

NOVEMBER 1968 2/6d

# tape recorder

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A VARIABLE SPEED  
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TRICKS AND ARTIFICES

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PETER BASTIN ON FILM

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FREDERICK TURNER'S  
VICTORIAN CAROUSEL

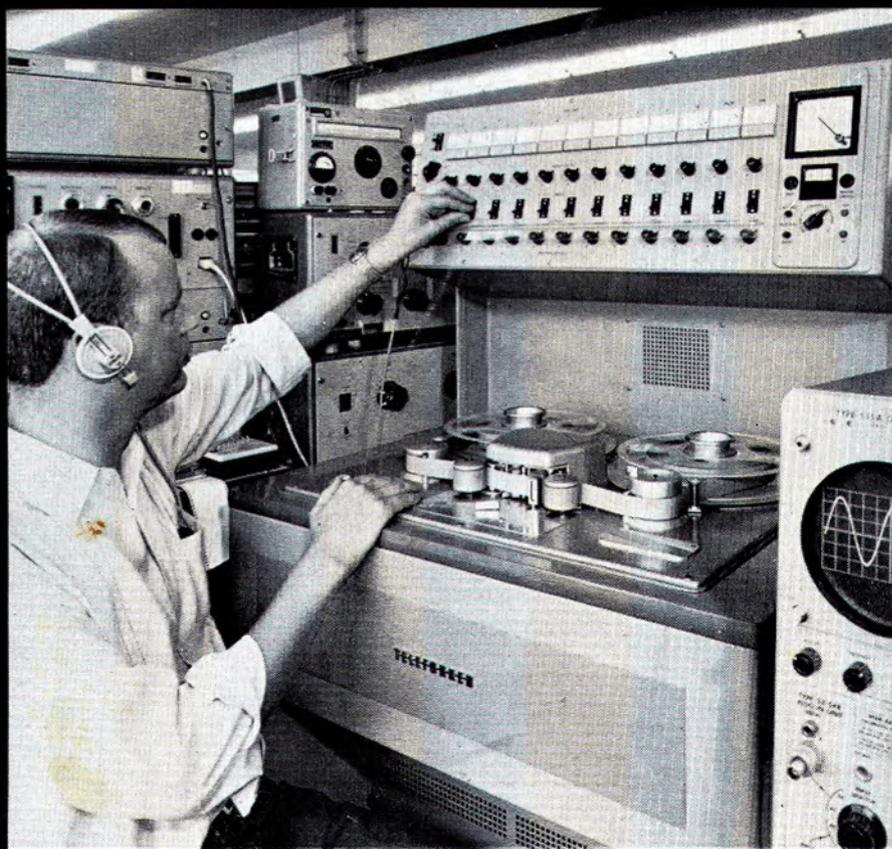
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FERGUSON 3232 REVIEW

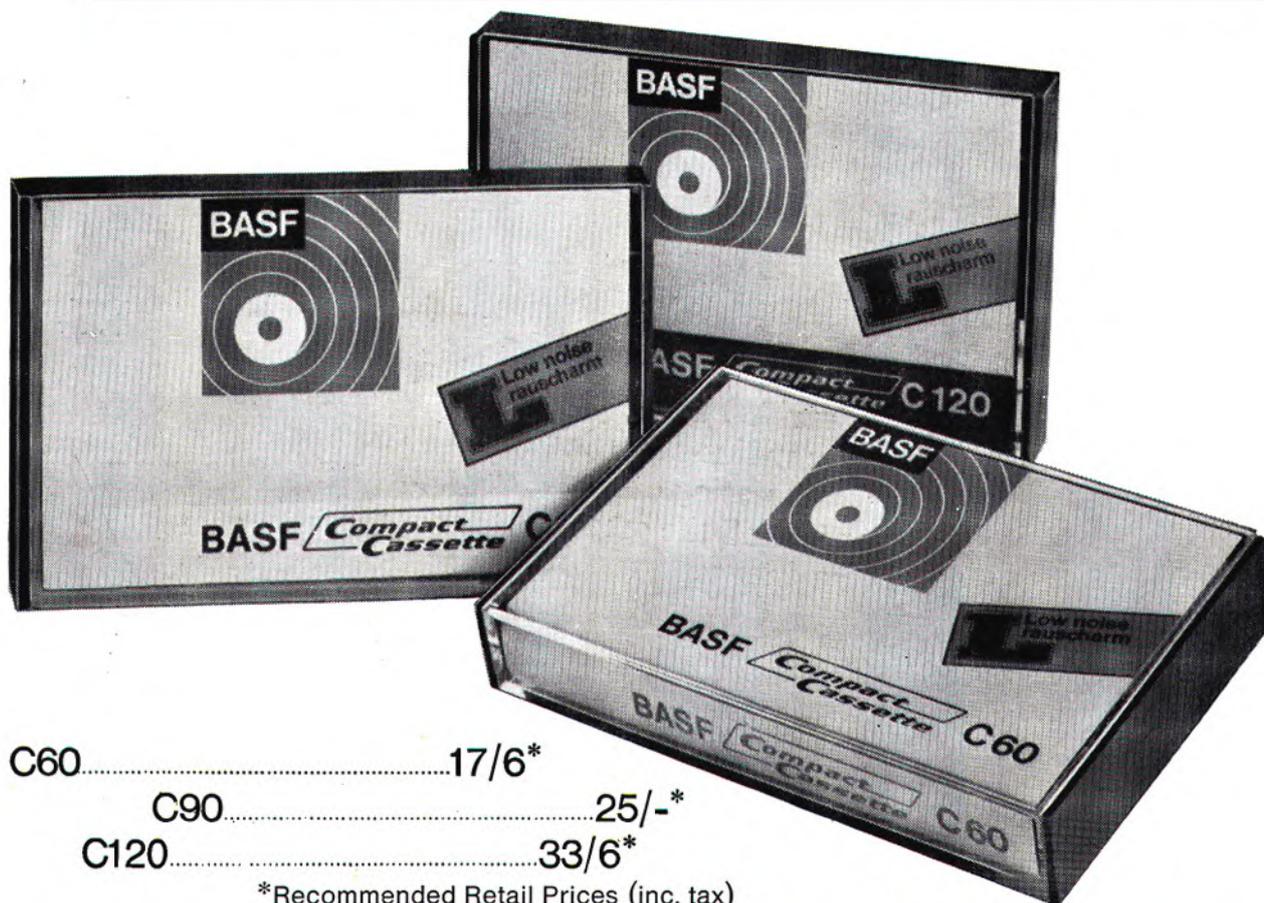
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PICTURES, FACTS  
AND SOUND

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# BASF announce the first complete range of Low Noise Compact Cassettes



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# TAPERECORDERCENTRE

**GO WHERE YOU KNOW**

**YOU GET THE  
BIGGEST SELECTION  
FINEST SERVICE  
BEST EASY TERMS**



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Akai, Ampex, B & O, Brenell, E.M.I., Elizabethan, Ferguson, Ferrograph, Grundig, Loewe-Opta, National, NuSound, Philips, Repts., Sanyo, Sharp, Sony, Tandberg, Telefunken, Truvox, Uher, Van Der Molen, Vortexion, Wyndson, etc., together with a wonderful range of Tape Accessories.

## SEE THIS EQUIPMENT

### **National** SPECIALISTS

See, hear and compare the complete range of National 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.



Latest National 4 track stereo Tape Recorder Model RS.760 98 gns.

Just one of the quality stereo Mono and Battery Portable Tape Recorders now available.

Come to The Tape Recorder Centre, the largest showrooms in Great Britain devoted exclusively to Tape-Recorders and Tape Recording Equipment. Whether you are interested in a general purpose tape recorder or a de luxe professional machine, the staff of The Tape Recorder Centre will be pleased to give you the benefit of their many years experience of selling everything in 'Tape'. Every make and model of tape recorder is available for immediate demonstration. Make your choice at The Tape Recorder Centre and be certain of purchasing the machine that is ideally suited to your individual requirements.

Remember—the Tape Recorder Centre Showrooms are the only showrooms in Great Britain specialising exclusively in the sales and service of tape recorders.

- Over 100 Models on Display
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Only one minute from Holborn Tube Station—Half-day Saturday  
WE OPERATE A PERSONAL EXPORT SCHEME  
SAVING UP TO 20% ON LIST PRICE

**\*BRITAIN'S  
LARGEST TAPE &  
HI-FI SPECIALISTS**

# THE TAPE RECORDER CENTRE



\* PART OF THE *NuSound* ORGANISATION

THE TAPE RECORDER CENTRE LTD. 82 HIGH HOLBORN, LONDON, W.C.1. TELEPHONE: CHAncery 7401/8354

# SHARP

Further developments to the highly successful designs of last year have produced the RD 505 and RD 303E.

Both matching the SHARP name for reliability, performance and audience appeal.



RD 505

**5 YEAR  
GUARANTEE**

# to the point of perfection!



Model RD 505. Solid state all transistor tape recorder, twin track, two speeds. Superb recording reproduction with outstanding simplicity of control. Entirely portable, will operate anywhere. The act of inserting the mains plug automatically changes over from batteries to its own built-in A.C. power unit. Designed to play or record in any position. Remote control switch on microphone allows full flexibility in use. Dimensions 12" x 10" x 4". Additional features include 3 digit tape counter, fully variable tone control, large internal speaker and automatic level control. Comes complete with dynamic microphone recording lead, earphone, batteries (6 x Ever Ready LPU2 or equivalents). 5" reel of tape and empty spool. **R.R.P. £39.18.0**

**RD303E** An all transistor solid state tape recorder. Two speeds, twin track. Fully portable with operation from internal batteries or A.C. mains. Automatic or manual recording level control. Remote control switch on microphone for instant start/stop. Uses 3" reels, utmost simplicity of control with brilliant performance—truly a miniature marvel. Dimensions 11½" x 3½" x 7½". Complete with dynamic microphone, recording lead, earphone, batteries (4 x Ever Ready LPU2 or equivalents). 3" reel of tape and empty spool. **R.R.P. £28.17.6**

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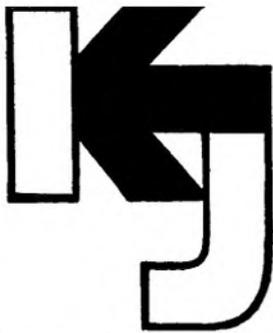
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SALES AND SERVICE

16/18 WORSLEY ROAD, SWINTON, MANCHESTER. Tel: SWI 3232 (5 lines)

For further details and leaflet contact:  
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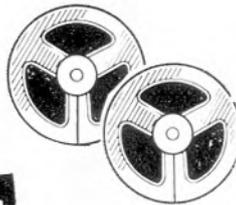
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T.8



# K. J. ENTERPRISES *for tapes*

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## BRANDED TAPE

BASF—EMI—GRUNDIG  
PHILIPS—SCOTCH  
AGFA

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

STANDARD PLAY	LIST PRICE	OUR PRICE	DOUBLE PLAY	LIST PRICE	OUR PRICE
5" 600' }	22/2	18/-	3" 300' Not Scotch	14/3	11/6
5 1/2" 900' } Except Agfa	29/5	24/-	3" 400' Scotch only	16/7	13/3
7" 1200' }	36/7	29/6	4" 600' }	26/-	21/-
			4 1/2" 900' Agfa, BASF only	31/-	25/-
<b>LONG PLAY</b>			5" 1200' }	43/2	35/-
3" 210' Not Scotch	9/3	7/6	*5 1/2" 1800' }	56/11	46/-
3" 300' Scotch only	9/7	7/9	*7" 2400' }	79/-	63/6
4" 450' }	14/9	12/-	10" 4600' Agfa only	140/9	112/9
4 1/2" 600' BASF, Agfa only	22/-	18/-	<b>TRIPLE PLAY</b>		
*5" 900' }	29/2	23/9	3" 450' Not Scotch	22/3	18/-
*5 1/2" 1200' }	36/5	29/6	3" 600' Scotch only	24/10	19/9
*7" 1800' }	51/7	41/9	4" 900' }	40/-	32/3
8 1/2" 2400' BASF Scotch	74/-	59/6	*4 1/2" 1200' Agfa, BASF only	50/-	40/3
10" 3280' Agfa only	85/9	68/9	5" 1800' Not Scotch	67/2	54/-
10" 3600' BASF only	96/6	77/6	5 1/2" 2400' } Agfa, BASF	91/4	73/6
10 1/2" 4200' Agfa, BASF only	113/6	91/6	7" 3600' } only	116/6	93/6
<b>SCOTCH DYNARANGE (L/P)</b>			<b>QUADRUPLE PLAY</b>		
5" 900' }	32/8	26/3	3" 600' }	37/-	29/6
5 1/2" 1200' }	41/-	33/-	3 1/2" 800' } Kodak only	46/3	37/-
7" 1800' }	58/1	46/6	4" 1200' }	64/6	51/6
8 1/2" 2400' (Metal Reel)	84/3	67/6	<b>COMPACT CASSETTES</b>		
<b>BASF PES.35 L/P Low Noise</b>			C.60	17/6	14/3
5" 900' }	36/10	29/9	C.90	25/-	20/3
5 1/2" 1200' }	45/6	35/6	C.120	33/6	27/-
7" 1800' }	63/-	50/9			
10" 3600' }	115/-	91/-			

Postage and Packing 2/6. Order over £3 post free.

## ILFORD - ZONAL TAPE

### 40% OFF!



### NEW KJ SPECTACULAR

From the Motion Picture & Magnetic Products Division of ILFORD LTD. we are proud to present a New Stupendous **BARGAIN OFFER!** Never before have you been offered such a breathtaking opportunity. **ILFORD-ZONAL** premium grade magnetic tape (extensively used by the B.B.C.) at a terrific reduction of 40%! Brand New, Boxed, Fully Guaranteed and complete with leaders, trailers and stop foil. **UNIQUE TO KJ**

DESCRIPTION	LIST PRICE	ONE	THREE	SIX
900' on 5" reel Long play P.V.C.	29/1	17/6	50/6	96/6
1200' on 5 1/2" reel Long play P.V.C.	36/1	22/6	65/-	125/-
1800' on 7" reel Long play P.V.C.	51/4	29/6	86/-	165/-
1200' on 5" reel Double Play (Polyester)	43/1	27/9	81/-	157/6
1800' on 5 1/2" reel Double Play (Polyester)	56/1	36/-	105/-	204/-
2400' on 7" reel Double Play (Polyester)	78/10	49/6	145/6	285/-

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 5 1/2" reel	38/6	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 5 1/2" reel	57/9	40/6	120/-	234/-

POST & PACKING 2/6. ORDERS OVER £3 POST FREE.

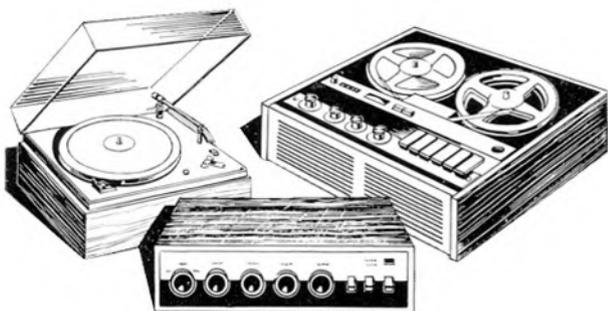
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and  
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| SONOTONE   | THORENS   | W.B.        |
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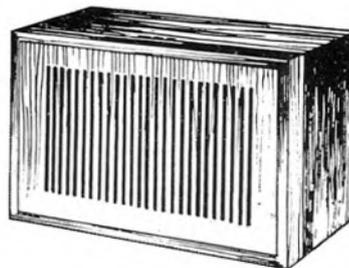
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**NOW FROM KJ THE FULL RANGE OF  
MUSICASSETTES**

AVAILABLE BY RETURN POST  
SEND FOR FREE CATALOGUE

**BARGAINS OF THE MONTH**



**SONOTONE "SOLENT"**

SAVE £6.10.0 on this SPEAKER SYSTEM

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

**THIS OFFER REMAINS OPEN ONLY WHILE STOCKS LAST !**

**Technical Specification**  
Cabinet Size 14" x 9" x 8 1/2"  
Woofer 6 1/2", 10,000 Gauss, 1" pole.  
Tweeter, 3 1/2" Acoustically loaded  
Frequency response 40—20,000 cps.  
Power Handling 12 watts.  
Impedance 8-15 Ohms. (4 ohm. if specified)  
Scandinavian style finish.

**WHAT THE REVIEWERS SAID:**  
"Recommended without reservation for this category of Loudspeaker". David Phillips and Donald Aldous.  
"Sonotone 'Solent' deserves to reach a wide Public". John Borwick.  
"A worthy member of the Hi-Fi family". R. L. West.

**ORIGINAL LIST PRICE £18.0.0**

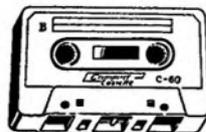
**Our Price Only £11.10.0**

CARRIAGE 10/- EXTRA PER UNIT

**FINEST LOUDSPEAKER VALUE ANYWHERE !**

**SPECIAL OFFER COMPACT CASSETTES**

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.

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| <b>MC. 60</b> | <b>MC. 90</b> |
| 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/-  |

Standard pattern to fit  
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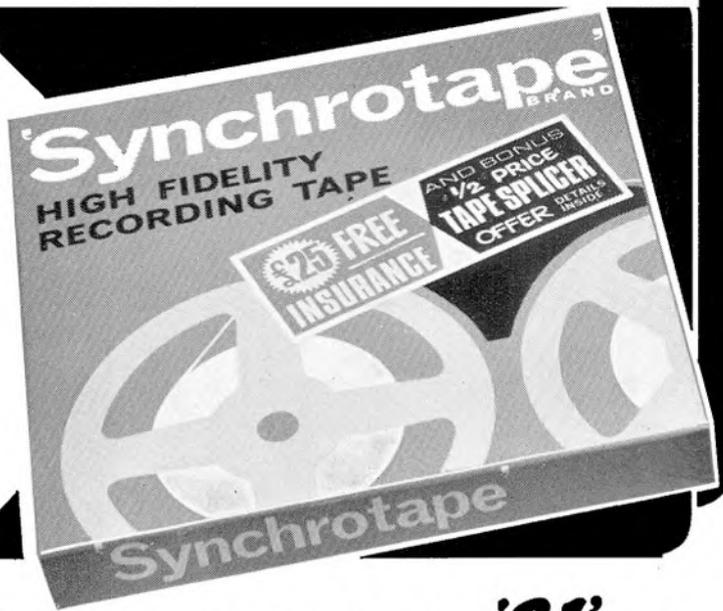
Post and Packing 2/6. Orders over £3 Post Free.

**Wealdstone, Middlesex Tel: 01-427 7758**  
**Return of post service on advertised lines**



**This box contains the best value-for-money Recording-Tape you can buy . . .**

*Heres why...*



**\* Synchronotape costs less.**

A British-made high-fidelity Recording Tape incorporating so many "plus" features and at the most competitive price.

**\* Synchronotape's quality specification.**

Only the finest quality PVC and Polyester base materials are used. No stretching, no snapping, no deterioration of recordings in storage.

**\* Synchronotape is so easy to use.**

Practically all sizes have coloured leaders, trailers and metallic stop-foils. Perfect for 2 or 4 track, mono or stereo.

**\* Synchronotape is unconditionally guaranteed**—against any defect whatsoever.

**\* Synchronotape has all the extras built in.**

Film-sealed rigid boxes, colour-coded and clearly labelled . . . a 12-page booklet containing useful tape recording data and the Synchronotape Recording Log.

**The Synchronotape '21' range**

SIZE	STANDARD	LONG	DOUBLE	TRIPLE
BASE	P.V.C.		POLYESTER/P.V.C.	
2 1/2"		200' - 5/9d.	300' - 8/9d.	
3"	150' - 4/9d.	225' - 6/3d.	300' - 8/9d.	450' - 13/9d.
4"		450' - 12/-	600' - 18/-	900' - 27/-
5"	600' - 15/-	900' - 18/6d.	1200' - 28/6d.	1800' - 45/-
5 1/2"	900' - 18/6d.	1200' - 22/6d.	1800' - 36/-	2400' - 67/6d.
7"	1200' - 22/6d.	1800' - 28/6d.	2400' - 48/-	3600' - 75/-

**NEW Synchronotape Editing Kit ...**

**ONLY 29/6**  
PLUS 6/6 P.T.



**NEW Synchronotape Editing Kit ... only 29/6. (+6/6 P.T.)**  
Here's big value for every tape enthusiast ... a "must" for editing and library compiling.

Packed in a see-through, crush-proof box, the Synchronotape Editing Kit comprises: ● The Adastra "Instant Cut & Trim" tape splicer. ● 4 reels of coloured leader tapes (each reel 45 ft.) ● 1 reel of metallic stop-foil (approx. 22 ft.) ● 1 reel self-adhesive jointing tape (18 ft.) ● 6 coloured tape securing clips. ● 24 self-adhesive labels. ● Synchronotape 12-page booklet with instructions, tape recording information, technical data and recording log.

**PLUS**

**Up to £25 Free Insurance** on your tape recorder against loss by fire or theft.

**Special Tape Splicer offer.** Collect three coupons from Synchronotape packs and for 7/6 get a superb Adastra "Instant Cut & Trim" tape splicer.

BRITISH MADE  
**Synchronotape**

**ADAstra ELECTRONICS LIMITED** 167, Finchley Rd, London, N.W.3. (Tel: MAI: 8164/5)



# Bang & Olufsen— for those who consider design and quality before price

Listen to the Beocord 2000K tape recorder. Check its semi-professional specification. Examine the impeccable Danish design and workmanship. You can live with the Beocord 2000K—you will certainly never outgrow it.

This is why: Fully transistorised stereo/mono tape recorder with professional wow and flutter specifications. 4-track recording, 2 and 4-track playback. 4-channel mixer section for microphone, gram., radio, sound-on-sound. Effect recording: Multiplay, sound-on-sound, synchro-playback, echo. Usable as microphone-amplifier during tape replay. 3 tape speeds, 7" tape spools, tape control lever, automatic tapebreak and foil stop, tape index counter. Instant pause control. Tape slack absorbers. 4 Bogen heads, Source/tape

monitoring. Variable input impedance switches. DIN standard in-put sockets on base of recorder. Switched sockets for two pairs of speakers. Independent headphone socket.

8-watt per channel stereo amplifier with independent volume control on each channel. Two illuminated recording level indicators. Amplifier can be used without motor. Separate bass and treble controls.

Teak or rosewood finish. £155. 10. 0d.\* Also available to the same specification is the Beocord 2000T which has detachable stereo speakers built into the lid of its portable carrying case.

