

JULY 1967

# TAPE

RECORDING MAGAZINE

2<sup>1</sup>/<sub>2</sub>

**INSIDE**  
**SPECIAL**  
**CASSETTE NUMBER**

What they are  
and what they do

**RECORDING**  
**IN AN AIRSHIP**

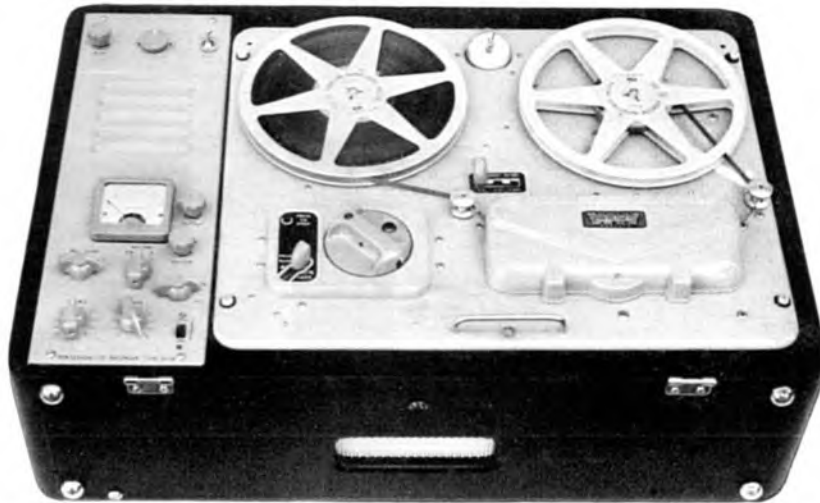
TEST BENCH  
MUSIC REVIEWS  
NEW PRODUCTS  
ETC., ETC.

*Second class postage paid at  
New York Post Office, N.Y.*



# *Vortexion* quality equipment

---



## TYPE W.V.B. TAPE RECORDER

The **Vortexion W.V.B.** is a high quality monaural machine with "Before and After" monitoring. The recording inputs are a high sensitivity socket for moving coil or ribbon microphone and a high impedance socket for radio, etc., either of which can be selected by a switch. Superimposing and echo work can be done, and the playback has reserve gain for abnormal requirements. This model cannot be converted for stereo playback, but it is a thoroughly reliable machine for the engineer specialising on monaural work.

Speeds  $1\frac{7}{8}/3\frac{3}{4}/7\frac{1}{2}$  i.p.s. Price: £115 10 0

Speeds  $3\frac{3}{4}/7\frac{1}{2}/15$  i.p.s. Price: £128 0 0

The **Vortexion W.V.A.** is a monaural machine which has a performance equal in sound quality to the other models. It possesses all the features of the W.V.B. except for "Before and After" monitoring, Dubbing and Echoes. The recording being made can be heard on the internal loudspeaker, as in the W.V.B. and C.B.L. The controls are uncomplicated.

Speeds  $1\frac{7}{8}/3\frac{3}{4}/7\frac{1}{2}$  i.p.s. Price: £96 7 0

Speeds  $3\frac{3}{4}/7\frac{1}{2}/15$  i.p.s. Price: £107 3 0

The **Vortexion C.B.L.** is a versatile stereophonic recorder which has no equal in its price group.

IT CAN record monaurally or stereophonically with its own mixed inputs from Gram., Radio or other sources and from high grade low impedance balanced line microphones. With good microphones, etc., the result is a suitable master for disc manufacturers. "Before and After" monitoring is provided together with adjustable metered bias for perfection.

IT CAN also make a recording on one track and then transfer it to the other track while measuring and listening to it and adding one or two more signals also metered. A special P.P.M. type meter is now used.

IT CAN repeat the process and transfer this combined signal to the first track with one or two more signals. Composers use it for this purpose. One track may have music or commentary and the other cueing signals or commentary, and either may be altered without the other.

IT CAN playback stereophonically or monaurally with its own amplifiers of  $3\frac{1}{2}$  watts each.

Speeds  $1\frac{7}{8}/3\frac{3}{4}/7\frac{1}{2}$  i.p.s. Price: £172 0 0

Speeds  $3\frac{3}{4}/7\frac{1}{2}/15$  i.p.s. Price: £180 0 0

All tape recorders have adjustable bias controls, low impedance mic. inputs for unlimited lengths of cable, highly accurate position indicators and meters to measure recording level and bias.

**VORTEXION LIMITED, 257-263 The Broadway, Wimbledon S.W.19**

Telephone: LIBerty 2814 and 6242-3-4

Telegrams: "Vortexion London, S.W.19"

---

# NEW from Agfa-Gevaert!



DC90

## ...Agfa Magneton Tape Cassettes

Now! The superb sound reproduction you enjoy from Agfa Magneton Tape—brought to you in dust-proof compact cassettes. No tension troubles; no threading or fiddling. Agfa-Gevaert brings you trouble-free tape recording.



C60 gives 60 minutes recording time (2 x 30) Compact Cassette  
DC90 gives 90 minutes recording time (2 x 45) System International  
Both in protective plastic storage box.

**PROVED BY THE PROFESSIONALS**

To: Magnetic Tape Division, Agfa-Gevaert Limited, Great West Road, Brentford, Middlesex.

Please send me illustrated brochure on the new Agfa Magneton Recording Tape Cassettes and comprehensive price list.

NAME.....

ADDRESS.....

AGFA-GEVAERT

# whatever the make....



**AKAI 1710 4-Track Stereo.** 3 speeds  $1\frac{1}{2}$ ,  $3\frac{1}{2}$  and  $7\frac{1}{2}$  (15 i.p.s. optional extra). F.M. Multiplex ready. Two built-in speakers. Automatic shut-off. Horizontal or vertical use. Demonstration tape included. **79 Gns.** Deposit £27 13s. 0d. and 12 monthly payments of £4 14s. 2d.

**AKAI M8 4-Track Stereo,** 4 speeds  $1\frac{1}{2}$ ,  $3\frac{1}{2}$ ,  $7\frac{1}{2}$  and 15 i.p.s. Three heads including Cross-field. Two speed Hysteresis Synchronous motor. Sound on Sound. Biased for F.M. Multiplex. Two speakers. Tape Cleaner. Four digital counter with reset. Vertical or horizontal use **125 Gns.** Deposit £44 5s. 0d. 12 monthly payments of £7 5s. 0d.



★ **INTEREST-FREE H.P. TERMS**

Open Saturday 6 p.m. Friday 6.30 p.m. If unable to call write for brochures.

★	Deposit		12 Monthly Payments		Cash Price
	£	s. d.	£	s. d.	Gns.
<b>MAINS 4-TRACK</b>					
Telefunken 201	11	18 0	1	19 8	34
Ferguson 3222	12	5 0	2	0 10	35
Grundig TK140	13	6 0	2	4 4	38
Philips EL3558	14	14 0	2	9 0	42
Ferguson 3224	15	8 0	2	11 4	44
Wyndor Vanguard	20	13 0	3	8 10	59
Philips EL3556	21	14 0	3	12 4	62

<b>MAINS 2-TRACK</b>					
Ferguson 3220	8	15 0	1	9 2	25
Grundig TK120	10	6 6	1	14 5	29½
Tandberg 823	18	18 0	3	3 0	54
Brenell Mk. 5/3	25	18 0	4	6 4	74
Brenell Mk. 5/3 'M'	32	11 0	5	8 6	93
Ferrograph 631	33	5 0	5	10 10	95
Ferrograph 633 Connoisseur	42	0 0	7	0 0	120

<b>STEREO MONO</b>					
Philips EL3312	16	16 0	2	16 0	48
Sony TC250A	19	19 0	3	6 6	57
Philips EL3555	26	5 0	4	7 6	75
Akai 1710	27	13 0	4	12 2	79
Sony TC260	33	19 0	5	13 2	97
Tandberg Series 12	36	15 0	6	2 6	105
Truvox PD104	36	15 0	6	2 6	105
Beocord 1500	36	15 0	6	2 6	105
Beocord 2000K De Luxe	43	15 0	7	5 10	125
Revox 736	44	9 0	7	8 2	127
Beocord 2000T De Luxe	45	3 0	7	10 6	129
Akai X-300	65	5 0	10	15 0	185
Akai X-355	83	6 4	13	17 9	239

<b>BATTERY</b>					
Philips EL3302	9	9 0	1	11 6	27
Telefunken 301 4-T	18	18 0	3	3 0	54
Akai X-4 Stereo	34	13 0	5	15 6	99
Uher 4000L	36	1 0	6	0 2	103

PART EXCHANGES

**THE RECORDER CO**  
 (DEPT. T) 186-188 WEST END LANE, WEST HAMPSTEAD, LONDON, NW6  
 Telephone: SW1 4977



**FOR PERFECTION IN SOUND**

**LOEWE OPTA**

**INTRODUCE THE NEW OPTACORD 450 BATTERY/MAINS**

**CASSETTE LOADING TAPE RECORDER for 39 GNS.**

**OPTACORD 450 THE UNIVERSAL TAPE RECORDER FOR BATTERY/MAINS OPERATION (Power-pack incorporated)**

- New compact-magazine-system bans tape threading (Philips type).
- Unlimited reproduction possibilities with self-made recordings or commercially available pre-recorded tapes.
- Ready for recordings per microphone supplied with the set, as well as from the radio-receiver, record player or any other tape recorder.

Other features include:

Further to operation on batteries (5 monocoils 1.5v each) or on mains (110/220 v a.c.) connection to car battery (6 or 12 V) also possible. Playing time with compact-magazine C 60 = 2 x 30 mins. with compact magazine C 90 = 2 x 45 mins. Monitoring via built-in loudspeaker, external speaker or headphone: Frequency response 50-8000 c/s; Contrast = 40dB.

Write for illustrated leaflet and further details to:



**HIGHGATE ACOUSTICS**

71/3 Gt. Portland Street, London, W.1.  
**MUSEum 2901/5**

# TAPES RECORDED FOR YOU



**3<sup>3</sup>/<sub>4</sub> I.P.S.**

## **The Beatles**

Sgt. Pepper's  
Lonely Hearts

Club Band

**Parlophone  
TA-PMC 7027**

## **The Hollies**

Evolution

**Parlophone  
TA-PMC 7022**

## **Vince Hill**

Edelweiss

**Columbia  
TA-SX 6141**

## **The Royal Guardsmen**

Snoopy vs.  
The Red Baron

**Stateside  
TA-SL 10202**

# FRANCIS OF STREATHAM

## MAINS TAPE RECORDERS

*Ampex 800 Series	£127.10.0
*Ampex 1100 Series	£149.10.0
*Akai 1710	79 gns.
*Akai X-300	190 gns.
*Akai 910	62 gns.
*Akai M8 Stereo	136 gns.
Akai 355 Stereo	239 gns.
*Beocord 2000	119 gns.
*Beocord 2000 de luxe	135 gns.
*Beocord 1500	89 gns.
*Beocord 1500 de luxe	105 gns.
*Beocord 1000	69 gns.
*Brenell STB2	£150.0.0
*Brenell Mk. 5 M Series 3	93 gns.
*Brenell Mk. V Series 3...	74 gns.
Elizabethan LZ32	32 gns.
Elizabethan LZ34	34 gns.
Ferguson 3218	34 gns.
Ferguson 3222	35 gns.
Ferguson 3216	49 gns.
*Ferrograph 633	120 gns.
*Ferrograph 631	95 gns.
*Ferrograph 632 Stereo...	126 gns.
Fidelity Playmatic	28 gns.
Grundig TK400 2sp. 4 Tr.	47 gns.
Grundig TK14L	37 gns.
Grundig TK17L	43 gns.
Grundig TK18L	39 gns.
Grundig 23L Auto	49 gns.
Grundig TK140	38 gns.
Grundig TK120	29½ gns.
Philips 3556...	62 gns.
Philips 3558...	42 gns.
Philips 3553...	36 gns.
Philips 3552...	24 gns.
*Revox 736	124 gns.
Sony TC260	97 gns.
Sony 250A Deck, Pre-amp	57 gns.
Sony 200	72 gns.
Sony 600	127 gns.

Stella 463	39 gns.
*Tandberg Series 6	110 gns.
*Tandberg Series 8, 2 Tr.	54 gns.
Tandberg Series 12	105 gns.
Telefunken 203	69 gns.
Telefunken 201	44 gns.
Telefunken 200	39 gns.
*Telefunken 85 de luxe	83 gns.
*Telefunken 204 Stereo	106 gns.
*Truvox PD102	93 gns.
*Truvox PD104 Stereo	89 gns.
Truvox R102	76 gns.
Truvox R104	79 gns.
Truvox R40...	44 gns.
Uher Hi-Fi Special	129 gns.
*Uher 724L...	75 gns.
*Vortexion WVA, 3 speed	£96.7.0
*Vortexion WVB, 3 speed	£115.10.0
*Vortexion CBL Stereo...	£172.0.0
*Van der Molen VR4	59 gns.
*Van der Molen VR7	39 gns.
*Uher 784 Royal	129 gns.
*Uher Hi-Fi Special	129 gns.

## BATTERY PORTABLES

Akai X-IV, 4 Tr. Stereo...	131 gns.
Cossor 1621	26 gns.
Grundig EN3 Notebook	23 gns.
Grundig TK6L	73 gns.
Grundig C100	39 gns.
Loewe Opta 408	39 gns.
Loewe Opta 416	51 gns.
Loewe Opta Cassette	39½ gns.
Philips EL3301	26 gns.
Philips 3586...	27 gns.
Sanyo Auto	22 gns.
Sanyo Batt./Mains	36 gns.
Stella 472	27 gns.
Telefunken 300	49 gns.
Telefunken 301 4 Tr.	54 gns.
Uher 4000L...	103 gns.

