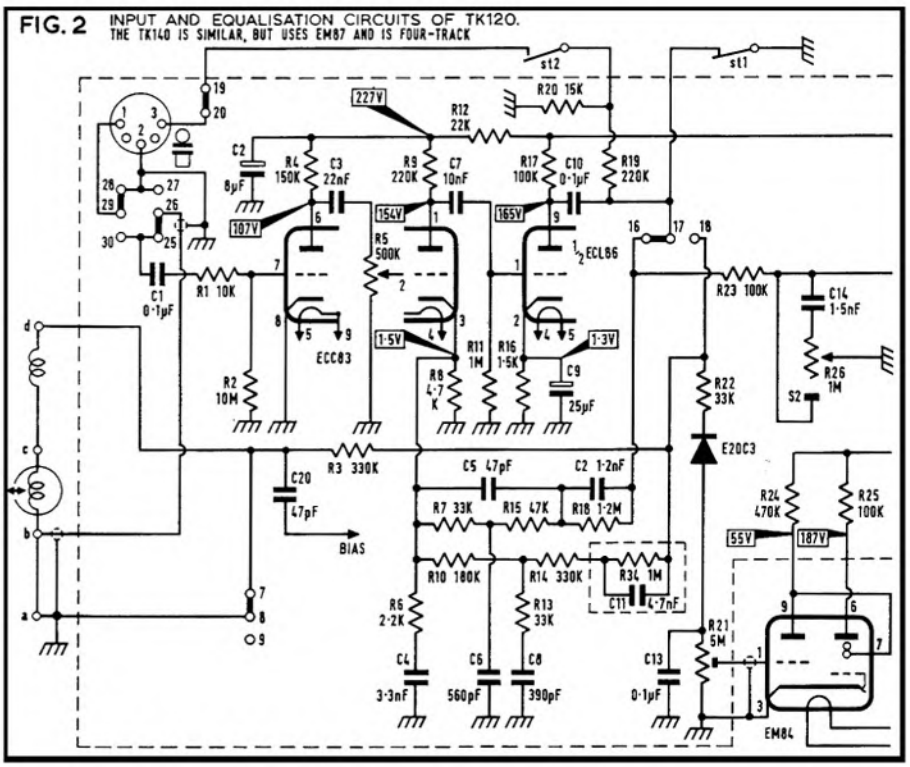
The mechanical construction of the whole range, fortunately, is very similar. There must be vital switching differences, as one would expect, and the way in which the complication of the Record switch has been overcome in the *TK145* has quite rightly been praised by our reviewer. Not only do we have an auto-manual control, but also a speech/music facility, with a change of time-constant, all ingeniously incorporated in the action of the same switch linking.

The *TK120* is the 'economy' version. In fact, it has been a staple offering from certain mail-order companies. It lacks what we serious chaps would regard as a vital necessity —a tape position indicator—which all the other versions have. The '*5*' versions have a tape stop, which is the usual Grundig type of switch post with solenoid-operated tripping device. This interrupts the mains supply, but does not involve itself in some of those mechanical neutralising capers that we have previously encountered. A lot must depend on clutch and brake tensions therefore, and it is with these that we must concern ourselves.

Clutches on the group of machines we are considering are quite individual. They would have been worthy of inclusion in the recent notes on clutch mechanisms that appeared in

(*continued on page 457*)

FIG. 2 INPUT AND EQUALISATION CIRCUITS OF TK120. THE TK140 IS SIMILAR, BUT USES EM87 AND IS FOUR-TRACK



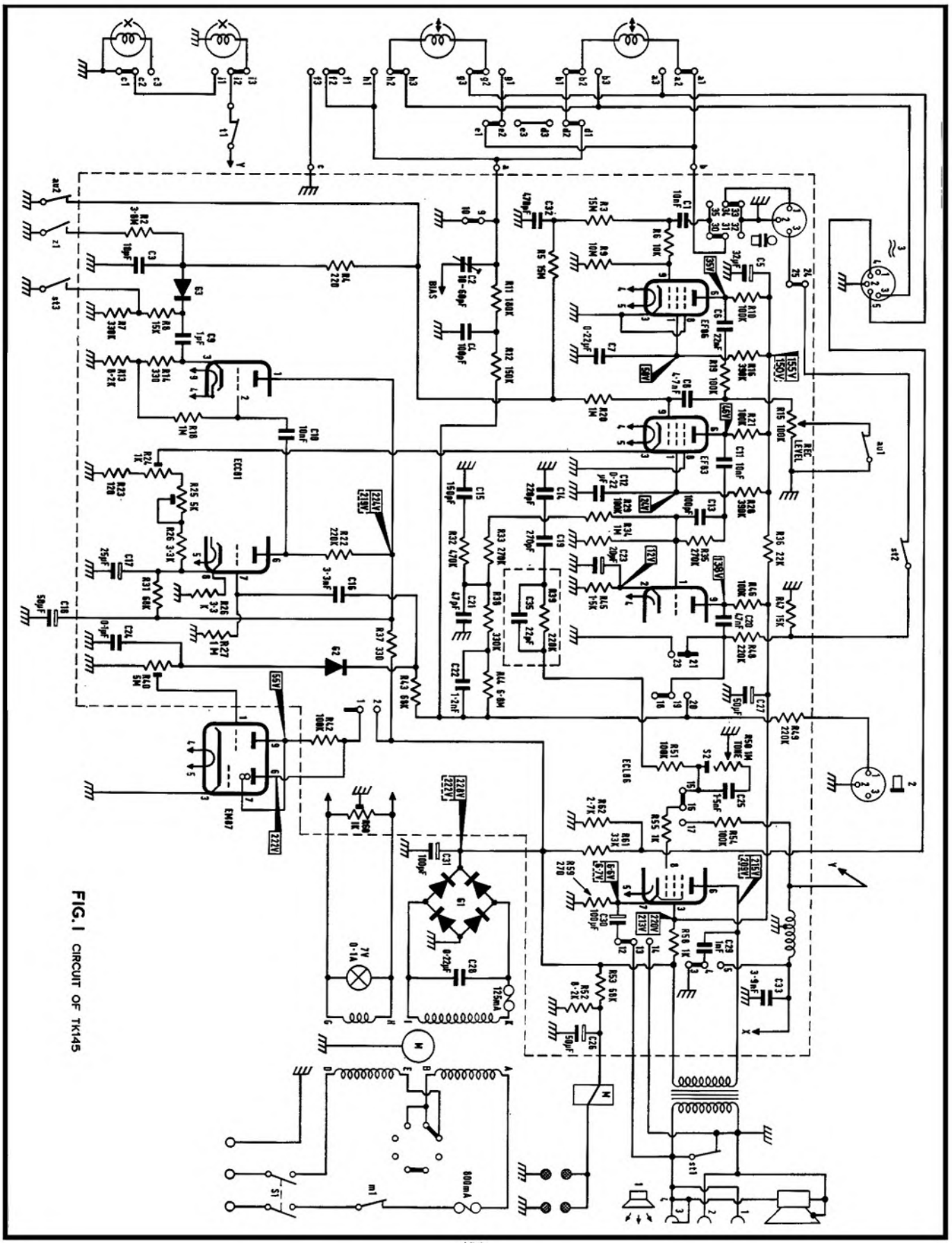


FIG. 1 CIRCUIT OF TK145

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THE BANG & OLUFSEN SPECIALISTS

these pages, if only on the grounds of originality. The spool carriers have spindles that go right through the two-part clutch assembly and into a bearing which is itself supported on a mobile bracket. Rotation of the *Easy-G* knob moves a lever arm which helps this bracket into place. Springs then do the necessary job of holding the assembly at the required angle. Take-up is via a belt from the flywheel to the rotating drum at the lower part of the clutch assembly, which is keyed into the upper part to provide a friction drive. The friction is obtained from discs of felt which are inserted in circular cut-outs on the top surface of this upper clutch plate, to be rubbed on by the underside of the spool carrier. **Fig. 3** gives an idea of the layout.

The shape of this upper plate and the disposition of the cut-outs, enables a very wide range of frictional pressures to be obtained. On the wedge-shaped portion there are four cut-outs and two each on the sides of the segment. As, in the words of the service manual, 'Non-symmetrical felt disc location is permissible' (for which boon, much thanks!) this gives a possible 56 combinations of the three felt discs, if my computations are correct. (*If not, no doubt you will be told*! **Ed.**)

The snag is that to make these changes it is necessary each time to remove the spool carrier. As we can see from **fig. 3,** this entails releasing the grip ring at the bottom, carefully holding the tape indicator pulley and washers, the lower and the upper disc in place, or, alternatively, slipping off the belts and replacing them after adjustment. Hence, if you do not possess a suitable spring balance to measure the torsions advised by the makers, some sort of juggling act will be necessary each time you want to change disc positions. And it will, according to Henry's Third Law of Recalcitrancy, always be the fifty-fifth adjustment that is needed. How do we get over this difficulty?

My own method has been to hold down the upper clutch plate with a thin piece of tinplate and 'follow-through' the spindle as it is withdrawn, using a screwdriver blade of suitable diameter. This way, all the washers and other parts stay in place, the top belt does not pull the lower clutch drum sideways, spilling the height adjustment washers out of alignment, and replacement only requires careful re-insertion of the spool carrier spindle, pushing the screwdriver out as it goes. This operation needs a little more height than the size of the machine allows and I find it very useful to keep a couple of wood blocks available for this and other jobs, standing the machine on these so that they support the frame of the cabinet. It would be interesting to know what methods are employed in the factory when these clutch adjustments are made.

Before embarking on what can be a frustrating operation, make sure that the take-up trouble is not just due to a slack belt. A little French chalk rubbed over the moving belt may improve matters, and if this is done when the machine is hot, and after cleaning of the driving surfaces with our ubiquitous methylated spirit, we may well find it the solution to a sluggish take-up problem. But, assuming the belt to be fairly new and the motor driving adequately—we shall come back to this point later—the only way of making these adjustments without the aid of a spring balance is to experiment with the felt disc positions.

The left-hand clutch is less important, and even lacks any adjustment for fast rewinding torque. The spool carrier engages directly with the motor pulley for this function, and if cleaning of the working surfaces does not improve a poor rewind, there may be some motor trouble ; but, as is more likely, the problem could be caused by too much back tension. This, again, could be caused by forward clutch action, or by the fast wind pulley touching on either takeup carrier or motor pulley. Clearance should be a half-millimetre and between 1 and 2 mm respectively when the machine is switched to start, and it is best to check this while the machine is actually running because of the motor suspension and the designed 'throw' in the pulley due to belt torque. To adjust this, we have to bend the small lug to which the spring on the bracket is attached where this pulley is mounted to get correct clearance, and it is worth taking a little care with this adjustment before delving any deeper.

Just as likely, unfortunately, is the old bogey of tape trapping. Grundig guides are pretty accurately machined and have no liking for slightly oversize tape. Too many tapes on sale, especially those at bargain prices, interpret the tape width specification too liberally or are sliced on the skew. So, before cursing the machine, try a good tape.

Fast forward winding is a very different proposition, although the operation looks the same. In the first place, we now have some adjustment, and secondly, the take-up belt and clutch arrangement can easily have a retarding effect, acting as an underspool brake. This is usually when the belt is a bit slack, and the symptoms will be that the adjustment spring has to be tensioned more by hooking it farther to the left, and that the forward wind tends to decelerate as the spool fills. The makers warn us that hooking this spring on to the farthest

(*continued on page 477*)

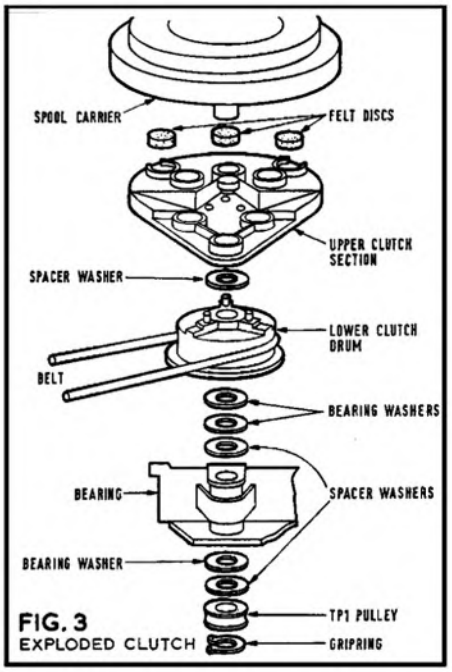


FIG. 3 EXPLODED CLUTCH

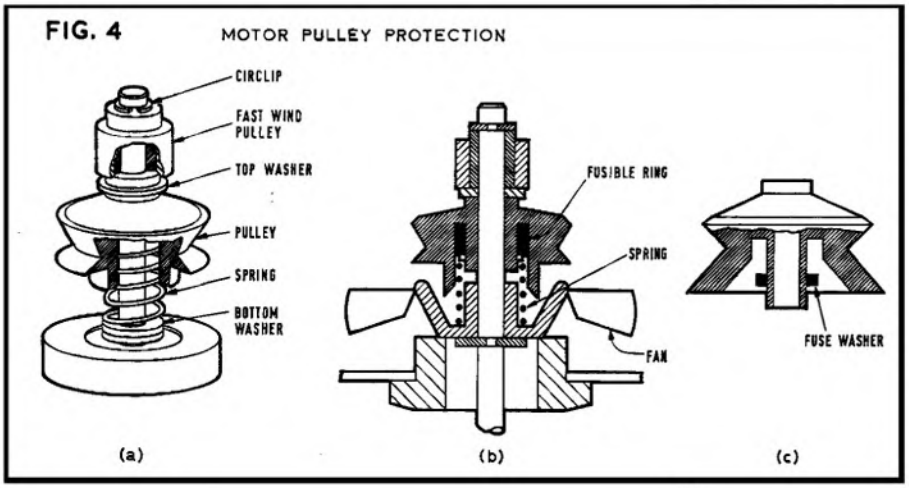


FIG. 4 MOTOR PULLEY PROTECTION

A SORT OF CHAIN REACTION

ERNEST WALKER

THE letter was dated 5th May and was from the Secretary of the *Silver Ring Choir*. "We thought that you would be interested to know that the EMI recordings are taking place on May 14th, 15th and 16th in the Pump Room, Bath. We were wondering if, as you did so much hard work in the early stages of this venture, you would like to come and stay with us again . . ."

Of course I jumped at the opportunity, and in due course sat-in at one of the recording sessions; but of this, more anon.

The venture began last summer, when my wife and I arranged to spend a holiday at Philipps House, a National Trust property near Salisbury, Wiltshire. The Warden had told me that, during our stay, the Bath Silver Ring Choir would be giving a recital, and that he was sure we would enjoy it. Little did he know how much I disliked singing, or that the idea of having to listen to a choir for a whole evening tempted me to cancel the holiday! However, I decided that on the evening of the recital we would have other arrangements.

As it happened, I was given no option: on our arrival the Warden espied my tape recorder, and not only charmed me into going to the concert but also into recording it! Nevertheless, I operated almost under protest. I had recently bought a second-hand Uher *4000S* recorder, but unfortunately no suitable microphone was available and I had to make do with one that belonged to a Sony *326B*, which totally mismatched the input of the Uher. Then there was difficulty in finding a suitable place for the equipment and microphone. I ended up on a first floor landing, high above and behind the choir! Add to these difficulties the fact that the choirmaster was out of my view; my limited knowledge of the 22 songs which were to be sung, and finally my inexperience of serious live recording. From the start, I felt the recording was doomed to failure.

The Silver Ring Choir was formed in 1951 by its conductor, Mr. Kelvin Thomas. It had about 80 members, male and female, and their recitals were almost invariably given for the benefit of charity. They were a most dedicated group, giving up two evenings a week to rehearsals. The proceeds from this particular recital went to the 'Samaritans'.

The recital was being given in the main hall of Philipps House, and the choir was positioned on the steps of the great stone staircase. I made the recordings on a 13 cm spool of LP *Electronic World*, which gave 48 minutes recording time on each side. I know now that I should have recorded at 19 cm/s, not at 9.5 cm/s, and should not have used both sides of the tape if I ever expected to do any editing. But as I have said, this was my first live recording, and I was not prepared for the extravaganza now being offered me. Also, I still had some of those stupid ideas that most novices have, the worst of which is being over economical with tape. Today, my advice would be: if you cannot afford tape at a penny per metre (you can get quite good tape even cheaper than this!) then sell or give away your recorder.

Though the recital was expected to last at least two hours, long before we had reached the interval I was beginning to enjoy the music. Strange how a life-long prejudice can disappear so easily! But I was very unhappy about the recording. I had no earphones, so had to judge the recording level by the VU-meter. This might give satisfactory results when recording an interview, but with music, which included rapid changes from *pp* to *ff*, the results can be most unsatisfactory. I might have managed better if the gain control had been larger. As it was, I was continually getting cramp in the fingers.

FAERY SONG

The recital included such pieces as Rutland Boughton's *Faery Song*, *David of the White Rock*, *Iona Boat Song* and *The Blue Bird*. The final item was Matyas Seiber's *Yugoslav Folk Songs*. It was beautifully sung, and the acoustics of the great stone hall did everything to make it one of the most memorable pieces of music I had ever heard. From that moment I was completely under the spell of this wonderful choir; but I had a gnawing feeling that my recording could not possibly have done anything like justice to their singing.

The following day I played back the recordings. I only had the Uher's monitoring speaker, yet to my surprise the programme sounded generally excellent. At a later date, after I had edited out all the sub-standard recordings, I revisited Philipps House and played it back over a good quality loudspeaker in the same large stone hall in which it had been recorded. About a dozen of us were present, just standing around in twos and threes, listening. The music filled the hall almost as the sound of the Choir had filled it. It was a good recording; and more than one person's eyes were filled with tears at the beauty of the singing.

Two months later, I was glancing through some earlier numbers of *Tape Recorder* when I came across the advertisement for the *British Amateur Tape Recording Contest*. I read through the rules and glanced at the application form. There was a special section for music! My mind was already on the recordings of the Silver Ring Choir—could I pick out some suitable material from this? Of course I could—but I would have to obtain the permission of the choirmaster. I dropped a line to the Warden of Philipps House telling him what I had in mind. He thought it an excellent idea and advised me to contact the secretary of the choir, Mr. Ken Lander. This I did, telling him I should like to submit three of their songs. He promised to put the matter before the choir committee at its next meeting. In due course I received their approval—and good wishes.

Then the problem of copyright arose. I soon discovered that by joining the Federation of British Tape Recordists and Clubs this problem, with others, could be overcome. So all that remained was to prepare the three tapes. I spent many hours copying, cutting, re-copying—and on one dreadful occasion ruining the original tape—before I finally had them ready. Dissatisfied, yet knowing that I could never improve on them with the equipment I had, I packed them up and mailed them.

Meanwhile I sent the choir an edited copy of the Philipps House concert. When it was played to the committee it came in for considerably more praise than it may have deserved. But they were impressed by the editing; and not a little surprised at the excellence of the singing!