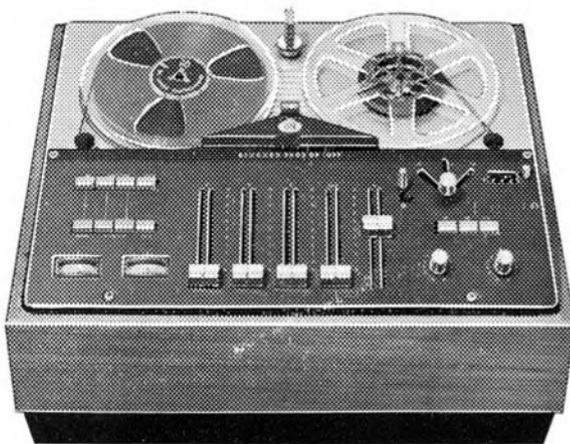
BEOGRAM 1000V—this 3-speed turntable unit features the world famous B & O ST/L15° tone arm with SP7

diamond-stylus cartridge and a built-in hydraulic pick-up lift. In teak or rosewood finish. Price £40. 15. 0d.\*

BEOMASTER 1400M—An advanced all-waveband radio/amplifier with 2x15 watts audio output. 4 F.M. pre-sets for instant pushbutton station selection F.M., Long, Medium, Shortwave 1 (66–200 metres), Shortwave 2 (16–49 metres) with bandspread. A B & O decoder is fitted for reception of stereo broadcasts. Available in teak or rosewood finish. Price £108. 10. 0d.\*

Bang & Olufsen audio equipment is made for those who consider design and quality first. Your B & O appointed dealer will advise you on the best way to start a system that will give you pleasure for the years ahead.

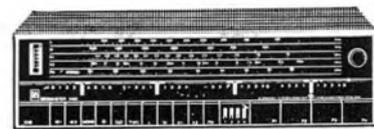
\*Recommended retail prices



BEOCORD 2000K



BEOGRAM 1000V



BEOMASTER 1400M

Fully descriptive literature is available from your B & O dealer or direct from:  
Bang & Olufsen United Kingdom Division, Eastbrook Road, Gloucester, Tel: 0452-21591 London Showrooms: 70/71 Welbeck Street, London, W.1. Tel.: 01-468 2144.

# 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 pre-setting 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.

the tape recorder with  
the hearing-is-believing sound



*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:

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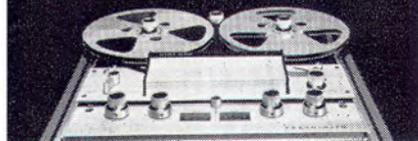
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Please send me a free brochure on the  
Ferrograph New Generation Series 7

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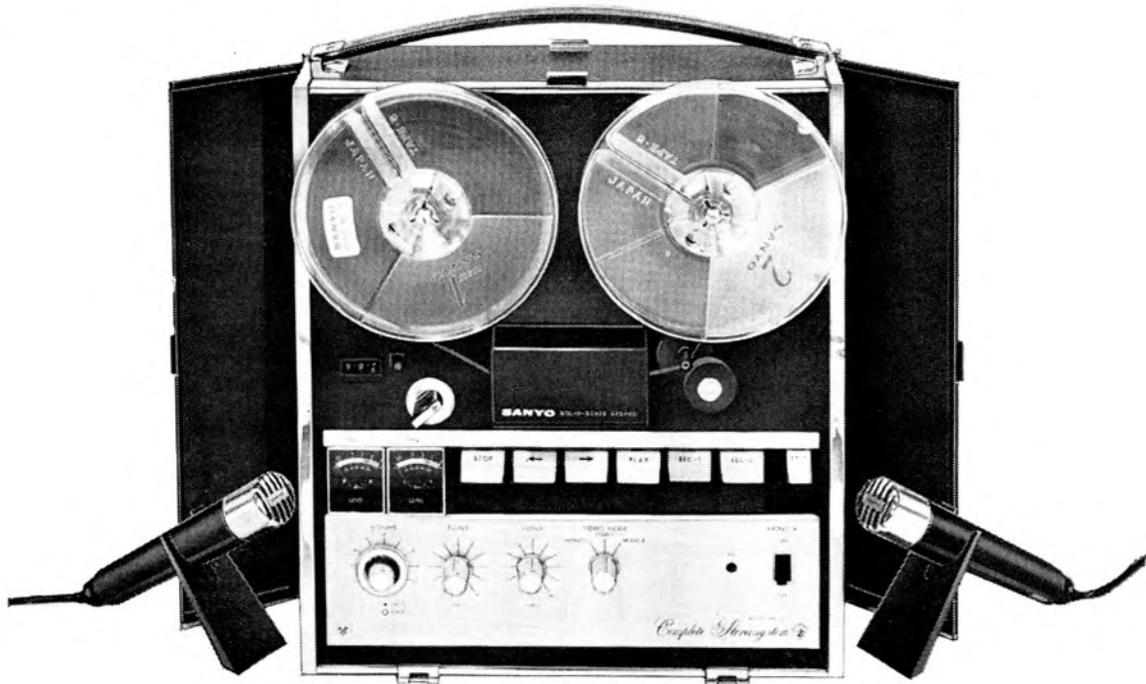
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the tape recorder with  
the hearing-is-believing sound



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## The MR151 mains/battery stereo tape recorder'

- Remote control
- Vertical operation
- 4 track
- Sound with sound

### Tape speeds

3 $\frac{3}{4}$  in/sec (9.5 cm/sec)  
1 $\frac{1}{2}$  in/sec (4.75 cm/sec)  
15/16 in/sec (2.4 cm/sec)

### Playing time

64 min x 2 at 3 $\frac{3}{4}$  ips  
(stereo 5", 50 $\mu$  tape)  
128 min x 2 at 1 $\frac{1}{2}$  ips  
(stereo 5", 50 $\mu$  tape)  
256 min x 2 at 15/16 ips  
(stereo 5", 50 $\mu$  tape)

### Frequency Response

3 $\frac{3}{4}$  ips: 100 - 10,000 c/s  
1 $\frac{1}{2}$  ips: 100 - 5,000 c/s  
15/16 ips: 100 - 2,500 c/s

### Output Power

Maximum 800mW  
per channel Undistorted  
750mW per channel

### Output Impedance

Ext. SP. - 8 ohm x 2  
Headphone - 8 ohm

### Weight

17 lbs (8 kg) approx.

### Accessories

Microphone x 2,  
5" full tape x 1,  
Empty reel x 1,  
Patch cord x 2,  
Splicing tape x 1,  
Microphone stand x 2,  
Power cord x 1.

### Recommended

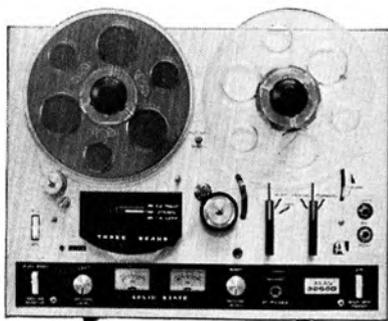
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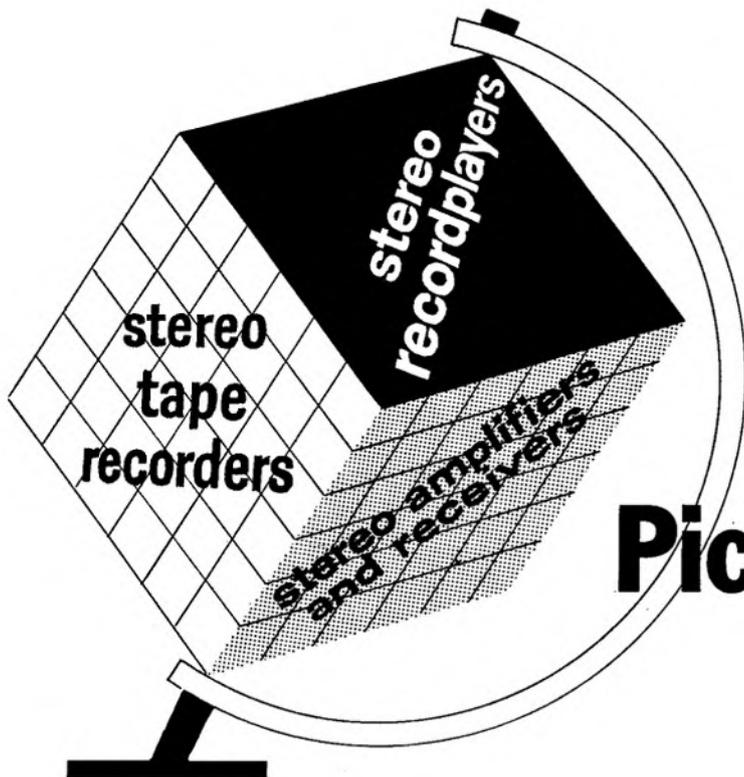
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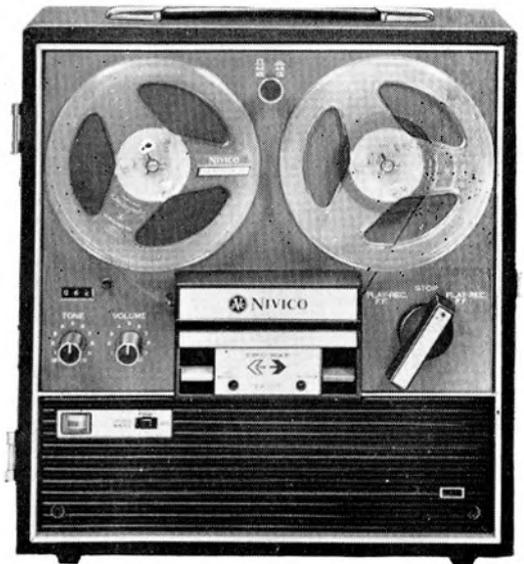
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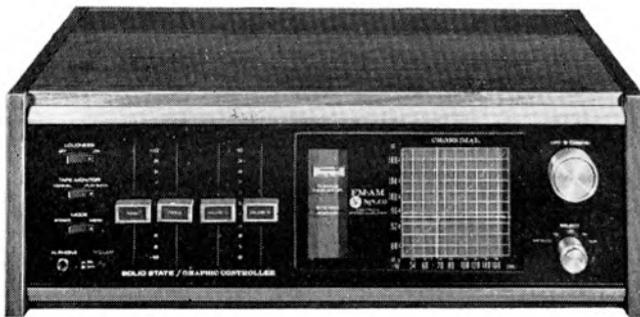


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This superb tape unit completes *your* system. You already have a power amplifier and a pair of speakers! Now add the Akai 3000D. The Akai 3000D has: ● three heads — erase, record and playback ● frequency response 30 to 22,000 Hz  $\pm 3$  db at  $7\frac{1}{2}$  ips. ● Signal to noise ratio: better than 50 db. ● first class tape transport. ● two speeds  $3\frac{3}{4}$  and  $7\frac{1}{2}$  ips. ● Headphone monitoring (or listening) when the unit is used away from your system. Everything you've ever wanted—ever needed in a stereo tape unit.

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NAME .....

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# Ferguson make 'more for



Model 3232

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

This sophisticated 3-speed  $\frac{1}{4}$ -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.

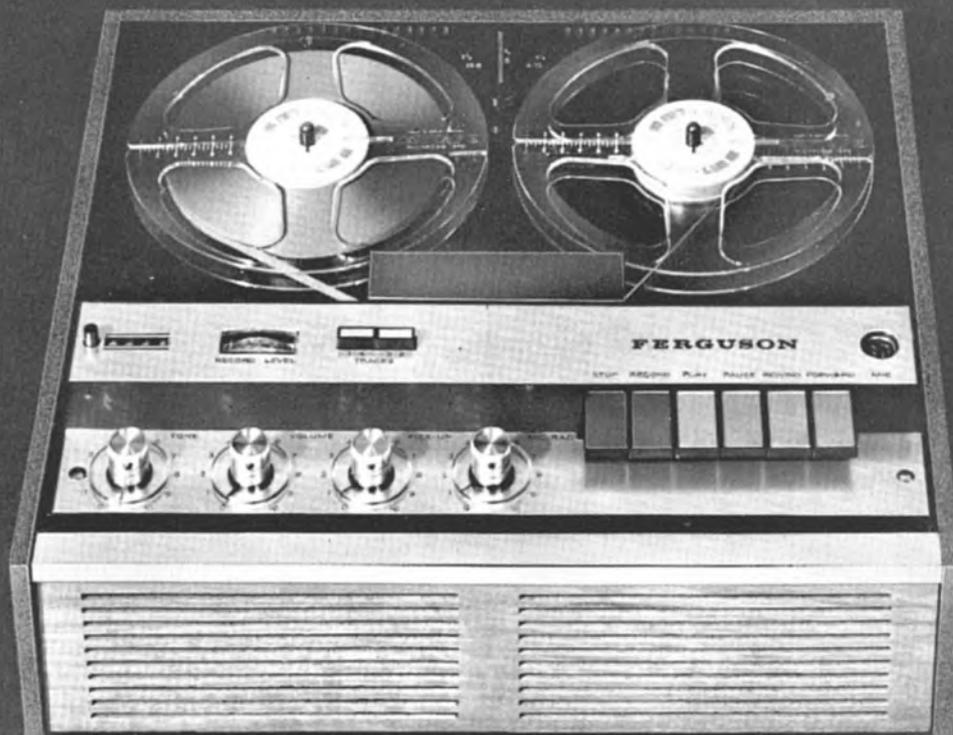
Model 3232-£91.13s.

## **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 • Me'er 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.

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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  $8\frac{7}{8}$ " , width 5" , depth  $2\frac{1}{8}$ " and it weighs only  $3\frac{3}{4}$  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.

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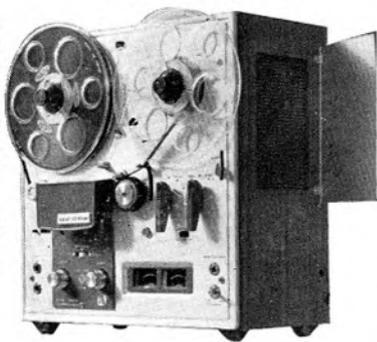
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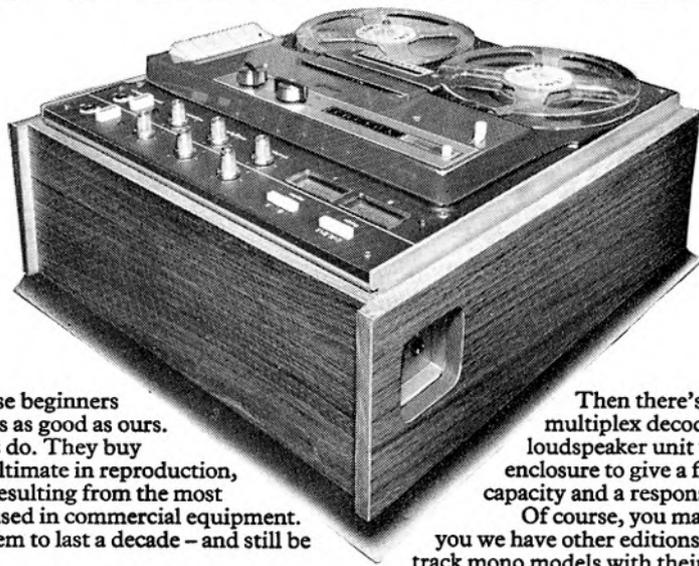


At every NuSound showroom you'll find a wonderfully comprehensive range of equipment backed by over 13 years' experience in this ever growing and highly specialised field—in which the NuSound reputation is "second to none".  
Three NuSound Centres specialise in High Fidelity Equipment and Tape Recorders and the other four NuSound Centres are devoted exclusively to Tape Recorders and Accessories.

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

# This won't be the first tape recorder you'll own.

# But it could be the last.



It won't be the first because beginners don't usually buy tape systems as good as ours.

But discriminating buyers do. They buy Truvox when they want the ultimate in reproduction, with facilities and reliability resulting from the most advanced circuit techniques used in commercial equipment. When in fact they want a system to last a decade - and still be ahead of its time.

Take a look at our Series 200. It's our top system and consists of tape unit, stereo amplifier, FM tuner and loudspeaker units. They're all in handsome teak cabinets and incorporate silicon solid-state circuitry.

The tape unit is the PD202/204. A  $\frac{1}{2}$  or  $\frac{1}{4}$  track stereo/mono 3 speed unit. It has separate record and playback amplifiers, 3 separate micro-gap heads, 3 motor die-cast Truvox tape deck, outer rotor capstan motor, auto stop, spool carrier hublocks, editing flap and balanced servo brakes. It gives you full mixing, off-the-tape monitoring, duo-play, track-to-track transfer, horizontal or vertical operation and true-to-life reproduction over wide dynamic range.

The TSA 200 transistor stereo amplifier connects with the tape unit's 0-1V emitter-follower output. It gives wide frequency response and 20 watt per channel output with insignificant noise distortion and cross-talk levels. It has extremely efficient scratch and rumble filters and zero-fade balance control.

Then there's the FM200 tuner with its slide-in multiplex decoder. And the matching LS200 loudspeaker unit which has an infinite baffle enclosure to give a full 12 watts RMS handling capacity and a response which belies its size.

Of course, you may not want a whole system. For you we have other editions of the Series 200. Two and four track mono models with their own built-in power amplifiers, like the RB202/204 in a teak cabinet and the R202/204 portable covered in tough grained P.V.C.

Or if you have to compromise on price but still want the finer things of life we've built the Series 50.

It's a 3 speed, 7" spool model using a completely new Truvox tape deck. Its many features include *two* loudspeakers.

No matter what you want, your Truvox dealer can supply it. Why not call and ask for a demonstration? If you don't live near a dealer, write to Gordon Lisle at Truvox. He will arrange a personal introduction to your nearest appointed Truvox expert.

That's a meeting you'll enjoy.



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## COVER PICTURE

Going west—seven 12-channel Telefunken *M10* recorders to tape the commentaries to the Mexico Olympic Games. They will be employed to record, and later replay, ten speech channels simultaneously. Our cover shows an *M10* undergoing a dress rehearsal at the AEG factory in Constance.

## 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.

IN APRIL 1966 we started publishing complete commercial circuit designs as part of H. W. Hellyer's long-running Tape Recorder Service. Mr. Hellyer's aim, and ours, was to bypass the infuriating embargo on service literature imposed by some sections of the trade. No manufacturer has ever complained of this action and we came eventually to the conclusion that retailers as well as general readers were finding the circuits of use. Requests for past circuits have also had the mundane though pleasing effect of depleting our stock of back issues.

The inclusion this month of a complete circuit in our *review* column may be accepted by many readers, not to say constructors, as a worthwhile step forward in the development of the journal. On the other hand it may not; we have nagging doubts from time to time about the mental makeup of the Average Reader, despite the agreeable findings of our recent questionnaire, and wonder if he in fact resents so much space being devoted to tape recorder circuits. No reader has ever yet complained of the space allocated to Tape Recorder Service and its attendant drawings; indeed this is one of the most popular columns in the journal. On the other hand our choice of cover photographs does provoke the occasional reader (page 541).

An obvious question arises when we look ahead to Mr. Hellyer's coverage of the Ferguson 3232. Do we publish the circuit a second time or refer to the out-of-print back issues? Neither: we shall refer back to the review on the assumption that old copies of *Tape Recorder* are stored with *Punch*, *Exchange & Mart* and the suitcases, under the bed. Alternatively, as many of our correspondents will know, we are able to supply photostats of circuits or articles no longer in print. This facility is now employed so much, however, that we are obliged to charge one shilling per page—at least until a cheaper alternative to electrostatic copying is developed. A horrible system, photocopying, but entirely irrelevant to this Editorial.

From a crude and costly way of making images to an elegant and inexpensive means for adding sound to cine film. The Contronics system described on page 543 makes 8 mm cine a serious proposition for the tape enthusiast, until those elusive low-price VTRS come to fruition. Hitherto, sprocketed tape has been the only practical means of achieving lip synchronisation for the amateur. Contronics have virtually brought Leever's Rich thinking into the home, though it remains to be seen whether their system is versatile enough to permit straightforward film/tape editing. Like videotape itself, at the present stage, the Contronics units may be technically appealing but artistically limited. We shall shortly be preparing a report on the *R.I* and *P.I* for our review columns.

The construction and operation of 8 mm

cine projectors provides endless amusement to those of us accustomed to decent engineering. Compared with even the plainest mains tape deck, projectors are laughably crude. Little attention is given to speed stability and none at all to noise. If tape recorders are difficult to lace up, the average projector verges on impossibility—the self-loading models are even worse unless (rare occasion) they are working properly.

Variable speed tape recorders are almost non-existent for the simple reason that speed is not supposed to vary. Reflectograph managed a fairly reliable mechanical idler/cone variable drive, in the bad old days, but even this managed to twist its strobe when the operator was not looking. A strictly non-mechanical variable-frequency power supply is described on page 525, providing a simple, reliable, and above all removable means of varying tape speed.