\*Microphone extra

LEADING STOCKISTS OF EQUIPMENT FOR

## TAPE and HI-FI

... and NO EXTRA FOR CREDIT TERMS

- ★ Minimum Deposit
- ★ No Interest or Service Charges on H.P. up to 18 months
- ★ Free Service during Guarantee Period

Prices subject to alteration as announced by manufacturers

## MAINS POWER PACKS

Philips, Stella or Cossor	£5.12.0
Uher 4000, with cell	18 gns.
Telefunken 300, with cell	£15.17.0

TAPE DECKS by Brenell, Wearite.  
TAPE-TO-DISC and Copy Service.

## MICROPHONES, MIXERS, etc.

Hammond Condenser M100	29 gns.
AKG D14S	£10.0.0
AKG D119	£20.10.0
AKG D19C	£17.10.0
AKG K50 Headphones	£7.10.0
Eagle Mixer	£3.30
Grampian Reflector	£6.15.0
Grampian DP 4 Dynamic	£8.5.0
Grampian Ribbon	£11.10.0
Grundig Mixer (Stereo)	18 gns.
Philips Preamp	£6.10.0
Reslo Ribbon	£12.2.0

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

● DEFLUXERS by Wearite, Walsingham

## PRE-RECORDED TAPES

by Columbia, H.M.V. and all E.M.I. labels, Crown, Phonoband, Eagle, etc.

TAPE SPLICERS by Bib, Bond, E.M.I. Matching transformers, plugs, sockets, etc.

STANDS of all types. TAPES

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

Between St. Leonard's Church and Streatham Station  
OPEN ALL DAY SATURDAY—1 p.m. Weds.

## Hi-Fi Dept.

- AMPLIFIERS (mono & stereo)
    - Quad Scott Tripletone
    - Leak Rogers Cadet Mk. III
    - Armstrong B. & O. Pye
    - Truvox
  - TUNERS
    - Quad Pye W.B. Wharfdale
    - Armstrong Pye Tripletone
  - LOUDSPEAKERS
    - Quad Pye W.B. Wharfdale
    - Goodmans Tannoy Leak
    - Lowther Kef Rogers Elac
    - S.H.B. Tandberg B. & O.
    - Truvox Ditton
  - MOTORS, PICKUPS
    - Garrard incl. Thorens
    - AT6, 401, etc. Tannoy
    - Goldingring Shure
    - Connoisseur Ronette
    - Decca Sonotone
    - Transcriptor B. & O. BSR
    - Philips SME Mk. II
    - Ortofon Pickering
    - Acos ADC
- All types of Diamond and Sapphire styli, stereo and mono. Microlifts, Garrard, Goldring, Acos Pressure Gauges, Disc Preener, Acos Dust Bug

Please note our only address as below

STreatham 0466/0192

● FREE CAR PARK, Prentis Road

# Van Der Molen SONIC EIGHT

## SPECIFICATION

- SYSTEM
  - Philips Cassette
- PLAYING TIME
  - 2 x 30 mins. or
  - 2 x 45 mins.
- OUTPUT
  - 4 watts per Channel
- CONTROLS
  - Volume and Tone
- FREQUENCY RESPONSE
  - 60-10,000 Hz.
- POWER SUPPLY
  - 110-245V, 50/60 Hz.
  - or 20/25V. DC
- INPUTS
  - Dynamic Mic.
  - and Tuner/Pick Up
- DIMENSIONS
  - 21" x 7½" x 5"
- CABINET FINISH
  - Teak Veneers
- DETACHABLE SPEAKER



## THE NEW LOOK IN "CASSETTE" TAPE RECORDERS

With this latest British made model true stereo separation is made possible by a detachable speaker which is normally housed inside the main cabinet. Recommended list price 49 gns.

Designed and manufactured in Britain by Van Der Molen Ltd., 42 Mawney Road, Romford, Essex. Phone: 41904

# Lord Montagu of Beaulieu



has this to say about the   
new Philips car cassettes.

"..for me the only way to really  
enjoy music in the car.."



...no interference, no sound distortion,  
and no juggling with controls. And I  
can listen to my personal favourites.  
I predict a very big future indeed for  
this wonderful new system"

**Fascinating Rhythm:** titles inc: That Old Black Magic, The Lady is a Tramp, Caroca CPP1028

**Thank Heaven for Little Girls:** titles inc: Laura, Maria, Stella by Starlight, Mona Lisa CPP1038

**Mister Wonderful:** titles inc: The Man That Got Away, Mad About The Boy CPP1037

**Small World:** titles inc: April in Paris, A Nightingale Sang in Berkeley Square, Sonny Boy CPP1027

**Let's Face The Music And Dance:** titles inc: Put on a Happy Face, Just in Time, How about you CPP1032

**Around The World:** titles inc: A Foggy Day, I Love Paris, From Russia with Love, America CPP1034

**Isn't This A Lovely Day:** titles inc: September Song, A Summer Place, It might as well be Spring CPP1042

**There's no Business Like Show Business:** titles inc: Stranger In Paradise, Somewhere CPP1025

**The Road To Dreamland:** titles inc: Blues In The Night, Two Sleepy People, Moon River CPP1030

**Falling In Love With Love:** titles inc: True Love, Love is a Many Splendoured Thing CPP1036

**Thanks For The Memory:** titles inc: Tea For Two, Pennies From Heaven, Yesterday's CPP1029

**Hello, Young Lovers:** titles inc: Young And Foolish, My Funny Valentine, Our Love Affair CPP1041

**Broadway Melody:** titles inc: Hey There, C'est Magnifique, Small Hotel CPP1040

**You Are My Lucky Star:** titles inc: Serenade In Blue, Bewitched, Sound Of Music CPP1031

**Dancing In The Dark:** titles inc: You Stepped Out Of A Dream, I Only Have Eyes For You CPP1033

**The Party's Over:** titles inc: Bye Bye Baby, Just One of Those Things, I Remember You CPP1039

**It's Magic:** titles include: Night And Day, Lover, Temptation, Days of Wine and Roses CPP1035

**Language Of Love:** titles inc: Till There Was You, I'm In The Mood For Love, My Foolish Heart CPP1031

(Each car cassette carries 12 titles) Orchestras playing for you on the car cassette series are:

Reg Tilsley, Johnny Gregory, Les Reed, Ivor Raymonde, Johnny Arthey, Dennis Wilson, Peter Knight, Ken Thorne.

\* And watch during July for the special *Golden Sounds Offer* of 2 sets of four musicassettes available at a saving of £2 per set. Your dealer will have information.

And for a full list of musicassettes suitable for the car write to Musicassette Dept, Stanhope House, Stanhope Place, London, W.C.2.

# ONLY FROM REW at this price!

Have endless pleasure and entertainment with this magnificent machine, by one of the world's leading manufacturers. Create your own library of living sound, record and replay speech, music, pre-recorded tapes, anything you like. Instant, brilliant new Cassette tape loading—as easy to use as a camera and much more fun! Just click—quick—terrific!

**Look at this galaxy of luxury features - all for only 27 gns. or 9 gns. deposit.**

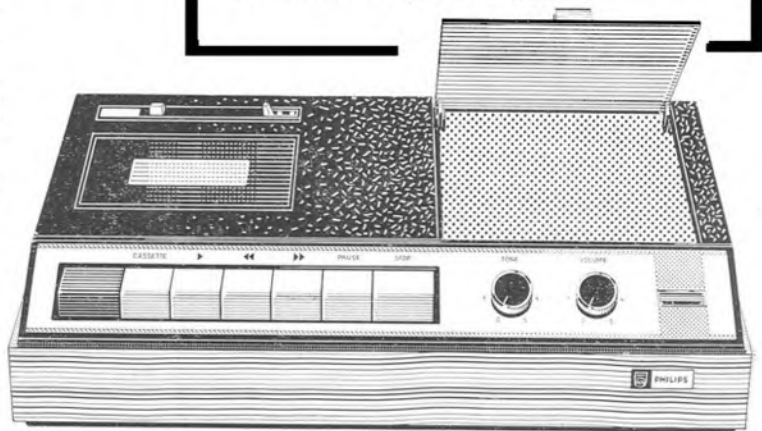
5 in. speaker and special acoustic reflector for high quality sound. (Extension speaker socket also provided). ●Sensitive microphone. ●Twin-track recording, 1 1/2 i.p.s. ●Ninety minutes' playing time without reloading. ●Automatic control of recording level volume. ●Programme indicator. ●Fast wind and rewind mechanism. ●Push button controls. ●Wide frequency range. ●TRANSISTORISED, Mains Operated, no "warming up" period.

Beautifully presented in teak finished cabinet, a machine you'll be proud to own and use, and one which will give you years of reliable, unique enjoyment.

**ORDER NOW!** by post - we are mail order specialists. Or call and see this machine - try it for yourself! Parking is easy.

**rew**

R.E.W. (Earlsfield) Ltd., Dept. T.R.M.,  
266 8 Upper Tooting Road, London, S.W.17.  
Telephone: 01-672 8267 or BAL 9175.  
Open 9 a.m. - 6 p.m. Weekdays. Closed  
1 p.m. Wednesday.



## Save 8 gns.

on this superb, Slim-line, Cassette  
loading

### PHILIPS TAPE RECORDER

Model EL3310 (current list price 35 gns.)  
R.E.W.'s Price

ONLY **27** GNS

(interest-free terms 9 gns. deposit, 12 monthly payments of £1.11.6). Carriage, insurance, packing 10/6.  
Brand New. Fully Guaranteed.

# HEATHKIT

The first choice in  
**Hi-Fi EQUIPMENT**

**OUR WIDE RANGE INCLUDES:—**

#### AUDIO

Cabinets, Turntable Units, Mono and Stereo Amplifiers, Pickups, Speaker Systems, Mono and Stereo Control Units, Tape Pre-amplifiers, Tape Decks, etc.

#### RADIO

AM/FM and FM Tuners, Car Radio, FM Decoder, Transistor Radios, SW and Communication Receivers.

#### MISCELLANEOUS

Children's Hobby Kits, Tool Kits, Intercom, Electric Organs, and a wide range of Amateur Radio Gear.

#### TEST

A range of Audio Test, Home Workshop, Service, and Laboratory Instruments.



TRANSISTOR MIXER,  
TM-1 Kit. £11.16.6



Transistor Stereo  
Amplifier Kit AA-22U from  
£39.10.0 less cabinet



Transistor FM Tuner Kit  
from £20.19.0 incl. P.T.



**FREE! CATALOGUE**  
Don't Delay! We are waiting  
to send your copy.

For enjoyment and pride in assembly, for long years of pleasure and performance, for new adventures in creative electronics, post the coupon below and get your personal copy of the Heathkit catalogue of quality build-it-yourself and assembled equipment. Read about models from radio to Hi-Fi equipment — from VVMs to oscilloscopes — analogue computers to tool kits. Every model covered by a money back guarantee. See for yourself, why Heathkit Models are the choice of the discriminating Builder. Britain's largest selection of quality electronic kits.

**HURRY! MAIL THIS COUPON TODAY.**

To DAYSTROM LTD., Gloucester. Tel.: 20217. Please send me  
**FREE BRITISH HEATHKIT CATALOGUE**

Full details of Model(s) .....  
Name .....  
Address .....  
(Block capitals please) .....

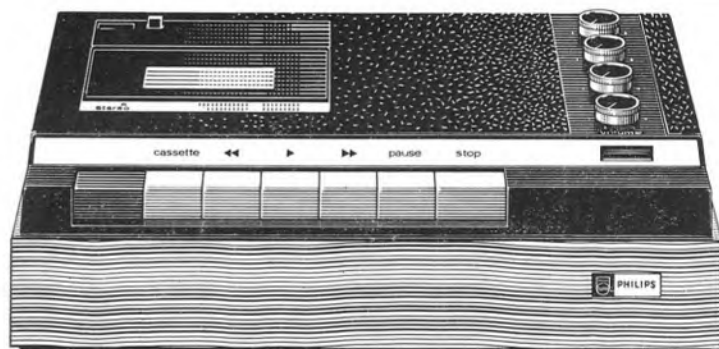
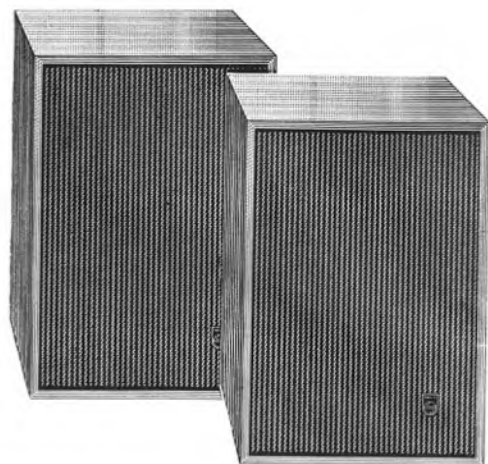
T.5

See Heathkit models in London, at The Heathkit Centre, 233 Tottenham Court Road, W.1 Telephone 01-636 7349



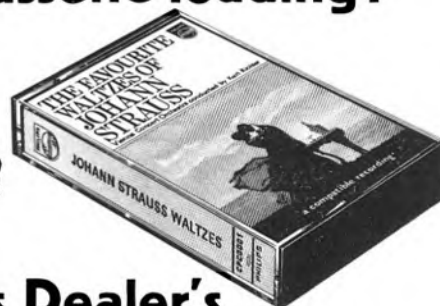


# The big advantage of Philips Stereo Cassette Recorder is stereo recording/play back



**Or is it easy cassette loading?**

**Or is it Musicassette reproduction?**



**You decide. At your Philips Dealer's**

You'll like Philips Mains/Stereo Cassette Recorder. To load it, just snap-in handy cassettes—you never touch the tape. A self-contained recorder with full stereo recording/playback facilities, it plays Musicassettes too—cassettes carrying all types of pre-recorded music and giving as much listening time as long-playing records. Its two GL559 Hi Fi speakers are optional extras (10 gns + P.T. surcharge each)—that way you save money if you already own stereo reproduction equipment. Your Philips dealer has the full story. Model EL3312 48gns with demonstration cassette, moving coil stereo microphone, library rack and recording/play-back leads.