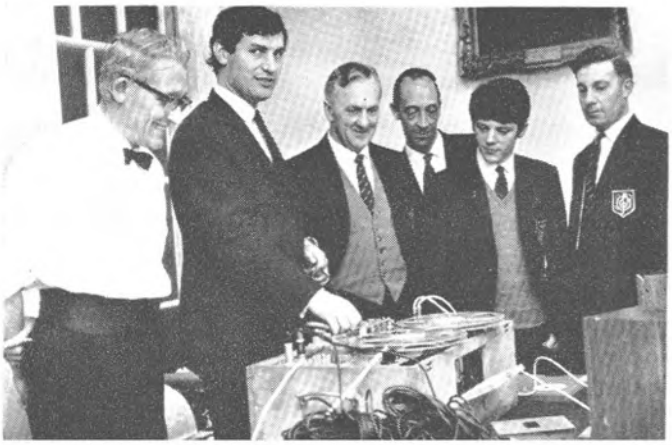
MUSIC FOR PLEASURE

Then one day in October I received a letter from the choir secretary, saying they had heard that EMI, through their *Music for Pleasure* associate company, were interested in making a recording of the choir, but that first they would like a tape containing some of the choir's repertoire. As this was too good a chance to miss, could I make the recording for them? I most certainly could, and three weeks later Mr. Lander collected my wife and I, together with all our equipment, and drove us off to Bath.

I should mention here that I had now bought a Sony *777A* recorder, and it was this that I took with me. As a reserve I also had the Uher, for which I had now obtained a matching microphone.

The recording session was not without its trials and tribulations. The microphone which came with the new Sony was an unknown quantity, so I bought a Grampian *DP4*. I had no stands, so we suspended the two by string from the overhead lights. I had hoped to be able to instal my equipment in a separate room—I had purposely brought an assortment of very long cables for this very reason. But no room was available and I had to share the hall with the Choir.

As monitoring through the loudspeaker system was out, and again I had no earphones, I was reduced to dependence on VU-meters. Fortunately the meter on the Sony is quite large and easily read; and the gain control a



Top left: John Boyden (second from left) and choir members with the EMI Revox.

Top right: Philipps House.

Left: The author at home with his equipment.

decent size. I think my worst moment came when, on playback of the first batch of recordings, I discovered that the Sony had picked up and recorded a radio conversation between a taxi driver and his headquarters! This right in the middle of a song. Because of this unwanted characteristic, together with several others, the recorder eventually had to go back to Gloucester for servicing.

However, I came home with two hours' music, this time recorded at 19 cm/s and in one direction of the tape only. I spent the following week editing the tape and making as perfect a copy as possible of extracts of this and the Philipps House recital. Then off it went to the secretary.

Early in December I heard from the secretary. "Just a short note to let you know that we have heard from the EMI people that they are impressed with the quality of performance and would like to make a recording. I hope you will feel as proud of us as we do of our recordist, for without your help and skill we could so easily have missed this chance." I truly was proud of them!

Then came the letter dated 5th May telling me that the recordings were to be made at the Pump Room, Bath, on May 14th, 15th and 16th.

Some months ago I watched the tape recording of an opera on television. Beside a control room full of equipment and the necessary experts to operate it, they also occupied much of the auditorium. When I arrived at Bath's famous Pump Room, I almost expected to find a similar set-up. But I was in for a surprise!

NO BEVY OF EXPERTS

The choir was assembled in the Pump Room, with the choirmaster on his rostrum. Close by was a very ordinary table on which were perched two tubular stands, each holding a microphone. In the hall-cum-lounge adjoining the Pump Room was the recording unit: the Master and his Magic Box. No room filled with equipment; no bevy of experts—not even an inter-com!

The secretary introduced me to the Master, Mr. John Boyden, and Mr. Boyden introduced me to his equipment. But first a word about Mr. Boyden. Basically he is a musician; his knowledge and understanding of recording depended primarily on his musical training. Years of experience produced the master tape recordist. Some questions I did not ask: his age, for example. But I judge him to be on the happy side of 30. He has many extraordinary attributes. First his hands: they are those of a magician! To see him lace up his recorder with a new tape was a revelation. But to watch him hovering over the machine during a recording was as fascinating as watching a concert pianist. And he has the ears of a Sir Henry Wood: listening to a choir of some 70 voices over his monitoring earphones he will pick out the voice of the occasional singer who is a fraction of a second out at the end of a sustained note. At one stage, he held up the singing because he maintained he could hear a faint creaking through his 'phones; it was the Choirmaster's rostrum which, presumably, had shifted from its original position and now rested on a loose floorboard.

As a professional, self-contained recording unit, Mr. Boyden completely filled the bill. But he did have some assistance: his charming Australian wife presently appeared, and besides taking over much of the paper work, occasionally liaised between her husband and the choirmaster. Apart from her knowledge of professional recording—she was closely associated with it until her marriage—she also was a musician. Her charm and diplomacy turned what could have been a strictly formal-business occasion into a happy social-business event, which must have had beneficial results both for the choir and the recording company.

And the equipment? One recorder only. It started life as a Revox *736/HS*, though in its specially made 'on location' cabinet was not easily recognisable. 25.5 cm Standard Play reels were used. The recordings were being made in stereo, the two AKG capacitor microphones in use originally cost £135 each.

Whilst recording, Mr. Boyden kept a sharp eye on the two VU-meters; but all the time he was listening intently with his earphones, and his right hand was hovering over the recorder. A pair of matched speakers were wired up on the table, and on several occasions he was asked by different people—including me—why he did not use them in preference to earphones. His answer: "For the best reason in the world —I can hear *everything* through the 'phones; I might miss something if I used the loudspeakers!"

At the end of each song, he would decide there and then whether or not it was acceptable. If accepted, the schedule was marked accordingly and the choirmaster given the go ahead for the next number. Where not acceptable, the choir would be asked to repeat the number —unless this was already their second or third attempt, in which case it would be marked down for re-recording later on, and they would start on a new song. If for some reason Mr. Boyden decided early in the recording of a particular song that it was not going to be acceptable, he or Mrs. Boyden would go into the Pump Room and the Choirmaster would

(*continued on page 477*)

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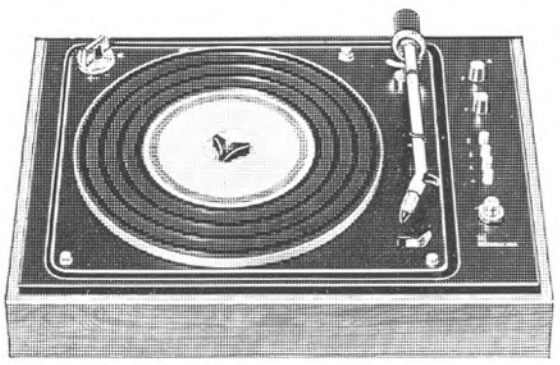
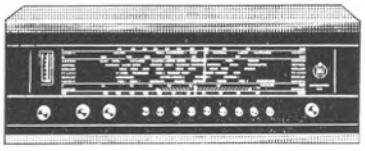
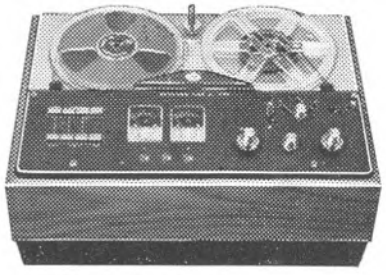


BEOGRAM 1500



BEOMASTER 900M



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A SIGHTLESS CONTRIBUTOR DESCRIBES HIS APPROACH TO TAPE RECORDING

BY M. HOWELL

JUSTIFIABLY, I have difficulty in recalling my attitude towards tape recorders in the days prior to my possessing such equipment, but in the six-week period between order and delivery of my first model (a portable from the Grundig stable), there was plenty of time to formulate theories on what could be expected from a battery machine of relatively low price. The choice of a portable as my first buy seemed automatic for although I had dreamed the romance of the situation before hearing the adverts my anticipations were very much in line with those of the promotion boys: "Can be taken anywhere. Will record in any place at any time."

The first hour of the Grundig's existence with me could never be forgotten, partly because the event is now soggy with nostalgia, but principally because the episode was symbolic of my electronic fortunes to come. A stout box housed the machine and when the plasticised gem was at last unsheathed from the packing, and when the shiny body-work and smell of new machinery had been admired by a few assembled friends, the recorder was switched on without a sign of activity. An immediate investigation revealed the total absence of batteries; it was Friday evening and the shops were well and truly closed.

As a blind person, I am convinced that few extra recording difficulties are imposed by the lack of sight. Indeed, it is somewhat ironical to reflect that most people use visual means alone to make sound recordings. There are one or two illusions which should be mentioned. On the other hand, there are probably many which are omitted simply because, living with both handicap and tape recorders, I rarely feel to be at anything of a disadvantage. On a recent visit to a well-known manufacturer from whom I had intended buying apparatus, the demonstration could not start until the question "But *how* do you manage to record ?" had been asked of me. The average recording requires little thought. Take, for example, a message tape—a piece of speech unlikely to deviate very much. The sighted person talks into a microphone, advancing the gain control to a point which registers 'satisfactory' on the level meter. Alternatively, he may remember the setting on the scale, in which case the volume will be positioned accordingly. Niched, arrowed and flat knobs are the blind recordist's salvation. On buying a new recorder, numerous checks have to be made to find the perfect level for various activities. Within a few days I have another list of figures in my head. But how do I set up with the aid of niches and crannies ?

The example of my portable is the most telling as its gain control is a serrated, finger-edge control and, from 'zero' to 'maximum', 42 ridges will pass a checking finger at the opening from which the serrations emerge. By this system I can set the volume with speed and assurance. Without the necessity for any checks, I know that Position 33 gives a well modulated signal with the majority of microphones used with that recorder. Where the sound source is going to vary often and with great suddenness—in a hall where music is being performed—I have never found it worthwhile to set the gain anything below ridge 24 as recordings of this nature are a compromise. This system is as near to ideal as possible, even though I am not keen on the edge-type control.

Looking at the worst possible situation, I have never yet found a recorder which utterly defied mastery without visual aid. Currently I have two machines which feature character-less smooth-surfaced knobs and the only way to set these with any degree of accuracy is by using the screw socket as a guide. Simply by the shape of the control, recording can be made a difficult or rapidly easy task.

Many machines are easier to operate than others. Critical reviewers hurl abuse at makers for unintelligent lay-out, yet the main difficulty I face concerns tapes produced from sources other than microphones. The input monitor should be a help here, even though monitor strengths can be deceptive if they are the sole aid to a good finished item. In these cases, niches and knob locations are not fully reliable, especially if material is to be taken from differing outputs. Monitor systems vary, some being integrated with the recording gain control, with an additional switch, while others use separate knobs for record and monitor level. The tragedy is that sensitivity varies enormously from one model to another, some recorders reaching distortion level at minute volume settings and there are others which can be turned well up before the supplied microphone distorts.

Only rarely am I obliged to wait until someone 'has time' to read the instructions to me. I find myself fumbling around the buttons, knobs and sockets until I have solved the Function Mystery. My method, as with most things, must be systematic. Whereas the sighted person will glance at the control markings of unfamiliar apparatus, I must remember locations, switching order, knob and socket positions as quickly as possible so that the model can be operated without cogitation or clumsiness. Complicated machinery often baffles me for many hours, largely because I am not prepared to rest until I have a sound knowledge of the layout. Sometimes I stand, gazing up at the ceiling, realising that only a genius could fathom out the workings of the monster at my hands.

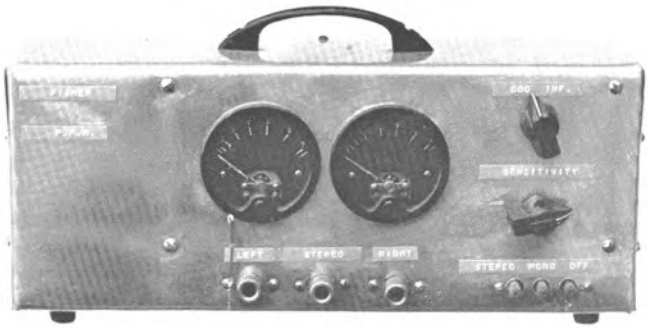
My fascination with tape recording stems from its wide scope—I still cannot take for granted that our very words can be reproduced by a man-made object. My interest has been sustained by a series of frustrating disappointments and discontentments—the tools of our game. When I came to know something of the hobby, I was soon aware that I would have to take recording seriously. My one piece of good fortune was that I was able to sell my original portable at an extortionate price. At this juncture there started a tapeographic tennis match whose see-sawing fortunes made the umpire realise that this was no ordinary game. Naturally, I started buying at the lower end of the price register but could never find a model whose deck fully complemented its electronics or vice-versa. Friends found it impossible to grasp why *that* machine had to be replaced. I reached the conclusion long ago that many people are half deaf or, to be more fair to them, cannot hear certain sounds unless they are trained to recognise them. And as for shops! I have even had to sell recorders in despair because mechanics were unable to trace certain faults of which I had complained. Had I the opportunity of opening an audio business, all my engineers would have to pass an aural sensitivity test. I dread the day when my hearing may lose much of its keenness (already my left ear can pick out far higher frequencies than its counterpart), but my family and friends may be somewhat relieved that the buying and selling pace may then slow to a crawl. They have at last accustomed themselves to regular removals and deliveries, 60% of which have to be returned for adjustment.

Automatic gain control, that inevitable feature which seemed so long in coming to tape recording, was something which dealers recommended to me as "Made for people in your circumstance". My curiosity proved too strong and, as no one could answer my many questions about the system in practice, I had to find the answers the expensive way. I used

(continued on page 487)

A BUDGET PPM

John Fisher



THE portable Peak Programme Meter design to be described was evolved to meet the author's need for a portable battery powered unit with separate meters for each channel rather than the usual system of metering the greater of two signals in a stereo system. There is nothing sensational in the design; the circuits are simple and the meters themselves inexpensive. The performance is in practice very close to that of a broadcast PPM and the total cost is not high.

The separate meters were required to enable one to compare the levels in both channels simultaneously, and also for alignment purposes. For most recording purposes a meter reading the greater of the two signals would be adequate provided the two channels are balanced; a meter reading either left or right channels or the sum of the channels would not be satisfactory. Having decided on two meters, the question of cost becomes very apparent: much as I would have liked a pair of Ernest Turner PPM meter units with scale and ballistics to a BBC spec., the outlay of about £15 on the meters alone made me consider a do-it-yourself job—modifying and rescaling less expensive meter units. This is a job for steady hands and stout hearts (if in doubt pay the £15) as meters are quite delicate and a lapse of concentration is very saddening, as I found on a previous occasion when building a valve PPM.

The main requirements of the meter units are that they shall have a short rise-time and negligible overshoot. No meter would have a rise-time fast enough to measure peaks down to about 2-3 mS, and this is taken care of in the measuring amplifier which has a decay time-constant long enough to ensure that the meter has time to move up to measure most of the peak level; too long a time-constant will, however, give a slightly misleading idea about mean peak levels by staying up a long time on the occasional peak and masking the fact that for the rest of the time the peak levels are quite low. In professional equipment with expensive meter units, a time-constant of about one second is used; a time-constant of about two seconds can be used with slower meters provided the overshoot performance is adequate and the rise-time reasonably short. An overshoot of more than 5% will give a serious overestimate of the peak level and result in under-recording and a poor signal-to-noise ratio. Overshoot is a point on which many inexpensive and otherwise suitable meters fall down.

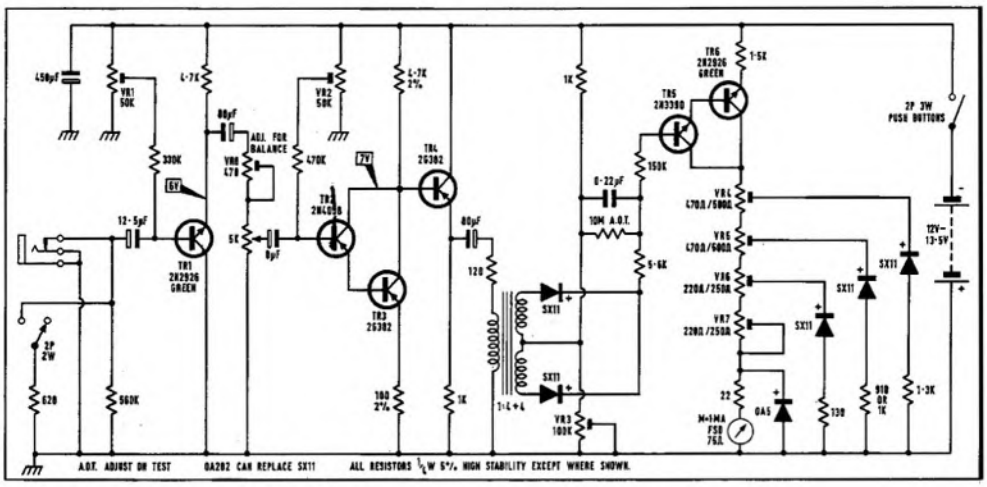
The meters used in the prototype were Ernest Turner 1 mA 5.4 cm diameter movements, type *W309*. They have appeared on the surplus market, unused and in new condition, for about £1 from time to time, and a square fronted version has also been seen at similar sources at about 30s. upwards. It was known from experiment that the rise-time of these meters was usably brief and that they are reasonably damped with only a small amount of overshoot. Also, particularly important for this application, the movement can be easily removed from its housing for rescaling, by removing three fine screws in the casing (normally covered with a varnish seal).

The actual modifications to the meter movements are easily carried out if one has patience and a steady hand. The movements are removed from their protective housing and the scale removed by unscrewing the two retaining screws. The first step then is to replace the scale with a thick piece of card which will just fit under the pointer without bending it and against which the pointer can safely be pressed. With the card screwed into position, the lobes at the tip of the pointer are then cut off flush with the pointer edge, using a razor blade; alternatively, before the card is inserted, the lobes may be snipped off with a pair of fine pointed surgical or sewing scissors (which must be very sharp to do the job neatly). Then with the card in place, the blacking on the meter pointer is very carefully removed with a needle, craft tool, mapping pen or other fine scraper, aided by very small amounts of carbon tetrachloride or lighter fuel applied sparingly with a fine artist's brush. Care must be taken to preserve the stiffening ridge down the centre of the pointer, as it is very thin and soft. When the front face is clean and silvery, remove the card and carefully—very carefully !—remove as much as possible of remaining blacking from the back of the pointer: this is the point where the operation is most likely to come to grief, so it is probably better to err on the side of leaving a little behind——it will not weigh a lot.