## FEATURE ARTICLES

- 516 TRICKS AND ARTIFICES  
By David Kirk
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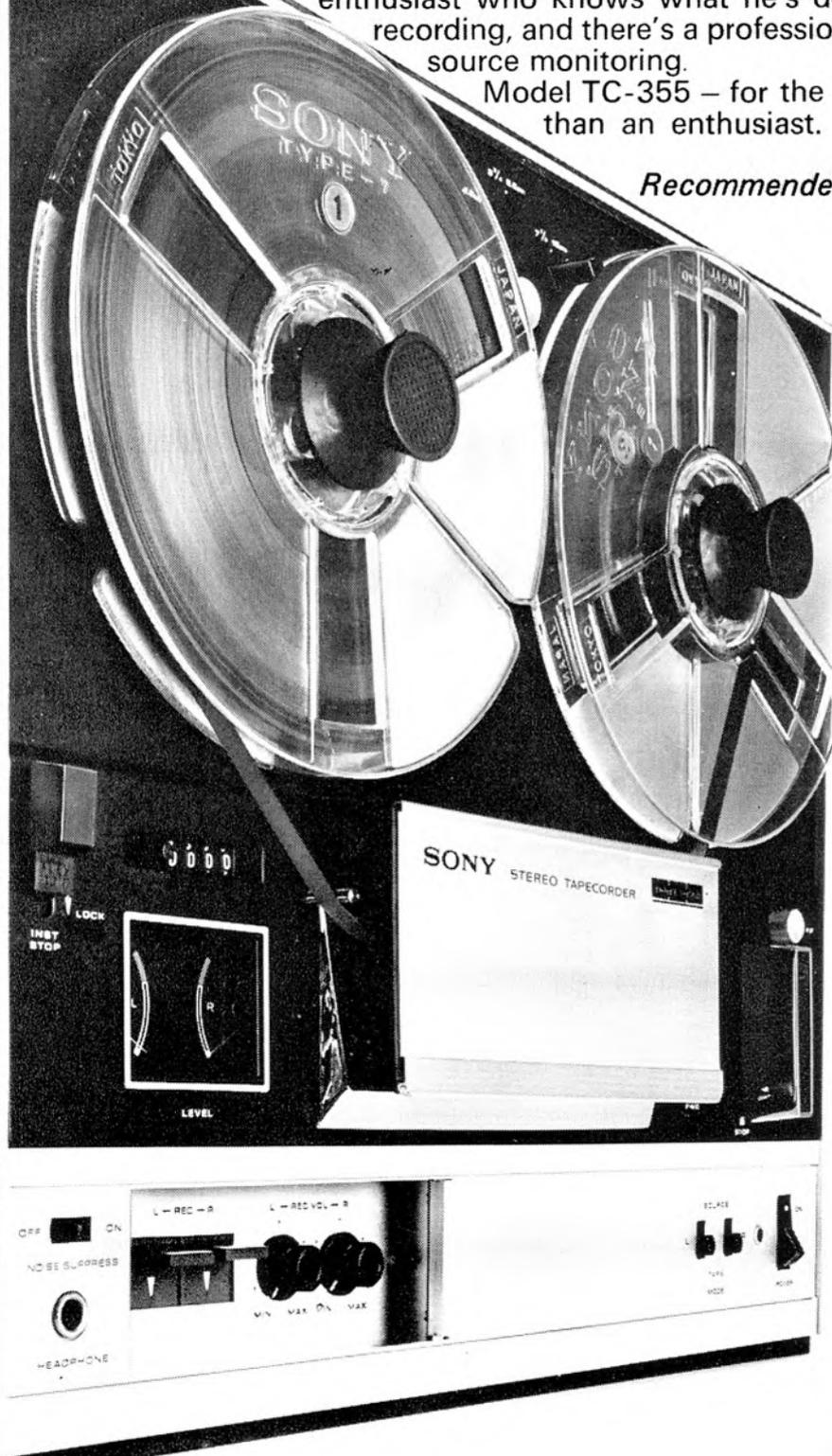
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Something new for the record . . . Here's the TC-355 tape deck – four tracks and two channels for stereo/mono recording and playback. Superb finish on the outside and SONY expertise inside – the TC-355 is for the enthusiast who knows what he's doing: allows sound-on-sound recording, and there's a professional three head system for tape/source monitoring.

Model TC-355 – for the man who is something more than an enthusiast.

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## Specifications

Recording system:	4-track stereo/mono recording and playback
Power requirement:	AC 100, 110, 117, 125, 220 or 240V 30 watts, 50/60 Hz
Tape speed:	7½ ips, 3¾ ips, 1½ ips
Reel capacity:	7" or smaller
Frequency response:	20 – 25,000 Hz at 7½ ips 30 – 20,000 Hz ± 3dB at 7½ ips 30 – 17,000 Hz at 3¾ ips 30 – 9,000 Hz at 1½ ips
Signal-to-noise ratio:	Better than 52 dB
Wow and Flutter:	Less than 0.15% at 7½ ips Less than 0.25% at 3¾ ips
Harmonic distortion:	Less than 1.6% at normal recording level
Level indication:	Dual VU meter
Inputs:	Microphone input jack: Sensitivity: -72dB (0.19mV) Impedance: 600 ohms Auxiliary input jack: Sensitivity: -22dB (0.06V) Impedance: Approx. 560K ohms
Outputs:	Line output jack: Output level: 0 dB (0.775V) Impedance: 100K ohms Headphone jack: Output level: -28dB (0.031V) Impedance: 8 ohms
Dimensions:	15 1/8" x 7 1/8" x 14"
Weight:	22 lbs
Optional accessories:	Microphone F-98 or equivalent (600 ohms) Stereo headset DR-3A, Microphone mixer MX-6S

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**COMPUTER EDITING AT THE IBC**  
**W**HILE lecturers bemoaned the limited versatility of video tape recording compared with cine film, in the convention room of Grosvenor House, Ampex displayed their new *HS-200* computer controlled editing system in the exhibition hall. One of many remarkable innovations at the International Broadcasting Convention held from September 9th to 13th, the system employs a plated aluminium disc to store 30 seconds of colour programme material requiring elaborate editing or frame-by-frame animation. A similar disc is incorporated in the *HS-100* instant-replay system to provide slow-motion facilities during, typically, a sports broadcast. Like the Telefunken on the cover, the *HS-100* will be used extensively during the October Olympic Games in Mexico; the unit at the exhibition was sold to London Weekend Television for this application.

Shure displayed a portable sound mixer with an impressive specification and relatively low price, the £95 *M67*, while Studer introduced an elaborate stereo mixing console. The *Nagra 4* was displayed and demonstrated by Hayden Laboratories; the basic model *4B* is £381, rising to £388 in the *4A* which features an automatic level control. Speed of these two models is 19 cm/s. Rumours of substantial price increases over the *Nagra 3* were evidently founded on the more elaborate *Neopilotone 4L* costing £595.

Another exhibitor Alexander Cole Ltd., produce *Colclene* instrument cleaner and sell it by frightening the life out of carbon tetrachloride users. "Inhalation of high concentrations of vapour can cause headache, mental confusion, depression, fatigue, loss of appetite, nausea, vomiting and coma, these symptoms sometimes taking many hours to appear. Taken by mouth . . . small doses have caused death." The other favourite, Benzine, "may cause severe, even fatal, blood disease . . . with repeated inhalation of low concentrations over a considerable period." Cole are marketing direct to the recording industry and the public from 114 Cranbrook Road, Ilford, Essex.

**MAGNAVOX SERVICING**  
**M**AGNAVOX Electronics of Barking, Essex, have announced that they are no longer prepared to service their products. They will continue, however, to supply components for their tape and disc mechanisms to individual customers and dealers.

**WILDLIFE RECORDING COMPETITION**  
**T**O attract recordings of animal life under natural conditions, the *Wildlife Sound Recording Society* in conjunction with 3M are organising a competition for naturalists and tape recordists. It is divided into three categories covering individual species of birds, individual species of mammals, reptiles and amphibians, and thirdly 'rarities'. The last class is expected to attract unusual entries, both of rare animals and common though difficult subjects. Recordings in the rarities section must be made in the British Isles though the other two categories are open to tapes produced anywhere in Europe. The animals must be wild and free and the noises unprovoked; any noise made by the creature is acceptable.

Technical quality will be high among the factors considered by the judges though entries may be submitted at 38, 19, 9.5 or 4.75 cm/s, full, half or ¼-track. Competitors must reside in the British Isles and, in fairness to amateurs, must not have had two or more recordings published commercially. Up to six recordings may be submitted, each being between 10 seconds and two minutes in duration. Six 18 cm reels of Scotch tape (*203 Dynarange* unless otherwise specified) plus an inscribed plaque will be presented to the winner in each section. Closing date for entries is December 1st. They should be sent to: **The Wildlife Sound Recording Society, 80 Mancetter Road, Mancetter, Atherstone, Warwickshire.**

**BROWN FOR DANGER**  
**N**EW regulations covering the colour code of domestic mains appliances will come into force on January 1st, 1970. The present green-earth, red-live and black-neutral code will be superseded by striped green-and-yellow-earth, brown-live and blue-neutral. These recommendations were made by an *International Commission on Rules for the Approval of Electrical Equipment (CEE)*. But for the intervention of the UK representative, still greater confusion could have arisen from the original plan to colour the live conductor black.

**STEEL TAPE USED IN DATA RECORDER**  
**A** FLIGHT data recorder using steel tape has been developed by Penny & Giles of Christchurch. The medium has been chosen as a more convenient alternative to steel wire, being more durable and heat-resistant than coated plastic tape. Up to 1000 flux reversals can be accommodated per second, in 10-bit digital groups, memory duration being 25 hours per cycle.

**HI-FI IN THE HOME**  
**A** PPEARING on the bookstalls as this issue is published, *Hi-Fi in the Home* by John Crabbe is aimed at the keen newcomer to domestic sound reproduction. The Editor's book assumes only that the reader enjoys listening to music and wishes to realise the highest quality from his audio equipment. After an examination of basic acoustics and electronics, the two subjects are combined in Chapter 3—*Basic Components for Music Reproduction* and elaborated in Chapters 4 and 5 on *High Fidelity*. A later chapter gives practical advice on *How to Choose Equipment*,

including tape recorders, the book progressing to *Installation and Adventures in Listening*, with a speculative conclusion entitled *Music in the Home*. A comprehensive glossary and index are included to assist reference and explain technical obscurities, plus a bibliography of manufacturers' addresses and suggested further reading. *Hi-Fi in the Home* contains 328 pages, illustrated, and is published by Blandford Press at 40s.

**NEW FORMAT FOR THE AUDIO FAIR**  
**T**HE 1969 Audio Fair will not be held at the Hotel Russell. Pressure has been growing among exhibitors to find a more practical alternative to hotel bedroom demonstrations, many companies being keen to emulate the recent *Hi-Fi 68* exhibition at Düsseldorf. There, soundproof rooms were erected in a large hall to combine spacious demonstration conditions with some semblance of domestic living room acoustics. No alternative venue has been decided upon and the 1969 Fair may even move to another season. There is a possibility, however, that the Audio Fair will share a London hall with another specialised exhibition. Only one thing seems certain: tickets are unlikely to be free in future years.

**GARRARD TO IMPORT ROLA**  
**R**ECORDING equipment manufactured in Australia by the Rola Company is now being marketed in Britain by Garrard; both companies are related to the Plessey Group. Among the products is an endless cartridge system intended for broadcasting applications and based on the *CT80R* record/play unit and the *CT80P* player. The *700 Series* professional audio recorders will be available in full track record/play form or (Model 707) as full-track players. Both the *700* and *CT80* systems are fully solid state and of modular construction. All commercial enquiries should be addressed to **Rola Recording Products Department, Garrard Engineering Ltd., Newcastle Street, Swindon.**

**AUDIO TALK**  
**O**VER one thousand specialised expressions used in audio, electronics and allied subjects are included in a booklet entitled 'Audio Talk' which is being given away with the October issue of *Hi-Fi News*. This issue is currently on the bookstalls but may be purchased direct from the publisher, in cases of difficulty, at 4s. 6d. including postage (4s. 3d. overseas). The booklet may be purchased separately at 2s. 6d. including postage. It is produced by **Link House Publications Ltd., Link House, Dingwall Avenue, Croydon CR9 2TA.**

**NEXT MONTH**  
**A SURVEY** of tape-to-disc transcription services will appear in our December issue, to be published on Saturday November 14th. Richard Golding visits *Leavers-Rich* and John Fisher modifies his *Budget PPM* (October) to accept an Ernest Turner meter.

# Tricks & artifices



BY DAVID KIRK

"MAKE your own abstract painting" said a sign at the *Do It Yourself Exhibition*. We fought our way to the booth and watched with awe the half-crowns changing hands, the oil paints being squirted haphazardly on sheets of paper, and the final transformation of unearthly mess into a more or less pleasing pattern. This transformation required a Gadget, though whether the exhibitor is in business to sell Gadgets or abstract paintings was never really clear. The device was nothing more than a rotating plate, designed to fling the paint centrifugally into an apparently well planned pattern.

The fact that a simple mechanism of this nature can produce aesthetically pleasing designs suggests a promising future for computers in the creative field. Alternatively, if I may anticipate Peter Turner, it sounds the death knell of The Arts.

I am not concerned with artistry, for the purposes of this article, but with the application of Gadgets to recorded sound. My rather rude views on musique concrete can be forgotten, the word *gadgets* substituted by *tape recorders*, and we are away.

The commonest trick effect obtainable with tape equipment is *superimposition*, where the erase head is killed electrically or with cardboard, allowing two recordings to be made over the same stretch of tape. In practice this is so vague and uncontrollable that it is almost useless. A usable variant is the *parallel playback* facility provided on most  $\frac{1}{4}$ -track recorders, where the two recordings may be made on separate tracks. In this case, the B track may be erased and re-recorded if unsatisfactory, without damaging the A track.

Most self-respecting  $\frac{1}{4}$ -track mono recorders incorporate a socket from which the signal at the unused head segment may be wired to an external amplifier. Philips, Thorn, Grundig and others produce accessories to simplify this task, the Thorn being available complete with loudspeaker, but in the last resort any radio or gramophone amplifier can be persuaded to make the appropriate noises. Whatever the quality, such an arrangement allows the original A track to be monitored while the B track is being added. Many stereo recorders provide this facility and those which do not can usually be modified quite easily.

Having achieved this *controlled superimposition* (for want of a label), we can proceed to a less well known but very effective technique for producing reverberation. A degree of reverberation can be attained simply by moving the microphones well back from the performer, but this technique has several limitations. Grand cathedral effects can be achieved without loss of quality by doctoring the performance *after* it has been recorded.

Let us assume a 19 cm/s mono recording occupying track A of a stereo or  $\frac{1}{4}$ -track mono recorder. This is replayed through any convenient loudspeaker and picked up by a distant microphone situated in an adjacent bathroom or hall. The microphone in turn feeds the B channel which is switched to record. (If medium or high-impedance microphones are employed, an external loudspeaker might more easily be placed in the bathroom, keeping the microphone within a few feet of the recorder.)

Dubbing from one track to another in this manner creates a channel of reverberation

running alongside the original recording, assuming a single record/play head to be in use. These channels must now be mixed together by pressing both track selectors simultaneously. With a stereo machine, the original and copied channels can be adjusted to achieve the desired effect. Balancing is more time-consuming in the case of a mono recorder, since the B track may have to be copied at several levels until a successful mixture is obtained.

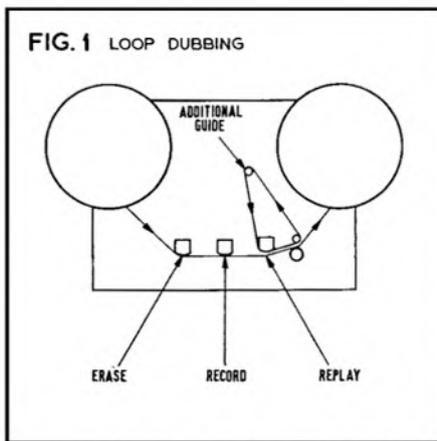
The musique concrete brigade need not think in terms of realism and may find a use for much greater degrees of reverberation than is tolerable with normal instruments. By dubbing the 19 cm/s original at 38 cm/s, the bathroom acoustics can be extended to cavernous proportions. Speed-to-speed copying of a 9.5 cm/s original at 38 cm/s provides an even longer reverberation, though the limitations of low-speed recording make the exercise questionable. Mr. Judd's circuit on page 525 suggests an intriguing form of variable-delay reverberation.

More elaborate three-head recorders generally allow the bathroom signal to be mixed with the A channel direct to the B track.

Echo, the now - we - are - yelling - from - a - mountain effect, is so widely used these days that it can scarcely be regarded as an original gimmick. Pre-echo is more interesting since it is never experienced in acoustic reality. A versatile  $\frac{1}{2}$ -track stereo recorder should provide the means for pre-echo, though the technique is so obscure that it is unlikely to be found in any operator's manual. Having recorded a chord accompaniment and slow guitar melody on track A, by multiplex or with two performers, the tape is re-threaded upside-down and played backwards. With the 1-2 and 2-1 positions selected on a *Revox* or *Chilton*, the reversed music can be mixed at will with echo on to the B track. Finally, the tape is re-threaded as before, the doctored track emerging with pre-echo. My own ears tend to disbelieve what they are hearing and regard the whole thing as an extraordinary flamenco. The chord backing, incidentally, should be strummed as monotonously as possible and might be better played on an organ, since any outstanding pre-echo on the accompaniment will give the game away.

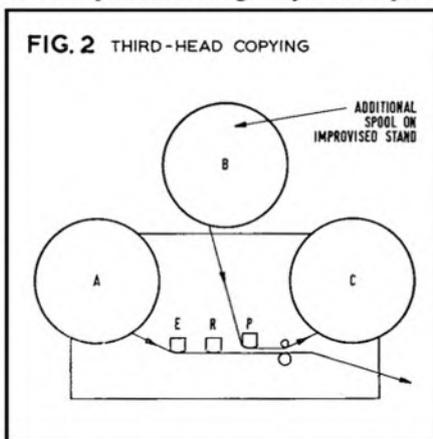
Automatic gain control does not readily lend itself to creative applications. Mis-using a battery recorder some while ago, I did uncover an unexpected aspect of AGC which has musical possibilities, even if only as a source of melodic ideas. The machine in question was a Sharp *RD-505*, which features both AGC and straight-through loudspeaker monitoring. Turning up the monitor level and moving the microphone casually around the loudspeaker, a random succession of feedback howls emerged. Pitch and loudness varied in a lively manner but were prevented from distorting or shrieking excessively by the AGC. Given an electric motor or two, and a piece of string, a fairly original Ideas Machine could be produced. Perhaps Stockhausen already has one.

Tape-to-tape dubbing facilities are essential to the creative sound enthusiast, but all too often enthusiasm is frustrated by poverty. Fig. 1 shows the ease with which a single three-head recorder can be persuaded to copy long or short tape loops. The source/tape control



is switched to the tape position, the monitor output being fed at line level back to the record input. The loop is laced through the capstan and pinch-wheel alongside the spooled tape and proceeds to a makeshift guide—anything from an ink bottle to an engineered post. Two possible sources of trouble: certain tape amplifiers go rapidly unstable if connected as described and some fiddling, possibly with an external mixing unit, may be necessary to cure this; secondly, in my days of enthusiastic poverty, the dubbed recording occasionally made its way back through the loop to the replay head, creating an unwanted low-level echo. This was overcome by inserting a small cardboard finger between the two tapes at the head, in my case mounted on a frame of Meccano. Most decent mains recorders have a Mu-metal hum shield against the replay head, which simplifies matters enormously; the spooled tape is then threaded outside the shield.

Straightforward dubbing from one reel to another requires more elaborate improvisation, again easily accomplished with Meccano, to produce a spool carrier. Apart from recommending the use of paper washers to overcome spool vibration, I would leave this construction to the experimenter's ingenuity. The tape to



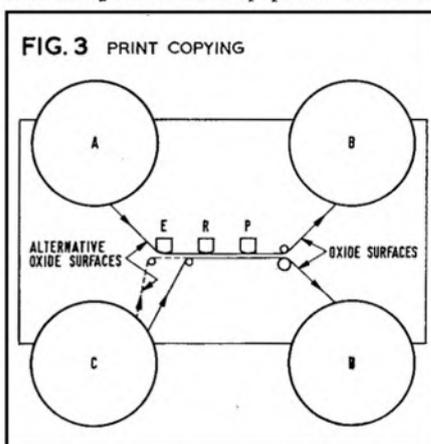
be copied is placed on the carrier (spool B in fig. 2) and threaded past the replay head and capstan to spool C. Spool A, on the left-hand turntable, contains the tape which will receive the copy. This is threaded in the normal way but travels from the capstan straight to a clean floor or wastepaper basket. There is absolutely no danger of tangling or damage, provided the

tape is not disturbed or trodden upon while stored in this manner. A similar superficially questionable technique known as *tank storage* is still used in some data recording systems.

Fig. 3 shows a theoretical method of dubbing on recorders using integrated record/play heads. The phenomenon of print-through is employed literally to print a recorded pattern on to a previously erased tape. Before commencing this experiment, a reel must be wound oxide-out and loaded as spool A. Spools C and D require improvised turntables but no twisting or re-spooling is needed to present the oxide coating to the heads. Spool C contains the recording to be dubbed—a recording that is itself in danger of being erased so please use nothing valuable if trying this one. Spool D could be replaced by a wastepaper basket as before, provided nothing longer than a few minutes of programme is to be copied at one run. Alternatively, the two tapes can be interleaved straight on to the B spool. Rewinding may prove difficult under this condition and one of the tapes may tend to creep after leaving the capstan.

Having set up the two tapes in the manner of fig. 3, with the C reel threaded away from the erase head, we are in a position to commence dubbing. The machine is switched to record, all gain controls being at their lowest position, and left to run for the required duration. When reel A is rewound and played, some trace of the C programme may be found, depending on the bias current in the record head and the coercivity of the two tapes.

One major drawback: the copy will in fact be backwards and retrievable only on full-track mono or  $\frac{1}{2}$ -track stereo equipment. There is a



solution to this, however. The experiment should be repeated with the C oxide reversed (facing away from the A tape coating). Although this will keep all tracks in their correct position, the C coating will be further from the record head gap than during the previous attempt. If a higher degree of print-through is required, the more powerful erase field can be employed by lacing the C tape in the more conventional dotted path of fig. 3. The success of this technique depends not only on the quality of the copy but also on the deterioration, if any, of the original recording. Practical or not, this is one of the most fascinating experiments to which a domestic recorder can be applied.

Finally cassettes. I have spent considerable time trying to devise interesting artifices with these and have discovered the following . . .

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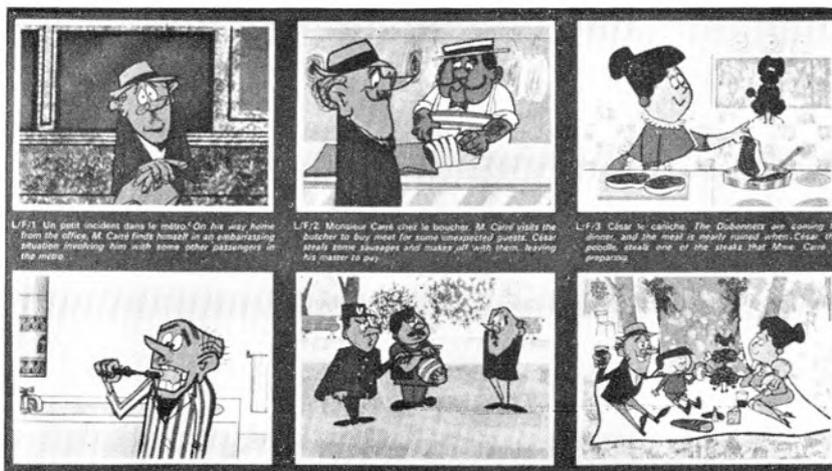
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# PICTURES, FACTS & SOUND

by richard golding



L.F.1: Un petit incident dans le métro. On his way home from the office, M. Carré finds himself in an embarrassing situation involving his neck when other passengers do the same.

L.F.2: Monsieur Carré chez le boucher. M. Carré visits the butcher to buy meat for some unexpected guests. Carré asks some help and makes off with them, leaving his master to pay.

L.F.3: César le catcheur. The Dubonnets are coming to dinner, and the meat is nearly ruined when César, the peacock, steals one of the steaks that Mrs. Carré is preparing.



WITH the audio-visual method, use is made of the correlation in the student's mind of the sounds of a word-group or linguistic structure with a projected picture illustrating its meaning. He hears the words, and he sees the picture; the one reinforces the other. The words, for the most part, will be on tape. The pictures, most probably, will be projected from a 35 mm filmstrip or an 8 mm film loop, but they could well be illustrations in a pamphlet or cutouts to be attached to a board. Whatever the material, the results are the same; a store of linguistic groups is built up in the student's mind which he learns to associate with certain visual images. Whenever he sees the latter, his memory is stimulated and he is helped to recall the words learned in context with them. The emphasis is on receiving a pictorial translation rather than a written one.