**PHILIPS**

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

# This MONO CARTRIDGE will play STEREO RECORDS



## *Specially designed with high vertical compliance*

With an eye to the future, Cosmocord engineers have already produced a mono cartridge which will play stereo discs. Even more important, it will track all stereo records causing no more wear than would be produced on an equivalent mono record. So Acos stay in the lead.

Remember GP.19 for the first LP's, GP.71 for the first stereo discs? Now stereo compatible cartridges, GP.91—1 S/C and GP.91—3 S/C for all mono record players.

This means that mono record players fitted with these cartridges are suitable for playing stereo records (in mono, of course).

If you would like more information on this subject, please write to:

Cosmocord Ltd Eleanor Cross Road Waltham Cross Herts  
Telephone: Waltham Cross 27331

# •acos•



Vcl. 11

No. 7

July 1967

### IN THIS ISSUE

Tape trends and tape talk	260
Douglas Brown	
"Techniques"	
THOUGHTS BEFORE RECORDING	261
Denys Killick	
CONVENIENCE OF CASSETTE AND CARTRIDGE	264
Deris Gilbert	
THE MUSICASSETTE STORY	265
Walter Woyda	
RECORDING IN AN AIRSHIP	266
Lord Ventry	
MULTIPLE COPYING	268
Laurence Graham	
A French Language Course	269
Cross Talk	270
By Audios	
Glossary of tape terms	271
Harry Mack	
Test Bench—AKAI X-300	272
A TRM Evaluation:	
MUSICASSETTE QUALITY	274
Tape Record Reviews	276
New Products	278

**COVER PHOTOGRAPH:** For our special Cassette Number we feature on our front cover the Philips Model EL-3302 battery portable. This popular lightweight is the direct descendant of the first cassette machine shown at the Hanover Fair in 1963. The split cassette clearly shows the internal, spool-to-spool, system of clean, simple design. This is the result of co-ordinating development teams to evolve a completely new approach to recording problems. One hardly dares ask what the next five or ten years might not bring.

"TAPE Recording Magazine" is published on the third Wednesday in the month, by Print and Press Services Ltd., from Prestige House, 14/18 Holborn, London, E.C.1.

"TAPE Recording Magazine" is available by a postal subscription of 25s. per annum (U.S.A. \$3.75) including postage, or it can be obtained at newsagents, bookstalls and radio and music dealers. In the event of difficulty, write to the Publishers at Prestige House, 14/18 Holborn, London, E.C.1.

Back numbers, if still in print, are available at 2s. 6d. per copy.

Address all communications

**PRESTIGE HOUSE,  
14/18 HOLBORN, LONDON, E.C.1**

#### EDITORIAL

01-242 4742

Publisher,  
R. DOUGLAS BROWN

#### ADVERTISING

01-242 4851

Editor,  
DENYS G. KILLICK

Advertisement Manager, VIVIENNE GOODING

# Tape trends and tape talk

By Douglas Brown

THE FUTURE of tape recording in this country presents some very interesting problems. One of the popular papers forecasts that before this year is out one of our principal manufacturers will be marketing a complete tape cassette playback-only machine costing ten guineas or less. In this issue, Walter Woyda, of Philips Records Ltd., confirms as fact the prospect of us seeing, in less than twelve months, a whole range of Philips' equipments, including a playback-only unit, a combined radio and cassette playback machine and even automatic cassette changers. In addition we are advised by the British firm of Van Der Molen Ltd. that they propose introducing, within a few weeks, a stereo playback-only cassette deck and pre-amplifier, intended for use with existing hi-fi installations, at a cost below twenty pounds. Inevitably Japanese ingenuity will be devoted to the production of even lower cost equipment. These events might be regarded as some of the most important developments in the industry to date.

In the past I have frequently prophesied the evolution of this trend, although contacts in industry have inclined to disagree. There is no doubt in my mind, however, that vast markets exist for playback-only units at really low prices.

We must speculate as to how far this trend will influence the development of tape recording as a hobby. One could also ask whether the mere enjoyment of the reproduction of music on tape could be classed as a hobby interest at all.

Tape recording, as an enthusiasts' interest, has always laboured under the difficulties of a dual personality. It may be enjoyed passively, or it may be elevated even to the dizzy heights of creative art. The creative artist enjoys his passive listening, and in the same way the passive listener may well develop an interest in the creative side of our hobby. Although at this stage of the art cassette equipments inhibit creative activity, it would be a wise—or perhaps foolish—man who would say that this will always be so.

Whilst the importance of cassette equipments in the reproduction of music might have been underestimated by many, it should be safe to assume that spool-to-spool equipment, running at  $7\frac{1}{2}$  ips, will always provide better quality than the slow speed, narrow track, cassettes. I say, "should be," advisedly. Who would have dared to forecast the advent of the Musicassette ten, or even five, years ago? The lower priced, conventional, spool-to-spool machines might well find their popularity declining in the face of this competition.

One thing is quite certain; manufacturers are now finding themselves under an obligation to produce better sound quality than ever before. Should they fail we shall inevitably see a sharp division in the tape recording market, with cassette machines at one end and top quality, spool-to-spool, equipment at the other. But our manufacturers have never failed us yet, and I see not the slightest prospect of them doing so in the future.

\* \* \*

THE Federation of British Tape Recording Clubs has now become the Federation of British Tape Recordists and Clubs. The initials are thus unchanged, but the change of title reflects a significant development.

The Annual General Meeting of the Federation in London recently was told that there are now over 200 individual members affiliated, as well as a record 32 clubs. And the list is now growing rapidly. Over 1,000 enthusiasts visited the Federation room at the last Audio Festival, and increasing membership is one direct result. Incidentally, Cyril Rex Hassan, Director of the Audio Festival, has agreed to serve as a Vice-President of the Federation, and several leading firms have become trade associates.

When, just over a year ago, I was asked to become the Federation President, I made it clear that one ambition I cherished was to see the majority of clubs and enthusiasts working smoothly together in a unified national movement. We have not achieved all I hoped for, but there now seems real prospect of creating such a genuinely national movement.

\* \* \*

CONTESTS are now proliferating—altogether, there are five this year. I do not think there can ever be too many. Amateurs need all the encouragement possible to try their hand at creative recording—it is a hobby that needs continuous stimuli.

The new local radio stations will, I think, play an important role in the contest business. At least three of them, it is suggested, will go on the air with tape recording contests featuring in their initial programmes. There is a genuine desire to bring the amateur into the local broadcasting picture.

With real hope now that the BBC Contest launched by the North Region last year is to become an annual affair, local radio station contests could perhaps later be integrated as local heats.

**N**OW there is a very real possibility of amateur recordings being broadcast through the new BBC network of local stations there should be an even greater incentive to produce good quality work than ever there was before. Last month, with this situation in mind, we discussed microphone positioning. Less obvious perhaps, but certainly no less important, are the steps that should be taken by the recording engineer to prepare his equipment immediately before starting a recording session. Lack of adequate preparation could easily spoil what might otherwise have been an excellent recording.

Even this, however, is not the first stage. The amateur, working under amateur conditions, will invariably combine the roles of director, producer and recording engineer. Before he can even think about preparing equipment he has all the administrative details connected with the recording to attend to, and looming large as a dire threat is the spectre of the 1956 Copyright Act.

Broadcasting authorities are most careful to ensure that all the requirements of the Copyright Act have been fulfilled in respect of material they transmit. When offering a tape for broadcast it will be up to you to actually prove that your material is not subject to any copyright limitations. So the very first requirement for every amateur is to have at least some knowledge of the implications of the law of copyright, and to exercise the very greatest care in this respect.

It is a well known maxim that "ignorance is no defence." Yet it is surprising how many readers betray from their letters to *TAPE Recording Magazine* an appalling ignorance of even the most fundamental principles.

It is a mistake to imagine that by confining the recording of musical works to the classics, or to those whose composers have been dead for more than fifty years, one will dodge all responsibility in this respect. Check firstly to ensure that the version being performed is not a modern arrangement in which copyright still subsists: this commonly happens with so-called traditional airs. The composer's copyright is only one problem—another, and equally important, is that of the performers themselves. Whoever is performing this work has a vested interest in the recording you take. Any individual performer has every right to refuse to be recorded in the first place, or to impose limitations on the use to which that recording may be put. This difficulty can only be overcome by obtaining a formal indemnity, signed by every performer and the conductor.

All these complications can sound most frightening. But they represent just a few of the hazards that must be overcome by the enthusiast. The great thing

## TAPE RECORDING TECHNIQUES BY DENYS KILICK

# THOUGHTS BEFORE RECORDING

is for the amateur to be aware of his obligations and to take appropriate steps to ensure that he neither unwittingly breaks the law, nor wastes his time on recordings that he will not be allowed to use for the purpose for which they were originally taken.

The law of copyright is a complex subject; specific problems should be referred to a qualified legal adviser. For a good, overall indication of the implications of the law I can thoroughly recommend our own handbook, "The Law and your Tape Recorder" by Andrew Phelan, Q.C., available from our own address, price 3s. 6d. post free. A careful study of this book, which deals with many aspects of copyright, will give the non-legal amateur a very good idea of what he may and may not do. It also advises on the law of libel.

One last legal restriction which is too often overlooked. The owner of a hall, or other premises, let out by rent for a performance, is entitled to place restrictions upon the use to which recordings taken in those premises may be put. For instance, although you may have cleared all other copyright obligations in respect of, say, a concert given at a public performance in a rented hall, the owner of that hall may stipulate that a fee must be paid before the recording taken can be broadcast. At small, local functions this is a situation unlikely to arise, but nevertheless it should be borne in mind.

Copyright is a depressing subject. But it will only lead to trouble if the enthusiast, in his enthusiasm, neglects to fulfil his obligations. The law might be an ass, but it is in our own interests to observe it meticulously.

Discussions on copyright must obviously take place well in advance of the actual performance date. They also serve a most useful purpose in establishing the precise programme content. One must know in advance the nature of the sound source to be recorded; the number of performers, whether there will be soloists and where they will be placed, etc., etc. Duration of items is also very important—upon this will depend the size

of tape spool to be used and the recording speed. Needless to say this latter should, wherever possible, be the fastest available on the equipment. Never accept the performer's vague ideas of programme duration too literally. Always allow additional tape for a possible over-run. Even conductors can be as much as 50 per cent out in their estimates of the duration of individual items. Running out of tape in the middle of a work is an unforgivable crime.

You can now think in terms of the actual preparation of the equipment to be used at the session. A great deal of time and trouble will have already been spent on the administrative side of this recording; it could all be jeopardised through failure to observe a strict routine in preparing equipment. The absolute minimum requirement is to at least plug in the recorder and check that its main functions are properly operating. But the professional would do a great deal more than this.

The simplest thing that any and every owner should do before any important recording session is to thoroughly clean the heads and tape guides of his machine. The correct method is to apply an absolute minimum of pure alcohol (methylated spirit is the commonly used equivalent) by means of a soft, lint-free cloth to all the parts against which the tape moves in its travel through the sound channel. Never approach any of these parts with any metal object such as a screwdriver. The cloth should be wrapped around the end of a wooden implement, like an orange stick, or even a matchstick. The object is to remove the layers of oxide which will have inevitably built up during the period since the heads were last cleaned. Neglect over a long time can cause quite thick deposits of oxide, which may be clearly visible to the eye. You should never let your equipment get into this state. However frequently you clean there will always be some oxide to remove; this will appear as a brown discolouration on the cleaning cloth. Continue cleaning until the cloth remains quite clean.

Special attention must be given to the capstan and pinchwheel. They are liable to accumulate oxide particles which can build up into solid cakes—these will unnecessarily increase the wow content of your recording.

Lastly, a check is needed on the tape guides. Again these parts are subject to oxide build-up which must be removed, but we must also watch carefully for wear. A fixed tape guide will develop a pronounced flat in its surface from the abrasive action of the tape. As soon as wear is noticeable the guide should be rotated to bring a new, curved surface into the tape path.

These maintenance procedures are extremely simple indeed. They take only a few minutes to carry out. However good your equipment might be, recording with dirty heads means just one thing—degradation of frequency response and loss of signal. In other words, what might have been a thoroughly good recording will be a thoroughly bad one, and all for the lack of a little forethought.

Another simple task is to demagnetise the heads. This operation, known as “defluxing,” was once described by Percy Wilson in the *Gramophone* as the magnetic equivalent of removing dust from a gramophone record before placing it on a turntable. Although I think this is a too simple description, it is perhaps not a bad picture to carry in one’s mind.