The pointer should now still be straight and at its original angle, silvery in appearance (which shows up well against a black scale without whitening)—and you can breathe again. The scale is then painted out with matt black paint (which will allow a small amount of the old scale to show through at very close range, as a guide for rescaling, or the reverse side of the scale may be painted instead) and the uncalibrated scale can then be screwed back to the movement. I preferred not to paint over the screw heads. The movement can then be replaced in its case until ready for calibration and scaling. The advantage of scaling the meter yourself is that you can make the law of the measuring circuit control the meter deflection to something very close to the required scaling, and then cheat slightly by painting in the calibrations to suit the law achieved. However, the divisions on the scale should be fairly even and they *must* be the same on both meters, otherwise the result is very confusing, so there are limits to the cheating even if this proves necessary !

Removal of the lobes from the tip of the pointers and black coating from the surface somewhat reduces the inertia of the meter movement, as well as providing the reflective lance shaped pointer that is required. However, since the pointer is statically balanced so that movement from the vertical to the horizontal does not shift the zero, the lighter pointer will need rebalancing, and this is achieved by very carefully removing a small bit of the wire counterweight at the opposite end of the pointer. This must be done very carefully to avoid removing too much and particularly to avoid damaging the delicate pivots of the moving-coil movement. It is a simple but delicate operation. The whole operation makes a slight but worthwhile improvement in the ballistics of the meter movements.

It is not proposed to describe the case of the unit in detail. The prototype can be seen in the photograph, and was intended to stand in the lid of my mixer which more or less decided its main dimensions. The case is of 16 SWG aluminium sheet with an 18 SWG back. The amplifiers are built on Veroboard, which hinges out on flexible leads for service and is



retained on pillars screwed to the front panel. All presets are mounted facing the back of the unit so that they can be adjusted as necessary with the amplifiers in position simply by removing the back of the case. Once fully aligned and calibrated, no adjustment should be necessary. The most important thing to remember is to mount the meters as close together as practical, as spacing of the meters makes it difficult to watch both at once and causes considerable eye-strain.

As mentioned before, all the amplifiers are very simple and are all built on a single large Veroboard sheet for easy assembly. The circuits are powered by two Ever Ready 6 v power pack batteries or three flat 4.5 v batteries lashed together, and the batteries are easily mounted inside the case. Consumption is low, and the batteries give a surprisingly long useful life. Apart from extreme portability the absence of a mains power pack removes one potential source of hum.

It had been my intention to bring the signal in straight on to a switched attenuator consisting of a host of sub-miniature presets fed from the switch wafer and mounted on the main amplifier panel; this would have provided zero level and 8 dB above and below, plus three preset sensitivities for regularly used signal sources. This high impedance attenuator would then have fed directly into the high impedance input of the drive amplifiers. However, when this was tried the high frequency response proved very sick, due to capacitive losses which varied according to setting. The solution was to bring the input signal straight to an emitter-follower buffer stage (see **fig. 1**) with the output to a low impedance attenuator. As a temporary measure I used a 5 K ganged 1 dB matched pot for the attenuator, and this (due to a degree of laziness, I admit !) has remained in use. The matching is in fact within 1 dB over the top three-quarters of the control, worsening considerably below; the control is normally used at the higher gain settings in stereo, and below the point of uncertainty the instrument is only used for mono measurements. However, it would be a simple matter to substitute, say, a 12-way attenuator, preferably giving 2 or 4 dB steps as a check on calibration.

In the mono mode, only one buffer, drive amplifier, and measuring amplifier are powered, to economise on batteries. Inputs are through separate jacks for left and right channel, and in parallel from a three contact jack for some stereo sources. A switch is provided to load the input to 600 ohms.

From the attenuator the signal goes to the high-impedance input of the drive amplifier, which is a Darlington pair arranged to give voltage gain. A preset resistor is provided to adjust the base bias for just over half supply volts at the collectors. An emitter-follower stage then provides a low impedance drive to a step-up transformer to provide full-wave rectification of the signal to drive the meter-control measuring circuit. The small series resistor (120 ohms) between emitter and the primary of the transformer is to prevent excessive currents through the transistor on switching transients. Details of the transformer are given at the end of the article but, briefly, it is a broadband type with a bi-filar wound secondary which is centre-tapped. A transformer with a single secondary winding could instead be used with a diode bridge (**fig. 3**). The earthy side of the bridge, or in this case the transformer centre-tap, is taken to a potential divider network which is adjusted so that a few microamps flow in the control circuit under no-signal conditions: this ensures the diodes are biased on and there is no threshold due to base-emitter voltages in the meter control stage. (Scale zero is about a pointer's width above the 'off' position of the needle.)

The rectified signal charges the 0.22 μF polyester capacitor via a 5.6 K resistor; this resistor and the reflected impedance of the drive stage and transformer resistance make up about 11-12 K, giving the required charging time-constant of about 2.5 mS for the circuit attack. The stored signal is fed through a current limiting resistor to the base of the Darlington pair meter control stage which presents a very high input impedance even at very low currents. Since the gain of both the transistors is very high, the decay time-constant will be determined largely by the shunt resistor of 10 M or higher which must be chosen to give a suitable time constant of 1.5-2.5 seconds, identical on each channel. The time-constant will be affected by the low-current gain of the Darlington pair if the standing current is too small, and a

(continued on page 465)

A BUDGET PPM

John Fisher

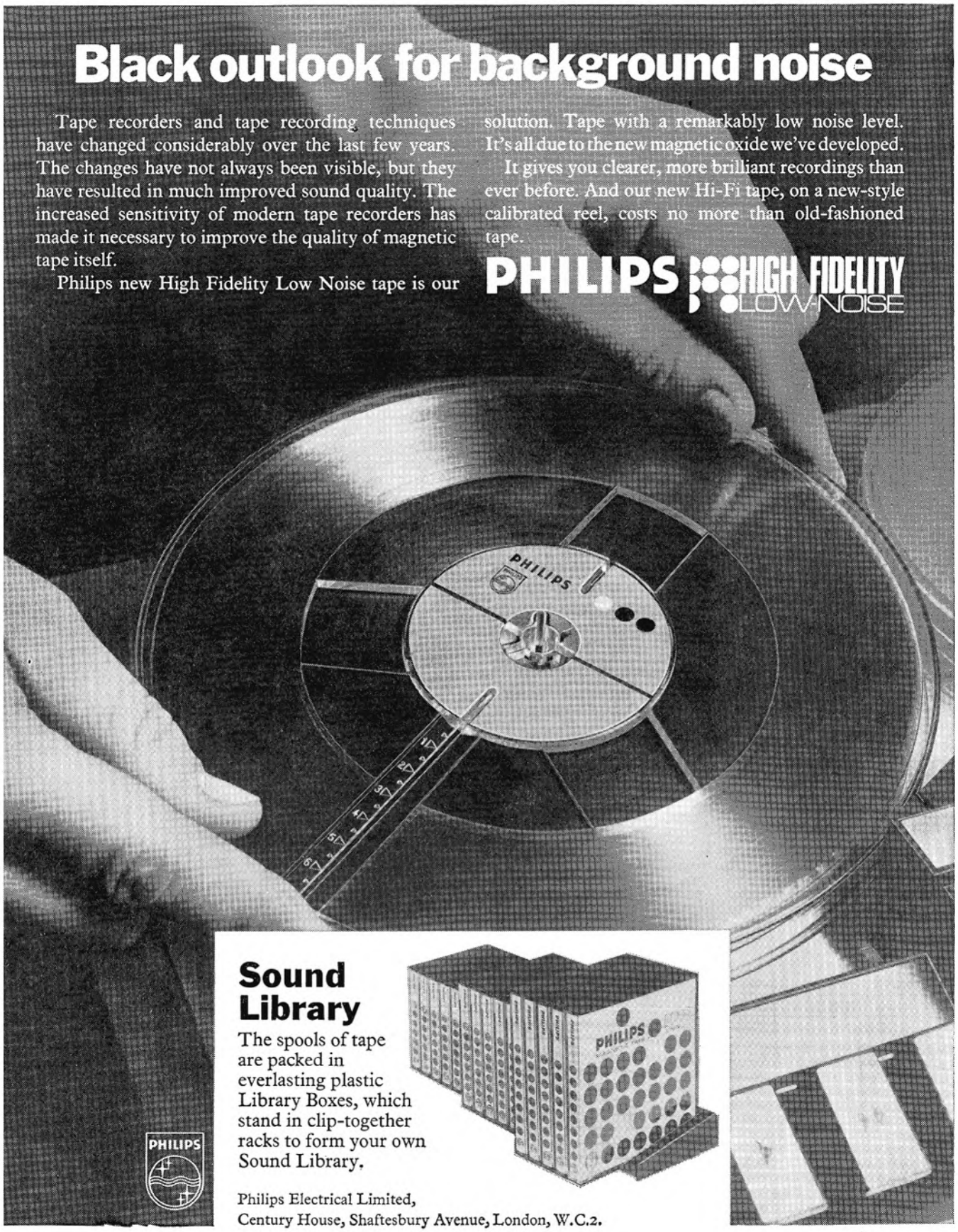
Black outlook for background noise

Tape recorders and tape recording techniques have changed considerably over the last few years. The changes have not always been visible, but they have resulted in much improved sound quality. The increased sensitivity of modern tape recorders has made it necessary to improve the quality of magnetic tape itself.

Philips new High Fidelity Low Noise tape is our solution. Tape with a remarkably low noise level. It's all due to the new magnetic oxide we've developed.

It gives you clearer, more brilliant recordings than ever before. And our new Hi-Fi tape, on a new-style calibrated reel, costs no more than old-fashioned tape.

PHILIPS HIGH FIDELITY LOW-NOISE



Sound Library

The spools of tape are packed in everlasting plastic Library Boxes, which stand in clip-together racks to form your own Sound Library.

PHILIPS

Philips Electrical Limited,
Century House, Shaftesbury Avenue, London, W.C.2.

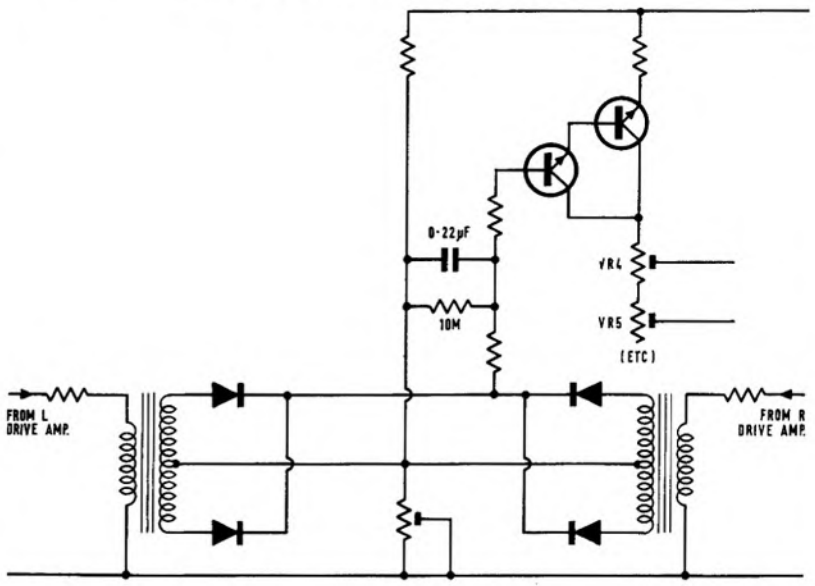
faulty diode in the rectifying stage, with a low back-resistance, can be a source of trouble if one does not suspect this and check. Germanium diodes are not suitable at this point, nor in the law circuit (except the *OA5* indicated).

The law of the meter circuit is determined by the network of preset resistors and diodes, etc. It was found that using subminiature presets, component tolerances were so high that slightly different values of fixed resistor had to be used on each channel to accommodate the adjustment. It is suggested that intending constructors try first the values indicated, and decrease (or possibly increase) values to suit their presets if the required law cannot be obtained. The *OA5* diode has a small effect on the law at the top end of the scale and also to some extent acts as a current limiter above that required for full deflection. Adjustment of the law circuit is simple if slightly tedious. A sinewave input signal is adjusted to give a reading of 1.5 on the scale with VR4 adjusted for minimum effect. The input level is then increased by exactly 6 dB and VR4 adjusted to give a reading of 3 on the scale; the input is increased a further 6 dB and VR5 adjusted to give a reading of 4½; the input level increased 6 dB and VR6 adjusted to read 6 on the PPM scale; the input level is increased 4 dB and VR7, initially set at zero resistance, is adjusted so that the meter reads 7, and a further increase of about 2 dB should bring the pointer to the end of the scale.

The process is then repeated twice, and if necessary any fixed resistors must be altered and the process repeated again. Once set up, however, the circuit is stable and the presets may be locked with small dabs of wax or balsa cement. If one intendes to cheat at all over the scaling, with divisions that are not quite to Turner's standards, it is best to mark in pencil the proposed scale at the extreme edge of the scale which will be masked by the meter case, and adjustments made to this. When the law required is obtained or patience exhausted, the actual position of the markings corresponding to the settings can be marked on to the scale proper—first lightly with pencil, then with white Letraset or white ink and mapping pen. Letraset gives the nicer finish but the pen is easier to use. The required levels can be monitored with a multimeter calibrated in dB or with an oscilloscope, or from the voltage scale of a sensitive multimeter or millivoltmeter. It is important that the scale and the decay time-constant are identical on each channel, otherwise the differences are very disconcerting.

That completes the description of this relatively simple unit. **Fig. 2** indicates how the two drive circuits may be connected to drive a single meter and its associated circuitry to measure only the greater of two stereo signals. Provided the transformer used in the circuit has adequate inductance and low resistance, the precise turns ratio is not critical, ratios of 1:3/3 or 1:5/5 could doubtless be accommodated, and the charging series resistor adjusted to suit: say 9.1 K for 1:3 or 1.8 K for 1:5. For the benefit of wind-it-yourself types or those on the prowl around surplus stores, the data on the prototype transformers is given below. It is hoped to publish a commercial source of suitable units in the near future.

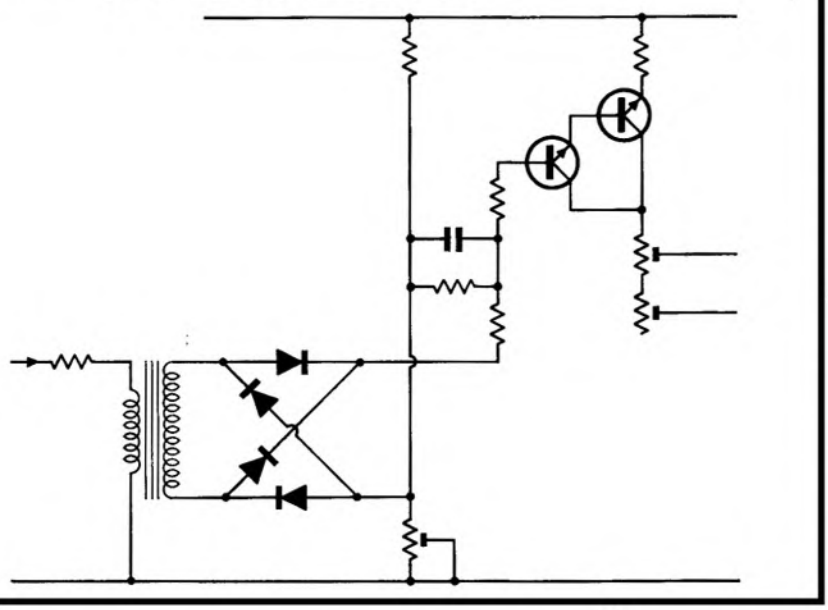
FIG. 2 CONNECTION OF TWO DRIVE AMPLIFIERS TO A SINGLE METER CIRCUIT TO READ THE GREATER OF THE TWO SIGNALS



Transformer data

Turns ratio	1:4+4
Primary inductance	600 mH
Primary resistance	40 ohms
Secondary resistance	400+400 ohms

FIG. 3 ALTERNATIVE CONNECTION OF SINGLE-SECONDARY TRANSFORMER TO DIODE BRIDGE TO DRIVE METER CIRCUIT



In conclusion, the portable stereo PPM has proved very useful both as a small instrument to take on recording sessions and as a piece of test equipment for doing frequency response checks on ancillary gear. The transformers in the prototype were particularly good and the performance was measured as ± 1dB from 50 Hz to 20 kHz overall, with an accuracy of about ± 0.5 dB scaling between 2 and 7 on the scale of the meters. The response is embarrassingly well maintained to bias frequencies, and the unit must be fed from sources free of stray bias voltages unless steps are taken to remove the bias by rolling off the response or otherwise. The PPM has become an essential item for use with the transistor mixer, and for recordings off the air and in dubbing; it is also used occasionally with a calibrated system to give some indication of the level recorded on commercial discs . . . which can be both interesting and alarming!

Snap-in sound

At home...

Our mains stereo recorder EL 3312 brings you all the exciting 3-dimensional sound realism of Musicassettes: Push-button controls include cassette ejector, fast wind and re-wind and pause. Playback or recording (on blank Compact Cassettes) is simply superb.

Matching teak-finished loudspeakers are available. And the 3312 has socket facilities for microphone, radio, gramophone, amplifier and second recorder, too.

And away...

Our battery/mains cassette recorder 2205 is great for 'music on the move'. In fact, you can play your favourite recordings absolutely anywhere — from the bathroom to the beach.

The 2205 gives 120 minutes recording/playback from a single C120 Compact cassette. It's small, light, easy to carry. But the wide frequency range and high efficiency speaker give true big-recorder reproduction.

The all-transistor amplifier needs no warm-up time.

And Musicassettes or Compact Cassettes are loaded quick-as-a-flip.

You've hundreds of Musicassettes to choose from . . .

There's a magnificent selection of pops and classics available on Musicassettes. They play as long as an EP or LP record. And they're permanent good value, because the tape, sealed in its dustproof cassette, can't get scratched or broken. Special offer – 3 EPs for only 34/6 and the voucher packed with every Philips cassette recorder.

Send for full colour brochure.

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Philips Electrical Limited, (Dept. TRC1), Century House, Shaftesbury Avenue, London W.C.2.

AMERICA TOMORROW

ARE WE SIMPLY A FEW YEARS BEHIND THE AMERICANS OR DOES THEIR INDUSTRY HAVE A CHAOS OF ITS OWN? BY EDWARD TATNALL CANBY

IF the giant Consumer Electronics Show, which late last spring sprawled its way through a maze of New York ball rooms, corridors and suites in three major hotels, is an indicator of next year's mass market, the world of 1969 will rollick along towards doom or salvation with a little marvel of an imported transistor radio in every man's shirt pocket and in every woman's purse. A dozen more will be spotted about in kitchens, bedrooms, nurseries, playpens, picnic baskets, bicycles, tricycles, work benches and anywhere else with a few square centimetres of unused space. For good measure (you will pardon me if my opening sentences reflect the non-stop pandemonium of this latest and largest of dealer-orientated festivals) there surely will be a cassette recorder dangling from every arm and a million more of the table-top sort in the living room, tape units and complete systems, mono and stereo; as well as a spate of new automobile cassette players to compete with the ¼-track and ⅛-track cartridge machines now already touring our tedious traffic tangles. It will be a heady year for consumer electronics, a perfectly enormous market—if it doesn't topple out of its own sheer redundancy.