It is because of this shift in emphasis that it is possible to start teaching a second language to quite young children in the primary school and, furthermore, to a larger number of secondary school pupils and evening class students than ever before. It is found that many students who cannot cope easily with learning a language in depth under the traditional method gain appreciably from the conversational approach used in the audio-visual method.

In the primary school, children are usually introduced to the spoken language long before they ever see any words in print. They learn first to understand and to speak the language by absorbing the atmosphere and culture of the people they are studying. This is done as follows: the tape recording and the visuals are run through several times so that the children understand the story being presented. The tape is then run again but stopped and re-started several times during the screening of one picture. Every time the tape stops the children repeat the phrase while studying the picture. Before going on to the next stage the teacher must make sure that all the children

understand the language and the situation presented. To proceed without this assurance is to invite parrot-learning which is undesirable. In the third phase, the pictures are presented again without the tape, and the children must speak the dialogue from memory following a question and answer technique with the teacher leading the way.

One of the most popular French courses for Primary schools is *Bon Voyage!* It is obtainable in two versions: (1) with discs and pamphlets and (2) with tapes and filmstrips. The cheaper version (Harrap) consists of light plastic discs, each containing two lessons, and an illustrated pamphlet (in sets for the whole class) for each lesson. The content is extremely varied with family situations, poems, song scenes from everyday French life, all providing a lively and attractive way of presenting the language to children. The pamphlets are expendable. They can be used for drawing upon and they can be cut up and used for classroom visual aids. If needed, copies can be run off for this purpose on a Banda machine, and the pamphlets retained for use the following year. The cost is about £20 for a year's supply for forty children, but if you are going to run off copies of the pamphlet the life of the course could be as long as the life of the discs.

Some people would regard this as something less than a proper audio-visual course but *Bon Voyage!* with tape and filmstrip is now available from Rank Audio Visual. It is a complete three year course for age ranges from 8-11 years. Each year is divided into three parts each of ten lessons, covering a full term's work. Each part comprises 10 filmstrips; 10 taped lessons, plus one summary lesson for practice, arranged on four 13 cm spools and recorded at 19 cm/s; working scripts for use by the children; and a teacher's handbook. The tapes have audio signals for use in conjunction with the filmstrip change. Purchase prices are: per part (one term's work of 10 lessons) £18; per year (three parts) £50.

A complete sample lesson is available from Rank for preview purposes.

Another popular Harrap course is *Bonjour Line*. It is designed for children from 8-11 years but I feel that it is more suitable for use with the 3rd and 4th years. Part 1 consists of 30 filmstrips and 9 reels of tape recorded at 9.5 cm/s. Each lesson presents an incident in a story concerning the adventures of a group of French children that runs right through the course. The situations are fairly short, employing not more than fifteen brief sentences. At the end of each filmstrip is an extra section called "Jeu des Questions" in which a French teacher poses questions to a doll-pupil.

Several recapitulation filmstrips are included, containing scenes from earlier lessons, which can be used for revision, and all manner of games that can be used in follow-up lessons to practise the material are suggested in the teacher's notes. Purchase price is: Filmstrips £26; Tapes £29; Teacher's Book £2 10s. Parts 2 and 3 are designed to provide further work to take the children into the next steps of language learning—reading and writing—but most Primary school teachers may feel that Part 1 is advanced enough anyway for their needs.

A very good audio-visual French course used in many Secondary schools and some Evening Colleges is *Voix et Images de France* (Harrap). This is based on *le français fondamental, premier degré*, the scientific study of the most frequently occurring vocabulary and structures of the contemporary French language. Part 1 uses 32 tapes on 13 cm reels, single track, at 9.5 cm/s, with 32 film strips. Each of the 32 lessons is divided into three parts. The first section consists of a small incident or story that is related in the cartoon pictures of the filmstrip, while the appropriate dialogue is heard from the tape. The second section is again the dialogue of an incident or situation but is arranged in such a way as to give practice

(continued on page 521)

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**PICTURES, FACTS AND SOUND CONTINUED**

in the use of a particular point of grammar. The third section consists of a phonetic exercise. This course is intended for oral use only for the first sixty hours of class work. After this the written language may be introduced. Purchase price is: Tapes £79 15s.; Filmstrips £40; Teacher's Book £1 19s. Structure drills based on the situations are available for the language laboratory. Part 2 of *Voix et Images de France* is a purely audio-lingual course consisting mainly of recorded dialogues on tape. It involves intensive study of a text and makes suggestions for both oral and written composition.

The *Harrap-Didier Audio-Visual Language Courses* are available in French, German, Russian, Italian, and Spanish and are intended for Secondary and Adult use. The theory used here is that one begins by learning word groups rather than isolated words, and the teacher uses these word groups in different situations and in different combinations, so that the identity of the individual words and their grammatical function becomes obvious, even though no translation is used. Each course consists of twenty-five lessons on tapes and filmstrips, with a language laboratory version for the German and Russian courses, and a book for the student. The book is a reproduction in print of the visual and aural elements of the course, somewhat like a comic strip cartoon with the recorded material forming a caption under each frame. Prices differ for each course, but not overmuch. The German version, for instance, costs: Tapes (10 reels at 9.5 cm/s) £39 3s.; Set of 25 Filmstrips £23; Student's Book 22s.; Teacher's Book 29s.

Holt, Rinehart and Winston Ltd. produce a wealth of interesting language material. *Une Année en France* comprises 15 filmstrips in colour, a script-booklet, and 5 reels of tape recording and is intended for use with any

intermediate or advanced French course. The commentary, recorded in French on one track and in English on the other, describes each frame of the filmstrip journey around France. Price £62. The German course, *In Deutschen Landen*, costs £58. *El Mundo Hispanico*, the Spanish course, also costs £58.

This firm operates a tape hire service for the UK. Programmed tapes are available on hire for duplication and the scheme operates under the condition that there is a class adoption of the text, and that tapes so copied are used only within the copying institution. There are courses in French, German, Spanish, and Italian. *Basic Conversational Spanish*, for instance, costs £6 to hire sixteen hours of recording on 7 1200 ft. reels. *Verstehen und Sprechen* costs £11 for 22 reels. The address: 120 Golden Lane, Barbican, London E.C.1.

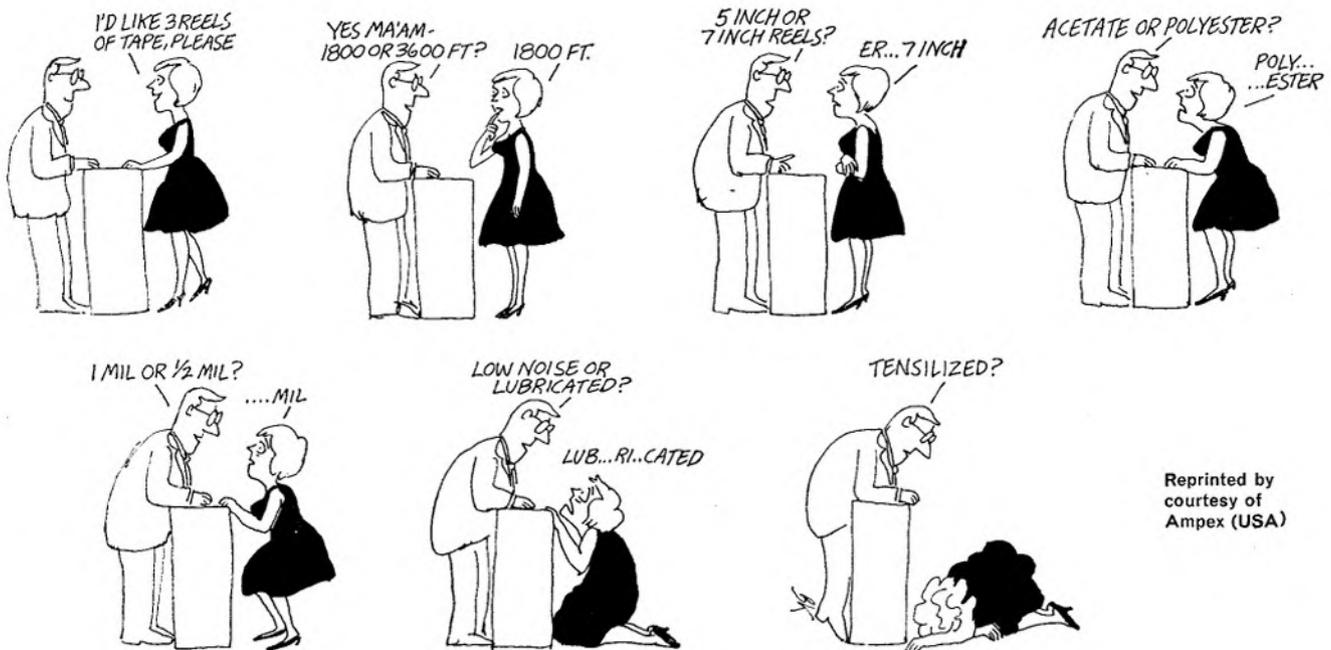
A very amusing and entertaining French course which appeals to my sense of humour very much is the *MacMillan Cine Loop Series*. These consist of cassette-loaded 8 mm film loops for use with the Technicolor 800 projector, and each loop depicts an incident in the life of the Carré family. They were devised by Gerald Fleming, head of the Modern Language Department of the William Penn School, Dulwich, in association with Halas and Batchelor, the internationally famous cartoon producers. The drawing and animation are superb, as one would expect with Halas and Batchelor, and the various situations of this typical French family are presented with gaiety and clarity. There are 12 loops in the series each at £3 7s. 6d. The tapes are intended as teacher's specimen commentaries, one for each cine loop; they are approximately synchronised and run at 9.5 cm/s and they cost £2 2s. 9d. each including purchase tax. The teacher, however, may use his own tapes and supply his own commentary, or the student may use the loops in a language laboratory and test his own powers of description in the French language by supplying his own commentary. This is not

a complete course, and the work with the film loops needs to be carefully integrated with the regular language teaching. I would say that the loops are more suitable for use with Secondary and Adult students than with Juniors.

MacMillan have now introduced a new Nuffield Russian audio-visual course for use with average and above average pupils in the early years of Secondary school. Stage 1 of *VPERYOD!*, as it is called, contains 18 introductory lessons together with various text books, 10 colour filmstrips, 34 flash cards and a set of Calendar Cards, and seven 13 cm tapes. The tapes are recorded at 9.5 cm/s and each side of the tape contains the recorded material of one Unit, with musical introduction. The tapes have been recorded by both male and female Russian speakers. The first recording of the presentations and situations is read straight through. The exploded version provides ample practice in repeating each phrase after the native voices. The recorded drills of the pattern practice provide additional oral practice of individual sentence patterns. Price £44 10s.

*Adelante* is another new Nuffield course from MacMillan intended for the same age range as *VPERYOD!* The visual content of this Spanish course, however, consists of coloured figurines, flashcards, dialogue posters, a teazegraph display board, teazle discs and text books. There are eleven 10 cm tapes recorded at 9.5 cm/s by Spanish speakers. Price £37 5s. Address is *MacMillan and Co. Ltd., Little Essex Street, London W.C.2.*

Most audio-visual language courses are the carefully planned results of several years of investigation into word counts and language structures. They involve steady progression from point to point in grammar, introducing vocabulary according to a systematised plan. If they are not taken seriously and worked through in the way the designers planned, there is no point in having them.



Reprinted by courtesy of Ampex (USA)

# Frederick Turners Victorian Carousel

BY ROBERT BARRIEDALE



**F**REDERICK Turner's scale model Victorian Carousel is identical in every way to the original Merry-Go-Round that travelled the coal mining areas of Derbyshire before the First World War, except that it is powered by electricity and the music is supplied by a Truvox R52 tape recorder.

As a young schoolboy, Frederick Turner used to count the days to the annual Bolsover Feast in August when the giant steam-traction engines would arrive with their loads of gaily painted fairground equipment including the golden, glittering Carousel. When at last this day came, with all its building-up operations, it seemed like magic to him, and he came to regard the Carousel as the true symbol of craftsmanship and engineering beauty.

Many years later, in 1958, and as part of an occupational therapy exercise recommended by an eye surgeon, he began to construct in minute detail his model as he saw it in those far-off days. It took him the first year to make the hundred detailed drawings of the various parts of the machine. The basic construction took a further eight years, with a regular daily working routine in his garage.

Almost all the parts were hand-made with ordinary tools, home-made equipment, and a small round-bed Drummond lathe. Altogether there are some 4,500 pieces of wood-carving, including horses, cockerels, ostriches and dragons.

For those who know their Merry-Go-Rounds, the centre organ is of the Gavioli style with working Bandmaster and his two Lightgirls. The polished brass and copper

centre steam engine is of the Frederick Savage type. The horses, cockerels and ostriches are suspended separately by traditional twisted polished brass rods from overhead crankshafts which give the galloping movement. There are two dragon-chariots, incredibly ornate, in which the Victorian Mama would ride with her brood of young children; and these dragons have pleated seats and coloured footmats. The dragons have been wired so that the eyes will slowly light up and then gradually fade away.

There are some four hundred lights in all, ranging from very small 2.5 v to larger ones at mains voltage, and they are all wired back to the mains control panel occupying one side of the Carousel underframe. The rotating lights are connected via a centre slip-ring located in the underframe. This location also takes care of the main drive motor, rated at 0.06 hp, together with the associated belt and pulley gear. The twelve overhead crankshafts were cold-pressed in one piece by a specially made hand jig unit; the bearing and gears were hand cut.

Completely in the atmosphere of the whole thing, the lathe is a 40 years old tool that he picked up from a scrap-heap. The woodcarving tools are in the same category; he bought them from a friend whose grandfather, a craftsman woodcarver, had used them for over half a century. The black leather roll is now falling to pieces, but the tools are in excellent condition. He intends to keep them that way, for he says that such things are worthy of preservation to the very last.

In August 1967, after over 8,000 working hours, the Carousel was finished. It stood five feet square and its height was six feet six inches including the underframe on chassis. It weighed 450 lbs.

During the early part of the construction of the scale model, Frederick Turner realised that the accurate reproduction of Fair Organ music would be of paramount importance. This matter occupied his mind for a long time, and he came to the conclusion that the problem would involve several main elements, consisting of:

- (a) finding the original Fair Organs that would be suitable and available for tape recording.
- (b) obtaining the necessary licences for tape recording and reproduction.
- (c) obtaining a suitable battery-powered tape recorder, light in weight and capable of high quality performance.
- (d) obtaining a suitable microphone, light in weight, robust in construction to withstand rough treatment in transit and in use, and capable of working through the full frequency range in order to capture the deep bass drums at the lower end, and the tinkling bells at the upper end.
- (e) obtaining a suitable mains operated tape recorder for reproducing the Carousel music. Such a machine to be capable of a very high standard of performance, and able to withstand prolonged runs, with a minimum maintenance requirement and a maximum standard of mechanical reliability.

# Frederick Turners Victorian Carousel

BY ROBERT BARRIEDALE



(f) finding a tape tolerant of very hard wear and capable of good quality.

(g) all the above equipment and associated material to be in an economic price range and, just as important, to be covered by adequate servicing and repair facilities.

He made a long and very careful research into all these basic points, and finally took the following decisions.

He joined the *Fairground Organ Preservation Society*. This Society is made up of Fair Organ Owners and enthusiasts throughout Britain and the Continent and is efficiently (but very friendly) run on business lines. For a modest annual subscription, the society produces and circulates a quarterly publication called *The Keyframe*. (This publication gives details of steam rallies, fairs, organ recitals and names and addresses of organ owners.)

Meetings are held at regular intervals and newcomers get the opportunity of meeting the members. He says that he personally has had the greatest possible assistance and co-operation of all organ owners approached.

Speaking on the subject of licences, Frederick Turner said, "A great deal has been written about the legal side of taping and playing back fair organ music. I do not pretend to understand the legal implications. Neither do I understand why it is necessary to obtain licences from two separate organisations. In my case, I have tried to avoid all possibility of legal transgression by accepting what appears to be the situation." The Authorities concerned are (1) *The Mechanical Copyright*

*Protection Society*, and (2) *The Performing Right Society Ltd.*

"I put my case fairly and squarely to both organisations and received fair treatment in return," he continues. "For an outlay of approximately £12 and with the express permission of the organ owners concerned I am clear to record and replay fair organ music for one year on any occasion, either in private or in public."

His final choice for a battery-powered tape recorder was the Fi-Cord 202 and the most suitable microphone he found for his purposes was the Gramplan DP4.

"For replay," he says, "I selected the Truvox R52 tape recorder, for over the years I have come to regard Truvox very highly. My other two Truvox recorders have been in constant use over the past eight years, averaging some three to four hours playing time for seven days per week, with an absolute minimum of maintenance or replacement."

He found that tape was the greatest variable of all. "I tried many brands," he says, "and some were excellent, but for the very best results over long periods I found BASF most suitable for my purpose. Mechanical strength is high and, very important, the tapes are supplied in very sensible containers designed to keep out the dust during storage."

The tape recordings he made on location include:

Messrs. Forest's Galloping Horses—Blackheath, London.

Miss Sally Beach's Gallopers—Richmond Deer Park, Surrey.

Messrs. Pettigrove's Gallopers—Mitcham, Surrey.

Mr. Chamberlain's Gavioli Organ in preservation—Fawcett.

Mr. Albert's Marengi Organ in preservation—Bolton.

Mr. C. H. Hart's Mortier Organs in preservation—St. Albans.

The late David Barlow's Mortier Organ—Wingham.

Mr. Hunt's Marengi Organ in preservation—Oldbury.

"Of the many different styles of music, my choice falls within the scope of the above mentioned instruments. Each separate organ has its own particular characteristics; there are no two alike, but they all breathe happiness and memories of the past. Tape recording of fair organs brings a great deal of pleasure. The actual technique may be varied to suit the individual. The two basic essentials in my experience can be defined as courtesy and the proper choice of equipment."

Already, Frederick Turner's whirling gleaming Victorian Carousel has been on show at The Royal Festival Hall, The Hampstead and Camden Arts Centre, London Olympia, Seymour Hall, Heals Ltd., and Schofields Ltd. of Leeds. The model is booked for the Motor Show at Earls Court, for a seven weeks run at Cockaynes Ltd. of Sheffield, and for the Barney Colehan BBC TV production—"The Good Old Days" from Leeds City Variety Hall. It is available for further hire. Mr. Turner's address being 421 Great West Road, Hounslow, Middlesex.

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**P**RACTICALLY all types of synchronous capstan motor employed in domestic tape recorders will synchronise themselves to frequencies other than the 50 Hz at which they are intended to operate. Most of these motors require a power of around 25 to 30 w at a nominal supply voltage of 230. Such motors will operate quite well between about 35 and 70 Hz, some even up to 90 Hz, and provided the voltage and power is maintained the motors will run at their normal efficiency but at a speed according to the frequency. This applies to earlier shaded pole types as well as the small Papst types with external rotors used, for example, in some Tandberg recorders. The speed variation obtained with a Tandberg 62 switched to 19 cm/s, by using the fig. 1 power amplifier, was between about 13 and 26 cm/s with a sine-wave input to the amplifier of between 35 and 70 Hz. Note that the amplifier will generate around 25 to 30 w output at 230 v, and this is sufficient only to run the tape drive motor but not separate spooling motors. The amplifier requires around 1 v input of sine-wave over the required frequency range and this can be obtained from a sine-wave signal generator or a phase shift oscillator employing a circuit like that in fig. 2. The values of the capacitors c1, c2 and c3 in fig. 2 may have to be determined experimentally in conjunction with vr1 to obtain variation in frequency between 30 and 70-80 Hz. The output from a phase shift oscillator of this kind is quite high, so some attenuation will be needed as shown in the circuit. It can be run from the same HT supply as the power amplifier.

The power amplifier is a quite conventional arrangement employing a preamplifier, phase splitter and a pair of 807 beam tetrodes for the output stage. The power supply for running the amplifier must be capable of delivering 400 v HT at 200 mA, since the 807s must be run at full rating to deliver the requisite power. They would of course develop much more power than 25 w with a normal audio output transformer but, as in this case the output voltage must be around 230 v, a mains transformer is used instead (T1 in the circuit). The centre-tapped secondary is used as the primary (in the anodes of the 807s) and the primary as the output winding. The efficiency of this arrangement is of course fairly low and to attain full output it is necessary to 'tune' the anode winding to the mid frequency of operation i.e., to around 50 Hz. The capacitor Cx is used for this and its value will depend on the inductance of the anode winding. The capacitor value will be around 0.25  $\mu$ F but must be adjusted one way or the other until maximum voltage is obtained at the output at a frequency of 50 Hz. The output voltage should then maintain itself to 230/240 v on load, between the requisite 30 to 80 Hz. The capacitor(s) used for tuning should be 1000 v working as the peak voltage developed across the anode winding is very high and incidentally dangerous. Under no circumstances must the output winding be earthed.

Connection of the amplifier output to the tape drive motor must be made *only* to the motor. If the motor is normally switched off whilst the tape is stationary or during rewind, then a switch must be incorporated in the leads between the amplifier output and the motor. My own arrangement for the Tandberg

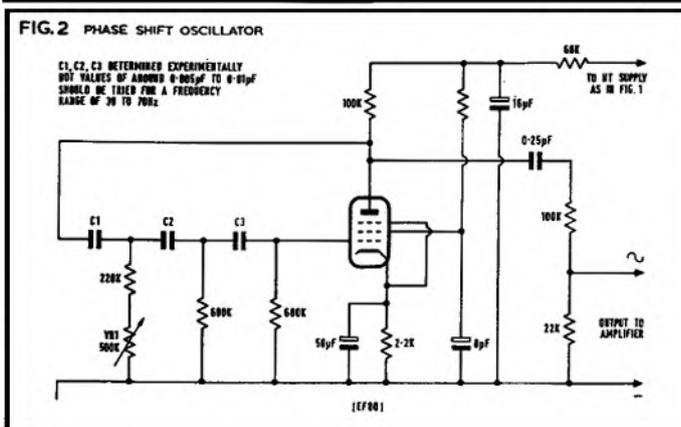
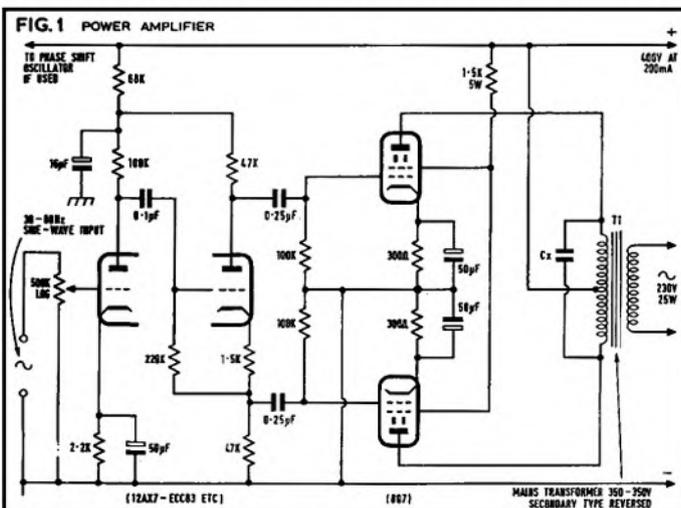
# A Variable Speed Drive System

BY F. C. JUDD

62 was a double-pole changeover switch in the motor leads so that the motor could be connected either to its own internal circuit or to the external power unit.