In an earlier article in this series we mentioned the effects of erasure by the application of a permanent magnet, rather than the alternating polarity imposed on a recorded tape by conventional erase heads. Because the recording of sound on tape is an electro-magnetic process, one of the few things likely to adversely affect a recording is the presence of unwanted magnetic fluxes.

This harmful effect is audible as an increase in hiss level. Unfortunately the hiss is “recorded” on the tape, in just the same way as the desired signal, and can be removed only when the tape is fully erased. All well designed circuits for tape recorders incorporate a “decay time” in the switching of the AC bias to the record head, and also to the alternating current to the erase head. The sole purpose of this decay time is to ensure that the magnetic fluxes deliberately set up within the heads die slowly away so as to leave both components in a neutral condition.

Two points to note are that this safety device comes into operation only when switching out of the record mode, so if a machine is used continuously for playback it is far more susceptible to trouble from this source, also as no AC current is ever fed to a separate playback head this will never be automatically demagnetised. This slow decay time to the record and erase heads does not offer

any protection at all against the build-up of magnetic fluxes in other metal parts that might lie within the tape path.

Defluxing, or “magnetic cleaning” as it might be called, is very simply performed using a specially designed tool, or defluxer. This implement is equipped with a metal prong, the tip of which is usually specially shaped to facilitate access to the working surfaces of the tape heads. In use the tool is plugged into the mains, the control button depressed, and then the prong is brought into contact with all the metal parts in the tape path. Great care is needed in its use. The control button must be depressed before the defluxer approaches the machine too closely, must remain depressed during the whole of the defluxing operation and not be released until it has been withdrawn to a safe distance. Careless use of a defluxer can leave more harmful residual fluxes than those it was intended to remove. The maker’s instructions should therefore be closely followed.

Defluxing and head cleaning are two standard routines that any professional will automatically carry out before using his equipment for an important recording. Amateurs would be well advised to follow the same practice. Another standard professional procedure is to check the bias requirement of the tape to be used at the recording session. This is a little more difficult, because most domestic type machines do not provide a facility for bias variation. One reason for this omission is because in unskilled hands better results would be obtained working to an average bias value, rather than a hopelessly inaccurate setting.

Where variable bias is available the correct value is easily determined. If a signal of fixed frequency and amplitude is recorded at a constant level whilst the bias level is varied from minimum through its full range to maximum, it will be found that there is an output variation from the tape recorder when the signal is played back. This is metered, and a note is made of the bias setting at the point of maximum output. This bias level is then increased by about ten per cent, and that is taken as the correct level for that spool of tape. If the necessary signal generator and meter should not be available, the test can be easily carried out by using the tuning signal from the radio as a fixed signal source; metering on playback can often be accomplished using a record level indicator in either the playback machine or another machine to show maximum amplitude.

Where bias alterations cannot be made it is essential for the recordist to ensure that the tape he is proposing to use has roughly the same bias requirement as that provided by the machine on which he intends to use it. A rough check is

easily made by comparing the outputs from various brands of tape using the kind recommended for use with the machine as a standard. For critical recording work use either the recommended brand or an alternative which gives, as nearly as can be judged, an equal output.

None of the procedures outlined above are either difficult to perform or very time consuming; the whole routine need take no more than five or ten minutes. Rather more time should be spent on checking cables and connections, taking special care to note if hum is present. A tiny whisker of wire from the braiding of a microphone lead can easily make contact with one of the conductors, and when this happens a very nasty hum will be recorded. The simplest test for the presence of hum is to connect the microphone (remembering to insert any extension leads that might be required for the actual recording), put the machine into record mode and increase the level gradually towards maximum. If this is done in complete silence there should be no appreciable movement in the record level indicator. If hum is present on the line the indicator will show the presence of a signal which increases as the gain increases, and decreases as it is brought down. As soon as you observe a steady movement in the record level indicator relating precisely to movement in the gain control, always suspect hum in the mike line. Remove extension cables from the line and check again. If the hum has disappeared you have traced it to one of the connections in the extension cable; if it is still there it is probably in the first plug in the line.

To clear the fault, open up the suspect connector and you will almost certainly find the cause of the trouble very easily. After removing the short circuit and carefully resoldering, check that all mike leads are free from loose whiskers and reassemble the plug.

When using low impedance microphones in conjunction with a low to high transformer, hum can be induced in the transformer itself if it is directly in the path of mains cables. With the microphone in circuit and the gain turned well up, try moving the transformer about on its short lead. Note any positions where hum occurs—then avoid them in the future like the very plague.

One advantage of adopting these simple check procedures is to increase one’s own self-confidence. When attending for a serious recording session one is reassured by the knowledge that all possible steps have been taken to ensure that recorded quality will be the best that could possibly be obtained using the equipment available. And that, after all, is what we are trying to do.

UP TO  
**50%**  
OFF!

## FANTASTIC SAVINGS

We have a fantastic selection of tape recorders, new, shopsoiled and secondhand showing savings on the manufacturers' list price of up to 50%. Our quoted prices are absolutely unbeatable, so why not call at any of our showrooms and see the fantastic savings that we, as Britain's largest tape recorder specialists company, are able to offer you by virtue of our ability to purchase large quantities and pass the savings thus obtained on to you! (Personal Callers only.)

- UNBEATABLE NO-INTEREST TERMS
- OVER 100 MODELS ON DISPLAY
- EXPERT STAFF EXPERT ADVICE
- GENEROUS PART EXCHANGES
- SAVINGS OF UP TO 50%

## THIS MONTH'S BARGAINS

PHILIPS EL4306—Latest 1967 4 track 2 speed model. List £44 2 0. Brand new, boxed.....	OUR PRICE	36gns.
SABA TK230—Superb 4 track 3 speed stereo model. Absolutely as new. List £100.....	OUR PRICE	45gns.
AKAI M8—Stereo. One only S.S. Latest 1967 Model. List £146	OUR PRICE	99gns.
WYNDSOR INTERNATIONAL—Superb 4 track 3 speed model. 10 watts output. Absolutely perfect condition. List £78.....	OUR PRICE	32gns.
AKAI 1710—Latest 4 track stereo. One only S.S. List £83.	OUR PRICE	64gns.
B. & O. 2000—2 track suitcase. Stereo. Absolutely as new. List £129.....	OUR PRICE	79gns.
AKAI X4—4 track stereo battery mains portable. List £143. Two only. Brand new (Brown model).....	OUR PRICE	79gns.
PHILIPS TYPE—Cassette battery mains portable. Brand new. List 27 gns. Few only.....	OUR PRICE	21gns.
PHILIPS EL4305—Latest 1967 model. List £37 16 0. Brand new, boxed. Few only.....	OUR PRICE	29½gns.
GRUNDIG TK45—4 track stereo. Perfect condition. 1 only. List £112.....	OUR PRICE	59gns.
PHILIPS EL3536—4 track mono stereo. Perfect condition. Original list £97.....	OUR PRICE	42gns.
UHER 4000S.—Superb 4 track. Battery mains portable. List £104. 1 only.....	OUR PRICE	59gns.
TELEFUNKEN 85KL—De luxe. Superb 2 track model. Brand new. List £95.....	OUR PRICE	59gns.
TANDBERG 64—4 track 3 speed tape deck. As new. List £115. One only.....	OUR PRICE	69gns.

PERSONAL CALLERS ONLY

**HURRY WHILE STILL AVAILABLE !**

**NuSound**  
TAPE RECORDER CENTRES

82 High HOLBORN, W.C.1 (200 yards Kingsway)	CHAncery 7401
228 BISHOPSGATE, E.C.2 (opposite Liverpool St. Station)	BIShopsgate 2609
36 LEWISHAM HIGH STREET, LEWISHAM, S.E.13	LEE Green 2399
242 4 PENTONVILLE ROAD, N.1 (200 yards Kings Cross)	TERminus 8200
2 MARYLAND STATION, STRATFORD, E.15	MARyland 5879

**633**  
the incomparable

# Ferrograph

We have never claimed perfection for the Ferrograph, but we believe it comes nearest of all to the ideal. Superbly engineered, with a specification that will withstand any test or evaluation, the Ferrograph adds enduring reliability to faithful recording. You'll enjoy moving up into the Ferrograph class.

**MODEL 633.** A monophonic recorder made, in limited numbers, for the connoisseur and professional. Guaranteed for 3 years and carrying a test certificate covering all important specification measurements. Spare parts—as with all Ferrograph instruments—are guaranteed available for at least 10 years.

**Model 633 120 gns. Model 633H 125 gns.**



- \* Three operational speeds: 633—1½, 3½ and 7½ i.p.s. 633H—3½, 7½ and 15 i.p.s.
- \* Monitoring of recorded programme.
- \* Comparison by "A-B" switching.
- \* Switched bias control.
- \* Level meter reads on both record and playback.
- \* Mixing facilities with separate gain controls.
- \* Modular construction to provide maximum service accessibility.
- \* Separate record and replay amplifiers.
- \* Separate record and replay heads.
- \* Fully compensated input socket for magnetic pick-up.
- \* Spot erase.
- \* 3 watts undistorted output.

Interested? Then complete and post this coupon to:

**THE FERROGRAPH CO. LIMITED**  
84 Blackfriars Road, London, S.E.1.

- Please send me the FREE illustrated Ferrograph leaflets.
- Please send me the comprehensive 64-page model 633 Ferrograph Manual, for which I enclose £1—refundable when I purchase my Ferrograph. (Tick items required in box at left)

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_



**Ferrograph**  
the incomparable tape recorder

T.R.M. BELIEVES THAT IN THE FUTURE WE SHALL LOOK BACK ON THE ARRIVAL OF CASSETTE SYSTEMS AS ONE OF THE MOST SIGNIFICANT DEVELOPMENTS OF RECENT YEARS

# THE CONVENIENCE OF CASSETTE AND CARTRIDGE

By Denis Gilbert

**I**F we look back through the history of the development of magnetic recording we will find that emphasis has not only been on improvement of quality. Much thought and effort has been devoted to convenience of use. Early wire recorders were not only inefficient, they were also highly inconvenient. The fine wire had a nasty habit of breaking very easily, developing kinks and all sorts of other troubles that are quite unknown to us today.

Paper tape was an improvement—until it got damp and soggy, until it dried out and shrank or until it stretched or broke. Plastic tape, as we know it today, seemed to be the answer. It was as near a perfect recording medium as one could wish for.

But it must be admitted that the system of two separate spools, involving threading the tape through the sound channel and lacing up on to an empty spool, is not the most convenient. It was predicted several years ago that the man who could develop an efficient cassette system would sweep the board and virtually monopolise the entire tape market. Well, we had our first cassette system, designed in this country and marketed by Garrard, and like so many new things it had its day and disappeared. Far from being a sensational success its sales were limited and its popularity waned.

It would be quite wrong to conclude from this that there would be no future in cassette systems. The basic trouble with the Garrard product was that it was really no more than a pair of standard spools enclosed in a rather cumbersome plastic case. Such a compromise was doomed to failure.

Which makes us wonder why, when new and revolutionary cassettes appeared as they did a couple of years ago, knowledgeable persons should bitterly complain about incompatibility, quoting differences in cassette sizes, differences in tape widths and differences in tape speeds. It was obvious that for a cassette to be successful it would have to embody a completely new and revolutionary approach. If a cassette had been designed so that it could be slapped on a piece of existing, standard, equipment, then that cassette would be so large and ungainly and inconvenient as to be useless.

The correct approach was developed on the Continent by Grundig and Philips. In both cases the cassette, a slim, neat, plastic container, was designed around tape half the width of standard recording tape, and

at the same time a special precision mechanism was built to accept it. The differences between the Grundig, or International DC system and the Philips, or Compact Cassette system, are relatively small. Small though they may be, however, they prevent one type of cassette being reproduced in the other type of mechanism. The DC system employs a slightly larger cassette and the tape speed is 2 ips. The Compact Cassette uses the same width of tape but the cassette itself is a little smaller, and the tape speed is  $1\frac{7}{8}$  ips.



**Of Japanese manufacture, the National RQ-3001S mono record/playback machine is typical of the new breed of ultra-lightweight cassette equipments**

There is, however, another fundamental difference between the systems. The Philips Compact Cassette system is capable of both recording and reproducing stereophonically when used in an appropriate stereo cassette machine. In conventional, quarter-track, spool-to-spool stereo recording adequate separation of the channels is ensured by placing them on alternate tracks on the tape; thus track one would be left-hand channel and track three right-hand channel—in the reverse direction track two would be left and track four right. This method has been abandoned in the Philips cassette system in favour of an adjacent track arrangement. Thus on  $\frac{1}{2}$ -inch wide tape the left-hand channel is track one, right is track two; in the reverse direction left is track four and right is track three.

The disadvantage of reduced channel separation (or, to put it another way, increased cross talk between channels) is the price that has to be paid for mono/stereo compatibility. If a pre-recorded stereo Musicassette (and all Musicassettes produced in this country are stereophonic) is reproduced on a mono machine, the head will scan tracks one and two, thus picking up



**Complete with its own built-in speaker, the Dansette JTR909 is a moderately priced portable with piano key operation, yet it weighs only 3 lb.**

both the stereo channels and resolving them into a single mono signal. When the same Musicassette is placed on a stereo machine equipped with a stereo head, then tracks one and two will be separately scanned, fed into the stereo amplifier and give the conventional right-hand and left-hand audio outputs.