Where one model of a given sort might do, there are now a hundred prepared for launching, all virtually identical except for the trade name and a brushing of superficial décor. Moreover, a very large proportion of this mass of goods is manufactured by a few large primary firms, mainly in Japan and the Netherlands, who would seem to be in a fine position to 'clean up', with a bet on every horse in the race! One can only gasp at the audacity of Philips who dominate the thousands of cassette machines, and the Japanese who have their fingers in that pie—as well as virtually monopolising miniature transistor radio production. Even television is now vigorously invaded—in spite of continued fierce competition among American manufacturers. Most of the video recorders shown were Japanese, as were a large number of television sets, both black-and-white and colour.

And so we see a somewhat astonishing phenomenon—Uncle Sam, the great primary producer of our industrial civilization, turned merchant for others' goods. It begins to look as though our *forte* in these hectic days is more and more in the realm of high-powered selling and less and less in consumer craftsmanship on a mass scale. So it is in the electronics field, at least. As some mythical American hayseed once observed, who'd a-thunk it!

The Hilton, Americana and Warwick hotels were straight out of Tokyo during the big Show. Granted that the ever-pliant Japanese are easy to spot; whereas the equally accomplished Dutch, Germans and British merge into the crowd in New York. Nevertheless, the sheer numbers of Japanese in and out of the displays, large quantities of them very youthful, yet every one with his official badge on the left breast pocket, made a profound impression. Most, too, seemed to be touring the show on their own, rather than tending their exhibits. It was a joyous, curious, lively crowd of youngsters, often with their girls, taking in every detail with indefatigable oriental interest. How did they get here—who paid for whole plane-loads, over such a vast distance? That's international commerce for you in this changing world. And, I might add, what *is* becoming of the Anglo-Saxon hegemony? If the British were almost non-existent at the show (except for a few 'component' exhibits), the Americans were in the process of being run off their own floor, good-naturedly of course.

'Consumer electronics' is a recent term, concocted to keep up with the expanding coverage of the mass market in electronics, which used to involve merely radio, phonographs and, later, TV. Not even the old term 'home', as in 'home appliance', is of further use, for of course the new electronic goods are primarily portable and settle down in the home almost as an afterthought, as lightly as a butterfly. The two key elements, now, are electronics (which means transistors and more and more, integrated circuitry) and mass production. But the big emphasis, this year, was on three elements of the market: tiny radios, television, and tape, particularly tape in cassette form. My own special interest in the show was the cassette since, to my mind, this device is currently the most promising overall factor in the most advanced areas of consumer tape technology, still in its infancy in terms of future potential. But I could not help looking at the other things. How could one avoid it?

The miniature radio is a marvellous and ingenious gadget, if not always very useful. Just the miracle of intelligible sound from such a tiny device is enough to fascinate. And, indeed, the challenge of small size seems to have stimulated whole new layers of creativity among designers. Many of the little radios are so preposterously useless as to be quite charming in their way. Or just plain silly. A few are genuine free-form works of art.

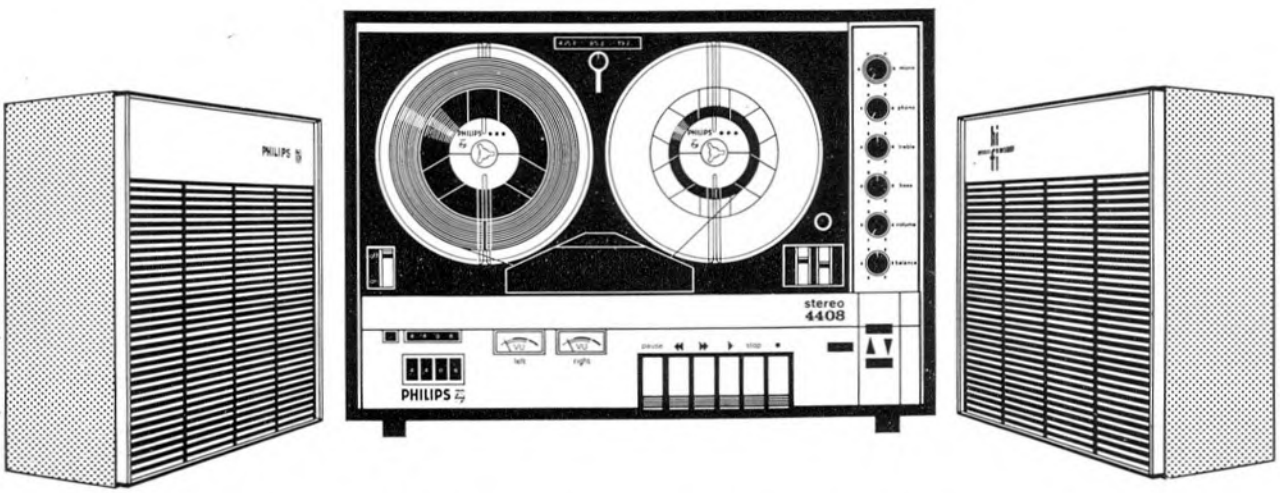
I picked up and listened to radios (surprisingly, very few of them were fastened down or chained) mounted inside the most incongruous array of externals that frivolity could imagine. There was sound out of bound leather books, out of shaving brushes, flashlights (electric torches to you), powder puffs, match boxes and cigarette cases, miniature locomotives, tiny models of antique cars, an antique gramophone with horn, assorted desk pen-and-pencil sets, jewel boxes, even whisky bottles. Some of these items were 'real', including the torch (but presumably not the shaving brush) and others were fakes (if that is the right word), including a telephone (how confusing can you get?) and a lamp.

In fact, so topsy-turvy were these zany offerings that at one exhibit I picked up a pair of binoculars to turn the enclosed radio on, only to discover they were real, with no radio included. Sold by the same company. The nadir in radios, I guess, was one that played inside a large, fake pink Pekinese dog.

Fantasy, however, ran riot with the intriguing smallness of the basic radio mechanism, which is scarcely larger than 3 cm each way including the tiny loudspeaker and yet produces an astonishingly loud noise. Total free forms, pure art, were profuse and appealing. I was

(*continued on page 469*)

Philips announce the stereo recorder you never thought you'd be able to afford!



The Philips 4408 stereo model sets a new standard of quality in tape recording. Here is a really sophisticated recorder which delivers superbly realistic 'Living sound'—at a sound price £133.16.8.

And what a machine! Four tracks, three speeds and the full range of input/output controls and sockets. Push-button tape control. Two perfectly matched detachable speakers can be positioned exactly for optimum stereo effect. Six watts output per channel gives impeccable reproduction to Hi Fi standards. Electronic ore-selector gives instant re-find of any item on the tape. Modulation level control has separate VU meters, dB calibrated for each channel. Illuminated red-green indicators for every recording and playback operation. Multiplay facility lets you build up composite recordings on one track. Even the shape is versatile—you can use the 4408 vertically or horizontally. Get the full-story brochure from us or your Philips dealer.

Free music tape With your 4408 you get a free tape carrying both popular and classical music. Ask your dealer to play it for you: here's what a tape recorder should sound like!

PHILIPS

Full Stereo Model 4408

PHILIPS ELECTRICAL LTD. (DEPT. TR1) CENTURY HOUSE, SHAFTESBURY AVENUE, LONDON, W.C.2

impressed by the Lloyd line, which includes, for example, a tiny decorative box of a radio with a black balloon-shaped object sprouting above it on a stalk.

As for TV, I skipped lightly past acres of identical images, lined up in long banks, colour and monochrome, all tuned to the same programme. Odd effect of multiple military precision in movement. As a jaundiced non-TV man my opinion is suspect, if fresh minted; I thought most of this 1969 colour TV was abominably bad, full of hideous orange-reds, gory purples and bleary greens, the human faces like grotesquely painted circus clowns, the darker shadows in the pictures a uniform colour of plum jelly. Compared to any halfway decent colour photograph, the TV picture is simply awful. Yet colour TV is on the up-and-up and I have no business complaining, I suppose, on a sharply rising market.

I must note, though, that a few well adjusted colour sets were producing a quite respectable picture, not too bad; I remember the Westinghouse display and a few of RCA's enormous furniture models as passably fine. Surprisingly, the Japanese colour seemed generally much inferior to the American.

But cassettes—cassettes everywhere—were the big significant development that is clearly in store for America this coming year. As previously reported, the cassette situation is most delicate and interesting right now, what with the present forms of tape forced to their utmost performance at the slow cassette speed, and the clear possibility of radical improvements via new forms of tape and more sophisticated drive mechanisms. The field is to be watched closely, and especially if Dupont gets its chromium tape into commercial channels in the next year or so, doubling the parameters of performance at the crucial slow speeds—but requiring a very high bias for recording, which is generally not practical in present consumer recorders. (For *playback* the bias is unnecessary and chrome pre-recorded cassettes are thus decidedly feasible.)

Of course the market in any given year is for all intents and purposes frozen in a given configuration. No amount of prying will persuade the sales promoters to admit that things could ever be different. So it is now, and will be for many months: cassettes are rigidly confined to three or four standard models, at what I am quite certain are arbitrary price levels—though you will of course be told otherwise with figures to prove it.

There is the miniature palm-of-the-hand cassette recorder, mono, sometimes with a built-in mike (Sony). Then comes a ubiquitous portable mono model, often of the 'piano key' sort and about the size of a squarish hand telephone—this one seems to be the leading seller-to-be and comes in literally scores of brands, most of which are made by the all-pervasive Philips, including its own Norelco model.

Next is the flat, desk-top miniature tape deck. And here, at last, we find cassette stereo, recording and playback. I am sure that battery portable stereo is entirely feasible at lower cost —but that will come in due time. Alternatively, these little stereo decks, hardly bigger than a hard-cover book, are offered in complete stereo systems, with speakers and often a built-in radio tuner. But I saw no true portables, suitcase type with handles. The current dogma says that for stereo you must stay indoors. And pay luxury prices. Arbitrary but, no doubt, very 'commercial' as of this year. A few fancier and larger cassette decks, and a variety of compound units that include the cassette, round out the present offerings at a fancy price. All of these, again, in endlessly repetitive and competitive lines, not one of which admits to being other than totally unique.

It is astonishing to realize that, apparently, *not a single cassette machine is now made in the* USA.

A word on pre-recorded cassette music. It is blossoming, if largely in popular and mood music areas following the automobile cartridges. There are relatively few 'classicals', mostly standard works and promenade type music, though some catalogues, Ampex and Philips, read impressively. Even so, present cassette classical repertory is to the LP as perhaps 1:1000. Poor pickings.

The choice in commercially recorded cartridges, on the other hand, is positively moronic, though a few prestige offerings are available—Beethoven and so on—with pretentious home equipment to match, not to mention the ¼-track and ⅛-track *recorders* now launched by Sony and a few others. These last are painfully useless, without fast rewind, except to tape off bulk music for your automobile player. That is enough, evidently, to sell a lot of them and more will go to the unfortunates who do not yet know of the endless loop cartridge's severe limitations.

A rival to the other cartridges is the aggressively promoted one-company Playtape cartridge and its playback equipment. It is a miniature ¼-track mono version of the larger re-entrant cartridges and covers a similar repertory, plus a large dose of children's fare and youth-orientated musical noise. Also some fancy educational lines.

Playtape (Japanese, of course) is basically a similar system than the cassette, of a comparable size, more limited and lower in cost, directly aimed at a tough popular market. Ampex, however, has just launched a cassette counterblast, the 'Micro-Cassette', a Philips-compatible cassette that contains only about 12 minutes of music and sells for $1.98, two popular 'singles' on each side. Like Playtapes, these are blister mounted in plastic on colourful cards (big enough to prevent pocket thefts!). Playtapes sell for $1.50, mono only. Micro-Cassettes are all in stereo, though intended mainly for low-cost mono players—thus, complete compatibility on any Philips cassette equipment, mono *or* stereo. That the Micro-Cassette is economically possible is highly significant, for the cassette container is not easy to produce at low cost and it had been supposed that only the longer LP cassettes, 30 minutes a side, would be saleable, at around $6 and up. So the cassette now enters the big-time pops field.

The Playtape versus Micro-Cassette battle for the youth market is joined by a third and quite different competitor, Philco-Ford's miniature Hip Pocket disc, a black vinyl flexible record only 5 cm across that plays at 45 r.p.m., with a 'single' on each side. There are swinging miniature players for these which, however, will also take standard 45s and even full-sized LPs. The little discs seem to play very solidly and you can tip or jiggle the hand-held player without dislodging the stylus. The records also play on any standard manual player but decidedly not on a changer mechanism. Too light and flexible. These discs were launched at 69 cents but were suddenly reduced to 39 cents, which perhaps indicates the arbitrariness of pricing. Or are they a flop? Not yet, and their low price is a good point.

A few final tape observations. It is to be noted that whereas almost all cassette machines now being offered have recording facilities, the opposite is true for the larger ¼- and ⅛-track cartridges. Here, virtually all the machines whether for automobiles or the home do not record. They are just players—even when built into a compound radio-phonograph. There are numerous cassette-radios which do offer internal recording, so that the radio sound can be directly taken down while it is being heard.

The missing link in the cassette machine picture is the low-cost player minus recording, in mono form but, more particularly, in stereo, which is now arbitrarily reserved for the "top of the line" recording models. We may be sure that these players will appear just as soon as a demand is formulated. Maybe next year. In the cassette itself the unfilled need is for radically improved tape to widen the frequency response and reduce the persistent background noise that now plagues all cassette sound. Chrome is a possible answer—but there are numerous indications of further improvement in conventional tape that may add up to a crucial advantage over the best now available. Bell and Howell, an old photographic concern now entering the tape field, has a special "Crystalined" tape which looks promising though perhaps merely equal to the top-quality low-noise tapes of other present US makers, as pioneered by 3M with its *Scotch 200* line. I listened to a Japanese 'extra-hi-fi' cassette filled with another new tape, the TDK cassette tape *SDX-01*, and was impressed by the absence of hiss—and the presence of highs. Very good, and to be available late in 1968.

I suspect that the impetus of the still-unavailable chrome tape, perhaps I should say its threat, will lead to many more bits of improvement of the sort.

One could go on and on (one has, already) and yet not cover a hundredth of the Big Show. Another aspect of the ingenious new miniature circuits is the plug-in radio receiver—even some with FM stereo and AM—which come in the form of a tape cartridge and fit directly into a cartridge player. Ingenious, if somehow putting the cart before the horse. Similarly, there are gadgets such as tape head cleaners made in the shape of a cassette and various test tapes. Channel Marketing Inc. of New York has an imaginative line of such goodies, including a *Stereo Position and Track Indicator*, an *Azimuth Adjustment Cartridge*, a *Frequency Response Cartridge* and others. Then there is the *Gidget*, a gadget that converts a ¼-track cartridge so it will play on an ⅛-track player. Last and almost least, there is the Starr cassette system, which is of enormous economic potential thanks to one, tiny change in the cassette mode of operation. With Starr, you can *push* the cassette into a socket, instead of having to drop it from above. Unimportant?

(*continued on page 477*)

Oki have hi-fi taped. Here is a fabulous selection of all-transistorised solid state tape recorders. The Oki range comprises complete monaural and stereo tape decks with pre-amps of professional quality and specifications. All in magnificently finished cabinets!

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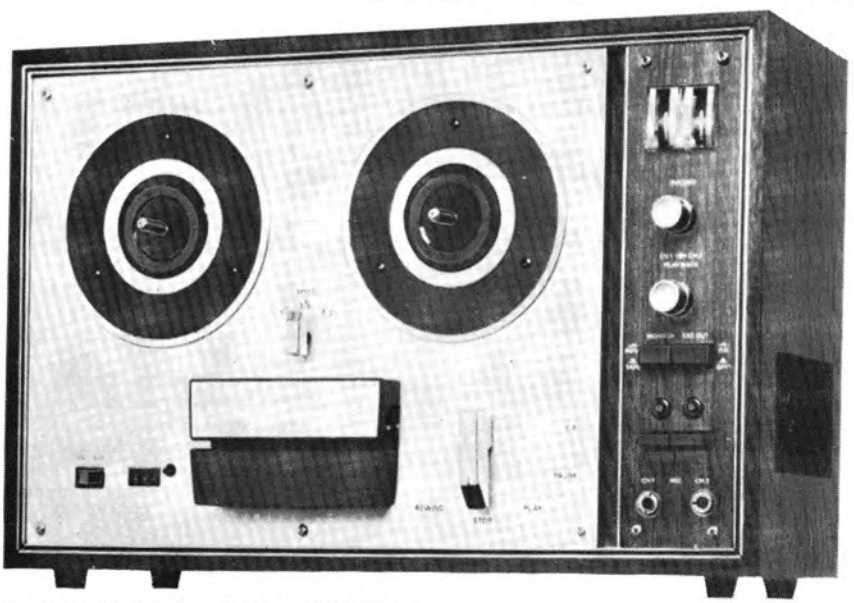

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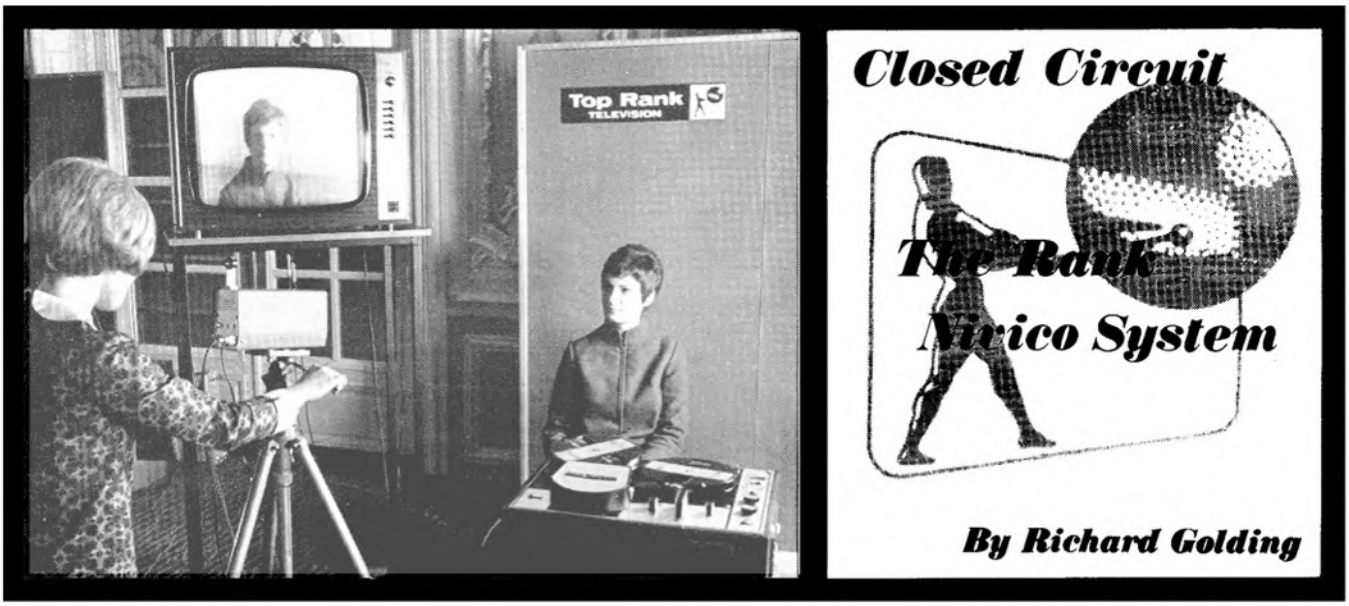


THE Rank Nivico is the latest low priced Japanese VTR to become available in this country and already it is being used to good effect in at least two areas in London. Goldsmiths College Television unit have added one to their Ampex *7000*, Ampex *5000* and Peto Scott machines to give the unit more mobility, and The Royal Free Hospital are using two machines in their International Museum Exchange.