The circuit of fig. 1 is given for its experimental value, but has been used successfully with a Tandberg 62 as mentioned above. A very careful check should be made on the tape recorder motor circuitry before attempting to use this system to make sure that the drive motor can be isolated completely without

upsetting the remainder of the circuit, particularly when other motors are used for spooling. Drive motors that have been made to run from this power unit include Collaro/Magnavox, Ferrograph and the small 25 w Papst types. The 807 valves can be obtained for around 10s. each from component and valve dealers such as P.C. Radio Limited, 170 Goldhawk Road, London W.12. The remainder of the components are quite standard and can be purchased from most stockists.



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## PHILIPS

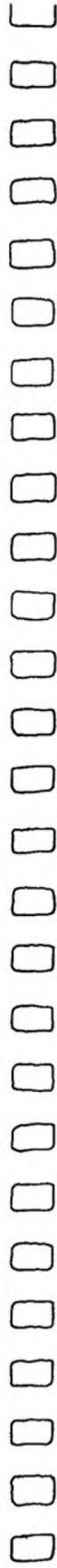
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CENTURY HOUSE, SHAFTESBURY AVENUE,  
LONDON, W.C.2.



BASTIN

FILM

Peter Bastin



I HAVE recorded dialogue and music for two films and have not got over it yet. To say that the work is exacting is putting it very mildly indeed, and to illustrate this as best as I can, I'll give you a blow-by-blow description of the chaos.

The film was a sort of travelogue about some beautiful countryside. It called for a narrative and background music. The music in question, the director decided, should be from discs and of the Melachrino Strings variety. As it happened, we took the music from pre-recorded tapes. The narrative, which I was to speak, was to be cued in to the film and the music was to provide the right atmosphere. It was decided to record the whole track on tape, in my studio, then transfer it to the film afterwards. The dialogue was prepared on cards and a cue light set up. A small projector, with a synchroniser, was arranged to project the film on to a glass panel, set up outside the studio door. I could then see the film and operate my equipment, shuffle about and speak the lines without the projector noise being apparent. The gear was set up and we stood and stared at it for a while. Let's try it, said the director.

The film started, my cue light blinked and I spoke the first piece of narrative; then the second. Everything was going fine until the tenth cue, when I stumbled over the first word. Cut, said the Director (or something like that) and we went back to the beginning again. Rewind the film, reset the synchroniser, draw breath, off we go. O.K. until about the thirtieth cue; back to the beginning again. Another blob. Blast, I said, let's push on and I'll edit the tape—but that proved to be a mistake, for when I had edited it, the timing was out by about two seconds and we had to start again. Five hours later, we completed the narrative track. Now the real reason for the dreadful time we took was basically that you cannot be narrator and sound engineer at the same time. This is an irrefutable fact and one that I learned the hard way and never argued with afterwards.

The narrative track was complete; all I had to do now was record the music track and fuse both together. Apart from some time spent selecting the music for suitability and similarity of recording quality, this was easy and I then ran both tracks together, balancing the music level against the speech. The final master tape I got rid of as quickly as possible. The time taken to record narrative and music for an hour-long film totalled some eight hours—not a very economical proposition.

The professional method in film studios differs very considerably. There, they leave nothing to chance and the music is recorded against the film with the most infinite care about timing. No hit and miss methods because they can't afford them. Which makes me wonder why I was asked, some time later, to do another film—no commentary, just music. The film was another travelogue, this time with a little more contrast. There was to be a professional commentator and a whole mass of people with bits of paper and switches. I decided to approach this a little differently, so I asked for a run-through of the silent film.

Against that I did a spoken descriptive analysis of the film on a portable—"lake, with ducks; splashes; mood changes—probably music change here," and so on. I also took a stopwatch timing of the film. All this meant that I could go into the studio and set about the music. As the Director did not want to be involved in copyright, I was commissioned to compose the music myself.

Basically, there were two moods in the film. A restful mood, allied to water and sleepy scenes and a vivacious mood applicable to town scenes. There, then, was my brief. The film ran for 65 minutes, about 60% of it drowsy stuff and the rest more energetic. There was also the title music which was probably the most important. I decided to use two electric guitars, treble and bass, and a glockenspiel—a sort of miniature vibraphone. I prepared a rhythm on a tape loop and after considerable thought decided to use this one rhythm throughout the film with the exception of the first five minute sequence and the title. This sequence was recorded first; the title music produced the impact necessary at the start of the film and the idiom was continued into the first sequence.

I pushed on and with, I must admit, some difficulty over timing, eventually completed the music for the first film reel. For the second reel, I decided that one sequence demanded an echoed-trumpet solo, so out came the faithful horn. In point of fact, the second reel was recorded without any trouble whatsoever, possibly due to the experience gained on the first reel. When all was safely in the can, I dubbed it on to a battery-mains portable and took it along to the main studios for a trial run against the film. Apart from being a disastrous 20 seconds out in the latter half of the second reel, it was fine. I went back home, chopped 20 seconds out, dubbed it again and tried it against the film. This time it was too short. After several cups of coffee and a lot of bad language, I realised why. The master recording, timed to the half second, was produced on a mains machine and dubbed on to another machine which was played back on battery-power. The batteries, although not down, were not producing the same power as the mains.

Came the day of the narrative recording. The narrator sat in one studio, cued by a chap sitting near the screen. I was hooked up by headphones and could also see the screen and I was using a mains machine! The poor chap reading the commentary could see nothing except two cue-lights in front of him. We went right through the film without a halt. The result was better than anyone had anticipated, the only faults being one stumbled word and some indecision as to the music level. Some thought it was all right but I insisted that it was too low; the narrator was nibbling his nails over the stumbled word, so we did it again. No one could have had a better job and we all let out our breath and smoked like chimneys. The final recording session had lasted just over four hours, which was pretty good, and we all congratulated ourselves. All that remained now was to clear up the appalling mess and go home. (continued on page 529)

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# PHILIPS



I also did a recording job for a television film. This required a very arty sound track and I was recording individual takes at 9.5 and 4.75 cm/s. This material was converted to a Westrex optical track on the film and I was pleasantly surprised at the very good sound quality, even when transmitted and received on the indifferent sound stage of a domestic TV receiver.

My experience in recording for films has, of course, been limited. They didn't think it worth bothering me to record the sound track for Lawrence of Arabia and glad I am about that. In the old days, they used to try to record sound and film together and at one time they used to build a sound-proof (?) box round the projector to cut out mechanical noise. Cinema-sound was produced on discs and it was touch and go whether sound and vision synchronised. Nowadays, vision is recorded with a token sound track, complete with noise, as a 'checking track'. The finished sound-track is recorded separately. In old films, outdoor scenes were particularly funny, from a sound point of view. Imagine the cowboy, out on the range, shouting to the chuck wagon a

hundred yards away. The sound would sound like—and in fact was—the actor standing at the other end of a reverberant studio. I can never understand why the film-makers thought that, to create audio distance, it was necessary to introduce reverberation. Try it yourself; pretend to be Tarzan by standing at the end of your hallway and shouting at a mike 20 feet away, then try it outside. You'll soon see the difference. One still hears this particular reverberant effect, even in modern films, and I suppose it is only our discerning ear which now rejects it as phoney.

Lip sync is a very great art and I believe that the most successful method is by a form of electronic cue to the actors. Watch any film or TV commercial and see just how perfect it can be. Watch also those ingenious foreign films where an English sound track is put against the original language. To achieve this, tremendous skill is required in selecting words which not only mean the same but which have the same 'mouth shape'. This, to my mind, is the ultimate in cine sound.

Recording for films is, as I have said, very exacting. Timing is critical and a fraction of a second out on two or three cues can play havoc with the sound-track later on. The only real advice I can offer is to have a projector and a copy of the film available. If possible, record

your cues as the film runs, or if this is not possible, do a dummy track, speaking the information you require to know. Time it over and over again and make allowances for the projector being cold. It is a good idea to let the projector warm up for half an hour before starting.

If the final sound-track is to be applied to the film by magnetic stripe, do not rely too much upon the quality of the oxide track, nor for that matter should you rely upon recording systems incorporated in some projectors. I would always advise against recording direct on to the film via the projector sound system. Record your track on tape at the highest possible quality, then transfer it to the striped film. As the striped tracks and their associated play-back mechanism tend to over-emphasise the higher frequencies, it is as well to damp the top on your recording before transferring. Whatever way you do it, have a dry-run first. It pays.

Film recording is, at the same time, good fun, wearing and chaotic. Inevitably, plugs do not fit and connections break loose. Inevitably, also, someone has a temperament and inevitably someone wants to re-record when you think all is perfect. Stick to your guns and take no notice of anyone except the director, the producer or your wife.



**book reviews**

**TAPE RECORDING** by C. N. G. Matthews. 128 pages, illustrated. Museum Press Ltd., 39 Parker Street, London W.C.2. Price 20s.

THIS book has been written, the author states, to introduce tape recording enthusiasts to the theory and design of their machines, so that better and wider use can be made of tape equipment in the home. Three chapters are devoted to the nature of sound, its collection and storage, and the role of magnetism as a recording medium. The next five chapters are spent on a study of the various processes necessary to make a tape recording. Another three chapters cover practical recording, followed by one on servicing and finally a survey of some modern recorders suitable for novices as well as enthusiasts.

It is doubtful if the first eight chapters on recording technicalities would help to produce first class recordings as the author claims. The chapters on practical recording will appeal only to those with virtually no experience in recording. For example, the section on mixers is far too brief to be of any value, one circuit

being meaningless as shown. The chapter on servicing is very well written, as a general guide, with some excellent fault-finding tips.

It is a difficult task to write a book on tape recording appealing to both novices and advanced amateur enthusiasts; this book fails to bridge the gap. It does offer much valuable information, however, to those new to the art of tape recording. **A.J.E.**

**STEREO HANDBOOK** by G. W. Schanz. 135 pages, illustrated. Philips Paperback, distributed by Iliffe Books Ltd., Dorset House, Stamford Street, London S.E.1. Price 16s.

PHILIPS have produced a long series of technical books of both general and more specialised interest, many of which have appeared in English editions. Very good some of them are. A stereo handbook is obviously taking a big bite at a very big subject and it would be surprising if it covered *everything* well. The review information sheet says this book has been designed expressly to give an explanation of the more important principles of stereo to a circle of readers consisting mainly of technicians and stereo enthusiasts: so I was all the more surprised to find the usual gentle introduction to sound reproduction being trotted out at some length in the opening chapters. However, the author has made up for this in the manner of learned works, particularly those of German origin, by an abundance of footnotes to reference material, much of it in German and not unnaturally including many other Philips publications. Throughout the book reference is made to items of Philips equipment, frequently by type numbers.

There are odd slips—the inevitable mV and  $\mu$ V confusion crops up which fortunately causes no trouble in context since what was meant is clear, and certain Americanisms are

written into an edition which is not for sale in the USA—but with a crashing of gears the book comes into its own in chapters 3, 4 and 5 which deal with stereo multiplex signals, their generation and decoding, as applied to stereo broadcasting. The chapters offer an excellent and thorough treatment of the subject with sufficient mathematics, symbols, diagrammatic representation and plain description to satisfy most people wanting more than just a general picture of how it all works.

It is a great pity that while the introduction is lucid, and Mr. J. v. Randerat's laudable translation only rarely causes difficulty in the more general passages, as the text becomes more technical the translation becomes a little further from colloquial and established English usage. While the occasional odd phrase or the term "wiper head" for erase head (and the old bogey "tube" for the good old English valve!) are unlikely to worry anyone unduly, at the height of this particularly interesting section on multiplex I did find some difficulty as the text did not flow as easily as it might. However, for those who are prepared to persevere, as sometimes they must, these chapters in particular are well worth reading; and the book is not after all particularly expensive. The translator's was an unenviable task and in a less documented field the results would pass without criticism: the publisher obviously felt that the merits of the text justified the virtually inevitable drawbacks in publishing a translated work.

The book concludes with some more generalised outlines of servicing stereo equipment and a quick run through items of test gear (more Philips examples) ending with an extensive bibliography and survey of companion Philips Paperbacks on related subjects. Slightly disappointing, I found, after my initial enthusiasm but it repays further consideration. **J.H.F.**

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- ★ Signal to noise ratio 55db below maximum recording level.

- ★ Frequency response:—  
 $7\frac{1}{2}$  ips : 30-20,000 Hz  
 (± 2dB40-16,000 Hz)  
 $3\frac{3}{4}$  ips : 30-13,000 Hz  
 (± 2dB50-10,000 Hz)  
 $1\frac{7}{8}$  ips : 30-7,000 Hz  
 (± 2dB60-5,000 Hz)

Elstone Electronics Limited,  
Hereford House,  
Vicar Lane, Leeds 2.

# Tandberg

*move up to*

# PERSONAL BIAS

SOUND EVIDENCE ?

BY JOHN ASHCROFT

IT is all very well seeing no difference in principle between taped and photographic evidence. Anyone involved in a trial can challenge the accuracy or validity of a recording but the magistrates or judge and jury would probably rely on their ears and commonsense—which are not good enough. In fact, sufficient of my working life is spent in cynically pondering the unlikely relationship between crimes and punishments to make me wonder if many magistrates actually *have* any commonsense. Anyway, whether those making decisions in such matters are honest hardworking people facing considerable difficulties as best they may, or whether they are retarded idealists, I am damned sure they do not realise what can be done to a tape recording.

Splicing, to me, is just one incidental aspect of an engrossing hobby; but I have sometimes deliberately edited people's own words in front of them, and the reaction is usually one of horror. Splice-editing can rescue the most horrible shambles, with care and luck. Suppose someone said: "Oh, let's see now . . . er, I came to Liverpool about . . . er, ten—what am I saying!—twenty years ago, just after the first—I mean the second world war." BBC editors, rather than transmit this mess which embarrasses the subject, irritates the listeners and consumes costly programme time, would simply reduce it to: "Oh, I came to Liverpool about twenty years ago—just after the second World War."

No one complains about responsible editing, least of all the speaker who hears the broadcast and feels pleasantly relieved at his nonchalant delivery—forgetting the stutters, stammers and repetitions.

But how would he (or she!) feel on hearing: "Oh, I came to Liverpool just after the first World War"? And, if stutters can be snipped out, they can also be copied, multiplied a thousandfold, and reinserted after every few words throughout the interview, so that one brief lapse could reduce a confident speaker to a dithering bag of nerves, with disastrous effects on public image.

Worse, sentences can be rearranged. A politician says: "Let us devote our energies and wealth towards feeding the children of developing nations; not waste them on producing nuclear weapons!" Razor-work produces: "Let us devote our energies and wealth towards producing nuclear weapons; not waste them on feeding the children of developing nations!"

Answers can be interchanged. Asked if world health problems can be solved, the same chap says: "Of course, and the sooner the better." He's less happy about this answer when somehow it follows the question: "Do you think there'll be a third World War?" With new questions taped in his absence, using

the same equipment and acoustics, etc., earlier answers can be inserted to create a horribly convincing encounter.

Secret recordings of a personality's laughter and comments, carefully chosen and doctored, can be mixed at strategic points into the recorded hubbub of an orgy which he or she never went near; that way, reputations go. Similarly, alibis can be arranged. Take the following simple example:

Smith does a smash-and-grab raid on the local audio-shop. Meanwhile, I throw a party at which the radio is yammering away, and record the merriment. Smith scuttles in, stashes the loot; we dub the party recording and he mixes in his own unmistakable remarks. Better still, we tape whatever programme coincides with the raid, and play it at the party when Smith returns, and we record the entire hubbub including Smith's voice yelling at somebody to "switch off that infernal wireless"—at which point the first tape is faded down.

More fiendish yet, Smith's vocal contributions are taped in advance and mixed into the party-and-radio recording even while he's still reaching through the shop window. Humanity's latest tinned triumph—Ashcroft's Instant Alibis! Well, what happens if the worst comes to pass and Smith gets accused and hauled into court?

Defence counsel produces the tape; the *Radio Times* verifies that the programme recognisable was broadcast only once at the precise time at which this pillar of respectability, this benign and angelic paragon of impeccable reputation and blinding-white virtue (may God forgive all barristers), was alleged to have been galloping up Whitechapel with a Vortexion under one arm, a Revox under the other, and a Tandberg on each shoulder. One rusty spanner in the prosecution's works.

## THE AVERAGE JURY

How foolproof is tape-faking? And could the average jury spot it?

Anyone can see splices in a tape; they give the game away, even if they are aurally undetectable. But what if the edited version is copied on to a brand-new tape, and the dub is produced in court? Again, background noises might display discontinuity as a result of splicing—if music from a radio is audible in the background, any splicing will be readily detectable. Therefore, if quite recognisable and unblemished music *is* audible throughout, the magistrates or jury can obviously rest assured that the recording has never been tampered with?

Think again. Was the music there during the interview? It could have been mixed in, while the doctored recording was being dubbed on to a new tape. Even the addition of

a sedately ticking and chiming clock might convince a jury that all is well—even though one of the parties goes purple in the face protesting that there was no clock in the room. And adding general background noise may help to disguise some splicing of less than professional smoothness.

Vocal inflexions could betray editing. If the word "not" is an octave above or below its neighbours, it might be a transplant from elsewhere on the tape; but nervousness under interrogation affects people's voices, so a few gulps or gabbles up and down the scale could be genuine . . . and how does a jury decide?

What if police recordings included automatically a recurrent sequence of sliding signals so that replay through test equipment revealed any variations due to tampering? Fair enough but again, what if the fortunately rare bird, the unscrupulous copper, organised a recording *without* such signals, edited the tape, and dubbed it on to a new reel, this time including the signals?

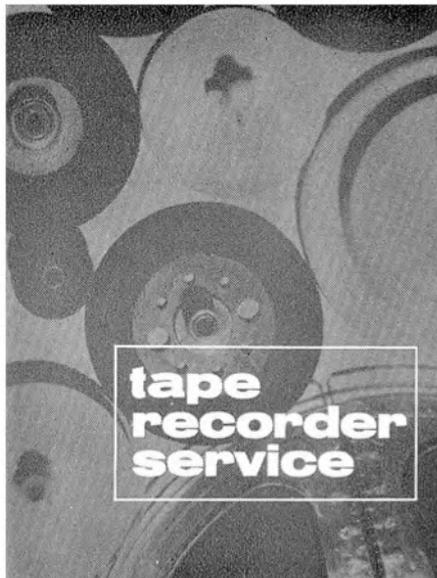
Well, why not use disc-equipment to record statements? But suppose an over-keen policeman tapes the original disc, edits the tape, and copies the results on to another disc? We can only lose.

Simultaneous recordings, one kept by the police and the other handed over immediately to the accused or his counsel, offer a tidy solution; but the jury might end up in nightmare confusion if the recordings differed somehow by the time the case reached the court.

And the faked interview, using answers out of context . . . difference in acoustics and recording quality or tone between the two voices may *not* be due to skulduggery, as you well know if you have tried balancing voices on a single mike. And if mixing as well as splicing is used in the assembly of a fake interview, the voices could overlap, interrupt each other, and the "interviewer" could add an occasional "Yes" or "I see" behind the victim's voice, with frightening results.

Test-equipment might reveal subtle variations in tape or amplifier or general background noise between parts of a doctored interview but, as I said earlier, the deliberate addition of background noise would help to disguise such signs.

I am not sure if the most expert splice leaves a still detectable bump, kink or drop-out in the bias signal on a tape after being copied; but I *am* sure that if the Boffin for the Prosecution and the Boffin for the Defence ever get into their stride in a test case, the judge's wig and the jury's hair could end up festooned on the rafters. Tapes appear with increasing frequency in lawcourts nowadays, and as yet I cannot recall any alleging or denying the use of razorblades and mixers. But it will come.



## TANDBERG SERIES 6

BY H. W. HELLYER

IT is remarkable to note how loyal Tandberg owners can be. They may change from  $\frac{1}{2}$ -track to  $\frac{1}{4}$ -track, from valves to transistors, from 'conventional' to opposed-field heads, but rarely admit that a rival machine is worthy of pride of place in their affections. Not without good cause: there seems a case for an owners' club on the lines of that formed by Ferrograph enthusiasts.

One of the reasons for this loyalty is undoubtedly the reliable service that these machines are capable of giving. They are built, if not like a battleship, at least like a cruiser. Another reason must be the way in which the distributors, Elstone Electronics, take as much pride in the product as if it were their own. So often, UK distributors give no more than lip service, and the trade engineer is reduced to despair when trying to get either technical information or odd spares. Not so, Elstone, who bend over backwards to help.

On the first count, we can find some corroboration in David Kirk's report on his visit to Oslo, which appeared in the May 1968 issue, accompanied by the illustration of the completed Series 6 deck that occupies our attention in this article. Our Deputy Editor, well-known to be a perfectionist, found the heady air around Lake Maridalsvatn very much to his liking. We humble stay-at-homes, who have to base our opinion merely on the machines that come before us for repair, can also vouch for the care that is obviously given to every detail of production. (Nevertheless, I do wish they would change to a type of screened cable whose inner insulation did not shrivel away at the approach of a hot iron: fine to work with in the 'open' conditions of the factory; not so much fun when one has to delve in a congested area of wiring and components, with a customer breathing down one's neck.)

Harking back again, we can satisfy the more technical bods by referring them to the original review of the *Series 64*, by our redoubtable Alec Tutchings, which appeared in February 1961. The *62* was covered a year later in April 1962. This gives some indication of the great reliability of these machines, for we are still getting the occasional Series 6 in for repair, looking as good as new and, after what usually turns out to be fairly modest renovation, performing better than many other designs of similar price still warm from their packing. What Mr. T. said then, still applies now: you can insert this machine in a hi-fi rig and, at 19 cm/s especially, barely know it is there. The A-B comparator switch giving direct comparison of source and recorded signal would make a good basis for a guessing game. Now you hear it, now you don't . . .

Like our reviewer, I am a firm believer in the importance of good mechanical design as a basis for high quality recording. The most refined electronics will not compensate for mechanical 'roughness', and a glance at the deck of any Tandberg machine will reveal why such good results can be obtained. I do not propose to spend much time on the mechanism here but later contributions will cover features that require special attention.