The increase in cross talk is not such a disadvantage as might at first be thought. Since spurious pick-up will involve only feeding a small proportion of the desired programme into the wrong channel, its effect will be no more objectionable than a slight lessening of the stereo image. Practical tests have confirmed that where the sound source has a pleasing stereophonic separation between the channels, then this is preserved with satisfying reality in cassette reproduction.

We must clarify the reference to Musicassettes. This is the trade name given to pre-recorded music in cassette form on the Philips system only. To our knowledge there is no plan to introduce pre-recorded cassettes on the DC system into this country, although this material is available on the Continent.

A wide range of equipments designed around the Compact Cassette system are marketed by Philips (the EL3312 stereophonic record/playback machine was reviewed in our May edition) and a number of other manufacturers are now producing equipment based on the Philips deck. Notable examples include the Dansette JTR909 battery portable at 26 guineas and the Japanese manufactured National RQ3301S at £27 6s. Although the machines mentioned utilise identical decks, it is extremely interesting to note from the photographs how designers can produce such a variation of styling.

But the D.C. International and Compact Cassette systems are not the beginning and end of the story. Far from it. If we were



to break open either of these cassettes we would find within the plastic case what is basically a spool-to-spool system. This is made clear in the split Compact Cassette shown on our front cover. Another family of cassettes—or "cartridges" as they are more properly called—has been developed in America. Employing standard width, quarter-inch, recording tape, the plastic cartridge contains but a single spool which operates on the re-entrant principle. Since Philips achieve four stereophonic tracks on  $\frac{1}{4}$ -inch tape there should be no reason why quarter-inch tape could not satisfactorily hold eight tracks; and this is precisely what most of these systems do.

This type of equipment is often playback only, and its principle use in America is in motorcars and other mobile locations. Recently, however, there has been a trend towards the development of mechanisms suitable for domestic use at home. Up to now neither the playback equipment nor the pre-recorded cartridges have been available in this country.

Always first with the news, *TAPE Recording Magazine* is now able to report exclusively on the introduction of the very first eight-track cartridge machine to be brought into this country. At the time of writing even the name under which it will be marketed has not been finally decided. What is known, however, is that the first



As can be seen from the illustration above, the newly announced 8-track cartridge playback machine referred to in the text is to be called "Dyna-Sound Stereo 8." The pre-recorded,  $\frac{1}{4}$ -inch tape wraps itself around a single, central hub within the cartridge. Equipments of this type have proved to be very popular indeed in America, where a large number of motor cars are fitted with them as a matter of course. Will they be equally popular in Great Britain?

equipments to arrive will be available by the time this article is in print, and they will sell retail at approximately £42 complete with a pair of speakers and all the necessary wiring, etc. These machines will have been designed primarily for use in motor cars, but it is anticipated that static models for home use will also arrive in the very near future.

Such an equipment, designed for playback only, is useless without a convenient supply of pre-recorded cartridges to feed into it. Another piece of exclusive news is that E.M.I. Records Limited, of Hayes, propose importing these eight track cartridges into this country and they should be available within the immediate future.

One of the great advantages of a cartridge system that has been primarily designed for mobile use lies in the safety factor. The insertion of a cartridge immediately puts the system into operation without distracting the driver in any way; if he should be dissatisfied with the programme on that track, a mere touch of a button changes to another track sequence. All enquiries regarding both the machines and cartridges should be addressed to the importers, Mann and Rankin Limited of 2a Maygrove Road, London, NW6.

We live today in the cassette age. Those who have not handled these delightful products can have no idea of the great convenience they bring to tape recording. At the same time they are going to bring into the world of magnetic recording vast numbers of people who would otherwise regard it as too technical or too difficult. Far from reacting against these trends we welcome them as a logical extension of the medium that is ultimately going to bring great benefit to all who are interested in tape recording.

**S**INCE the launching of Musicassettes in October 1966, when Philips issued 26 releases and E.M.I. 20, two factors have dominated their development. Firstly, it was desirable to enlarge the release pattern to include as many manufacturers of pre-recorded music as possible. Not only E.M.I., but also Pye, Polydor and C.B.S. have now made their repertoire available. Secondly, it was necessary to extend the range and choice of repertoire for the consumer as rapidly as possible.

At the time of writing there are some two hundred titles available, ranging from classics and language courses to jazz and folk music, from light orchestral selections and original cast albums to some of the greatest artistes of the pop music scene today. And it is anticipated that this choice will be doubled by the autumn. Quite apart from the introduction of Musicassettes of playing times equivalent to L.P. records, we saw for the first time in May this year extended play Musicassettes, each containing four major pop hits by various artistes.

How did Musicassettes originate? The story began at the Hanover Fair in 1963. Philips demonstrated a small, portable, battery-operated cassette recorder, featuring simplicity of operation, extreme portability and reasonable cost. A modified version of this machine is still available today, and nearly 2,000,000 are now in consumer homes throughout the world. But that was only the beginning. The need for pre-recorded music on tape was never doubted—the problem was to bring the benefits of cassette operation into the field of commercial records. Many music lovers who have previously been under the impression that spool-to-spool tape recorders were too

THE  
MUSICASSETTE  
STORY  
BY  
WALTER WOYDA  
OF  
PHILIPS RECORDS LTD.

troublesome or mechanically complex could use cassette equipment with confidence.

After much research and experiment a way was found of offering pre-recorded music on Compact Cassettes, and the first Musicassettes were introduced in Holland and Germany in March 1965. A great deal of thought went into the further development of both the Musicassette itself, and its associated equipment. It was only in October last year that we in this country were able to introduce the familiar stereo/mono compatible Musicassettes.

Quality recording on  $\frac{1}{4}$ -inch tape at  $1\frac{1}{2}$  ips was at one time thought to be impossible; to obtain reliable sound reproduction and true stereo separation would be to realise a dream. Today we have both. This does not imply that the final result has been achieved; to the contrary, much research is still going on. Even at this stage of development, however, there are some 63 manufacturers of equipment throughout the world making both recorders and playback only equipment for the cassette system, and in addition more than 100 record labels have had repertoire issued on Musicassettes. In this country there are now some 16 different pieces of equipment, ranging from stereo home recorders and playback units to

car mono recorders and stereo reproducers, apart from a variety of items of portable equipment. Not only is this number growing rapidly, but the Musicassette repertoire is at present issued on no fewer than 18 commercial labels.

Of the system's many advantages, one of the most important is mono/stereo compatibility. This permits the Musicassette to become part of a complete system, allowing for true stereo reproduction in the home, stereo or mono reproduction in the car or boat and mono reproduction in portable equipment. The same Musicassette can therefore be enjoyed wherever the user wishes.

In addition to its more obvious entertainment value, the cassette system has an enormous potential as an educational aid. Because of its fast wind facility it is possible to select tracks and to allow for repetition. By an adaptation of the track combination, and by using special equipment, it is possible for the tutor to use one band and the student to record his answers on the other. By rewinding comparisons can be made between the student's version and the tutor's, and wrong answers can be erased. The tutor's track would, of course, be permanent. Such an equipment is not yet available but it is hoped that it will be by the end of this year.

The twin hub system employed within the cassette reduces friction built up by tape travel; less friction means less wear and longer life. Another ingenious feature is the provision of a pair of lugs on the spine of the cassette. If these two lugs are deliberately broken off and removed the recording within that cassette cannot be erased, either intentionally or accidentally. By means of rather clever mechanical interlocking it will be found that the recorder just will not go into record when such a cassette is inserted.

Although the cassette system has only been introduced relatively recently, it is developing at a truly astounding pace. Space does not permit me to romanticise with today's

(Please turn to page 269)

THE age of the airship is, perhaps, over. With it has died one of the most gracious and beautiful means of transport ever devised by man. Today's aircraft, apparently destined to become even noisier as they blast their way through the sound barrier, hurtle the passenger in his hermetically sealed tin can through the stratosphere. The traveller is subjected to boredom and psychological strain in roughly equal proportions.

There was no more beautiful sight than that of a giant airship as it nosed its leisurely way across the blue sky. For its passengers it offered a great deal more than a mere means of transport. To fly in an airship was an unforgettable experience.

But the airship is not quite an extinct breed. Outside the Iron Curtain there are now just three ships flying. Two, the *Columbia* and the *Mayflower*, are owned by Goodyears, and operate in the United States of America. The third is the German-based *Schwab*. She is owned by the great mail-order concern, Friedrich Schwab of Hanau, and is usually commissioned from March to October of each year.



The airship, Schwab, in which the author took many trips, about to take off

Now nearly twenty years old, this ship was built by Goodyears as the L.19 of the U.S. Navy. In 1961 a new envelope was made by one of the oldest aeronautical firms in the world, Ballon Fabrik of Augsburg. Elderly though she might be, the ship is still in excellent condition.

First named the *Underberg* and then rechristened *Guldenring* and latterly *Schwab*, she has been flying in Germany since March 16, 1956. Thanks to the co-operation of the various owners, I have been able to spend a few days with the ship almost every year since then. Since 1958 I have always carried a battery-operated tape recorder with me on these trips.

The first recorder I used was a Stuzzi. Later I changed to the smaller Belsona which, just turning the scales at 4 lb., was half the weight of the Stuzzi. However, neither machine gave me the convenience or ease of operation that was really required for this rather specialised work. I must admit that more than once when something rather special turned up the tapes got them-

## AN UNUSUAL ADVENTURE FROM RECORDING IN AN AIRSHIP

BY LORD VENTRY  
A REGULAR READER



Schwab in flight, photographed from the flight car of another airship

selves tangled in the excitement and what would have been a good recording was lost.

I was delighted when Philips introduced their cassette-loaded EL3300 battery tape recorder. Weighing only 4 lb., it is smaller than the Belsona, but its great advantage lies in the cassette system. These cassettes very rarely give trouble, and it is the work of a moment to take one out and insert a new one. The combined weight of my Kodak Instamatic 500 camera and the recorder is only about 5½ lb. It is an ideal outfit for recording scene and sound because both are cassette-loading.

The first real test of the cassette equipment was in 1964, when the BBC were kind enough to invite me to make recordings whilst flying in the airship. I had a grand time and learnt a lot, but how I pitied the professionals with their heavy, costly and complicated gear!

My very first airship tape recording was taken in 1958. At that time the Trumpf chocolate people of Aachen were also flying an airship and I was invited to participate when she was on trials. At that time I was using the Stuzzi, and instead of scribbling notes I just chatted away to the microphone. I shall never forget sitting out on the grass at Stuttgart on the lovely summer morning of July 17, 1958, listening to the playback. This material formed the basis of a report for *The Aeroplane*.

My first attempts at recording in the air were not very successful; I picked up far too much engine noise. From experience I learned the need to turn the gain control as low as possible, whilst at the same time bringing the microphone up fairly close to the mouth and speaking quietly. This arrangement produced just the right amount of background noise from the two motors, giving an authentic reality to the sound.

These airships are used for advertising purposes, and so their passage must be heard above the noise of traffic. The engines are of from 145 to 180 horse power each, and could easily be silenced if required. Unlike an aeroplane, an airship's

speed can be varied, just like a motorcar, by merely throttling down. In fact, the engines can be cut altogether when the ship will float in perfect silence.

When flying from Blankensee Airport, near the lovely Hanseatic city of Lubeck, we used to cruise along the Baltic coast, flying over bathers and boats and over the numerous camps which lined the shore. The pilot often hovered over the multi-coloured tents, and, with engines throttled well down, we would shout to the waving campers only 100 feet below us. Their replies could be clearly heard. With engines stopped the ship would drift with the wind in dead silence like a free balloon.

We often flew along the coast at less than 500 feet. Airships can operate at this height without risk; if the engines stopped she would gain altitude by merely dropping ballast. There is very little view from the small portholes of a modern aircraft. Life is very different in the low-flying, slow-cruising airship. Not only did we have a real bird's-eye view through large windows, but these could even be opened if we wished to lean out! Naturally, the earth-bound mortals used to wave enthusiastically to us, and we in turn would wave back.



The author at one of the airship windows as the craft is man-handled by ground staff

When I play my recordings these delightful scenes are vividly recalled. I remember Father arriving home just as we approached. Looking up at us he went inside and a few moments later came out again with the rest of the family. They all waved, the children dancing about with excitement as they watched the big silvery airship circling low over their heads. On another occasion we were flying through a lovely wooded valley, when we saw a fairy-like castle perched on a hilltop. If any of the inmates had heard the hum of our motors as we sailed by they could have looked down on us. Impressions of this kind were recorded with the tape recorder on my lap, and the microphone in my breast pocket. My favourite position was by the open window with the sun streaming in. It was sheer delight.

# RECORDING IN AN AIRSHIP



A Dutch liner off the New Jersey coast with part of the airship cabin structure well in the picture

When over a town I liked to move from one side of the airship car to the other. Then the tape recorder hung from its strap over my shoulder. As a motorist it was fascinating watching the traffic, following the fortunes of an individual car as it wormed its way from one jam to the next. Airships would be ideal for plotting "black spots." On board the ship there is no vibration, no bumping, and little noise can be heard when throttled down. Road planners could land after many hours aloft, still feeling fresh and free from strain.

On one occasion I wanted to record the mooring of the airship from the ground. To pass the time whilst waiting for her arrival I recorded the sounds of aeroplane and helicopter take-offs and landings. It was a lovely, sunny afternoon as I waited in the flight van to record the airship's landing. All very pleasant . . . All very sleepy . . . I woke up with a start. There was the airship already on the mooring mast only a few yards away. As I had dozed off she had come in so quietly that I had slept through it all.