Paul Barnes of the Goldsmiths College unit seems quite pleased with the Nivico performance. He uses it mainly to dub off from the Ampexes and the Peto Scott for playing back in schools, and sometimes to record off air when the other machines are not available. Where schools are concerned, the Nivico has two main advantages: it is cheaper to run than the 25 mm tape models—with more mobility, and it is so simple to operate that it can be left safely in a classroom for a teacher to play back alone for the whole of the tape run. For classroom observation, it is set up on a trolley, the Philips camera is switched on and the levels are set on the VTR. As it has been found that there is no need to re-adjust levels during a recording, the technician can withdraw for the whole of the 60-minute period.

The Royal Free Hospital's Museum Exchange has been set up by Mr. W. Steele, FIMLT, Chief Technician of the Royal Free Hospital Group, under the direction of the Professor of Pathology. Television cameras are used at post mortem examinations to record the pathologist's work and findings. The videotape is then played back to introduce findings at clinic conferences following post mortem examinations, to which all academic staff and students are invited. Colour slides of the subject under discussion are projected on to a large suspended screen. A television camera picks out the minute details of the subject on the lecture table and transmits them to Bush television monitors, strategically placed throughout the lecture theatre.

Another CCTV camera attached to a microscope is used for very detailed study. To enable many students at one time to study tissue and blood cell changes, the camera picks out these points while students watch the monitors. This leads to useful discussion and research into the further treatment of similar diseases. The methods used at the Royal Free Hospital are creating a good deal of interest both at home and overseas and discussions are now taking place with a view to establishing another similar centre in Ghana.

International 12.5 mm videotape exchange is now on with this link between London and Ghana, and everyone I have spoken to who has been concerned with the operation of the Nivico has found complete compatibility between one machine and another, so it could prove very successful.

An attractive feature of this machine is its threading action. The take-up spool is mounted horizontally as normal, but the feed spool is raised on a plinth which slopes down towards the front of the deck, and this helps maintain correct tape tensioning. The helical drum cover lifts up and the tape is slipped in or out quickly and easily with no bother at all in an omega path around the drum. Tape speed is 24 cm/s; tape width is 12.5 mm; and the maximum reel size of 20 cm gives a total recording time of 63 minutes.

The video signal is recorded in a helical scan by two rotary heads and the sound and synchronising tracks are recorded linearly with full-width erasing used except when the machine is set in the audio mode only. During a full recording, the audio level can be switched to auto, thus allowing the operator to concentrate on the video levels.

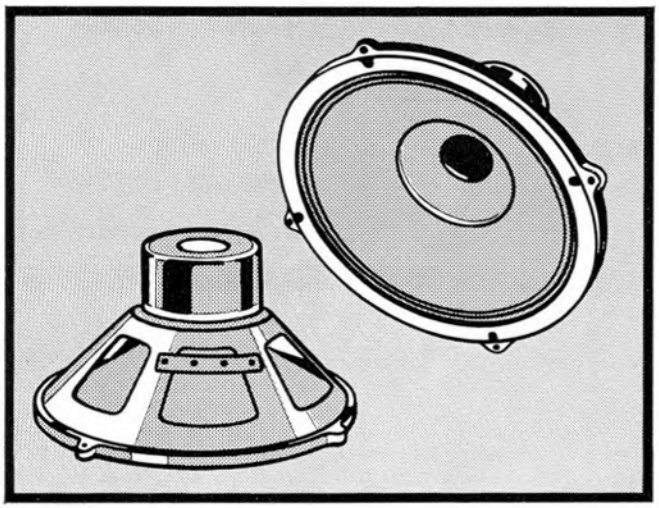
The mechanical controls are very simple and are located on the deck, front right. Three separate levers control the following functions: *still frame* and *fast forward* on the left; *rewind, stop* and *play* in the centre; and *total record* or *audio record only* on the right, but switchable only when the central lever is in the *stop* position. Above these, on the deck at the right, are the vision and sound level controls in a separate panel. So all the controls you need for record or playback are directly to hand. A digital counter (belt-driven) is situated front left on the deck. All the controls are fairly easy to work, but the fast wind can only be effected when the central lever is set in the play mode. It is possible, however, when shutting off too quickly on rewinding to go over to fast forward, but a clear-cut action of the control is all that is necessary here and this is nothing to worry about. There is no mains failure protection although the still frame control also works when the machine is recording, thus providing a pause facility on record. I doubt if this facility will ever be needed while recording, but at least it is there

(*continued on page 487*)

SPECIFICATION OF KV800

Video	
Recording system:	2-Head Helican scan
TV signal:	405/625 line standard
Recording time:	63 minutes maximum
Tape width:	12.5 mm
Max. reel size:	20 cm
Tape speed:	24 cm/s
Video input:	1 Vpp/75 ohms
Video output:	1 Vpp/75 ohms
Frequency response:	2.5 MHz
Signal to noise ratio:	More than 40 dB
Still picture playback	
Audio	
Input, microphone:	—60 d/B10 K unbal.
Input, line:	—10 dB/30 K unbal.
Output:	0 dB/2 K unbalanced
Frequency range:	70 Hz-10 kHz
Signal-to-noise ratio:	More than 40 dB
General	
Power supply:	240 V AC, 50 Hz
Dimensions:	53 x 44 x 30 cm
Weight:	66 lb.
Styling:	Wooden case table model

Faithful Reproduction



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REPS R10 (M/2)	Our price ONLY 29 gns.
GRUNDIG TK6 (BP/M/2)	Our price ONLY 35 gns.
BRENELL Mk 5 (M/2)	Our price ONLY 35 gns.
BUTOBA MT5 (BP/M/2)	Our price ONLY 35 gns.
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GRUNDIG TM60 (S/2)	Our price ONLY 35 gns.
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PERSONAL BIAS

INSIDE OUTSIDE OXIDE BY JOHN ASHCROFT

IT is gratifying to hear your work announced and broadcast on local radio—until they add an apology for the muffled quality. Which reminds me, what causes pre-echo on so many LP discs?

"Print-through on the master tape," say discophiles. Tell me another . . . have found pre-echo on mint copies of original 78 r.p.m. collectors' items.

"Mechanical effect caused by one groove affecting its neighbour," say the tape brigade. I used to believe them, too. Then I bought a *Mercury* LP of Bartok's *Concerto for Orchestra* to find that the run-off groove on Side I contained a long, clear and startling preview of the music on the start of Side II.

But let us be charitable: perhaps during the tape-to-disc transfer somebody did not completely drop the gain control when he should have done, and a supposedly silent run-off groove caught some of the music as the complete tape ran on.

Mmmmm . . . but on my copy of *Storyville's* 'Folksay' LP, the intended silence between two songs contains a fantastically loud pre-echo of something on the other side of the disc. I assume that the original 78's were taped, vicious print-through occurred, then the order of the songs on the mastertape was changed, leaving a loud ghost looking for its body.

So . . . sometimes we blame the grooves, sometimes the master tape. Experts claim that 99% of the trouble is groove-originated, but I have met enough samples that do not coincide with the disc's rotation (apart from weirdies like those detailed above) to convince me that a much less confident estimate is advisable.

Some users deny that print-through can occur in normal conditions. But I have often experienced it. The very existence of such a phenomenon was seriously doubted by one enthusiast—whose message and magazine tapes are often prize examples. I sometimes think I am the only one around whose ears are tuned to detect it.

(Running a fingertip on the deck of an inadequately earthed machine makes my remaining hair stand up, whereas everyone else present derives no sensation at all; and my imagination is often accused of putting me into a permanent minority of one; but it cannot *all* be in the mind !)

SILENT SURFACE

Lately I have adopted a tape which really has the silent surface claimed for it (compared with others, that is); it is marvellous—but I obtained print-through on it. Perhaps I *am* inclined to overmodulate; this may date back to the time when I was the only quarter-tracker exchanging tapes in a group of half-trackers, and had to ensure the loudest possible signals to stop them from grumbling at my lower strength. But I know other enthusiasts who have hit the same snag with this new tape. Of course, we may be getting print-through on other brands whose noisier surfaces help to disguise its presence; but it became noticeable on the new stuff, and no amount of frequent fast-winding or rewinding reduced it.

There's a twist to this story. Literally !

At a BBC demonstration, a chap played the prepared tape on an ordinary-style deck, but deliberately twisted the tape on either side of the head-assembly. The tape came off the spool with its oxide coating outwards; was twisted over to bring the oxide against the heads; and twisted again to be taken up, oxide facing outwards.

My query received a vague "Oh, we often store 'em wound like that; some technical reason." A fortnight later, a studio boffin discussed this question with one of my friends and mentioned some EMI machines with clockwise take-up turntables.

Someone else said many professionals stored tape 'oxide outside' as a visual indication that it contained recordings (a time-saving precaution against erasure); and that this was often done deliberately even when conventional tape transport systems were employed. Which explained the twists on the BBC demonstration tape.

If you think life's getting complicated, there's worse to come. The studio boffin added casually to my friend "Also, they've noticed that storing tapes that way reduces the effect of print-through."

I uttered a baying hoot and extended the leg with bells on. But I tried it and it worked. Having re-wound my affected tapes, I stored them 'oxide outside' for a week; when I replayed them, the print-through had diminished or even vanished.

So I recorded the same sounds at identical gain on two lengths of the new tape, storing one normally and the other 'oxide outside.' Replaying them, a few days later, I felt like one of Pasteur's sceptics when the cattle-pen was opened to reveal that the injected cattle were fighting fit while the others were dead of anthrax. No print-through audible on the 'oxide outside' version; some print-through noticeable on the normally-wound tape. And, on both, generous gain had been used.

Soon afterwards, my heritage was graced by two esteemed colleagues, Terry Brown of the Middleton Tape Group and George West of the British Ferrograph Owners Club. I mentioned the problem; they scowled and began to theorise.

Someone—Terry, I think—said: "With normal winding, the oxide carrying the magnetic patterns is in a state of acute compression and concentration; with this 'oxide outside' winding, it's stretched out and thinned in a state of tension."

We drank a toast to this observation; after several more toasts it became the obvious explanation, everything was crystal-clear, and I am only sorry that next morning for some reason, I couldn't recall the precise logic of the full discussion.

I have since met BBC bods familiar with 'oxide outside' winding and others who boggle at the concept. But I now store all my recordings on this new tape that way—though constant alertness is required, or the most embarrassing things happen whenever I replay them for visitors. Oh, and twisting the tape on either side of the heads cures one source of twitches: being tilted almost horizontally as it enters or leaves the spools, the tape never catches or squeaks on their rims.

Now ! A fortnight ago I took some amateur tapes for a sort of audition to a local radio station which shall be nameless. The BBC chap automatically twisted the first as he laced it into the deck, and I had to jump in and remind him that these tapes were conventionally wound. "Sorry !" he said. "It becomes a habit." And, let us be fair, this new tape *is* fairly dark and glossy on both sides compared with most brands, and mistakes are easy in anything but the best lighting.

DISMAL QUALITY

The following week the station broadcast some work they had asked me to do, said it was my work, and apologised afterwards for the dismal quality; in fact, what came over the air was a hideously muffled travesty of the recording I'd sent in. I'd submitted it, wound conventionally. It was returned, twisted over.

Think about that. They used full-track replay: my tape was half-track, using one track only, so if they twisted it they'd be scanning it through the thickness of the backing *but* in the right direction. And it was thin tape. I deliberately played it at home, through its backing, using the lower head of a ¼-track machine. It emerged intelligible but abominably muffled . . . just like the broadcast. I cannot help having a suspicious mind. That sort of thing happens to me !

Oh, and the Editor tells me that oxide-outside winding "simply reverses the sequential sound of recorded music material from turn to turn".

But the whole question still seems mysterious and the expert quoted by John Crabbe didn't sound entirely convinced about it . . . also, it seems to suggest that print-through on adjacent windings will travel only in one direction. I spent two hours, drawing spirals with shading for oxide and backing thicknesses, and suddenly in a blinding flash of light the whole question became as clear as mud. And there isn't even any relief in screaming, because the padding on these walls gives an utterly dead acoustic and takes all the fun out of it.

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RELIABILITY IS BUILT IN

THE HOME TUTOR

Richard Golding examines the home language teaching market and the role of the tape recorder

A LANGUAGE teaching unit in Novosibirsk, USSR, claims to be able to teach a foreign language in one week and reports that a student who knew not a word of English was able after a week's tuition to converse with a visiting US physicist who did not understand Russian.

The method used is to place the student in a linguistic isolation chamber. He stays there for fourteen hours each day for a whole week while six teachers in succession instruct him in the foreign language. Not a single word of Russian is used throughout the course which has its full share of visual aids, language drill tapes, foreign films with the original sound track, and a plentiful supply of journals and newspapers.

This is the really hard way to learn a language, provided that you can keep your sanity, but I have no doubt that this Russian unit is achieving fantastic results with these methods. There is no easy way; mastery of a foreign language demands endless repetition and reinforcement and a will to learn. Sleep learning, for instance, which is considered by some teachers to be the opposite extreme to the Russian method, is not all that its name indicates and might perhaps be called 'sleep reinforcement'.

The theory behind sleep learning is that the subconscious mind is at a receptive peak just before and after deep sleep, and at these times suggestions and information can be processed by the subconscious mind. A tape recorder is used to play back information through a pillow loudspeaker during times of reverie, typically about thirty minutes or so after getting into bed and about the same time before normally waking in the morning. Specially built tape recorders and a variety of tapes for this purpose are marketed by Educational Tapes Ltd., *163 Fellows Road, London N.W.3.* The price of the recorder is £40 19s. and this includes demonstration and conditioning tapes, microphone, pillow speaker, and time-switch. A model with the time-switch built-in costs £51 19s. The demonstration tape explains the theory of sleep learning and therapy, while the conditioning tape contains a twenty-minute recording of a voice intended to lull the sleeper into a receptive state to absorb whatever recorded material follows. The rest of the tape is left blank and is intended to be filled by the user with any learning material he desires to absorb. The tape may be re-recorded over again and the learning material changed as often as possible providing that the conditioning part of the tape is not erased. The standard tape is recorded at 9.5 cm/s on 15 cm reel of LP tape. There are two tracks, both containing conditioning. The actual learning material can be your own recording from a study text or portions transferred from a language tape. *Many people find, however, that sleep learning gives them bad dreams and often nightmares when they first start, but apparently these tend to diminish after the third or fourth night.*

The conditioning tape may be bought separately for £3 3s. and tapes intended for normal conscious study plus supplementary pre-sleep study are available in French, German, Russian, Spanish and Italian. They come at various prices; the *Elementary French Conversation* in fifteen lessons costs £4 5s. 6d. for instance, and the *Spoken German for Students and Travellers* in 62 lessons costs £9. All courses have a handbook.

Educational Tapes Ltd. also supply holiday language tapes in French, German, Italian and Spanish. Each course is recorded at 9.5 cm/s on two 13 cm reels and costs £6 6s. These tapes are not intended to be used as full courses of study but are specially prepared to give an elementary knowledge of the language sufficient to get around the country concerned on holiday or business. They differ from normal tape courses and have been designed for tape recorder learning without a text book. Study can be confined to listening both fully consciously and as a background to other activities such as dressing, having meals, ironing and bathing. The foreign text is spoken by a native teacher and this is immediately followed by the English translation in an English native voice; the foreign text is then repeated, so that you have a sandwich comprising the foreign voice either side of the English translation.

A great variety of language courses on tape are available from Tutor Tape Company Ltd., *2 Replingham Road, London S.W.18.* These are normally recorded at 9.5 cm/s but 19 cm/s tapes can be supplied on request at 40% surcharge. The catalogue contains details of 21 French courses, 25 German courses, 18 Russian courses, 10 Spanish courses, 7 Italian courses, and 1 each of Hebrew, Arabic, Modern Greek and Colloquial Portuguese. Prices start around £3 for elementary conversation courses and go up progressively for longer, more involved recordings. For example, the *Advanced French Conversation* (by Kany and Dando) consists of 25 conversational lessons recorded by four native lecturers and is recommended for students interested in acquiring fluency. Lessons are subdivided into sections dealing with the weather, looking for lodgings, sports, car-driving, visits to beauty salons, etc. Duration is over one hour, supplied on one 13 cm reel, and costs £5 7s. including purchase tax. Textbook 8s. 6d. *Spoken Spanish or Students and Travellers* is on two reels and lasts for 2½ hours. It includes both elementary and advanced conversational lessons without grammar. The 90 lessons deal with everyday subjects and the conversations are constructed in such a way that the student can quickly acquire a working knowledge of the language. Each Spanish sentence is provided with a written translation and the textbook contains a brief survey of the grammar. The last ten lessons of this course deal with South American Spanish. The whole of the course is recorded by five lecturers in Castilian dialect. Cost is £9 6s. 6d. including purchase tax. Textbook £1 4s.

Language courses available on tape from the Linguaphone Institute Ltd., *207 Regent Street, London W.1*, include French, German, Italian, Spanish, Portuguese, Dutch, Norwegian, Russian and Swedish. Twenty-eight other languages are available on disc. The exact make-up of the courses differs according to the language studied, but in general they each consist of a series of fifty lessons. Some lessons are descriptive, others give conversational practice. The content is intended to provide variety and interest and to involve the student in the realistic everyday incidents of the foreign country, among modern, educated people. Each course contains a phonetic sounds recording and the main textbook carries the full text of all recorded lessons with illustrations of the objects mentioned in them. Other books include a vocabulary, which gives the meaning of every word, a book including all the necessary grammatical explanations, and one giving detailed instructions for the use of the course. The cost of each course is 17 or 18 guineas according to the language chosen and this includes a Personal Study Plan drawn up by the Institute before you start the course, and an Advisory Correspondence Service. The study plan is based on a questionnaire that you fill in when applying for the course, stating the knowledge you have of the language, your special aim, e.g., travel, examinations, business, and the time you can spare to study. The advisory service is not compulsory, but it is certainly worthwhile for it provides a constant link with the Institute's tutors to whom you can send in written work for correction and comment without extra charge.