As can be seen from **figs 1 and 2**, the 11-valve circuit can be reduced to five individual sections; record amplifier, playback amplifier, oscillator, signal level indicator and power supply plus control section. The valves are all conventional types, apart from the 'magic eyes', which are a pair of *EAM 86* tubes whose beams close in from the sides when the valve is viewed 'vertically'. More about these in due course.

The record amplifier can be further split into two sections, the first valve being a two-stage preamplifier and the second part the corrected main amplifier, again a double valve. In earlier models, this was an *ECC83*, but was later changed to *ECC81* in the interests of greater stability. This has entailed changing a number of associated components, and for owners with machines prior to serial number *661001* who may wish to carry out the simple modification, the alterations are as follows:

V3 and V4—change from *ECC83* to *ECC81*.  
R129/R130—change from 510 ohms to 390 ohms.

R135/R136 change from 10 K to 2 K.  
R303/R304 change from 100 K to 82 K.

**Model 64**—the last two resistors are 120 K in earlier models. This is, of course, the series resistor to the recording head to preserve the constant current recording characteristic which has been talked about in a number of theoretical articles. The only other relevant change from the  $\frac{1}{4}$ -track circuit of **fig. 1** is a reduction of the feedback capacitor C117/C118 from 0.022  $\mu$ F to 0.01  $\mu$ F. These notes may help some readers who ask what circuit changes are needed when fitting alternative heads to their decks.

Stripped to its essentials, we see that the recording amplifier feedback circuit consists of a loop from the anode of the fourth stage to the cathode of the third, component values being altered by the speed switch. A series resistor is taken to a tapping of a network across the cathode circuit, giving treble lift which is greater at the lower speed. That is, there is more capacity across the cathode circuit at

4.75 cm/s and more in series with the resistive network, also across the cathode bias resistor. The feedback capacitor in the network, which was previously mentioned, namely C117/C118, gives a slight bass lift (+1.5 dB at 30 Hz is specified, but in all cases I have measured it has been slightly greater than this). Note also that there is a 15 pF capacitor from anode to grid of the fourth stage. This important little fellow stabilises the high frequency performance of the amplifier. It is easily identified, being the only pair of small ceramic capacitors on this board, and its mounting wires can be disturbed if the board is removed during service.

The phrase 'pair of' in the foregoing sentence may be misleading, for the printed circuit boards on these machines are not laid out with a regard for stereo symmetry, and one needs a layout plan to find one's way around. This applies also to the presets for recording level and indicator setting. Looking down on the board, with the equalising switch running vertically, the record level preset for Channel 1 is at the top, that for Channel 2 at the bottom and the indicator level presets are to the right, with the Channel 1 control nearer the edge of the board. It is not always easy to get at these with the machine in the operational position and the boards in place, and the classic 'insulated tool' a filed plastic knitting needle, is very necessary. Do not use a metal-bladed tool.

Playback amplifiers can be a stumbling block to constructors and students, with their need for exact equalisation to obtain the required characteristic from a correctly modulated tape. There is a little more than 20 dB lift at about 45 Hz at all speeds, with a falling curve to -8 dB at 5 kHz at the highest speed (19 cm/s), while the slope is less at the slowest speed, coming down from +20 to +5 dB at about 18 kHz, the 9.5 cm/s curve dropping to just below the 0 dB mark at 3 kHz. Each curve has a lift at its extreme treble end; quite marked during measurements, of as much as 3 dB for the highest speed, 2 dB for the others, occurring around the 10 kHz frequency. This gives an NARTB characteristic, although the 9.5 cm/s curve can be as near the CCR requirement as makes no difference.

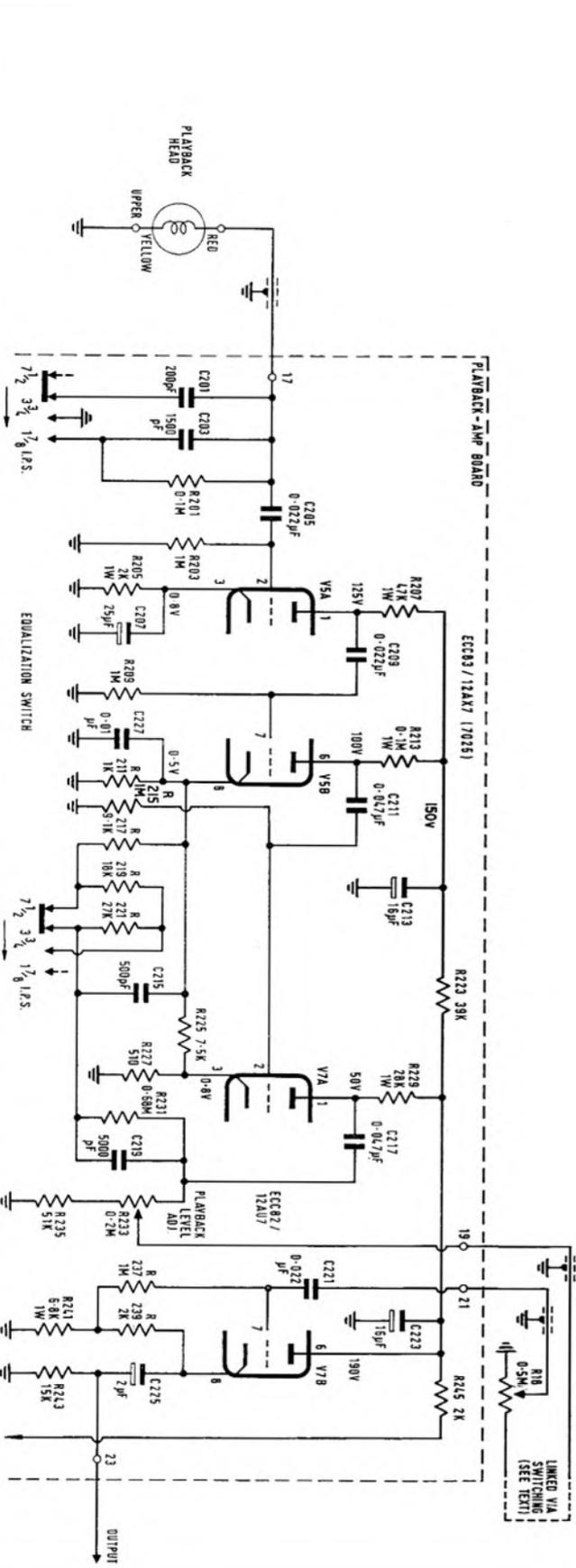
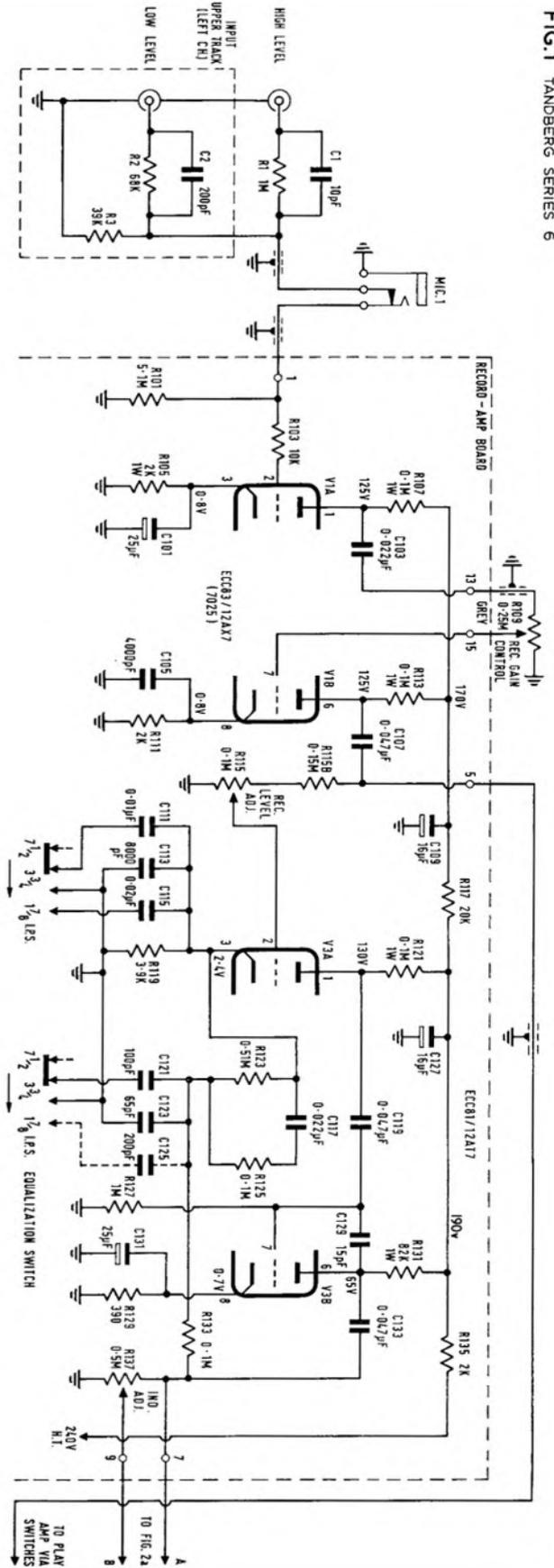
A look at **fig. 1(b)** quickly shows how this curve is achieved. A resonant circuit across the playback head tunes it to compensate for high frequency losses. A loop from the cathode of the third stage to the cathode of the second stage provides feedback whose resistive element is increased at the slower speeds. Capacitive feedback is fixed.

The first stage is a straight head preamplifier, designed as much for stability as gain, with quite a sizeable cathode bypass capacitor. The output stage of the playback amplifier is a cathode follower. A preset control from the anode of the third stage of this section allows setting of playback gain, 1.5 V being obtained with the volume control at maximum, from a test tape. The volume control is in the input to this stage, shunting the grid to chassis, while the actual grid load is taken to the bias tapping on the cathode network. DC blocking is provided by the 2  $\mu$ F capacitor and output matching is from 2 K upwards.

With the comparator switch in the A position,

(continued on page 534)

FIG. 1 YANBERG SERIES 6



a signal from the recording pre-amplifier is taken to the input of the cathode follower. Where A-B discrepancies are fairly noticeable, it is wise to check the various preset level adjustments rather than jumping to the conclusion that playback head wear is the trouble. A rough test of the playback pre-amplifiers can be made by replaying a single track and selecting the appropriate button while monitoring first at one then the other cathode follower output. Switching places these two stages in parallel when either button is depressed separately and with the selector switch in Normal or Sound-on-Sound.

Then, by changing tracks and reversing the procedure, some idea of the discrepancy between channels may give a clue to the fault. The point is that head wear is seldom regular. Quite often, one track suffers more than the other, especially at the HF end. For this purpose, we keep a stereo recorded, parallel-track, test tape handy. Readers who have stereo machines with individual track switching, i.e., stereo-mono systems, are advised to make and keep such a pseudo stereo tape for direct comparison and 'kitchen-table adjustment' purposes. Simply record from any good source, preferably live piano or guitar, with a few sustained tones, and with the input leads paralleled so that each track receives precisely the same signal. Do this when the machine is new, and you have a ready-made comparator test for all future occasions. In addition, if the tape is made with the actual machine being tested later, a direct comparison with the previous recording can be obtained. For this, we need only leave stretches of tape blank on one or other channel. For example, record 0 to 100 with parallel tracking, 100 to 200 Channel 1, 200 to 300 parallel, then 300 to 400 Channel 2. The purpose of the mid-section is to allow a 'follow-on' assessment to be made; very useful if one is only using one's ears to test.

The magic-eye signal is tapped off by a preset at the head feed end of the record amplifier, with a series filter circuit to the anode of the diode section of the *EAM86*. The diode load is tapped off to the grid of the amplifier section, with damping provided by the combination of the 10M resistor, the 0.022  $\mu$ F capacitor and the loading of the grid cathode impedance of the valve. The amplifier anode is connected to the anode of the target section, with the target electrode taken to the HT supply. In this way, a sensitive, yet well-damped, beam is obtained. The preset should be adjusted to close at 3% distortion on a 400 Hz recording, measured on playback. This adjustment must be made after the playback amplifier is fully checked and adjusted, otherwise the overall conditions will be quite false. Correct sequence with this as with many other three-head systems, is to check head alignment on replay, check playback response, adjust the record head while recording for correct alignment, make any bias and erase adjustments necessary, check recording amplifier response and modulation level as replayed, with distortion tests. Then, and only then, adjust the indicator to give 0 dB or beam closure at maximum recording level.

Tandberg favour a push-pull oscillator,

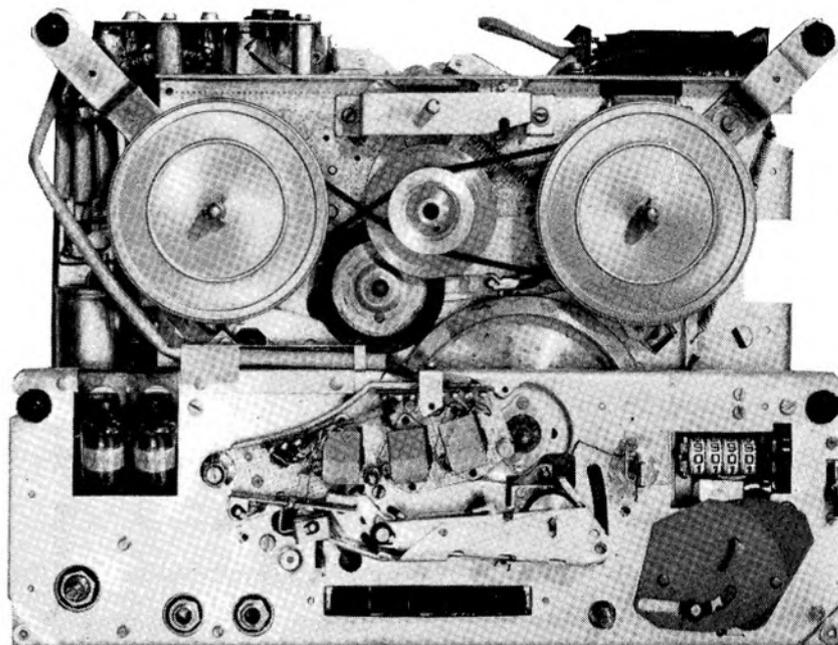
which in this instance is parallel-fed to the erase and bias circuits, with the simple expedient of switched alterations in the HT feed to maintain constant oscillator output under the varying conditions of mono or stereo recording. A pair of 2.7 K resistors in the HT line are arranged in the switch circuit so that selection of either track alone puts one in series with the primary tapping of the oscillator transformer, while pressing both buttons together for stereo recording shorts out both resistors and gives the oscillator an increased HT and thus a higher output. Power is not applied to the oscillator until the start button is pressed.

Across the secondary winding, a 50-250 pF variable capacitor is connected with series switching for the two channels, so that it is only in circuit during stereo recording. This compensates for any frequency variation that may tend to occur due to changes in loading between mono and stereo recording. Basic frequency is 78 kHz and is adjusted by the core of the transformer—but please do not adjust unless you are absolutely certain that this is needed. Resetting can be a tedious business and almost impossible without instruments.

Buffering is always the problem when a

re-entering the amplifier. A simple check on their efficiency is to record a test tone and note the indicator setting, then check the same input setting with the Start button released, when the recording signal will be present but without bias, as for straight-through amplifier. Break-through of bias tends to make the edge of the indicator beam slightly fuzzy.

Power supplies are interesting for several reasons. A fairly hefty mains transformer is a feature of this machine; necessary because the 245 volts AC needed for the Papst or Engels motor is obtained from a secondary of the transformer. The same secondary supplies the metal rectifier for the 310 V HT line. From this HT point and prior to smoothing circuits, a supply is tapped off to feed the solenoid circuit which operates the stop-start mechanism. A large, 20 mF capacitor is charged through a bleeder resistor of 15 K. This is a 3 W component and prime suspect when trouble occurs. Normally, when the function lever is put to play and the power then switched on, even without the start button pressed, the machine will start to run. Then, pressing the start button, releasing it and starting again should bring matters to normal, but if this does not regain equilibrium, check the charge circuit.



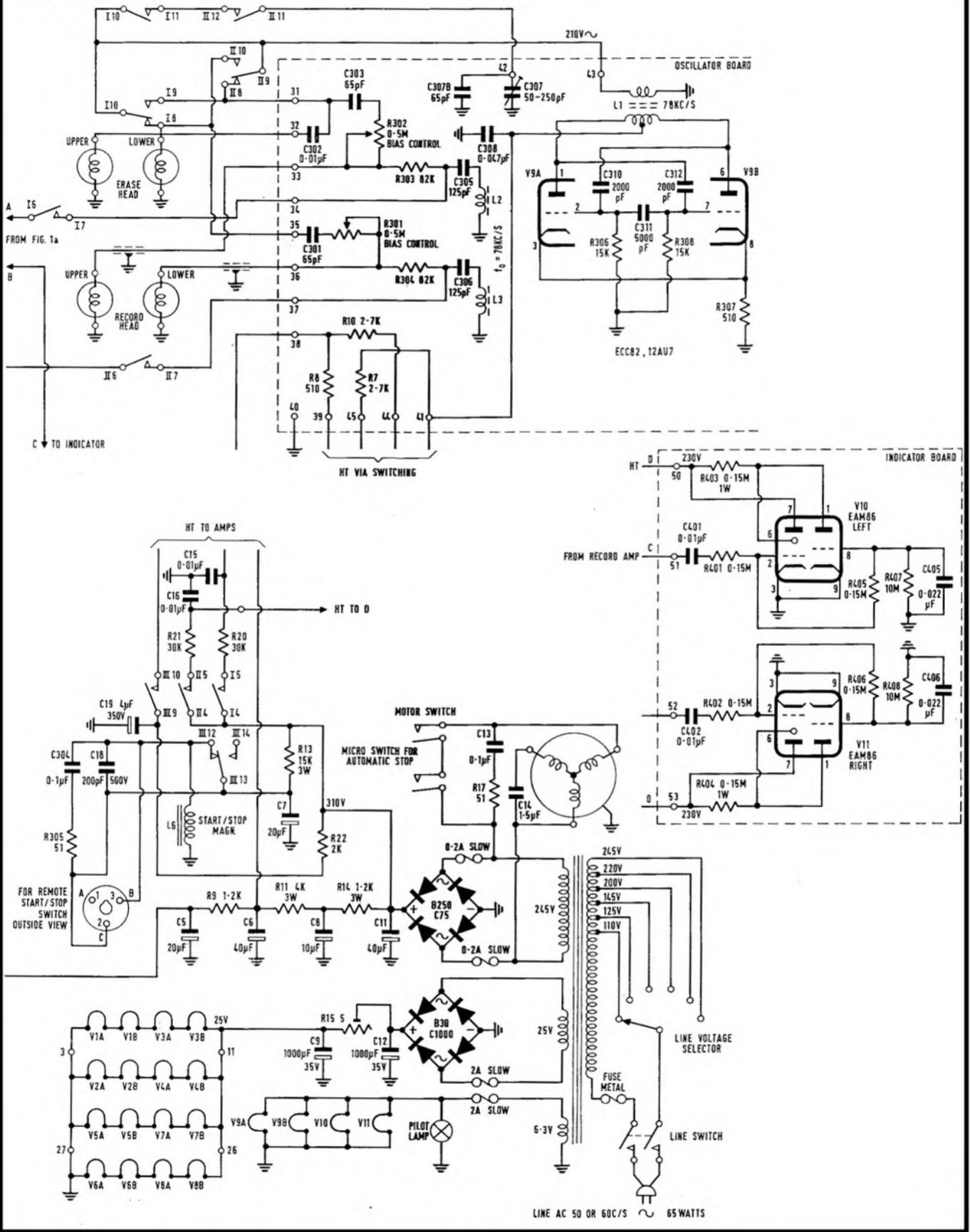
single oscillator is used to feed stereo heads—and provision of separate oscillators leads to other and greater problems. Tandberg get over the difficulty quite simply by feeding one erase head directly from the secondary, Channel 2 in their case, while the Channel 1 head is supplied with a series capacitor. This is large enough, at 0.01  $\mu$ F, not to affect the waveform or its amplitude to any significant extent.

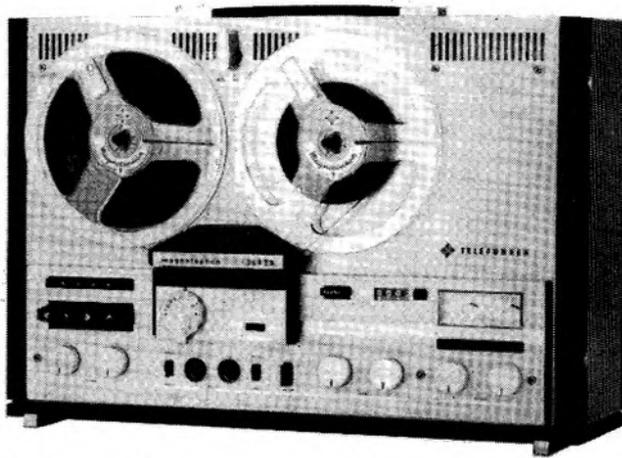
Bias is obtained via series variable resistors from the erase head connection point with fixed 65 pF capacitors peaking up the circuit to resonance. The combination inductor and capacitor networks across each head circuit, with the damping resistors in series, act as bias traps to prevent the oscillator frequencies from

One interesting fault we had a short while ago was a leak in the suppressor capacitor, C304, which effectively by-passed the start button and neutralised the circuit. The machine had come in with a complaint "faulty brakes" which is rather a giggle as the Tandberg does not possess brakes in the normal sense of the word. But mechanical details will have to wait until next time.

For now, we need only make a final note of the DC heater supply to the amplifier valves, which are thus wired in series-parallel from a 25 V DC supply provided by a low-voltage rectifier from another secondary. The third winding supplies the oscillator and inductor valve heaters and the pilot lamp.