Mooring an airship can be a rather delicate operation. One fine evening the *Trumpf* arrived after a twelve hour flight. Having burnt a lot of fuel she had lost weight and was very "light." As the propellers were put into reverse she started to rise with one of the ground crew hanging on to the car.

I was recording at the time, but had to immediately run forward to help man a handling guy to stop the ship from rising further. This could have been a very nasty episode, but the ship was soon brought under control again and no damage was done. At least I thought no damage had been done until I went to use the tape recorder again. In the excitement I had quite forgotten to switch off, and the batteries were exhausted.

The German airships are really very

modest in size, having a volume of about 157,000 cubic feet. At one time I was on board a U.S. Naval airship with a volume of just over 1,000,000 cubic feet. We cruised up and down off the New Jersey coast on a blindingly hot day. The bathers waved to us as we passed low overhead.

After some four hours in the air we came in to land on a large area of black tarmac. I was in the control car with half-a-dozen senior naval airship pilots. The pilot ballasted up, and made a nice aeroplane style landing. But then we suddenly caught a side gust of wind and started to move, crabwise, across the tarmac. At once the Captain dropped a thousand pounds of ballast and we took off again, passing rather close to some buildings. Nobody in the control car said a word. If only I had been on my own with the recorder in the officers' quarters on the upper deck of the 80-foot long car I could have recorded the event just as it happened. As it was I could hardly break the silence. On playing back this tape all one can hear of the drama is the screech of the landing wheel tyres as they hit the asphalt and then bounced off again. All too often I have found myself unable to take advantage of the most exciting moments.

However, I obtained some very valuable recordings of talks with the leading airship experts. The last one was with Admiral Rosendahl, who led the U.S. airships at the end of World War II. He is an acknowledged world expert, and we sat chatting on a lovely, sunny day in the garden of his house at Toms River. The background to that interview was the singing of birds and the sound of passing motorboats as they made their way up the river. A most delightful conversation, vividly brought to life whenever the tape is played back.

Is travel by airship dangerous? That depends what you mean by dangerous. The worst accident I ever suffered kept me out of action in hospital for four months. But that was nothing to do with airships at all—I simply tripped over a mat at home! When I went into hospital I took my well used cassette machine with me. Although very weak I could still handle it easily, and had some great fun recording nurses and doctors. But when I was taken down to the operating theatre they very unkindly switched the machine off, so I never did find out what they were up to whilst I was on the table.

But I am always impatient to be aloft. Thanks to the B.B.C. and Wing-Commander Turnbull, I was recently able to take the cassette recorder on its first free balloon run. This was a new experience, and the results were very interesting. Never satisfied, we hope to do better next time—but that could make another story.



Whilst on the subject of tape recorders in the sky take a look at this historic photograph. Jumping from an altitude of 12,000 feet during heavy weather conditions the parachutists are conducting, in free fall, the very first professionally recorded sky-diving interview. It has always been our contention that tape recording involves very much more than merely sitting at home and twiddling a few knobs—but surely this is carrying things a bit far!

The sky-divers are from the crack British Greenjackets' Parachute Club and the purpose of the interview was to put the new Ampex AG-20 battery-operated portable tape recorder through dramatic tests over Thruxton, England. It is said that the resultant recording was of high broadcast quality in spite of the severity of the treatment.

*Will readers please note that we do not, under any circumstances, propose adopting this procedure as a standard test routine in our own machine reviews.—EDITOR.*

## THE BALLOON RACE

**I**n the age of space exploration and astronauts, the term "aeronaut" rarely finds a use, yet the aeronauts of yesterday were the real pioneers of man's conquest of the element. They, with their balloons, airships, and bi-planes, must be awarded the first honours of the air.

But, as this page proves, the quest for adventure is still followed by many. This month the sixth international balloon "race" across the Alps takes place. Of the seven entries, the single British one will be manned by Wing Commander Turnbull, who is referred to in the accompanying article by Lord Ventry. The Wing Commander will take with him a photographer, and he anticipates reaching a height of 17,000 feet. Lacking motive power the rest will depend upon air currents and prevailing winds.

We are advised that Thos. Cook, the travel agents, have been offering passenger places in competitors' balloons at £500 per ticket. This adventure is open to anyone with enough money—and enough courage—to take part. The contest is not a race in the accepted sense of the word; the prize is awarded to the crew who have exhibited the highest safety standards and the most accurate navigation.

Let us wish them bon voyage, favourable winds and safe landings.



The copying room at Walthamstow. The first bank of four machines are the two pairs of "mothers"; the eight "slaves" can be seen behind them. Ron Holmes, Works Manager, left, is talking to one of his technicians



The cutting machine senses a cutting signal recorded on the tape and stops in precisely the correct position for the operator to cut. Complete programme copies, together with leaders and hubs, are placed on the tray on the right

# MULTIPLE COPYING AT WALTHAMSTOW

By Laurence Graham

ONE of the disadvantages of music on tape is the cost of mass production. When making gramophone records the preparation of the master discs, "stamper" as they are called, is a highly skilled job; but once the stamper is in the press the manufacture of exact copies is a speedy and efficient business.

Music on tape cannot be mass produced in this simple manner. The process must involve some form of copying on exactly the same principle the amateur would use if he wanted to obtain a copy of an existing recording. The original, or master, tape is played back on one machine and re-recorded on to another.

Even when producing a single copy of a single recording this can be a lengthy and tedious job. If the original programme material is of, say, one hour's duration, then it will take exactly one hour to obtain a copy, plus of course the necessary setting-up time. If commercial tapes were to be duplicated in this way their cost would be enormous, and yet the basic principle of manufacture is precisely the same.

To investigate this problem in more detail I paid a visit to the Philips factory at Walthamstow. This is the works where Musicassettes are made. The difficulties that have to be overcome in the manufacture of ordinary, spool-to-spool, tape records must also be present in making Musicassettes, together with the added complication that the finished tape has to be enclosed in its plastic container. So by kind invitation of Philips Records Limited, and under the guidance of Mr. Ron Holmes, Works Manager, I was given an open invitation to inspect the various manufacturing processes.

The Philips works at Walthamstow covers a very large area and employs a great many people; the Musicassette Department is a small, self-contained unit in one corner of the works. Light and airy. I was at once struck by its apparent simplicity. Arranged in two separate sections, one comprises the copying and cutting room, and the other, larger, area is devoted to assembly and packing.

All the copying is carried out on what at first glance appears to be a battery of twelve standard professional Philips recorders. Closer investigation revealed the true nature of these machines; eight are "slaves" producing the copies, and four are "mothers," arranged in two pairs, playing back the masters.

The way in which the system operates is very ingenious. The first pair of mothers each have a master tape, the first being side one recorded *backwards*, the second carries side two, forwards. At the touch of a control these two machines start playing back simultaneously, and at the same time all eight slaves come into operation, each producing a complete copy. Since this copy is derived from the pair of mothers it will have the full programme, i.e. both sides, recorded on it simultaneously, and the reason for the apparently contrary direction arrangement is so that in the cutting room the individual programmes will be spooled off "right way round."

The duration of a single side is probably in the order of about twenty minutes. The recorded speed of the master tape is 15 ips and that of the copy must be  $1\frac{1}{4}$  ips. To save time the whole process is carried out at eight times the actual speeds. This means that the master is playing back at the fantastically fast speed of 120 ips, and the recording slaves run at 15 ips. Thus programmes are copied in one-eighth of the time it would take if the machines were to run at their true speeds.

But there is another complication. The slave machines are fitted with large spools

of one-eighth-inch wide tape. (For the sake of accuracy I should mention that the precise width of the tape is not one-eighth, but 150 thousandths of an inch.) When the equipment is first set up and put into operation the first pair of mothers will play back their programme. This will take something in the order of two, to two and a half, minutes. As soon as this dubbing is completed, that pair of mothers will immediately stop and fast wind back to the beginning of the programme again. Whilst this is happening the second pair of mothers take over and reproduce a second version of the same programme. When they come to the end of their tapes the first pair will have finished rewinding and will automatically go into playback whilst the second pair are fast winding ready for version number four.

It is most uncanny to watch these various operations being carried out automatically. A technician is in attendance to keep an eye on things, but all the switching is completely automatic. Once a copying session is started it will carry on unaided until reaching the end of the tapes on the slave machines. Truly a remarkable example of automation.

Something more is done besides just copying programme material. In between each complete programme a signal is recorded by the slaves to tell the automatic cutting machine exactly where to cut. In the event of any trouble or breakdown in the system this cutting signal is immediately put on all the copy tapes, thus ensuring that faulty recordings are always discarded and never packed and sold as perfect.

The completed copy tapes are taken across to the cutting machine where they are fitted with leaders, stamped with their Musicassette number, wound on to the special cassette hub, cut, fitted with leader tapes and hubs at the other end. All this sounds by description to be a long and laborious process. In fact the operations were so swift that my eyes simply could not follow them. Slap, slap, bang and it was

done. Virtually as quick as that. The dexterity of the operator was amazing. Several times I tried to follow the action of his hands, but he was always too quick for me.

From the cutting machine trays of recorded programme material go into the assembly department for fitting into their plastic cases. I am really quite ashamed when I think of my own bungling efforts to investigate the interior of a cassette. I did once get one apart, and I did manage to put it together again, but it took me the best part of ten minutes. These girls assemble their Musicassettes at a simply staggering rate. Each recording has to be precisely positioned on the base plate, a layer of insulating material inserted and the cover plate screwed into position. Next they travel to the labelling and then on to the packaging departments, where the plastic outer covers and card sleeves are inserted.



The assembly of recorded tapes into their plastic containers is delicate work at which the girl operatives excel



Each Musicassette is tested at the beginning and end of its programme. Note the apparently standard playback machines used for this task. The meters attached are simply to keep a check on current consumption, which must be within certain fixed limits

And that's really all there is to it. Just as simple as that. In this small corner of the Philips works about twelve thousand Musicassettes are produced every week. I particularly noted the available space for expansion. The existing mother machines could handle an additional eight slaves; as there are only eight slaves running at present, this would double the production capacity at a single stroke. Works Manager Ron Holmes is constantly devising new methods of cutting down time, particularly in the assembly department. Nuts and bolts for cassette assembly have been abandoned in favour of self-tapping screws. Self-tapping screws will be abandoned when more effi-

cient and more modern fixing methods have been perfected. All the time the accent is on progress and efficiency.

I have not mentioned the extensive test department. Comprehensive records are kept from all the slave units showing precisely what their performance has been from day to day. One of the aims of the testing department is to ensure that no copy shall ever vary more than plus or minus two dB from the original master tape. Flicking through the record sheets for the past week I noted that the recorded figures were well within these limits. As a further precaution the last programme produced by each slave on every spool is always discarded. This is a rule that is strictly adhered to—there's always the danger that a machine might have run out of tape just before the end of a programme. Just to make doubly sure, the beginning and end of every completed Musicassette is also individually checked.

Musicassettes have only been in production for about six months. The factory I toured is the only one in this country producing them. The expertise that has been developed in this short time can only be described as astounding. I have not the slightest doubt that whatever demands are made upon the Walthamstow factory they will be met—and at the same time the already high quality standard will most certainly be improved upon.

The final word was from Mr. Ron Holmes. "We have a good product here and we're proud of it. But in audio work there is always room for improvement and I believe that in a year or two we shall be turning out Musicassettes in such a quantity and of such a quality that will really surprise everyone." I am quite sure he is right.

## MUSICASSETTES from page 265

dreams, even though they may well be reality within a very few years. Confining ourselves to concrete fact, the autumn of this year and beginning of next year will bring many additions: a pre-amplified playback unit which can be plugged into any existing stereo reproducing audio system, a unit no larger than existing car radios but incorporating cassette playback and radio combined, automatic changers for cassettes and transistorised radios incorporating cassette playback facilities. All these things will be commonplace before twelve months have passed.

This month we shall see the introduction of 18 specially recorded L.P. Musicassettes in the Moods Orchestral series, providing ideal background music for motorcar use. In the autumn the choice of classical repertoire will be greatly extended. Playing time presents no difficulty; up to 90 minutes can be recorded on a single Musicassette, which, of course, is very much longer than either a conventional gramophone record or, indeed, an eight track cartridge. Although the single Musicassette is much further away, it will become a reality with the introduction of very low cost playback equipment, the first of which will be seen in the early autumn.

The Musicassette is not an enemy to the gramophone record—it is a partner. Its use makes it possible to listen to one's own choice and type of music in the most convenient form yet devised. And in more serious moments it can be used for learning and perfecting a foreign language. Time alone will tell how important a factor it will become in the audio world and how soon this will come about. Of its success there can be no doubt.

## A TRM REVIEW

### PHILIPS VISAPHONE INTERPRET LANGUAGE COURSE, FRENCH, CPL 0900 £4 12s. 6d.

Educationalists are agreed that the best way to learn a foreign language is to hear it spoken. For that reason we have had for many years language courses offered on gramophone records. These have certain disadvantages however; the records are cumbersome, liable to damage, and can only be reproduced on the gramophone at home. So one of the latest Musicassette developments is to offer "Interpret" courses in either French, German, Italian, or Spanish. In cassette form, together with accompanying textbook material. The one examined is that devoted to French.