Some Correspondence Colleges now provide tapes as part of their A and O level courses in language. The National Extension College, Shaftesbury Road, Cambridge, also provides a course of eight lessons for beginners. The French Beginners is an audio-visual course where no English is used except to give instructions and the student learns the direct way by using pictures, text and tape recordings in conjunction. The tapes also contain drills and exercises both for practice and to return to the tutor. The German and Russian Beginners follow the same pattern while the Spanish Beginners uses LP discs. The NEC uses tapes with its O-level French, Russian, German and Spanish and also with Mandarin Chinese. This course aims to provide an approach to Mandarin Chinese by way of the spoken language. The basic textbook is supplemented by additional material and exercises in the ten course booklets, together

(*continued on page 477*)

A PLAGUE ON BOTH

SOME EXPERIENCES WITH TAPE RECORDS BY WILLIAM HENRY

I HAVE just ruined a good tape. Not a cheap, bargain-offer substitute emery-cloth or reject computer-type tape; not even a bit of an odd reel that I could splice away and forget, but an expensive pre-recorded gem, fresh from the Surrey hills.

Although I contend that it was not wholly my fault, I do not have the cheek to take advantage of *World Record Club's* dainty little packing slip, which tells me I can whip it back to them in case of complaint. In the first place, they have been good to me over the years, sending me annually their tempting lists of offerings, with odd chats from people like Steve Race thrown in, and I have only once actually received a tape that screamed out to be sent back—on which, by some oversight, they had omitted to record anything at all. Good for testing noise levels, but I have Mr. Tutchings's excellent recordings for that job.

From which, readers will have gathered that I am not one of those fortunate few who get regular review copies forwarded, and who make such erudite comments about them in these and other columns. (What do they *do* with them all, I wonder?) I pay hard cash for my pleasure, and this particular 13 cm reel set me back all of £2 19s. 0d. It was *TT658/659*, a double ration—just my luck—with the celebration recording of Elgar's *Dream of Gerontius*, in honour of Sir Malcolm Sargent's 60th birthday (which was, in case you want to know, back in 1955). Sargent was conducting the Liverpool Philharmonic Orchestra, with the Huddersfield Choral Society, and Richard Lewis, Marjorie Thomas, John Cameron as soloists—the result demonstrating his incomparable technique. How we shall miss that man.

Expensive, yes, but worth it, if only WRC had not tried to be so ambitious. On this 13 cm. spool they had wound what I calculate to be 937.5ft. of LP tape, which is just two minutes too much—the more annoying because, in their usual desire to impose a 'natural break', they had started Part Two of the *Dream* by the end of Side One of this ½-track tape and left wads of unrecorded time at the end of Side Two, when the recording was concluded. This meant that the tape, though tightly spooled, sat right out to the flange edge of the spool. Some machines I know would make hay of that rewind, and I shall proceed to respool this on

(continued on page 481)

THE HOME TUTOR CONTINUED

with tapes and a series of fifteen résumés which link the course to the textbook and the recorded material. The course is considered to be well within the capabilities of anyone with an average aptitude for the more commonly studied European languages. Chinese characters are not introduced, but the level attained at the end of this course will be approximately o-level, and students will then be able to enrol for tuition in the reading and writing of Chinese characters, a course which is now being prepared. Prices and full details on application.

It is well to know what is involved in the actual examination for o-level before considering the syllabus. The London Board sets a written and an oral examination. The written examination for French and German includes an overall comprehension test (in which a passage is read in the foreign language and questions have to be answered in English), translation into and out of the language, dictation and free composition. For Russian and Spanish the syllabus is the same, except that there is no aural comprehension test. For all these languages there is also an oral examination in which students are asked to read a passage supplied by the examiner and carry on a simple conversation.

Generally, the tape recorder is an invaluable aid to learning a new language and the increased comprehension that develops through the repeated imitation of a good native speaker's voice cannot be over estimated. It can make rote-learning quite a painless affair but the machine must not be expected to do all the work; to attain any sort of proficiency the language must be studied in depth, regular periods set aside for learning, and passages translated at regular intervals. Sleep learning may be used to reinforce study if you care for this method, but do not leave it entirely to the reverie periods to absorb the language for you. This will not work at all, for proficiency only comes with understanding and use.

TAPE RECORDER SERVICE CONTINUED

left adjustment position can impose too much side thrust on the motor bearing. This slows the motor down and leads to overheating. The opposite condition, of an incorrect adjustment, too far right, gives some pulley slip and erratic winding, which should be obvious on inspection.

The *TK120*, lacking the extra drag of the tape position indicator drive, can have the spring on the right-hand lug, but those with a t.p.i. should have correct torque with the spring on the centre lug. Ageing will, of course, alter these conditions and the range of adjustment allows for this. Just as important, for good fast winding, is the 'riding' action of the fast wind pulley, which is at the top of its travel during this function. It may be necessary to bend the bracket slightly to ensure a free movement.

Brakes are essentially simple on this machine, being felt rings fitted on lugs on long levers, so that switching to stop retards the outer sides of the spool carriers. The only adjustment is a lug that acts as a limiting stop, and clearances should be 0.6 mm from these stops when brakes are applied and 0.8 mm from the carriers to the felt rings when start is selected.

Anybody who has already had experience of dismantling this machine will by now be wondering why I have not mentioned the vital factor, the pivot points of the brake and clutch levers. These appear to be ridiculously inadequate—but they work well if undisturbed. They are simply lugs on the operating levers that protrude just sufficiently through the top plate of the machine. There is no sort of bearing, no lubricating point, no leeway for adjustment. And if one has been foolish enough to try dismantling by releasing the screws of the top plate these lugs are the very devil to relocate. Again, the makers warn us that we should *not* remove the four tempting screws that secure the top plate.

So how do we change the belts, you may ask? A good question, and like so many others, having a simple answer. The trick is to invert the machine and remove the rectangular plate that acts as lower bearing for the flywheel. Then, the belts can be looped from their pulleys and allowed to slacken toward the flywheel, and withdrawn through the aperture at the bottom. Before doing this, and again before renewing the belts, the flywheel bearing should be degreased with a little spirit. After replacement, a smear of soft Vaseline grease on the nylon bearing will be sufficient. Do not overlubricate. This is the greatest mistake, to judge by the condition of many machines that have landed on my bench.

Now, let us explain a rather cryptic remark made earlier on the general subject of motors. Grundig have come up with a clever protection idea, no doubt as a result of numerous complaints about motor torque—not all justified—on their earlier models. I have attempted to depict this in fig. 4. The protection is a ring or washer, of fusible material soldered inside the motor pulley. If external conditions cause the motor to stall, overheating will ensue, and the solder will melt at a temperature of 96°C. The stalling force is released, the motor can turn and will cool down to safe limits. However, the fault remains, and the fuse ring will have to be replaced, and this is where the snag occurs.

There are three versions: the original, as in fig. 4a, has no fuse ring, and the compression spring is longer than in the later version 4b. On the later version a fan is fitted, and there may be either a thin washer of fuse material as in 4c or a ring as in 4b. The trouble comes when an intermediate fault stage is reached: when the motor stalls temporarily and the fuse melts only enough to deform and allow the washer to push upwards by the spring pressure. Then, re-running will have all the symptoms of a faulty motor. The moral is: before condemning the motor, take a look at the pulley and its fusible ring. Always clear any odd bits of fuse metal away, and refit washers above and below the spring to get the right pulley height so that the flywheel belt can sit horizontally, parallel to the chassis.

Remember that the identifying feature is a fan at the top, and if replacing pulleys at any time, always stipulate what sort is wanted. When replacing an old type with a new one, a shorter compression spring will be needed, and it is not a bad idea to get a couple of extra washers for height adjustment. Finally, take care to insert one washer at least adjacent to the lower grip-ring. To raise the pulley, insert an extra washer at the bottom and remove one at the top; to lower, proceed vice-versa. On the old type there is a little more leeway, and extra washers can be added; but on the new type, a strict balance will be needed to stop any inadvertent compression of the soft fuse metal.

A SORT OF CHAIN REACTION CONTINUED

stop the singing. But if the choir was well over half way through before deciding against it, he would allow them to finish before asking them to repeat the number. It was on these occasions that he would allow me to listen to the choir through the earphones. Until then I did not believe it possible to obtain such a clean background.

Every song had to be recorded in entirety, and to perfection, twice. Some were recorded a third time for good measure. Occasionally Mr. Boyden would ask the choirmaster to come and listen to a particular song being played back over the speakers. As a result, a song would sometimes be re-recorded. On one occasion, all the members of the bass section were invited to listen to a piece they had just sung. They were horrified! And the choirmaster took them through it twice before it was again recorded, this time to everyone's satisfaction.

In between recordings and during the recess, I discussed with Mr. Boyden the various aspects of professional recording. His philosophy seemed to be: plan everything down to the last detail—but keep it simple; make sure your equipment is functioning perfectly, then get on with the job. Problems? Sort them out if and when they arise. With his experience in recording everything from a drum and fife band to modern aircraft noises, and from choirs to symphony orchestras, he must have had plenty of them.

Sitting-in at this recording session was one of the major events of my life. To hear the choir singing those songs I had grown to love was a great pleasure; to know they were being recorded for posterity gave me enormous satisfaction. And to see a professional of Mr. Boyden's calibre at work was a revelation.

So to Mr. Boyden and his charming wife, my warmest thanks; and to the Silver Ring Choir, their choirmaster and their secretary, congratulations, and may their record—due out towards the end of the year—be a really great success.

AMERICA TOMORROW CONTINUED

Far from it! In automobiles the cassette is dangerous because loading it requires momentary use of the eyes. The Starr system (by the original developer of the cassette, I am told) makes possible a push-in cassette player that at last can compete directly with the push-in ¼- and ⅛-track cartridges. Worth millions!

The day I left the Big Show, Resurrection City, in Washington DC, was evacuated and the Poor People started back home. Chances are slight that there were any cassette players in their mule wagons. Sometimes I wonder where we think we are going—but don't get me wrong; I *like* electronics. Somehow, though, we ought to keep them in perspective.

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- ★ Bass switch
- ★ Equalizer for each tape speed
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- ★ DIN jack, Stereo headphone jacks
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- ★ Finely oil-finished wooden cabinet
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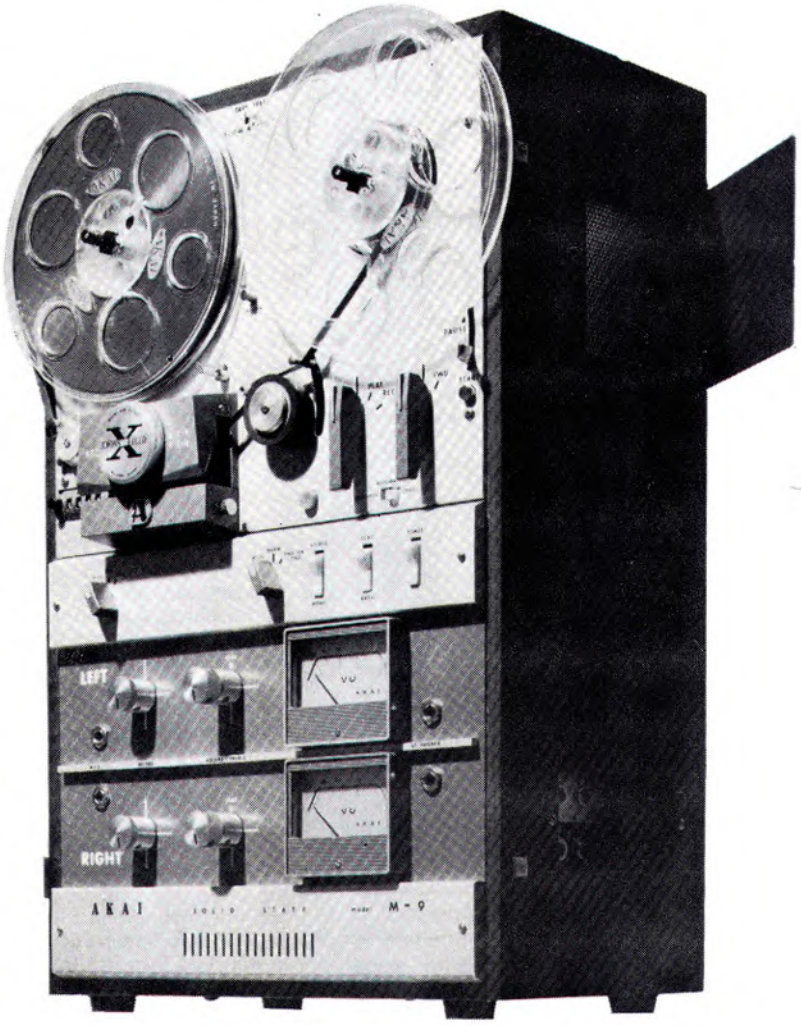

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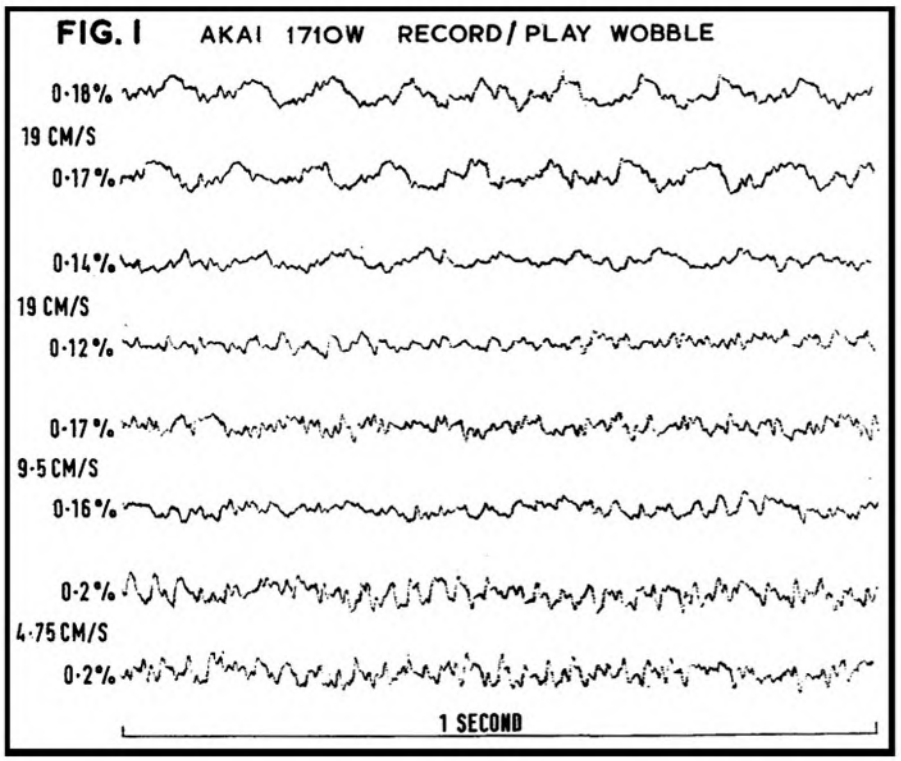
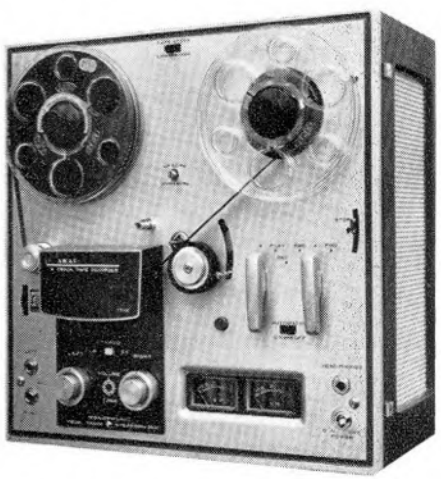
equipment reviews

AKAI 1710W STEREO *(Model 1710 illustrated, without reflectors)*



MANUFACTURER'S SPECIFICATION: (19 cm/s) Quarter-track stereo recorder with self-contained power amplifiers and side-facing loudspeakers. **Wow and flutter:** 0.16% RMS (play only). **Frequency range:** 40 Hz-18 kHz. **Distortion:** within 2% at 0 VU. **Signal-to-noise ratio:** 50 dB. **Equalisation:** NAB. **Dimensions:** 36 x 34.5 x 19 cm. **Weight:** 33 lb. **Manufacturer:** Akai Electric Co. Ltd., 12, 2-chome, Higashi-Kojiya, Ohta-ku, Tokyo, Japan. **Distributor: Pullin Photographic Ltd., 11 Aintree Road, Perivale, Greenford, Middlesex. Price:** £89 10s. plus £20 7s. 3d. purchase tax.



THIS is the standard Akai deck, this time with a switched-pole motor to give a 2:1 change of speed and a slip-on capstan sleeve to provide a further 2:1 increase covering 19, 9.5 and 4.75 cm/s.

Silicon transistors are used for the pre-amplifier stages with triode-pentode valve power amplifiers for each channel. The bias-erase oscillator is also a valve.

The sideways-facing speakers are provided with metal reflector flaps, which direct the high frequency sound forward to the listener.

Tape transport is controlled by two robust levers, one of which operates the pinch wheel for normal tape transport with a second position for record, while the other lever provides fast wind and rewind facilities. The winding time is dependent on the position of the motor speed switch and, on the 19 cm/s (high) speed, an 1,800 ft. reel of LP tape is spooled in two minutes 15 seconds.

The three-digit tape position indicator is driven from the supply reel and is geared to clock up exactly one digit per reel revolution, i.e., 10 turns of the reel gives a reading of 10.

A heavy 10 Hz capstan wow was noticed when the recorder was first submitted and six further capstan sleeves were sent to me by Pullin Photographic to measure the spread of the wow and flutter characteristics with this controversial method of tape speed changing.

The top pen trace of **fig. 1** shows that the original sleeve was indeed beyond the specification limits, giving a combined wow and flutter reading up to 0.18% RMS, and a wow-only reading from a low wow and flutter test tape of 0.12% (see panel B). The six spare sleeves gave wow-only readings ranging from 0.035% to 0.05% on the test tape, and No. 2 was selected as an average sample for the rest of the pen recorded tests. Combined wow and flutter on record and play gave readings ranging from 0.12% to 0.14%. 9.5 cm/s readings were 0.16% to 0.17% with capstan wow and tape friction flutter in about equal proportions. At 4.75 cm/s 25 Hz flutter from the drive motor became a little more obvious, with RMS readings averaging 0.2%. Thus the short-term speed variations were within the normal domestic recorder limits without being outstanding for a machine in this price class.

Table A **Play-only wow and wobble from test tape**

19 cm/s	Wow 0.04% W+F 0.13%	9.5 cm/s	Wow 0.06% W+F 0.16%

Table B **Wow-only, playing test tape at 19 cm/s with six capstan sleeves**

Original	0.12%		
1	0.045%	4	0.035%
2	0.04%	5	0.05%
3	0.065%	6	0.045%

(Sleeve 2 used for other speed tests in this review)

Fig. 2 shows the responses and tone control knob positions on standard DIN CCIR 70 and 140 μS test tapes. Similar curves were obtained on NAB 50 and 90 μS test tapes with the tone controls turned about 20° anti-clockwise. System noise with no tape passing the heads was 40 dB below test tape level (10 mM/mm) with the volume control fully advanced. At lower settings of the gain control the output stages contributed some hum which degraded the measured signal-to-noise ratio.