FIG. 2 TANDBERG SERIES 6





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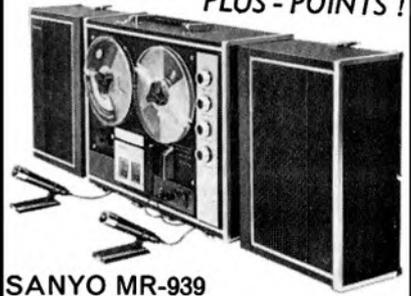
4-TRACK STEREO/MONO	Deposit		12 Monthly Payments		Cash Price				
	£	s. d.	£	s. d.	£	s. d.			
Philips EL3312...	16	19	4	3	4	66	19	10	
Ferguson 3232...	22	18	3	5	14	7	91	13	0
Sony TC200...	23	15	0	5	18	9	95	0	0
Sanyo MR929...	24	0	0	6	0	0	96	0	0
Philips EL3555...	25	19	4	6	5	8	101	19	4
Aiwa TP1012...	26	0	0	6	8	2	102	18	0
Akai 1710W...	27	17	3	6	16	8	109	17	3
Sanyo MR939...	28	0	0	6	16	8	110	0	0
Sony TC260...	29	5	0	7	5	0	116	5	0
Tandberg 12/21/41...	31	10	0	7	17	6	126	0	0
Telefunken 204'E...	34	12	5	8	10	0	136	12	5
Philips EL4408...	33	16	8	8	6	8	133	16	8
Beocord 2000K...	39	10	0	9	13	4	155	10	0
Beocord 2000T...	40	10	0	10	2	6	162	0	0
Sony TC530...	41	10	0	10	6	3	165	5	0
Ferrograph 722/4...	46	15	0	11	10	5	185	0	0
Akai M9...	49	3	5	12	3	4	195	3	5

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	£	s. d.	£	s. d.	£	s. d.			
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Grundig TK140	11	14	6	2	18	4	46	14	6
Philips EL4305...	11	17	9	2	16	8	45	17	9
Ferguson 3226...	11	10	0	2	16	8	45	10	0
Telefunken 201	11	18	9	2	19	7	47	13	9
Ferguson 3228...	11	19	0	3	0	0	47	19	0
Philips EL4306...	14	1	8	3	10	0	56	1	8
Ferguson 3230...	14	13	0	3	13	2	58	11	0
Ferguson 3216...	16	19	0	4	0	0	64	19	0
REPS M10	18	18	0	4	14	6	75	12	0
Truvox R54	18	18	3	4	14	11	75	17	3
Wyndor									
Vanguard	18	18	0	4	14	6	75	12	0
Tandberg 1526...	20	19	0	5	3	4	82	19	0
Truvox R204	31	14	2	7	15	0	124	14	2

STEREO TAPE UNITS	Deposit		12 Monthly Payments		Cash Price				
	£	s. d.	£	s. d.	£	s. d.			
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Sony TC250A...	20	10	0	4	18	4	79	10	0
Akai 3000D...	26	11	4	6	11	8	105	11	4
Sony TC350...	27	5	0	6	16	3	109	0	0
Beocord 1500...	31	10	0	7	11	8	122	10	0
Tandberg 62/64X	36	18	0	9	0	0	144	18	0
Ferrograph 702/704	40	6	8	10	0	0	160	6	8
MAINS TWIN TRACK									
Fidelity Playtime	7	18	6	1	16	8	29	18	6
Ferguson 3224...	8	6	0	2	1	4	33	2	0
Grundig TK120	9	17	6	2	9	2	39	7	6
Philips EL3310...	10	5	10	2	11	5	41	2	10
Tandberg 1521...	18	19	6	4	10	0	72	19	6
Truvox R52	18	17	3	4	15	0	75	17	3
Brenell Mk. V/3									
Std. ...	26	17	9	6	10	0	104	17	9
Brenell Mk. V/3									
Mtr. ...	28	0	2	7	0	0	112	0	2
Beocord 1100	24	10	0	6	2	6	98	0	0
Truvox R202	31	14	2	7	15	0	124	14	2
Brenell V/3/M	32	16	8	8	5	0	131	16	8
Ferrograph 713	33	18	4	8	9	7	135	18	4
Ferrograph 713/H	35	16	8	8	16	8	141	16	8

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# FURTHER THOUGHTS ON INDEXING

K. C. HART

MY previous article, in March, showed how tapes could be coded to permit relacing of a full right-hand spool to an empty left-hand spool and at the same time to set the index counter to the correct position so that any passage on the track last played could be correctly re-indexed without the customary requirement of a complete rewind merely to set the counter to 000.

Another operation which saves winding time, and sometimes unnecessary tape wear lies in an ability to remove partly run tapes without completely rewinding. This is easily done on those machines having counters which can be set to intermediate numbers 111, 222, 333 and so on, up to 999 and 000. You merely run the tape to the nearest of these numbers, then lift off both spools. It is as well to add a note, for example "Removed at 444"; then when you have run your second tape, with full use of the counter, you can replace the first tape spools, reset the counter to 444, then run on or back to the section last in use.

I find this feature a great time saver when re-recording on to a single spool from a number of spools and I wish to change the order of the items. Thus the sequences on a spool can be interrupted by an item from another spool without fully rewinding the first before the second is run.

I normally keep a 13 cm spool on a recorder ready for picking up odd television items, but it occasionally happens that I want to run another tape, so I merely run the TV tape to the nearest triple digit number, then lift off both spools. This never involves winding through more than 55 counter units, however large the spool.

A final aid to quick indexing lies in an ability to tell what index numbers are 'passing' on the track (or tracks if a four-track model) opposite to that which is being played back at any given moment. By the 'opposite track' I mean that which can be played only by

reversing the spools left for right and turning over the tape. By way of basic illustration, starting at 000 on a spool with a total indexed turns of 692, 000 on the track about to be used must equal 692 on *THAT END* of the 'opposite track': but whilst you run the tape, the numbers on the played track are increasing whilst those on the 'opposite track' are diminishing. An exact knowledge of the relationship can be gained by spending an average of 10 minutes, once, on each of your spools, and will enable you to turn tapes at selected points to run items that could be reached normally only by a complete rewind. This can be an immense time saver when editing by re-recording, or when you wish a friend to hear an item from one track followed by another item from the opposite track and you are anxious that he shall not lose interest whilst you laboriously rewind!

As an example of how to find corresponding index numbers for the opposite track I will take my 13 cm No. 14 spool which, when I reeled from an 18 cm spool of DP tape, I arranged to have 1000 index counter units of turns.

Set the spool to wind from left to right, set the counter to 000. Fast wind on to 111 and insert a slip of paper between the reel and the oncoming tape on the right-hand spool. 8 cm strips of newspaper can be fed in parallel with the tape to form a neat wrapper. Wind on to 222 and insert the second paper marker. Carry on in this way through 333, 444, and so on, until the right-hand spool is full. The numbers at which papers are inserted in the right hand spool are set out as a vertical column at the left, as in the table. On completion of the operation, change the spools left for right and set the index to 000. Now commence winding from left to right, and at the same time watch (from the rear) for the ejection of the paper slips. As each is freed, stop winding and note the index number.

The first paper to be ejected, will, of course, be the last one to be inserted, and in this case, due to inevitable small index counter errors, the 999 paper was released at 002, so this is written down to the right of 999 at the bottom of the column. The 888 paper was freed at 049, the 777 at 105, and so on down to the 111 slip which was released at 766. I have indexed all 17 of my spools in this way.

With the sample given, the numbers are used in the following way. Suppose you have played up to 249 on one track, say red start, and you next wish to run a portion commencing at 456 on the green start track. From the table you will see that if you wind only two index units to 251, you can reverse the spools left for right, set the index to 555, then run back 99 counter units to 456 and play your desired piece. You will have reached the number in 101 index units instead of the 1207 required by first fully rewinding the reel and again winding up to 456. You will also see that you can dodge from track to track as often as you wish.

Inevitable small counter errors can be corrected, if necessary, by lifting the spool and hand-turning the spindle until the index agrees with the logged number for the tape position.

If you care to construct a graph from the figures of your own finding similar to those in the table, you can use the graph to find what passages on the opposite track you may cut into and spoil if you are editing by cutting and splicing matter from the 'first' track, and you happen to have used the opposite track. I found that a graph drawn to the scale of 3 mm to ten index units could be read to within two units.

Opposite-track indexing can be carried out with the push-button type of counter that can be set to only 000, but it requires that the left column of the table be indexed in round hundreds, and that subsequently 000 be read and remembered as 100, 200, and so on, according to the figure reached, or chosen in the right hand column for the spool change. For push-button counters it is really better to draw a graph which will then show the exact middle of a tape: then if you change over spools at this point, the counter will remain correct for the opposite track.

You will, of course, appreciate that the three quick indexing facilities I have described can be used individually or in combination, as dictated by circumstances; and give tape spools advantages approaching those afforded by gramophone records where the pickup can be lowered immediately at any desired position on either side.

First indexing Papers inserted at	Second indexing Papers ejected at
111	766
222	593
333	458
444	345
555	251
666	172
777	105
888	049
999	002

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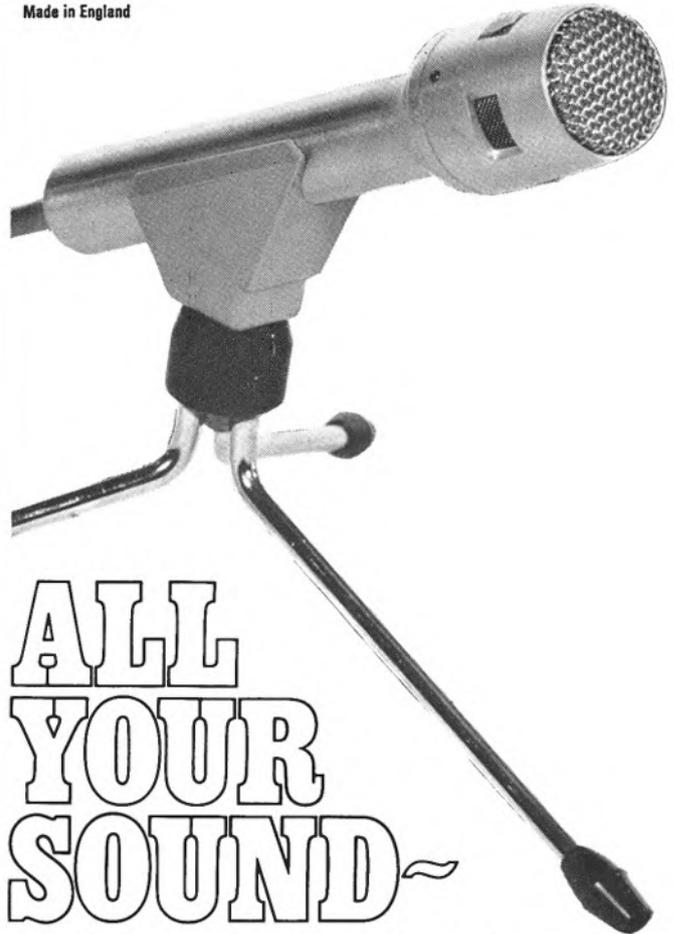
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## readers' problems

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

### A HISSING B & O

Dear Sir, I wrote to you some time ago regarding some snags which arose on my Bang & Olufsen 2000T. After carrying out your instructions, the faults were cured. The recorder has since developed a loud hiss in the right hand power amplifier. Head demagnetising has had no effect.

Yours faithfully, P.V.L., RAF Waddington.

*Hiss in the 2000 is almost inevitably associated with the rather touchy AC128 transistor and if you have followed recent service articles on this recorder you may have noted the recommendation that AC153 transistors be substituted where possible.*

*The output section uses an AC128 in the driver stage, in conjunction with an AC107 and AC127/AD139 combination. You can prove whether this is the section by transposing the modules. If the hiss then moves to the other channel, you should first check the AC128—and fit an AC153.*

*If the trouble is not in the output section, proved by monitoring from the line output through a good wide range amplifier, then you will have to look to the replay preamplifier, where the trouble could be the 10 K resistor from the base of the first AC126 to the 11 V line, or the 125 µF feedback electrolytic to the emitter of the same transistor. There are a dozen other possibilities but these are the most likely.*

### AND A HISSING SONY

Dear Sir, I have a noise problem with my Sony TC350 stereo tape unit which the local agents have been unable to solve.

I have owned the unit for about 15 months now, with a Pioneer ER420 tuner/amplifier

and Lenco turntable. An unacceptable hiss has developed in the TC350 over the last six months which is unaffected by head cleaning or degaussing.

Yours faithfully, A.L.D.M., York.

*You must first check whether the hiss is indeed recorded on to tape or, as is more likely, the result of replay. This can only be done by replaying a bulk-erased or new tape and noting whether the hiss level is exorbitant.*

*A good test if no instruments are available is to replay a tape made on a known good recorder. Note the level setting at which slightly higher than comfortable output is heard. Then load your "clean" tape and replay this at the same setting. The noise should now be unobtrusive—in audible more than a foot or so from the loudspeaker. If not, tackle the playback fault first.*

*If hiss is noted when the tape is halted, you will probably find that replacement of the two input transistors (play preamplifier stages 1 and 2) will cure it. Fitting a BC108/BC109 combination produces a great improvement in these circuits—not to cure a fault but to take advantage of transistor developments since the 350 was designed. But this is a service department job, needing bias adjustment to get the first base conditions exact for minimum noise.*

*You should not overlook the possibility of a worn head. Look for evidence of a dip in the head facing—one very real drawback with Sony heads, especially the 44 range. They tend to polish rather badly and frequent head cleaning is imperative. We would recommend regular use of a Bib kit, even if this turns out not to be your prime problem.*

### SQUEAKING CASSETTES?

Dear Sir, I was most interested to read the letter from J. C. B. of West Worthing in the August issue. He complained of a squeak on his Philips EL3302 cassette recorder.

I have the same model and, unfortunately, the same trouble, but cannot agree with you that the cassettes are to blame. I have over a dozen cassettes and the squeak is present with all of them. To try and locate the noise, I switched on without a cassette and grasped fairly tightly the right hand take-up spindle. This is where the squeak occurs though, curiously, it is not apparent during fast winding, except from the cassette itself. In this case it is caused by the small guide rollers riding up and down on their spindles. This seems most common on BASF C120 cassettes. I have had no such trouble with the Philips tapes; they seem to run more freely though the take-up squeak still persists. I hope to have this cured under the guarantee.

Yours faithfully, E.D., London N.1.

*There are indeed many occasions when the retardation of the take-up spool will provoke squeaks. Complete dismantling, softening of the felt pad, cleaning of the underside pulley, and a touch of lubrication will effect a cure. But the fault is aggravated by some cassettes and can be caused, even on an otherwise good machine, by a bad cassette. The nylon or PVC sheet in the cassette itself is quite often a cause of retardation, especially if after dismantling it has become a trifle crumpled, or is trapped on*

*reassembly. The rollers also, and any deviation from straight of their pins, can accentuate the problem. Altogether we seem in agreement and the conclusions generally can be summed up in the Editor's phrase: "Not being great supporters of the cassette system..." However the system has the advantage of convenience and we use them occasionally for note-taking.*

### BIAS AND DROPOUT

Dear Sir, Could you please explain why frequency response and dropout incidence are influenced by the strength of the HF bias signal applied to the recording head?

Yours faithfully, J.A.B., Dartford.

*Dropouts almost always are due to nodules above the tape surface which lift a relatively large area of the coating away from the head as they pass. A nodule only 1.25 microns high will cause an audible dropout in ½-track recording at 4.75 cm/s, though probably not in the case of a ¼-track recording where the area lifted off is a small proportion of the track width. Dropouts can also be caused by actual holes in the coating but need to be at least 500 microns square in the case of ¼-track, and proportionately larger for wider tracks and higher speeds.*

*If most dropouts are due to momentary spacings away from the heads, it follows that spacing the whole recording away from the heads will reduce the effect of nodules. To the head, something which moves out of contact to 1.25 microns away changes more than something which moves (say) from 2.5 to 3.75 microns. Increasing the bias has exactly this effect, driving the short wavelength (HF) signals deeper into the coating and therefore increasing the effective spacing between them and the heads. However the HF signals, which suffer most from spacing away from the heads, are naturally reduced overall by this means. This loss must either be accepted as a reasonable price for reduced dropout, or can be recovered by further equalisation at the risk of increasing background noise.*

### FLASHING LAMPS

Dear Sir, I would appreciate your advice on two problems relating to a Truvox Series 104 recorder. Frequently, though not always, the red indicator lamp flashes violently on and off for periods of 10-15 seconds, some 10 minutes after first switching on to record or play. The flashing is audible in the loudspeaker but has no apparent effect on the spool movement.

Yours faithfully, R.E.B., London S.W.2.

*The lamp circuit is from a separate winding on the mains transformer and is completely isolated. It is extremely unlikely that any short-term fault violent enough to vary the lamp intensity would not also blow the 150 mA fuse.*

*Much more likely is a simple intermittent connection in the lampholder, a fault in the lamp itself, or at the transformer winding. Any arcing would, as described, radiate sharp pulses that would be quite audible on record or replay.*

*Lack of sensitivity on this machine, if the head is exonerated on replay, is most likely to be a transistor fault. VT3, the OC71 in the third stage of the replay chain, is the most likely culprit.*

(continued on page 541)

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**MATCHING A DPA/1**

Dear Sir, I intend purchasing some recording equipment of fairly high quality but, being a musician and not an engineer, I am confused as regards the multitudes of impedances quoted.

The recorder will probably be a TRD DPA/1. I am also thinking in terms of a Vortexion four-way mixer. I have at present two 60-ohm microphones but wish to buy an AKG D224. The impedance of this is 250 ohms and AKG recommend a load of not less than 500 ohms. Will I have to use a transformer to load the mixer correctly? (I would also like to use this microphone with a Uher 4000L portable.) Also, if in the future I can afford a capacitor microphone, how can this be used with the mixer?

Yours faithfully, T.Y., London E.12.

*We are uncertain from your letter whether you plan to use the TRD in stereo or not; your mention of the single D224 makes us wonder, unless you require it mainly as a spot microphone. Even if you intend initially recording in mono, or indulging in duoplay or mono multiplay, it would be wise to buy a stereo mixer rather than make an expensive change later.*

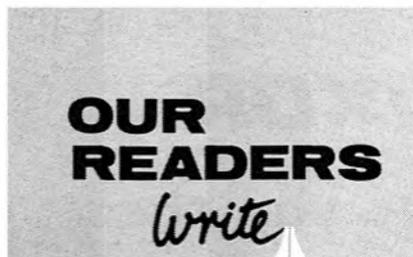
*Vortexion mixers are in general very good instruments. The valve designs have given reliable service and the transistor models look promising. The valve equipment normally comes matched for 30/60 ohm microphones but other impedances including 600 ohms are available. If you write to them you should find the company helpful in supplying your particular needs.*

*AKG will, or used to, supply microphones to feed 60-ohm inputs to order, so a further letter to Politechna should eliminate impedance problems—either by arranging a dual impedance mixer (which can be useful anyway) or bringing all your microphones to feed the same nominal input impedance. External transformers should be avoided; the really good ones are expensive and, apart from being easily lost, are a potential source of hum pick-up.*

*From the flexibility viewpoint, you might at least consider Elcom's six-channel modular mixer, assembled to customer requirements and intended "for the budget-conscious market". Their address is Elcom (Northampton) Ltd., Weedon Road Industrial Estate, Northampton. (Tel. Northampton 51873.)*

*It seems to be normal practice to feed the Uher portable from a medium impedance (200-600 ohms nominal) microphone and the 250-ohm D224 should feed the recorder adequately. If you do find yourself short of signal, you could contact Uher for a 0.6:2 K matching transformer.*

*The majority of capacitor microphones will feed into your mixer via their power supply units though again you will have to feed into the appropriate impedance. The exception is the kind like the Mikrokit which had a low impedance cathode follower output and required to be fed into a high impedance higher-level input, or via a matching transformer. Some capacitor microphones may overload sensitive input stages unless the input is padded to reduce signal level. A range of inexpensive capacitor microphones is available from Fi-Cord.*



**... about the August cover**

**From: W. Marsh, 51 Langdale Avenue, Levenshulme, Manchester 19.**

Dear Sir, It was with some relief that I found on the front page of your September issue a picture in keeping with the technical nature of the contents. There has been a tendency of late, also with the *Hi-Fi News*, to have more and more pictures, particularly in adverts, featuring young ladies, scantily clad, posing and almost excluding the equipment we readers wish to see.

This process is now complete with most of the photographic magazines and I would not wish to see the same thing happen with the various electronic publications. The cover on the August *Tape Recorder* almost convinced me that you had now incorporated *Girlie* magazine and I resolved to cancel my order as soon as Mr. Hellyer had completed his articles on the Bang & Olufsen 2000, a machine I myself own. However the danger is temporarily over and I can relax, at least for the moment.

Yours faithfully

**... about synchronising two channels**  
**From: J. E. Stainbank, 15 Rowan Crescent, Letchworth, Hertfordshire.**

Dear Sir, Neither your editorials nor your correspondents yet give a satisfying method for synchronising replay, on separate channels, of recordings made on different occasions.

A standard Brenell deck provides the means, using two combination record/play heads, one head for each track. Although the recordings are staggered spacially, replay is necessarily synchronised. I take it, however, you aimed to stress that the facility provided on the Brenell deck should be the rule instead of a possible exception. I agree, and am trying to install an alternative method using two replay heads.

By this method, the delay in reading the two tracks must be made the same as the delay in recording the second track while monitoring the first recording. This is *not* merely duoplay, as Mr. Hill supposed (page 320, July); the accompaniment can itself be a compound recording built up by multiplay, leaving the solo melody to be added last, and separated, on the parallel track. Moreover, if his claims for the new Ferrograph include this, the fact is not apparent from the publicity, nor was it from enquiries by letter and by telephone to the company.

The lack of four-head decks with solid-state circuitry has driven me to extend the idea, with the extra advantage of tape transfer (as

well as the usual track transfer). A complete two-channel, two-head system is contained in two single-channel recorders, but with a play head put in place of one of the record heads and with some re-wiring to the switches.

On the related matter of channel transfer facilities, with or without track transfer re-recording, the scathing champion of Ferrograph was indeed out of touch, despite his laborious explanations and his exclamation marks. Every operation he describes has been available for some time on the Dynatron STR 1, a machine which, I still aver, deserves better machinery.

Yours faithfully

**... about a home-built video recorder**

**From: G. I. Shaw, 5 Elm Close, Keyworth, Nottingham NG12 5AP.**

Dear Sir, A report in your September *World of Tape* gave brief details of a Japanese video tape recorder developed by Akai, using a rotating head drum on standard audio tape. You state that this was the first VTR known to use helical scan on 6.25 mm tape. I would like to bring to your notice my own experiments in this field.

In 1957 I developed a working VTR using the above system to achieve a picture resolution of 300 lines. Audio and cue tracks were 0.25 mm in width. I was granted a patent for this machine in 1963 but never bothered to follow it up. Specification of the four-motor system was as follows: 28 cm spool capacity, standard 0.25 mm tape. Four ferrite video heads, one audio, one cue and two erase heads. One master erase head. 1800 RPM video head drum speed, silver graphite/silver rings brush gear, 35.6 cm/s linear tape speed, 1500 hours video head life. Automatic head protection was provided during fast forward and reverse wind, video and audio levels being monitored by meter.

I have nearly finished my new VTR which is only the size of a normal stereo tape machine; the old model described was large and mounted on castors (see photo).

Incidentally, I made my first wire recorder in 1948 and linear VTR in 1956. The latter operated at 523.5 cm/s (17 feet per second). I am not an electronics engineer but a fitter engineer (mechanical). Electronics is a hobby.