The course arrives in a stout, hinged, cardboard container, within which is found a single Musicassette, a 104 page, hard-backed textbook and a small, pocket-size, paper-backed French/English and English/French vocabulary. The basis of the course is what, for want of a better word, must be referred to as a textbook. In fact it bears no resemblance whatsoever to the familiar school book; beautifully presented, it is lavishly—and humorously—illustrated on every page in full colour.

Most of the text comprises phrases in French with their English equivalents and illustrations alongside. These are divided into 36 chapters under a wide range of headings, such as Greeting, The Weather, At the Station, Paris by Night, In the Village, etc., etc. Obviously designed primarily with the holidaymaker in mind, the choice of phrases is particularly good. In the chapter entitled "Comprehension," I was relieved to

note the inclusion of the sentences: "Unfortunately I don't understand what you are saying. My knowledge of French is very limited," and also, "Yes, I do speak a little English." For some those words might represent the total knowledge required for a holiday in France.

But the more adventurous will, by a study of this course, be able to advise the dentist exactly which tooth is to be extracted, or discuss the "in" restaurants of Montmartre. And this is not all, because in addition to language instruction other chapters are devoted to French history, sociology and habits of French living generally. Did you know that frogs' legs were first tested for edibility during a severe famine in the Middle Ages? Did you know that the French eat snails simply because the vine-dressers of Burgundy realised that the only successful way to get rid of the vermin was to devise a recipe which would make them palatable? These facts will surely increase any Englishman's enjoyment of his visit.

The whole of the French/English dialogue in the book has been recorded in French on the single Musicassette, which replaces the several gramophone records of the more conventional language course. It was particularly noted that the lugs on the spine of the cassette had been removed, thus preventing accidental erasure. This may therefore be regarded as an indestructible recording. The way to learn is by endless repetition, and for this the cassette undoubtedly stands supreme. Phrases can be played back time and time again without risk of wear or damage, if a battery portable cassette machine is available all those otherwise wasted odd moments throughout the day can be turned to good use.

# CROSS

# TALK

## By Audios

SO we are to be deprived of the benefits of a local broadcasting station in London. The newly elected GLC have decided, in their wisdom, to abandon any plans their predecessors might have had and to tell the BBC they are just not interested.

The reason that this, one of the greatest capital cities in the world, is to be so deprived is one of cost. As I pointed out in this column several months ago, local broadcasting costs money and someone has to foot the bill. If the station is commercial, then the advertiser pays; an alternative method would have been to increase the normal BBC sound licence fee and so make the local station "sub-regional"—the obvious next step down the decentralisation ladder from existing, regional broadcasting structure.

However, in the event it was decided, not illogically, that the burden of cost should fall principally upon those who would most benefit, that is the citizens of the city or area that the local station was designed to serve. And the only way to gather in such revenue is via the rates. Hence the GLC's refusal to place an additional burden on the already tightly squeezed London ratepayer.

At least such a decision is sincere. It's a pleasant change to see a new Council exercising its prerogative to save, rather than spend, the ratepayers' money. On the other hand, I believe this to be a thoroughly mistaken and misguided approach.

The appalling tragedy of commercially run sound radio should be only too obvious to any who have had to endure it for even a short while in Canada or the United States. I am quite sure that most people, apart perhaps from a few vested commercial interests, would prefer to preserve the integrity of our sound broadcasting services, even if it means a small increase in the rates bill.

At least we have been saved the unending miseries of commercial radio. But in its place we in London are to have—nothing. If we want non-commercial local broadcasting then we must pay for it—if we don't want to pay for it then we shall at least have silence. And that sometimes is not such a bad thing.

OUR old friends, the Mechanical Copyright Protection Society, are getting themselves into hot water I see. The South Devon Tape Recording Club complain of being accused publicly of ignoring their obligations under the Copyright Act. South Devon point out that the choral recording to which MCPS referred consisted of work specially written and/or arranged. One of the items was the nursery rhyme theme, "Baa, Baa, Blacksheep."

It should be clearly understood that the function of MCPS is to protect the copyright interests of a published list of associated composers. They have no right to interfere with the recording of works that are either out of copyright, or are specially composed by persons unconnected with them. It is only too easy for the amateur to be wrongly impressed by apparent authority. It is one thing to comply with the law, but it is quite another to meet the unjust, bureaucratic demands, apparently backed by the full force of the law, of an official organisation.

Any Act of Parliament which is not capable of enforcement is a bad law. We all know perfectly well that within the privacy of the home the Copyright Act is infringed regularly by thousands and thousands of otherwise law abiding citizens. Do we gaoil half the population, or do we change the law? In the United States of America at the moment there is a move to throw out a Bill now before Congress on this very subject, simply because it is not only unenforceable but it also represents a gross and unwarranted intrusion into the private lives of individual citizens. If commonsense prevails there, perhaps it might also one day permeate the cloistered seclusion of Westminster.

IT was very pleasant to note that the June edition of *Tape Recorder* named three demonstrations at the Audio Fair as "most closely approaching the real thing." One of these was described as, "the clean, sweet tones of a piano reproduced in the Vortexion room by a stereo CBL feeding direct from its internal amplifiers to a pair of Wharfedale speakers."

This is extremely gratifying, since that tape was a copy of a master recorded live by your Editor. It underlines the wisdom of carefully studying his advice on microphone placing, since I happen to know that this was one of the most tricky recordings he has undertaken. The piano, a full-sized Steinway Grand, was in the corner of an ordinary, domestic living room. Under the very best conditions this could create enormous problems. In this case, however, the piano was "the wrong way round." The sound reflector, or lid, was bouncing the sound directly into the corner of the room a few inches away, instead of out across the main floor area.

Many would say that this was a hopeless recording situation. Moving the piano was impossible (have you ever tried swinging a grand piano about in a small room full of other furniture?) and yet the recording was acknowledged as one of the three best at the Fair. The equipment used was a Vortexion CBL recorder, a pair of Sennheiser 405 condenser microphones with specially made attenuators between the mikes and the recorder to reduce the heavy signal output to a level that could be handled by the machine.

Asked to comment on this, Denys Killick asserts that most of the credit is due to the fact that the piano was a superb instrument, professionally maintained, and the pianist

himself, Heinz Hershmann, had for many years been a leading concert performer.

He also added that, practising what he preaches, he actually took a second recording at that session using a pair of cardioid dynamic microphones costing well under £20 each. Although there was a detectable quality difference between these and the condensers, that difference was so small as to pass unnoticed by many. Certainly the second recording was well up to broadcasting standards, and in fact was better than a great deal of piano music regularly heard over the air.

*HAVE you seen the film, "The Spy with the Cold Nose"? If you did I wonder if you spotted the two Ferrograph recorders featured in several of the scenes. One was the familiar Model 631, but the other was the Industrial Model YD6A which the ordinary user doesn't come across very often. I am assured that both machines were used "live," and they functioned perfectly throughout the arduous filming. But then whoever heard of a spy with a tape recorder that didn't work?*

WE hear rumours that the Continental Telephone Supply Company, of New York, are contemplating marketing their products in Europe. This is not a statement calculated to arouse very great interest, until we learn that these devices include equipment specially designed for "bugging," or secret recording. There have been references to microphone cufflinks, wristwatch transmitters, briefcases with built-in tape recorders, fountain pens which jam transmissions on other eavesdropping equipment and cigarette lighters incorporating cameras and sound transmitters.

Well, well! What a jolly picture of living in the electronic age this presents! Apart from the fact that the unlicensed use of radio transmitting equipment is illegal, the mere thought of the kind of bugging that these devices are obviously intended to accomplish is utterly repugnant to all decent minded persons. It is just conceivable that this equipment might have some legitimate use—it is equally obvious that in the wrong hands it could be a source of constant abuse of the rights of the individual.

All reputable publications, in common with right thinking persons, will roundly condemn such practices. Let us hope that our legislators will take speedy steps to prohibit the marketing of such devices in this country. If we are to maintain the moral integrity of our chosen interest it is up to all of us, as individuals, to both refrain from dubious activities of this kind and to help to stamp them out. Personally I think even the secret live microphone at a party, which is certainly used for nothing more than honest fun, is one of the sourest jokes imaginable. Apart from which it usually doesn't cause much fun.

SOME years ago one of the tape manufacturers advertised his product by showing that it could be either frozen solid into a block of ice in the refrigerator, or boiled in a saucepan of water, and yet after both such drastic treatments its efficiency would be unimpaired.

I heard an amusing story the other day of an alleged complaint about this advertising. The enthusiast claimed that he had frozen and thawed his tape quite successfully without damage, but when he came to the boiling treatment he was really in trouble. What happened? "Well," he answered "I was all right till I put it in the boiling water, but then the spool melted . . . !"

# A glossary of tape terms—part 15

BY HARRY MACK

**THERMAL NOISE.** As the name indicates, this is a type of noise caused by heat. Current passing through a resistance generates heat, causes movement of particles of the conductor and sets up interference over a wide band of frequencies. (See also "White Noise.") This is troublesome at an early stage of amplification, where signal levels are small. The effect is caused by the electron stream through a valve, but should not be confused with "shot noise," generated by the same electron stream, but with a characteristic "rushing water" sound, caused by irregularity of the electron flow from the cathode.

Where carbon resistors are employed in early stages, a reduction of thermal noise can be gained by substituting wirewound or metal oxide components.

\* \* \*

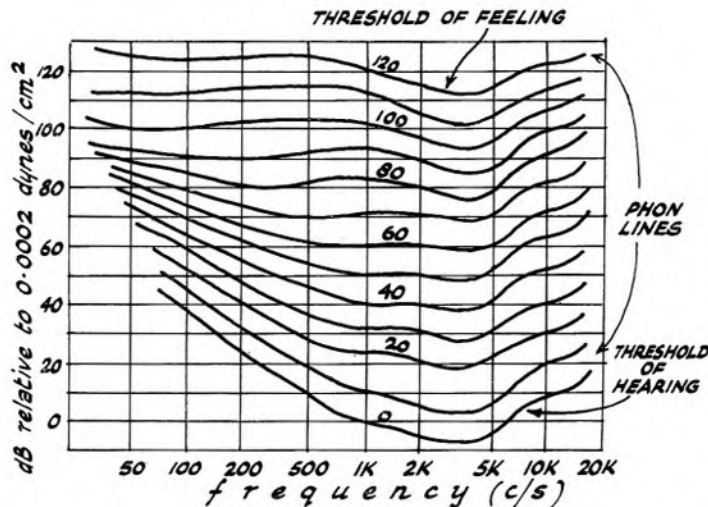
**THERMAL RUNAWAY.** Transistors are temperature-sensitive devices, and high ambient temperatures should be avoided. Where fitted, heat-sinks should always be correctly seated for maximum conduction. If a collector junction is allowed to heat up leakage currents will rise, causing an increase in junction current and a consequent rise in the temperature which causes more current, more heat and eventually the destruction of the transistor.

\* \* \*

**THERMOPLASTIC RECORDING.** A development that some authorities promise holds much for the future consists of varying the plasticity of a tape in proportion to the modulating audio frequency. A positively charged thermoplastic layer with a low melting point is used to coat the tape. This coating softens when heated and returns to normal when cooled. By heating the tape to the melting point of the charged thermoplastic layer and forming ripples by a modulating electron beam, a signal is imposed on the tape. This is "frozen" into the ripple formation by the dielectric process, and the modulated tape can be replayed through an optical system. The great advantage is the wide bandwidth that is available—theoretically, up to 50 MHz.

The disadvantage is the vacuum pumping equipment that is needed. The heating of the tape is performed by dielectric effect in a vacuum, and the ripples are formed by the electron beam of a cathode ray tube. One line of development consists of a tube with a mosaic of fine wires in place of the usual phosphor screen. These wires are embedded in the glass, and thus form an electrical extension of the beam which eliminates the need for vacuum sealing at the modulating point.

This technique, originally developed for radar purposes, may eventually solve some videotape problems.



The well-known Fletcher-Munson equal loudness contours, showing variations of the ear's response with the intensity of sound, and the upper and lower thresholds

**THREE-HEAD SYSTEM.** Method of tape recording which employs separate Record, Playback and Erase heads. The immediate advantage is the availability of the recorded signal for "off-tape monitoring." Other advantages include the improved head design possible when the playback and recording heads are tailored to their specific purpose and not, as with general combination heads, a technical compromise.

The term may occasionally be used to indicate the use of a separate head for bias purposes, as when "Cross-field" bias is employed.

\* \* \*

**THRESHOLD.** A term used in audio matters to denote the point at which feeling becomes hearing. Work done by Fletcher and Munson and the Bell Telephone Laboratories has made the Noise Criteria and Loudness curves and charts familiar. From these it is apparent that the human ear is not constantly sensitive to increases in amplitude. As pitch and timbre change, so do the impressions of loudness alter for sounds of the same measured output. The sensitivity of human ear is at a maximum around 3 kHz, where the threshold of hearing is at the lowest point. At the upper end of the sound intensity spectrum, the loudness level of some 120 phons again gives us a threshold—this time of feeling, sometimes called the "threshold of pain."

\* \* \*

**TIMBRE.** Distinctive quality of a note, independent of its volume or pitch. Thus, the sound of a particular instrument makes

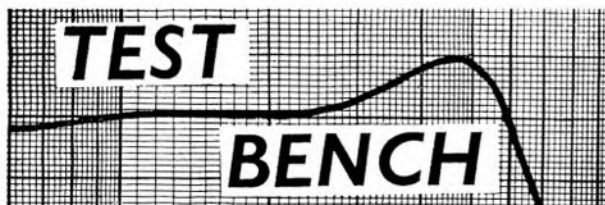
it recognisable whether played loud or soft, high or low. This distinctiveness is caused by the relationships of the harmonics produced by the instrument. Much of the work done in tape recorder amplifiers and in hi-fi research generally is specifically aimed at preserving the timbre of the original sound.