Record-play tests gave the responses shown in **fig. 3.** At 19 cm/s the tone control had to be turned nearly fully anticlockwise for a level response, showing that the pre-emphasis was somewhat fiercer than that required for the NAB 50 μs characteristic. At the two lower speeds the full treble settings used for **fig. 2** gave the responses shown.

Third harmonic distortion was measured at test tape level (40 mM/mm), 12 dB above peak recording level, and found to be 2.8% with the tone control set for a level response and 4.2%

(continued on page 481)

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SPECIFICATION

● ¼-track stereo or mono record and playback at 7½, 3¾ and 1⅞ ips ● Sound-on-sound and sound-with-sound capabilities ● Stereo record, stereo playback, mono record on either channel ● 18 transistor circuit for cool, instant and dependable operation ● Moving coil record level indicator ● Digital counter with thumb-wheel zero reset ● Stereo microphone and auxiliary inputs and speaker/headphone outputs . . . front panel mounted for easy access ● Push-button controls for operational modes ● Built-in audio power amplifiers giving 4 watts rms per channel ● Two high efficiency 8"x 5" speakers ● Operates on 230V AC supply.

STR-1 SPECIFICATION : Tape Speeds : 7½, 3¾ and 1⅞ ips. **Wow and Flutter :** Better than 0.15% rms on 7½ ips ; 0.25% rms on 3¾ ips ; 0.35% rms on 1⅞ ips. **Tape size :** ¼" wide, Long or Standard play. **Reel size :** Standard up to 7". 5¾" spools and tapes supplied. **Digital Counter :** 3 digit counter with zero reset. **Heads :** ¼-track erase record and playback. **Microphone :** Moving coil hand microphone (mono) supplied. **Semi-conductor Complement :** 18 transistor, 1 silicon bridge rectifier. **Frequency Response :** 3dB, 40 Hz to 18 kHz at 7½ ips, 3dB, 40 Hz to 12 kHz at 3¾ ips ; 3 dB, 40 Hz to 7½ kHz at 1⅞ ips. **Signal-to-noise ratio (unweighted) :** Better than 40dB. **Inputs per channel :** Microphone 0.35mV. Auxiliary 50mV. **Outputs per channel :** 4 watt rms into 15 ohms, 1 volt rms (1,000 ohms source). **Speakers :** Two high efficiency 8" x 5" pm, 15 ohms. **Power requirements :** 200-250V AC 50 Hz 60 watts. **Cabinet :** Materials, 9mm. plywood covered with two-tone Rexine with chrome fittings. **Dimensions :** 19½" wide x 7½" high x 15½" deep.

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with the tone control set for maximum top response as in the dotted curve of **fig. 3.** This reminds us that harmonic distortion is quite dependent on playback equalisation, and of course on recording pre-emphasis.

Output stage overload occurred just above 3 v across the internal 8 ohm speakers, distortion at 3 v level was 5%. This maximum undistorted voltage and speaker impedance gives a calculated peak power output of only 1.1 w, which is a long way from the specified 'music power' output of 4 w per channel. Even so, the speakers were fairly efficient and adequate volume without audible distortion was obtained for stereo listening in a small room.

The effect of the tone control on each channel is best seen in the overall acoustic responses of **fig. 4.** These were taken on the axis of one of the speakers at a distance of 1 ft. On 19 cm/s ¼-track stereo recordings, the mid position shown in the solid curve gave the most balanced response.

FIG. 2 AKAI 1710W PLAY-ONLY RESPONSE (TEST TAPE TO LINE OUTPUT)

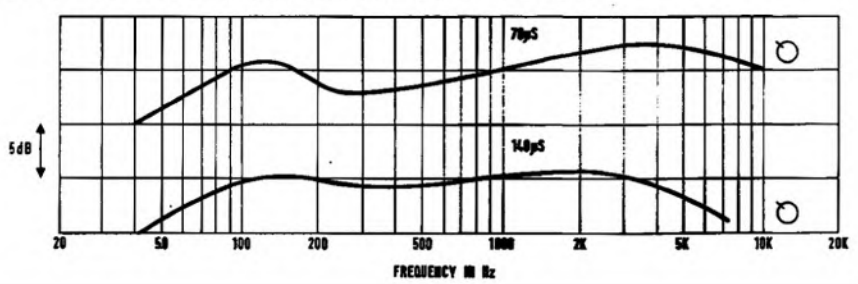


FIG. 3 AKAI 1710W RECORD-PLAY RESPONSE (LINE IN TO LINE OUT)

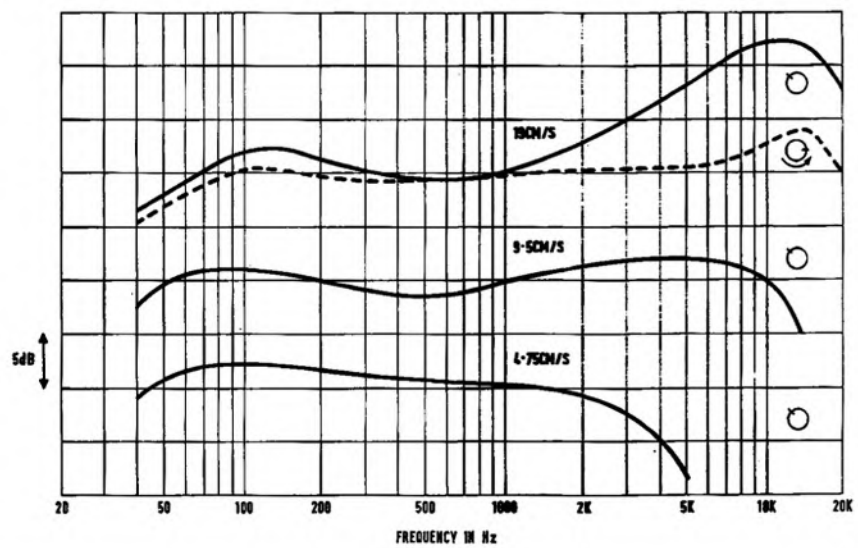
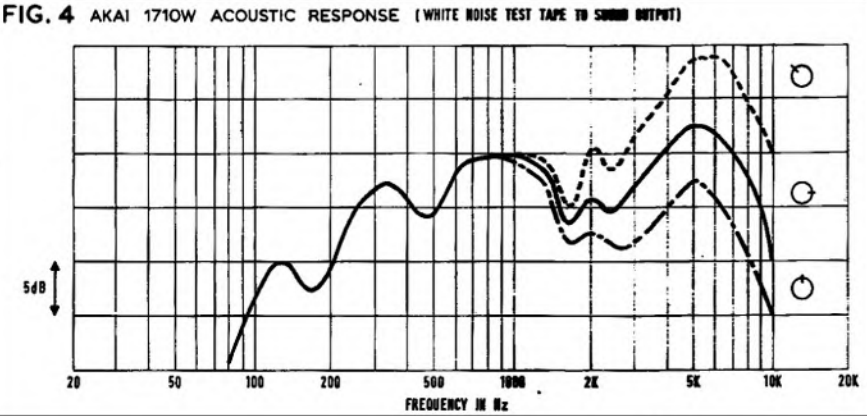


FIG. 4 AKAI 1710W ACOUSTIC RESPONSE (WHITE NOISE TEST TAPE TO SPEAKER OUTPUT)



COMMENT

The small scale stereo effect obtainable from this recorder is much more satisfying than that obtained from a number of stereo recorders with self-contained speakers recently reviewed. I can only assume that it is partly due to better acoustic separation of the speakers in the cabinet and to the mass of machinery and circuitry between them, and perhaps to a fortuitous choice of speakers whose responses happen to match the cabinet shape and dimensions more accurately than usual. To get this effect one has to sit no further than 4-5 ft. from the machine, but it is very pleasant for personal listening. At greater distances, the stereo separation is negligible and external speakers properly placed in the room are essential for realistic stereo balance.

A. Tutchings

to an 18 cm. spool at the earliest opportunity—having now to sacrifice some three minutes or so of the introduction.

Why? Well, this is where my reluctance to complain comes in. I was stuck for the evening, with nothing but a Grundig *TK400* for company, with "Paul Temple" on *Radio 2* (and, for all I know, on *Radio 1*), with a programme on the Victorian Age on *Radio 4* and even on *Radio 3* something quite unacceptable to this hungry listener—"Trade Unions in 1968—An Inquiry" I swear it—you have the *Radio Times* for evidence. So, daringly, I laced up *Gerontius* on the *TK400* and got back to the typewriter, one ear cocked. Unfortunately, I didn't have one eye cocked and it was not until an ominous snarling warned me that I swivelled round to see the horrific sight of festoons of tape all over the floor, and, as it turned out, round the capstan burying itself in the head channel.

SHOULD HAVE KNOWN

So, an old stager like me should have known better. The *TK400* had hesitated after the first few centimetres and failed to take up the slack. Moreover, this machine has no removable head cover, and to get the top plate off one has to remove the spools and lay them aside carefully, then take off umpteen little knobs and things, and ease the whole plate upwards so as not to do any more damage to the precious music. Then comes the fun of turning back by hand and choking back the tears as all the tape creases are revealed. Stop laughing, darn you!

So it would not have happened if I had used another machine. But I say it also might not have happened had the tape not been so generously spooled on to a 13 cm. reel. Hang it all, they will want to get the *Ring* on a cassette next, and moderate Wagnerites like me will be tempted to go over to disc.

The moral should be obvious. Be watchful. Don't take the functions of your tape recorder for granted—and if you own a *TK400*, run it as you would your car, keeping its mechanism in good order. And next time you grumble because WRC only put the programme they advertise on the tape, leaving acres of blankness, just think of me! I had too much for my money!

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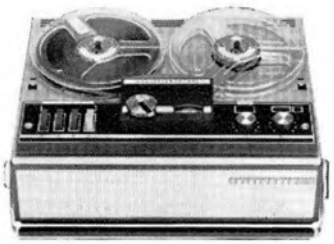

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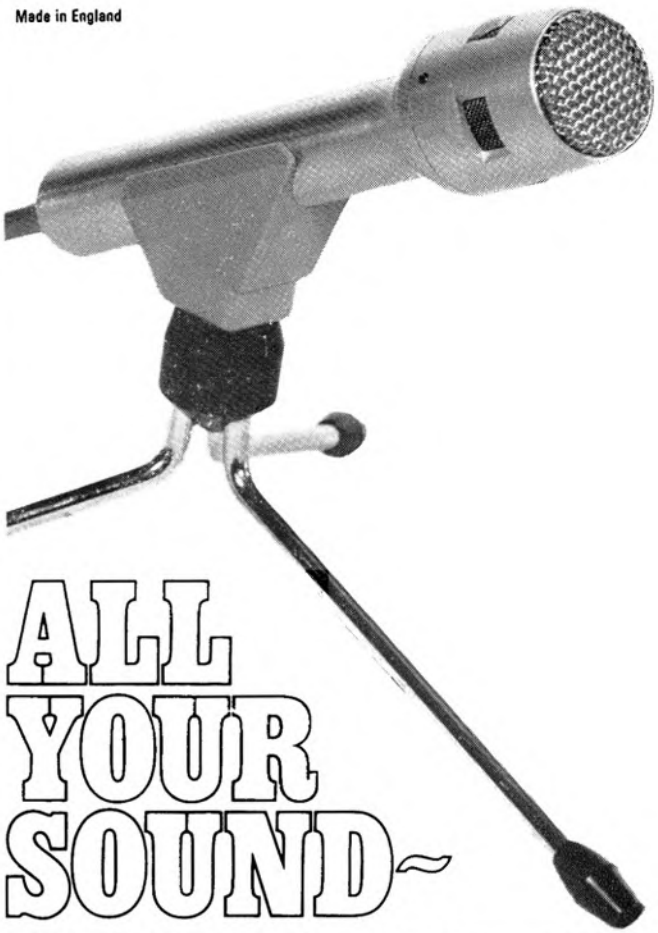

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MAC AUDIO ADAPTOR UNITS

MODEL AAU-1

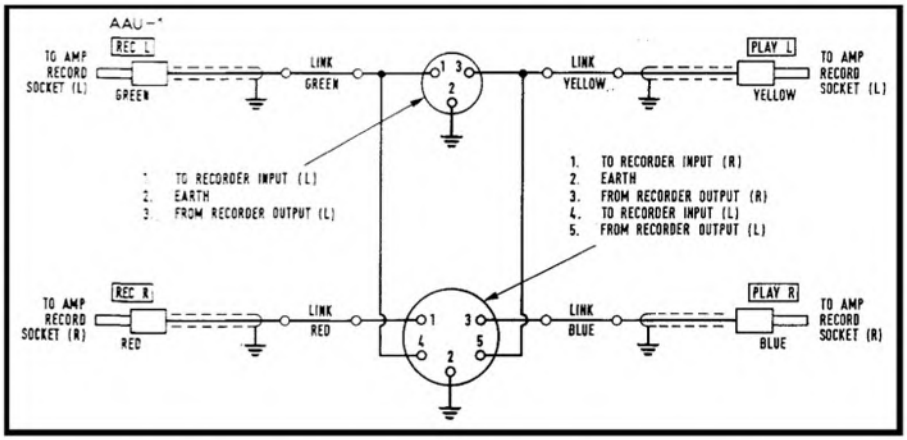
AUDIO Adaptor Units are a range of switching and connecting devices designed to facilitate the interconnection of equipment, and provide panel mounted sockets to simplify connection of external equipment such as a tape recorder to a permanent installation. The facia panels are finished in matt satin chrome with clear, engraved and black-filled legends. Metal knobs on switches are matt chrome finished to match and are locked securely in place with an Allen (hexagonal socket) screw for which a key is provided.

First impressions are very good. The unit arrives securely packed, with instructions, in a moulded expanded-polystyrene box which has separate compartments for all the small extras. The connecting instructions printed in the leaflet are duplicated briefly on a black shrunk-fit PVC sleeve on the tubular aluminium body of the unit, and the plugs are labelled as well as colour coded.

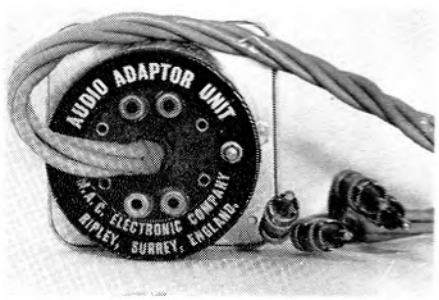
The units are mounted by cutting a 6.4 cm diameter hole in the equipment cabinet panel, through which the rear tubular section of the unit is inserted. After removing the facia, the unit is secured by four wood screws which are covered when the facia is refitted and secured very neatly by two Allen screws locked by the same key—a nice touch, why has no one done this before? Sockets (and switches) are mounted directly on to the front panel, and the internal wiring is between these components and circular Paxolin pinboards which are supported on threaded brass rods and spacers. Colour coded wire links are provided between certain pins, the intention being that these can be replaced by attenuator resistors, etc., where necessary. Provided only these links are modified, the unit remains under its guarantee when the extra components are fitted. The units are purely passive, containing no amplifiers.

A 6 BA spanner is required to open the housing to fit resistors, etc.; this is not provided. Pliers will scar the chromed brass dome nuts, but these must not in any case be over-tightened as the soft brass thread of the mounting pillars strips easily. The tubular housing is earthed by clamping between the front and back plates.

MANUFACTURER'S SPECIFICATION: Provides record/replay connections for a cabinet-mounted audio system to external tape recorders, either 1 stereo or 2 mono. **Fittings:** 3-pin DIN socket, 5-pin DIN socket, four leads with phono plugs. **Accessories supplied:** 1 3-pin plug, 1 5-pin plug (DIN), 1 hexagon key, 4 wood screws, instructions. **Finish:** satin chrome, legends engraved and filled black. **Price:** £3 12s. 6d **Manufacturer: MAC Electronic Company, Portsmouth Road, Ripley, Surrey.**



Rear view of AAU-4



THE FRONT PANEL of the *AAU-1* is fitted with a 3-pin DIN socket which provides record/replay connections for the left channel, and a 5-pin (180°) DIN socket provides record/play facilities for the right channel on the corresponding pins, with the left channel connected in parallel to the remaining pins (4, 5). Stereo connection can therefore be made by separate 3-pin plugs to the two sockets, or both channels can be accommodated via the 5-pin socket. With the amplifier switched to mono, two mono recorders can be fed simultaneously with an identical signal. While allowing flexibility of connection, the pin arrangement used is the reverse of DIN practice for stereo, resulting in a swapping of channels if connection is made by a standard lead fitted with a 5-pin plug; this the makers point out, and a lead must be modified or made up specially unless separate plugs for each channel are used at the recorder end, when they can simply be reversed. This could be something of an irritation, since I would expect a large number of potential users to be just those who are looking for something to skate round the fiddling job of soldering up DIN plugs and becoming involved in the mystique of how things actually work, and who would wish to buy the ready-made leads from one of the manufacturers offering them made up. This unit has added one more combination to the DIN miscellany, and it might be an idea for MAC to supply such leads as accessories: I imagine the price of the *AAU-1* would discourage many who brandish soldering irons, despite the very attractive appearance of the end product.

Fitted to the back of the unit are four screened leads terminated with colour coded phono plugs (or on a special version, the *AAU-1Q*, which was not submitted, with a 5-pin DIN plug) to provide inputs from and feed to a stereo amplifier. Unfortunately those whose equipment is fitted with jacks (or co-axial sockets, which I find preferable to phonos) are not at present catered for.

Sockets are secured by a spring clip mounting which appears quite adequate, although I still wonder whether a screw mounting could not have been used. Leads at the rear of the unit emerge through a rubber grommet and are secured only by wrapping and soldering of the screens between two tags on the support pillars, with no other clamping. The leads could be damaged by strain, but this is unlikely to happen and they withstood a hard tug with no damage whatsoever. Locknuts on the mounting pillars are cemented to the main plate with Araldite or similar adhesive, and also withstood modest maltreatment without mishap.

Electrically there are no faults. Contacts all worked on the DIN and phono sockets and there should be little risk of noise pick-up provided the unit is kept away from power transformers and motors. High frequency losses were virtually unmeasurable at AF within the device and certainly quite negligible, being well under 0.5 dB at 20 kHz feeding from a 100 K source into a 200 K load. Care should however be taken to keep the other leads as short as possible with high impedance circuits.

(continued overleaf)

and particularly when attenuators are incorporated. All phono plugs and screens are earthed—this could conceivably give rise to hum problems due to earth loops, which may be overcome by pushing one or more of the phono plugs only partly home to break the earth loop, a slightly dicey solution. The earthing of external equipment will in any case have to be watched to avoid earth loops.