Yours faithfully

(Mr. Shaw has offered to describe his work in more detail and we hope this will lead to our first VTR constructional project.—Ed.)



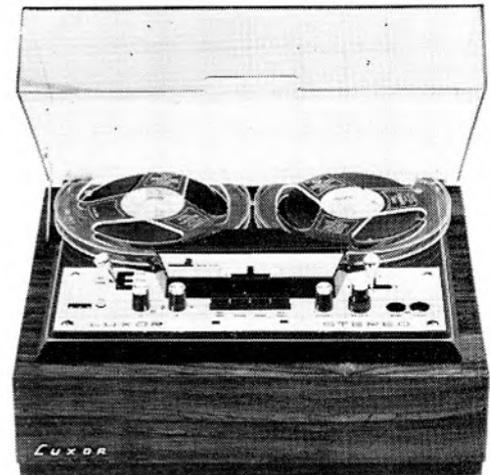


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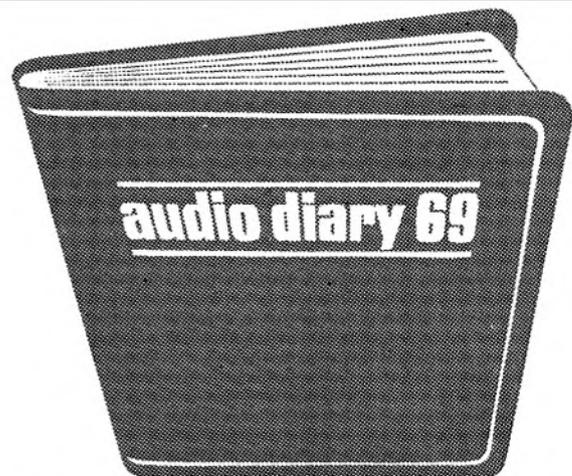
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## NEW PRODUCTS



### AKAI REEL/CARTRIDGE RECORDERS

A NEW approach to cartridges emerges from Akai with the new 1800 and X-1800D recorders. Both are essentially conventional  $\frac{1}{4}$ -track stereo reel-to-reel machines but with additional facilities for dubbing from, or simply recording and playing, 8-track stereo cartridges. Simplest of the two designs is the 1800, priced at £158 6s. 11d. (including £29 6s. 11d. purchase tax) and operating at 19 and 9.5 cm/s. The higher speed is achieved by sliding a built-in sleeve straight up the capstan spindle. The cartridge transport operates at 9.5 cm/s only, using standard 6.25 mm tape.

Conventional bias is employed to give a claimed 50 Hz-15 kHz  $\pm 3$  dB frequency response at 19 cm/s, with 50 dB signal-to-noise ratio and 2% 1 kHz distortion at 0 vu.

Essentially similar to the 1800, the X-1800 employs cross-field bias to achieve a quoted 30 Hz-23 kHz  $\pm 3$  dB frequency response at 19 cm/s, signal-to-noise ratio being 50 dB with 2% 1 kHz distortion at 0 vu. In this model, a two-speed induction motor provides 9.5 and 4.75 cm/s with a detachable capstan sleeve being used to obtain 19 cm/s. Price of this model is £201 6s. 2d. including £37 6s. 2d. purchase tax.

Distributor: Pullin Photographic Ltd., 11 Aintree Road, Perivale, Greenford, Middlesex.

### GRUNDIG HEAD ALIGNMENT TAPES

TEST tapes for conventional, cassette and Stenorette recorders are now available from Grundig. All are intended to assist head alignment, Tape 63 being for normal  $\frac{1}{4}$ -track recorders and the 464 for  $\frac{1}{2}$ -track. Both have 500 Hz, 1 kHz and 8 kHz sequences when played at 9.5 cm/s, and cost £2 10s. each. Tape 465 comprises 8 kHz, 1 kHz, 3.15 kHz and 50 Hz tones at 5 cm/s on a Grundig DCI cassette costing £1 10s. The 469 is identical save for its 4.75 cm/s tape speed and Philips Compact cassette format.

6 kHz and 1 kHz tones are contained on the

596, intended for 0615, S, C, M and L Stenorette machines. Finally the 730 is intended for EN7 miniature dictation recorders and contains a 3 kHz tone. Price is £1 5s.

Also being introduced is a Stenorette No. 2 Tool Kit covering L, 101 and 201 dictation machines and costing £9.

Manufacturer: Grundig (Great Britain) Ltd., London S.E.26.

### TELEFUNKEN STEREO RECORDERS

TWO new recorders based on the 204E have been announced by AEG. Separate  $\frac{1}{4}$ -track stereo record and play heads are incorporated on the M250 providing source/tape monitoring, echo and multiplay. Speeds are 19 and 9.5 cm/s and spool capacity is 18 cm. Frequency range is quoted as 40 Hz-18 kHz at the fastest speed, with 54 dB signal-to-noise ratio and  $\pm 0.2\%$  RMS wobble. Solenoid autostop, four-digit instant-reset spool rotation counter, and pre-set sliding gain controls are among other features. No power



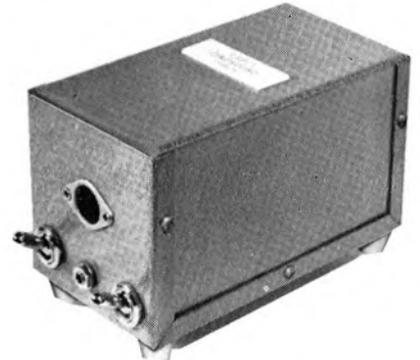
amplifiers are fitted, other than a headphone monitor feed. Price is £157 10s. including purchase tax.

The  $\frac{1}{4}$ -track stereo 204TS is complete with side-facing internal loudspeakers but uses a combined record/play head. General layout is similar to the original 204E, operating at 19 and 9.5 cm/s. A third speed, 4.75 cm/s, has now been added for which  $\pm 0.4\%$  RMS wobble is quoted. Frequency range at 19 cm/s is 40-18 kHz with 50 dB signal-to-noise ratio and  $\pm 0.15\%$  RMS wobble. Two 6W output stages and multiplay facilities are featured. Like the M250, this recorder incorporates a solenoid autostop and may be operated safely from a mains time switch. The 204TS retails at £136 12s. 5d.

Distributor: AEG (Great Britain) Ltd., Lonsdale Chambers, 27 Chancery Lane, London W.C.2.



**LIP SYNC SIMPLIFIED**  
THE major drawback to 8 mm cine photography, apart from film cost, has long been the difficulty of synchronising sound tracks. A low price lip sync system modelled on the professional pilot-tone technique is now being produced by Contronics. Retailing at £4 19s. 1d., the R.1 converts a make-and-break



pulse generated within the camera to an inaudible pilot signal. This signal is recorded with the film sound on to a conventional single-channel tape recorder. The R.1 is battery powered, measures 10 x 5 x 4 cm, and incorporates a miniature jack pulse input and three-pin DIN tape output. A battery life meter is also fitted.

Model P.1 is mains powered and synchronises recorder and projector when the film is

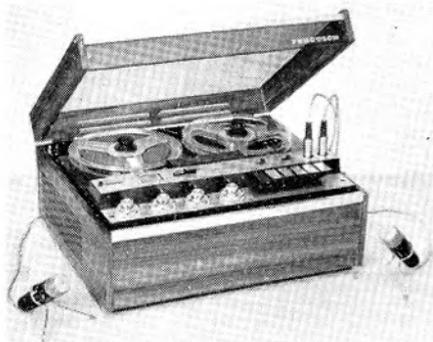


reproduced. Connections are via miniature jack, DIN and Octal sockets. Dimensions are 13.5 x 7.5 x 7.5 cm and the price is £14 17s. 2d. Both units come complete with connection leads and plugs.

Manufacturer: Contronics Ltd., Deepcut, Camberley, Surrey.



# equipment reviews



FERGUSON 3232

**Manufacturer's specification (19 cm/s).** Quarter-track mains stereo recorder with internal power amplifiers and side-facing loudspeakers. **Frequency range:** 40 Hz-18 kHz. **Wow and flutter:** 0.15% RMS. **Signal-to-noise ratio:** 45 dB unweighted. **Crosstalk (stereo):** -50 dB. **Output power:** 5 W per channel. **Input sensitivity:** 250  $\mu$ V at 4.7 K (microphone and radio), 100 mV at 100 K (gram), 50 mV at 1 M (pickup). **Line output:** 500 mV at 10 K. **External speakers (switched):** 5 W at 8 ohms. **Tape speeds:** 19, 9.5 and 4.75 cm/s. **Facilities:** Solenoid autostop and remote pause; stereo or parallel mono internal monitoring; gram and mic/radio/pickup mixing; coaxial record and replay gain and treble-cut controls; lockable pause; automatic head demagnetisation (fading bias). **Accessories supplied:** 1200 ft. LP tape, take-up spool, two dynamic microphones with detachable stands, remote-control switch and recording lead. **Dimensions:** 42 x 36 x 19 cm (w d h). **Manufacturer:** British Radio Corporation Ltd., 284 Southbury Road, Enfield, Middx. **Price:** £91 13s. including purchase tax.

THE styling and basic mechanical design of this stereo machine are similar to the 3214 mono recorder reviewed in July 1967.

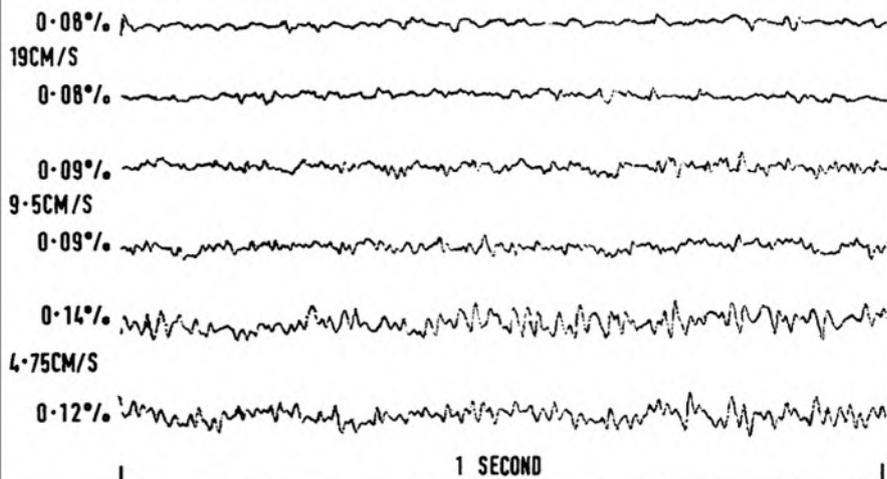
Circuits are now all solid state (fig. 1) with the complementary pair push-pull power output stages left in circuit for mono or stereo monitoring whilst recording. A separate push-pull bias and erase oscillator is fitted which automatically degausses the heads by fading the bias on cessation of recording. The frequency of the oscillator is raised just prior to switching off by removing C29 from across the tuned circuit as the HT falls.

Record and play equalisation takes place in feedback loops over the second and third amplifier stages of each channel. Playback equalisation for the three speeds is accomplished by a simple change of time constant, but a switched tuned circuit is used in the record equalisation network to ensure a sharp rise in response at the top of each frequency range to give extended response without under biasing.

Tone control is by simple passive circuits between the preamplifiers and power amplifiers immediately following the volume controls.

On the machine under test the tape speed was 1.7% fast at the start of an 18 cm reel, falling to 1% fast at the end of the reel. This

FIG. 2 FERGUSON 3232 RECORD/PLAY WOW AND FLUTTER



is well within the usual  $\pm 2\%$  limits for domestic machines.

Short term speed fluctuations were very low as will be seen in the pen recordings of fig. 2, which show the cumulative wow and flutter on record and play. The wow meter readings were very steady showing that little adding or cancelling of the various cyclical speed variations occurred. Only at the lowest speed of 4.75 cm/s was it possible to phase the record and play 3 Hz wow to alter the meter reading over the range of 0.12% to 0.14%.

Play-only wow and flutter, from a low wobble test tape, gave readings of 0.03% wow and 0.07% wobble at 19 cm/s, and 0.04% wow and 0.09% wobble at 4.75 cm/s. It will

**Play only wow and wobble from test tape**

19 cm/s Wow 0.03%	Wobble 0.07%
9.5 cm/s Wow 0.04%	Wobble 0.09%

be seen that these readings closely match the record/play readings shown against the pen recordings.

Play-only responses from 70 and 140  $\mu$ S test tapes are shown in fig. 3. The mean equalisation is exactly to the CCR characteristics but there is some evidence of wavelength

effect at low frequencies due to the short pole face of the heads. Such a small deviation from a level response is not audible on pre-recorded tapes, or tapes recorded once through the machine. Successive track to track transfers can build the fluctuation up to noticeable proportions, giving a heavy uneven bass response.

The combined record-play responses of fig. 4 show that a little extreme bass lift is used in recording, together with well proportioned high note pre-emphasis to give an extended treble response without the common mid high frequency peak.

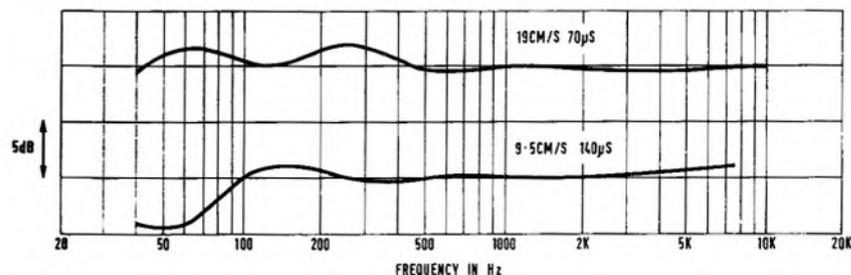
System noise, with no tape passing the heads, was 42 dB below test tape level. Bulk erased tape was -40dB and machine erased tape -35 dB.

Overload tests showed that tape distortion was below 3% at a level 12 dB above that of the test tape (10 mM/mm) so that the unweighted signal-to-noise ratio between peak recorded tape and erased tape noise was 47 dB.

Wind and rewind times for an 18 cm reel of LP tape were 3.5 minutes and 3.75 minutes respectively.

The four-digit tape position indicator  
(continued on page 547)

FIG. 3 FERGUSON 3232 PLAY-ONLY RESPONSE (TEST TAPE TO LINE OUTPUT)



# TELEFUNKEN

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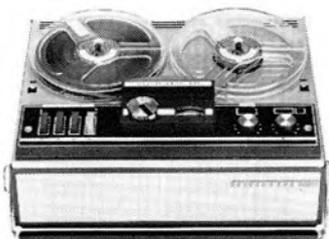
Always ready to hand, music straight from the tape with the portable M302—4 track, 2 speed (3½ and 1½ ips), 5" spools. Battery AC/mains adaptable. Rechargeable cell—can operate in a car. Price £76.0.10 with microphone, tape and spool and lead.

Other portables available M301 4-track 3½ ips £69.12.10. M330—2 track 3½ ips. £63.3.1.

## M20S TS

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clocked up 30 digits for 10 revolutions of the supply reel. Such a high ratio gives a false idea of the accuracy in finding a given spot on a tape and errors of up to 4 or 5 digits must be expected on a long tape.

Fig. 5 shows the overall acoustic response from a 19 cm/s white noise test tape to the measured sound output on the axis of one of the side facing speakers. It will be seen that there is a bump in the sensitive 1 to 2 kHz range which may help to explain the rather poor stereo separation mentioned later. The dotted response shows the effect of operating the treble cut tone control.

The microphone, which will be recognised as a well known (LM) moving coil stick, gave the very even response shown in fig. 5. It was noticed that the sound entrance at the cable end of the 'stick' had been blocked for this particular application to give a slight roll off of extreme low frequencies below 100 Hz.

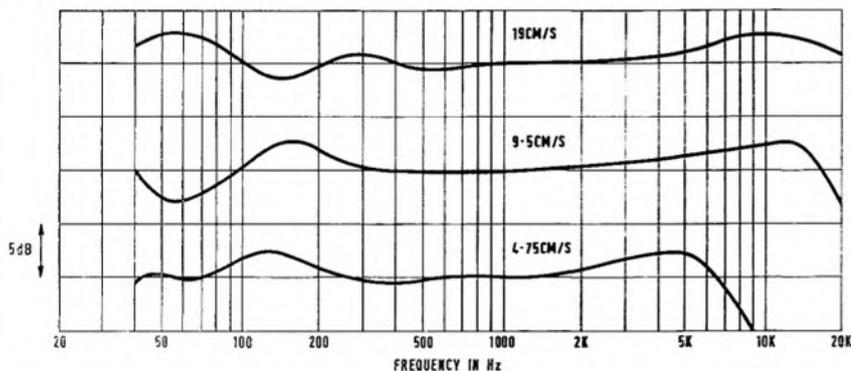
Such non-directional microphones must be used in the spaced microphone technique for stereo recording.

**COMMENT**

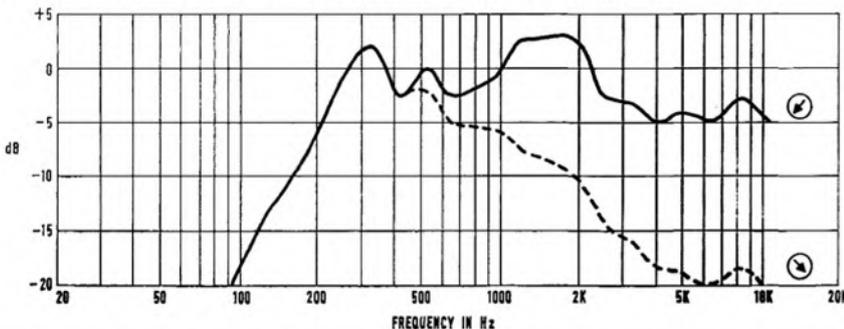
I have left my comments on stereo performance for this section, which I reserve for my own subjective impressions or preferences that can often not be pinned down to objective measurements. Once again we are presented with a machine which measures well on all electrical tests but which fails to give good stereo sound due to the unfortunate combination of internal loudspeakers and cabinet design adopted.

I know very well that a relatively small cabinet can only give, at best, a close up stereo performance, but I have tested a number of machines which, within these limitations, give very satisfactory small scale stereo. This one, even on an American gimmicked stereo demonstration tape, made me look again at the 'stereo-mono' switch  
*(continued overleaf)*

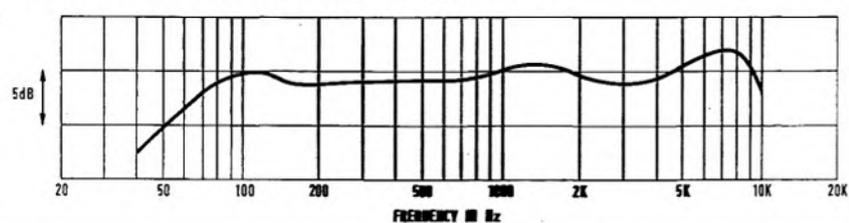
**FIG. 4** FERGUSON 3232 RECORD/PLAY RESPONSE (LINE INPUT TO LINE OUTPUT)



**FIG. 5** FERGUSON 3232 ACOUSTIC RESPONSE (WHITE NOISE TEST TAPE)



**FIG. 6** FERGUSON 3232 MICROPHONE RESPONSE (500 OHMS)



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FERGUSON 3232 REVIEW CONTINUED

to make sure I was not on 'mono'. I even played a single track tape in both directions to make sure that the sound came from first one speaker and then the other to convince myself that there was not a wiring fault. As expected, external speakers gave excellent stereo performance and separation, which confirmed all my measurements, and for use in this way I can thoroughly recommend it. The internal speakers are of very limited use for monitoring or judging a stereo recording in the field, or indeed for anything but relatively poor quality mono listening.

As this manufacturer makes excellent record players with much superior stereo sound, the necessary 'know how' is obviously available somewhere in the organisation. It should be used as quickly as possible.

A. Tutchings.

column  
speaker

AN  
OCCASIONAL  
COMMENTARY  
BY DROPOUT

WHEN this column was first started, I offered the hospitality of it to any tape-recording club which had interesting news to impart about creative activities. I have never forgotten a remark of David Kirk's about "those god-forsaken clubs"—a remark which hurt me at the time, as I happen to know one which is not. I was hoping that a flood of letters would provide me with convincing evidence that David was as wrong as I thought him. Months have passed; and not one single item has been sent to me.

Now who was right? Must I apologise humbly to David? Or is it simply that clubs are too busy to bother to write about what they are doing? I wish I could think so; but I suspect that most tape-men are toy-men: what truly interests them is what a recorder will do rather than doing what it will do. Let me say that I am all for the technical, being as ignorant as a stone myself. I am grateful to the experts

who design the truly superb equipment now available to us at a price which is ridiculous when compared with what one had to give for such quality when I first took an interest in the game some fifteen years ago. But surely the only point of such equipment is what one does with it? There is a satisfaction in owning a Leica or a Nagra and revelling in the sheer beauty and excellence of the thing; but to me the promenader who applauds until his arms drop off after an indifferent performance of Rakkers Two or Tchaik Six is nearer the kingdom of God than he who clicks off an empty Nikon merely to rejoice in its silky movement.

So will somebody prove to David—and me—that tape clubs and tape men can and do use their equipment to *make something*?

One thing's for sure: you won't create very much without editing, and most people won't edit convincingly unless they cut and splice tape. As a matter of fact, I have listened with utter amazement to tapes from a blind enthusiast, edited between two machines, without cutting a single splice, of such perfection that most of the razor-blade-and-block types are mere beginners by comparison. But he is a genius; and such are not common. For us lesser men, the splice is the only way—though machines like the new Ferrograph are now fitted with pause-controls which operate with such smooth rapidity that editing by dubbing ought to be possible on them. As, however, it will be a very long time before I can sport two new Ferrographs, I revert to the chopping-block.

My own preference is for the EMI *Editall*, though there are others and you may prefer them. But what I do find bothersome is the fact that my block is not screwed to the deck. The Wearite decks are drilled to accept a *Bib* splicer—though, in my judgment, in the wrong place. It should be immediately below the heads, not away in the left-hand corner of the deck. And the *Editall* screw-holes do not register with the holes on the Wearite deck. (Those of the *Romagna* do, by the way.) So one is left with the thing able to slide all over the place while one works with it, and easily brushed off between cuts—to say nothing of its propensity to scratch off the enamel from the deck-plate.

Here is a point which deserves attention from designers. If they would copy Wearite but provide two sets of threaded holes, one for the *Editall* and one for the *Bib*, we could all be happy, and that much more skilful.



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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 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.

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'Tape Recorder' copies for sale from 1959-March 1968 in complete volumes. Also 'Amateur Tape Recorder' and 'Tape Recording' from 1959-1963. Box No. 541 (Surrey).

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