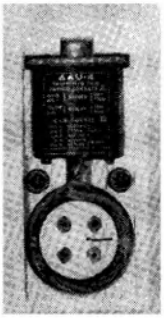
COMMENT

The *AAU-1* unit supplied was well made, the standard of soldering excellent, it was generally robust and unlikely to be damaged except possibly for scratches, and very attractively styled and finished.

MODEL AAU-4

MANUFACTURER'S SPECIFICATION: Provides stereo record/replay connections between two stereo or mono tape recorders, and one stereo amplifier; one recorder can be mounted in the equipment cabinet, one used externally. **Fittings:** 5-pin DIN socket and 3-way selector switch, four screened leads with phono plugs and four phono sockets. **Accessories supplied:** one 5-pin DIN plug, 4 coloured phono plugs, 1 hexagon key, 4 wood screws, instruction sheet. **Finish:** Satin chrome, satin chrome knob, legends engraved and filled black. **Price:** £4 7s. 6d. **Manufacturer: MAC Electronic Company, Portsmouth Road, Ripley, Surrey.**

THIS unit provides stereo record/play connections between two stereo or mono tape recorders and one stereo amplifier; one recorder can be permanently installed with the amplifier and connected via the rear phono sockets, the other used externally and connected to the front panel socket via the 5-pin 180° DIN socket and the selector switch, enabling various combinations of copying, recording and replaying. Four 57 cm screened leads are fitted to the rear of the unit, and terminate in colour-coded and labelled phono plugs for connection to the main amplifier: modified versions of this unit are available at extra cost with 5-pin DIN plugs or sockets at the rear, and a further version for amplifiers incorporating tape monitor circuits which do not permit the signal from their own tape replay sockets to



AAU-4 in manufacturers' packing

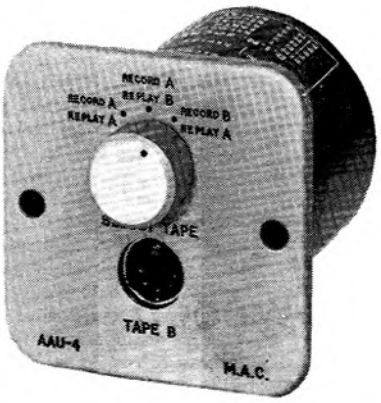
be made available at their own record sockets for feeding to other tape recorders—these have not been examined.

The three-function switch, (1) connects the internal recorder to the amplifier for both record and replay, (2) connects the internal recorder to the amplifier record sockets and the external recorder to the amplifier replay sockets, and (3) connects the external recorder to the amplifier record sockets and the internal recorder to the amplifier replay sockets. Either recorder can be replayed through the amplifier while the other records the signal, copying the original tape. This sounds a little complicated in black and white, but provided the associated equipment has all the right sockets it becomes very simple and logical once the connections are made. Naturally it is a matter of personal needs and tastes (and I confess I shall be sticking to my old tangle of leads!) but the unit goes a long way to neatly tidying up connections.

The finish of the *AAU-4* matches that of the *AAU-1*. It is supplied with DIN and phono plugs for connection to the user's leads, and with the necessary hardware and concise instructions. It should be noted that in this case the connections to the DIN socket conform to DIN practice, so anyone using both an *AAU-4* and an *AAU-1* will have to think twice before putting in a plug to avoid reversing channels!

Colour coded links again provide facilities for inserting attenuators in the housing; it should be noted that the fine sleeving on the lead out wires inside the unit matches the thicker sleeving of the phono leads, while the plugs are slightly different in colour.

Internal construction is again of a high standard, the connections well soldered and the switch a solid nylon-bodied type that operates smoothly and precisely. Physically, the unit is built up on the same threaded rod and paxolin pinboard principle as the *AAU-1*, and the reservations about the strength of the thread apply although the unit as a whole is robust. Contact was good at the phono and DIN connectors. High frequency losses within the unit and in the fixed leads were again found to be completely negligible (<0.5 dB) at 20 kHz

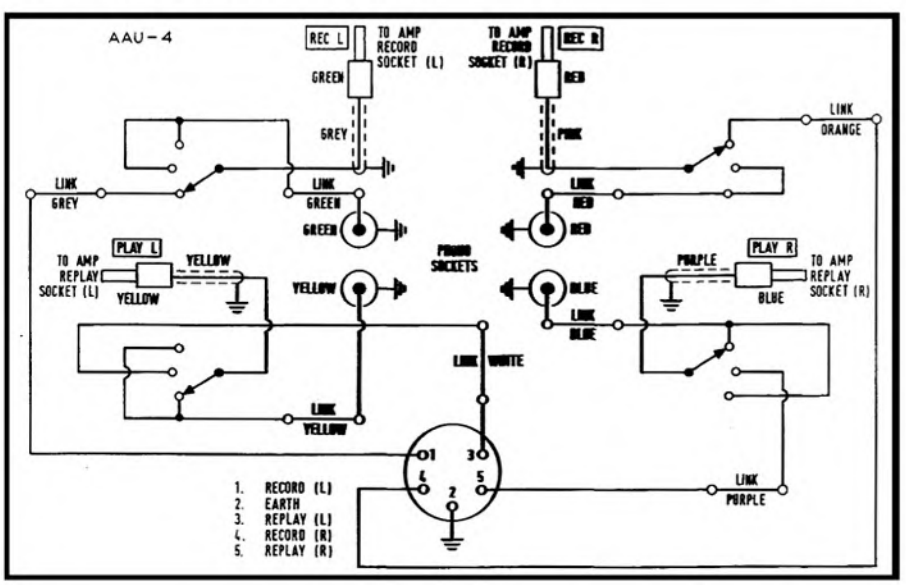


fed from a 100 K source into a 200 K load between any terminated input and output. Crosstalk was also negligibly low, being not greater than —40 dB at 10 kHz with 200 K loads, between any pair of connections. Care should be taken to keep external leads as short as possible. The screened leads are retained only by a rubber grommet and liable to some strain on the soldered joints.

COMMENT

To sum up, the *AAU-4* is electrically sound, does the job for which it is intended, and looks extremely elegant: it is expensive by comparison with the equivalent home-made article, but will provide an attractive and professional finish to an installation requiring connections to an external tape recorder. The idea of providing the colour coded link pins for fitting attenuators is a good one (though anyone doing this must be prepared to make small adjustments to the values unless both the attenuator resistors and the input resistors of the associated stage are close tolerance types, to preserve stereo balance) and certainly preferable to the practice of fitting resistors in leads or plugs, but it is a pity no circuit diagram is provided for the convenience of anyone wishing to make use of the pins: perhaps MAC would consider including one with the instructions?

John Fisher



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this recorder (until the deck fell below specification) with good results and still possess much of the material produced by that curio. For the enthusiast, however, fully automatic recorders have grave limitations when fades are desired.

From the early days I have advocated battery portables incorporating both automatic and manual facilities but only recently have examples appeared which warrant serious consideration.

While the blind continue to devise their own individual ways of conquering recording difficulties, attempts have been made to offer equivalents to some of the purely visual aspects of a good recorder. While one manufacturer had braille markings included on equipment sold to blind individuals, the Royal National Institute for the Blind developed a clock mechanism with braille numerals to serve as a revolution counter. Most braille scales are first-class pieces of engineering, the drawback in this instance being that the fitting depended on the design of the recorder, thus every counter had to be fitted in London by the Institute. I admire this introduction very much but have not found it necessary to make that long journey for the fittings to be made. (*An ingenious add-on braille counter has lately been introduced by the RNIB to suit almost all domestic mains recorders currently available* — **Ed.**) Rarely do I want to find single items on any of my many tapes. I rely too strongly on an already over-taxed memory which only fails occasionally when friends come to listen to something. One day (or week) I shall get down to what appears at present to be the thankless task of cataloguing my library. I would have to spend a lot of time in winding and listening to be able to list full details of the tapes' contents, but the method I will use is simple. On the tape box will be the number; in the catalogue under that number will be a list of material to be found on that tape.

More recently the Institute were working on a system to develop a braille magic eye, but a long silence from those quarters means either that the idea has been abandoned or the problem still baffles those with the technical know-how.

for use. The braking is positive and no apparent tape stretch results when changing from fast wind to stop, but if the mains supply is cut when in either of the fast wind positions the spools do run on and this could produce tape spill. A microswitch is placed in the transport path which switches off the control voltage to the motor when the end of the tape runs off the spool.

The phasing control alters the head switching point in the picture and is pre-set in recording. During playback it determines whether the head switching falls in the active or inactive part of the picture. When placed in the active picture a disturbance of a few lines is noticeable, but in most cases it can be set to fall in the field blanking area so that the disturbance is not visible. Once this control is set for a recording or playback there should be no further need for adjustment.

To examine any part of a recording in detail all you have to do is turn the play control and switch in to still picture, but when you have found the correct point the spools have to be inched by hand to cut out distortion. Even when you do this there is still some bending of vertical lines at the top of the picture. Rank maintain that this only happens with cheap cameras, but it happened to me with a very good Philips; maybe it was not my day. Paul Barnes is not impressed either with the still picture quality, but I suppose that more than this is a lot to expect from a very cheaply priced VTR.

With monitoring, the signal is modulated and then demodulated and passed to the output socket which can be connected to a separate monitor. Picture levels can thus be checked more accurately and an idea of the quality of the recording obtained. Sound monitoring is included in this facility.

The price is £360 and this includes the VTR, take-up spool, tool kit, cleaning outfit, set of plugs and mains connector, and instruction manual. The necessary accessories are: television receiver monitor (Rank supply a dual standard model capable of feeding sound and vision signals to VTR and to replay sound and vision signals from the VTR) at £73 10s. (inc. PT); multi-way connector with 8-way plug for VTR connection £1 3s.; Top Rank TV camera complete with vidicon and f/1.9 25 mm lens £110; heavy weight tripod with pan and tilt head £23; cardioid microphone on table stand with clip for floor stand £7 7s.; 20 cm reel recording tape with 63 minutes playing time £18 10s. The complete kit runs out at £585.

There are many other accessories of course; included in the price lists are cameras between £400 and £500, and a video mixer at £499; but if you are prepared to spend that much money on associated equipment then you will be wasting money in buying a cheap video recorder. Another consideration is the cost of tape. If you are going to use a great deal of tape you could eventually spend more on tape than on the VTR, but if your tape requirements are fairly small this is certainly a machine to consider. It is more suitable for use with 405 line sources than 625 line sources for, with the latter, definition of fine detail suffers.

During the past year or so, a mobile videotape unit has been touring London schools taking recordings of lessons and activities. The recordings will be used to show adult students in colleges of education the classroom situation.

The unit, called the ILEA Mobile VTR Recording Unit, consists of an 18-seater bus adapted for a four-man crew comprising educational director, two cameramen and one technician. The equipment consists of two cameras, microphones, sound and vision mixing equipment, two-way talkback and three video recorders.

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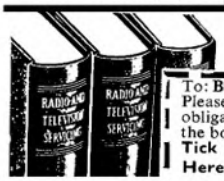

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AN
OCCASIONAL
COMMENTARY
BY DROPOUT

HOW well I remember my first personal encounter with a tape-recorder. An old friend bought one, and invited me to join him on a location exercise. I went. I knew the name of only one kind of machine, and I asked him: "What is it, John, a ——?". A faint smile. "No, it's a Ferrograph." As I helped him to hump the thing into the hall, I became aware for the first time of the sheer weight of the thing. It was one of the earliest of the breed: pre-*2 A/N*. It is still giving good results, with the same set of heads, to this day; and that must have been getting on for 12 or 15 years ago. From that moment on, I came to regard the Ferrograph as the standard by which all other recorders are to be judged.

I have had a Series *4*, *5* and *6* mono, and a Series *4* stereo by this time—the last two I still have. None has given me any significant trouble; and I have always found that the company takes pride in putting right even the most trivial fault: they have sent me spare parts without any question or argument—let alone any charge. Most important of all: I have never taken any of these machines to a location and found it not functioning when I got there. All have ground on hour by hour, making copies; all have been carried hundreds of miles by car. All have been kept scrupulously clean outside and in; odd valves have been changed, as has the occasional noisy pot. A drop of oil here and there: nothing else. I swear by them.

Now, if you put the instruments on a Ferrograph when it is new, you will get results which will not set you raving: I have never regarded the Ferrograph as the last word in hi-fi. But if you repeat your tests at the end of several years' hard work, you will find them little changed; and if there be any such change, you get in touch with South Shields, down comes a massive transit-crate, you send the thing off, and back it comes after a few weeks, once more on spec and good for years more. Incomparable, indeed. I once made the mistake of trading in two Ferrographs and getting another machine. It was superb; I was enchanted. But . . . I got through two sets of heads in 18 months; I had trouble with the elaborate switching; the cross-talk when used in the mono mode was distractingly high. When it was going, it was a beauty; but too often I was inside the thing, trying to put it right—or more often somebody competent was. I gave up, and went back to Ferrograph.

Now there is a new-generation Ferrograph, which I have not even seen and certainly cannot afford to buy. I have no doubt that it is a better machine, if they say so; but I keep asking myself—why, for Heaven's sake ? The great beauty of the old faithful was that it had been evolved over years, while remaining essentially the same. Could not that process have been continued ? I remember going to visit a friend —now, alas, dead—who had his Ferrograph Series 5 open on a trolley. I could not refrain from the remark: "Even if that weren't a real one, by golly it looks like one!". There was something unrepentantly functional about the old one: it stood there and said: "I am a tape-recorder". Simple to operate, rugged to the point of indestructibility (I know of one which was dropped down a flight of stone steps and was still working when it reached the bottom, though the case was broken), the old Ferrograph was the archetype of all recorders. It will be around for a long time yet: a vintage, second-hand buy. Go seek, brother: you will never regret it.

A little time back I found myself in the Swinging City. Naturally, I rang the editor of *Tape Recorder* for a natter, and he invited me to the BKSTS meeting to be held that night in honour of the great A. D. Blumlein. Gladly abandoning the idea of an evening alone in the West End (I suffer from travel-sickness and swinging has no appeal for me) I went along, to find myself in a room crowded with the high-ups of the audio and electrical-engineering world. What, I asked myself, was I doing there ? Happily, Donald Aldous was ready with a cheering word: I felt honoured to be recognised in such company.

The lectures were beyond me, though I suppose I got something from all of them. Then EMI arranged playback of some of the earliest stereo experiments—made on disc, of course, but transferred to tape for that evening. And there, if you please, was Blumlein himself, doing what you and I did when we got our first stereo machines: walking about, with unstealthy tread, between the mikes, and talking continuously the while! That cheered me up no end.

But there was more: the lecturers were one and all men of the highest distinction: loaded with degrees, awards, professorships. It was dazzling. But to that brilliant audience they lectured through the ropiest public-address system it has ever been my lot to strain my ears to; and none seemed to have the faintest idea how to use a microphone. You and I could have done much better, brothers. I was perfectly happy as I toddled through the bright lights to my hotel; and in the Swinging City my loud laughter provoked no comment.

CLASSIFIED ADVERTISEMENTS

Advertisements for this section must be pre-paid. The rate is 6d. per word (private) minimum 7s. 6d. Box Nos. 1s. 6d. extra. Trade rates 9d. per word, minimum 12s., Box Nos. 2s. extra. Copy and remittance for advertisements in **NOVEMBER 1968** issue must reach these offices by **20th SEPTEMBER** addressed to: The Advertisement Manager, Tape Recorder, Link House, Dingwall Avenue, Croydon, CR9 2TA.

Replies to Box Nos. should be addressed to the Advertisement Manager, Tape Recorder, Link House, Dingwall Avenue, Croydon, CR9 2TA, and the Box No. quoted on the outside of the envelope. The district after the Box No. indicates its locality.

SITUATIONS VACANT

Hi-Fi and Tape Recorder salesman required by R.E.W. (Earlsfield) Ltd. at their Tooting branch. Good pay and conditions. Apply the Manager, 266 Upper Tooting Road, London S.W.17. Tel. 01-672 9175 or 672 8267.

FOR SALE—PRIVATE

Sharp portable tape recorder RD505 batteries or mains, brand new, cost £39 10s. £26 unused. 2 speeds, 5" spools. Miss Goff, 2 Priors Hatch Lane, Godalming, Surrey.

Uher 4000L, microphone, accumulator and mains unit/charger, 9 months old, offers around £75. Box No. 540.

FOR SALE—TRADE

Blackburn has Lancashire's leading Hi-Fidelity/Tape Recorder stockists and Electronic Engineers at Holdings Audio Centre, Mincing Lane/Derwent Street, Blackburn (Tel. 59595).

Always be careful (and money-wise) before buying quality equipment. Send your requirement list to Audio Supply Association for evaluation and quotation. See below . . .

If quality matters consult first our 70-page photographically illustrated catalogue (5/6) and equipment housing guide (1/6). Members enjoy unbiased advisory service, preferential terms. Membership 7/6. Our associates also manufacture records from your own tapes, or record the Master at our studios (Steinway Grand). Bulk terms for choirs, fund-raising. Please specify requirements. Audio Supply Association, 18 Blenheim Road, London, W.4.

Annual Sale of shopsoiled and display Tape Recorders, Ferrograph 633 reduced to £115, Beocord type 1100 at £74, Optacord portable £42, Dual Stereo Tape Unit £68. One only of each item, complete with makers guarantee. Lancs Hi-Fi, 8 Deansgate, Manchester 3.

TAPE EXCHANGE

Chatterbox Recording Club, The Tape-sponding Club whose members could share in prizes from £25 to £25,000. Annual membership U.K. 5s. Overseas 6s. S.A.E. please. 368 Rush Green Road, Romford, Essex, England.

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 PAD 55291.

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STUDIO FACILITIES

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MISCELLANEOUS

Repairs. Our modern service department equipped with the latest test equipment (including a wow and flutter meter and multiplex Stereo Signal Generator) is able to repair Hi-Fi and Tape Recording equipment to manufacturer's standards. Telesonic Ltd., 92 Tottenham Court Road, London, W1. 01-636-8177.

Skilled tape recorder repairs carried out by expert personnel of many years' experience backed by extensive test equipment: Wow and flutter meter, audio valve voltmeter, audio generator, oscilloscope, etc., with final test performance figures quoted if required—Ferrograph specialists. Tape Recorder Centre, Tel-Lee-Radio, 220 The Broadway, Wimbledon, S.W.19. 01-542-4946.

Free with **Do It Yourself Gardening Annual** 1968—a packet of guaranteed-to-grow Crackerjack African Marigold seeds. These magnificent plants have superb golden and yellow blooms 3in. to 4in. across. Other top features include: 20 ways to a better garden; Complete guide to lawns; How to cope with pests and diseases; Labelling garden plants; Easy-to-build lily pool; The rose—Queen of flowers; Gardening without soil—beginners guide to hydroponics; What's new in vegetables for 1968; Caring for house plants; 3/- from newsagents or 3/11 (pp) from Link House, Dingwall Avenue, Croydon CR9 2TA.

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