\* \* \*

**TIME CONSTANT.** (See also Standards.) This term is simply a statement of a resistor-capacitor combination that will give a known curve. The term can thus be used to define a curve and is used to define equalisation standards, now agreed internationally. The time constant of an R-C combination is obtained by multiplying the two values (in whole units) to obtain the time in seconds in which the capacitor will charge to 63.2 per cent of the applied voltage. A capacitor is frequency-conscious, its reactance falling as the applied frequency increases, and so there will be one particular frequency at which the reactance of the capacitor exactly equals the ohmic value of the resistance, and this point on our curve gives us the term "Turnover frequency," also dealt with later.

This term (time-constant), is also useful when applied to delay systems, as used in automatic tape recorder circuits. The controlling circuit has to rise quickly to its given value when an overload signal appears, and then discharge slowly to the standard level. The slow discharge, avoiding great discrepancies in level of the recorded sound, is achieved by designing circuits with a "long time constant."

Please turn to Page 273



# AKAI X-300

INVESTIGATED BY R. HIRST AND D. KILICK

## MANUFACTURER'S SPECIFICATION Akai X-300

Tape Speed: 3¼, 7½ ips with 15 ips optional.

Wow and Flutter: Less than 0.05 per cent RMS at 7½ ips. 0.085 per cent at 3¼ ips (Playback only).

Timing Accuracy: ±0.3 per cent at all tape speeds.

Frequency Response:  
30 to 24,000 Hz ±3 dB at 7½ ips  
30 to 18,000 Hz ±3 dB at 3¼ ips.

Distortion: Within 4.0 per cent, 1,000 Hz, 0 VU at 10 watts (total harmonic).

Signal/Noise Ratio: Better than 47 dB.

Crosstalk: Less than -82 dB Mono, less than -45 dB Stereo.

Input Level: Mic. more than 0.5 mV. Line more than 50 mV.

Power Output:  
25 watts at Music Power maximum on each channel:

20 watts at Undistorted Power Output maximum on each channel.

Equalisation: To N.A.B. curve.

Bias Frequency: 90 kHz.

Record Level Indicators: VU meters x 2.

Recording System: 2-track stereo/mono, Crossfield bias system; alternative model, 4-track.

Fast Wind Time: 45 seconds for 1,200 feet tape.

Maximum Reel Size: 10½ inch.

Heads: Four low impedance, one each, Record, Erase, Playback and Bias.

Motor: Hysteresis synchronous, 2 speed for direct drive capstan.

Speakers: 6 inch x 4 inch, one each channel.

Circuitry: 26 Transistors. 5 diodes and 1 Rectifier.

Power Supply: AC 100 to 240 Volts. 50/60 cycles.

Power Consumption: 55 VA (at non signal) to 140 VA (at maximum output).

Dimensions: 13½ inches high, 16½ inches wide and 9 inches deep.

Weight: 46.9 lbs.

Price: 185 guineas.

Distributors: Pullin Photographic Ltd., 11, Aintree Road, Perivale, Greenford, Middx.

AKAI X-300 TEST CHART, ½ TRACK MODEL

Frequency Hz	Overall Response dB		Playback Only dB	Signal/Noise Ratio dB	Crosstalk dB	Distortion
	7½ i.p.s.	3¼ i.p.s.				
40	+0.2	-2.0	0	-52	54	2.4%
50	+1	-1.8	+1			
60	+1.7	0	+1.5			
100	+1.8	+0.8	+1.6			
250	+0.6	+1	+0.4			
500	+0.5	0	+0.4			
1000	0	0	0			
2000	-0.8	-1.0	-1			
4000	-1.3	-1.8	-1.2			
6000	-2.0	-2.2	-1.8			
8000	-2.0	-2.4	-1.9			
10000	-2.0	-2.2	-1.7			
12000	-2.0	-2	-1.4			
14000	-1.5	-2.8	-1			
16000	-1.4		-0.8			
18000	-1.8		-0.8			
20000	-2.4		-1.5			
Wow and Flutter ....	0.04%	0.07%				

NOTES.—The Overall Response figures relate to record and playback. Playback Only relates to the reproduction of a 50 microsecond test tape at 7½ i.p.s. (N.A.B.).

For Signal-to-Noise Ratio the tape was recorded at peak level and then the input signal was removed from the record amplifier. By reference to the signal level recorded and the resultant tape noise, the noise voltage was read off, with the tape still in motion. Distortion is quoted against a 1,000 Hz signal recorded at the correct maximum level as indicated by the manufacturers, and the figure is an R.M.S. value.

Wow and Flutter is also R.M.S., the test frequency being 3,000 Hz. Test equipment used includes: Bruel and Kjaer Signal Generator, B & K. Frequency Analyser Type 2107, B & K. Level Recorder Type 2305, Marconi Distortion Factor Analyser and Gaumont-Kaylee Wow and Flutter Meter.

**R**ECENT reviews of recording equipment have all investigated machines of outstanding interest, and the present example is no exception. The Akai X-300 employs the much publicised "Crossfield" head system. Very briefly, this involves the application of high frequency bias to the tape during the recording process by means of a completely separate bias head which is brought into contact with the rear of the tape. The conventional system of biasing is, of course, to feed bias direct to

the record head together with the signal being recorded. The manufacturers have made claims of substantially improved frequency response, which they attribute to the use of the Crossfield head system.

It must be pointed out that the mere ability to either record or reproduce frequencies over an exceptionally wide range is of no value at all unless the response curve is reasonably flat, the distortion content low and the signal to noise ratio at least as good as obtainable on comparative equipment. With these



thoughts uppermost your reviewers took a very close and careful look at the Akai X-300, bearing in mind the results it is felt the consumer has a right to expect from equipment in this price range.

First impressions were of rugged construction and functional design. Weighing nearly 47 lb., the two remarkably robust lifting handles serve a double purpose as legs for vertical operation. They are moulded from what appears to be a non-scratch material for this purpose. Alternatively the machine may be used in the "horizontal" plane. This, in fact, is not quite horizontal since two pegs at the rear (which serve as cleats for storage of the mains lead) tilt the equipment forward into a convenient operating position. Neatly packed within the transit carton was found the most complete set of accessories we have yet seen with this class of machine.

The laboratory readings are quoted in the accompanying test chart, and reference to those figures will confirm that this instrument can be regarded as a truly professional device. We would particularly draw attention to the 7½ ips replay characteristic, which, as the specification indicates, is to the NAB equalisation standard, not CCIR. The curves obtained are really quite outstanding.

From the technical point of view it is a pleasure to find that the manual does not promise the performance of miracles; instead it presents a table of data that we found to be strictly adhered to as a minimum condition in the machine under test. In fact, the manufacturer's figures are somewhat inferior to those revealed by our investigation. The one exception, perhaps, relates to the power output, which is quoted at 25 watts per channel "Music Power." This term, Music Power, is a somewhat euphemistic American standard which can be misleading. There is undoubtedly a genuine 10 watts RMS output per channel by British standards, which should be enough to satisfy anyone. Readings for signal to noise ratio and crosstalk are exceptionally good, whilst the record distortion at 2.4 per cent is exemplary.

Summarising the laboratory tests we can confirm that the manufacturer's claims for extended frequency response are fully justified, since that response was achieved well within the quoted tolerance of plus or minus 3 dB. However, we do feel, as always, that technical excellence is meaningless unless it is closely allied to practical usefulness, and so we continued with user tests.

Vertical operation calls for some means of retaining the tape spools on their hubs—otherwise they will be liable to literally take flight. These might be in the form of screw hub caps or rubber retainers, both of which involve the use of small, separate, accessories liable to get lost. In the Akai the hub spindle is much longer than standard, and split into two parts, the top half of which is spring loaded. When the spool is placed on the machine the top half of the spindle is merely rotated half a turn to give complete security.

Tape transport functions are obtained by the operation of a row of five very substantial metal piano keys. These are, from

left to right, Rewind, Record, Stop, Start, and Fast Forward. The mechanical operation of these controls, and indeed of the tape transport system as a whole, was truly a joy to experience—offering exactly the smoothness and precision that one expects at this price level. Delightfully quiet in action, the mechanism performs the tasks expected of any good tape transport system, but it does so with a Rolls Royce feeling of efficiency, power, and reliability. An unusual deck control is the tape tension switch which enables the user to adjust mechanically to suit different spool sizes; surely this is a refinement which justifies our reference to Rolls Royce.

Surprisingly, the equalisation network is not ganged to the speed change switch; a separate equalisation control must be operated in conjunction with speed changing. Line In, Line Out and Extension Speaker sockets are all sensible jack connections, neatly grouped in a recessed panel on the right. Record level indicators are a pair of large VU meters lit by internal lamps for easy reading. They operate on both record and playback so that visual evidence of programme material being piped to a distant speaker is available. The equipment has a separate playback head and amplifiers, and the Before/After record monitoring selection is simply made by means of a two-way rocker switch on the front panel. This switch controls both the pair of internal speakers mounted, one for each channel, in the two sides of the recorder, and also the outlet to extension speaker sockets. Tone controls are conspicuous by their absence, apart from a push-button low frequency boost which is tucked away rather inconveniently on the jack socket recessed panel.

In use we soon established two rather severe criticisms. The record level controls comprise two pairs of ganged knobs, the upper half of each controlling the microphone input and the other half line. Playback volume level is also controlled by a pair of similarly styled knobs on the right. We must state that these record level controls are some of the worst we have had the misfortune to come across. Too small and too close together, their shiny surfaces are difficult to grip and fine adjustment is virtually impossible. Rotation of either the top or bottom half alters the setting of the other. There is no reference point on the deck itself, although the knobs do each have a single black engraved line. The importance of adequate gain controls cannot be overstressed, and we would regard this feature on the Akai X-300 to be its weakest and least professional. We would recommend users to remove the existing knobs and throw them away, replacing with more sensible substitutes after applying numeric transfers to the escutcheon plate.

The other criticism refers to ease of editing. This is something which should always be given high priority in the design of equipment for professional use. The operator must be able to inch the tape past a live playback head, and he must have clear access to the rear of the tape for marking with chinagraph. In the present case it was necessary to unscrew and completely remove the rear half of the head cover assembly, and even then access was not particularly convenient.

So much for our criticisms. For the rest of our user tests we have nothing but unqualified praise. The equipment performs in precisely the manner that the technical report leads one to expect. Naturally, the small internal speakers are not capable of handling anything like the (10 watts RMS!) output of the amplifiers. When a pair of

full range speakers are connected directly to the external speaker sockets the sound quality is exceptionally crisp, with a minimum of background noise.

The absence of tone controls was rather strange, but it must be remembered that in any professional applications tonal correction, if required, would always be applied at a later stage. The overriding professional requirement is for a flat response, and this the X-300 will give—to the NAB characteristic and providing one has not forgotten the cunningly concealed bass boost button—every time.

In our experience we have found throughout the years that, despite all developments of modern technology, quality sound recording is invariably equated with physical weight. No-one would suggest that this is an easily portable unit. We have the quality certainly but, as always, at the cost of weight. Transportation by car should, however, offer no difficulty. As previously mentioned, styling (apart from those wretched knobs) is ruggedly functional, and as such meets with our wholehearted approval; some ladies may find the X-300 to be less than ornamental in their drawing rooms.

We have tried to be as objective as possible and to make clear the few disadvantages we came across in this equipment. Bearing this in mind, we should like to add that this is a machine that both your reviewers would not only be proud to own, but which they would subject to continuous professional use without the slightest hesitation.

## GLOSSARY from page 271

**TIME CONTROL.** Method of remotely switching a tape recorder on and off, by a clock-controlled switch. This is useful both for some commercial applications, such as "musical wallpaper," or for sleep-learning. Crude methods simply make and break supply circuits, but more refined methods include neutralisation of the tape transport system, to avoid possible flattening of rubber-tyred idlers and pinch rollers.

**TIMING TAPE.** Although a stroboscope is the quickest and most direct method of measuring tape speed, there are occasions when its employment is not possible, either because the deck arrangements do not allow its fitting or insertion, or where a finely balanced clutch system will not tolerate any additional drag (especially if faulty!). In such cases a timing tape may be a convenient method. There are two approaches. Noises can be recorded on the tape at timed intervals, made visible with Indicord, or a similar preparation, and the pulses measured on the tape length. Alternatively, pulses or other recognisable audible signals (including silences made by blanking off small portions of tape) can be replayed and the resulting signals timed. Some errors may be made if short-term measurements are used and perhaps the best method is to make a loop of tape of given length, record a "knock" at one point of the loop, replay the loop and count the knocks over a period, averaging the total for the calculated speed.

As an example, a 3 ft. 9 in. loop of clean tape, played through at 3½ ips, will replay one "knock" as the joint passes every twelve seconds, or five times per minute. If the timing takes place over several minutes, variations in regular speed become apparent by the discrepancy between the expected and the actual "knock."

# AN ASSESSMENT OF MUSICASSETTE QUALITY

**T**HE comparative evaluation of either different pieces of equipment, or different sound sources, can be most revealing. The human ear is a highly sensitive instrument; unfortunately the area of the brain devoted to the interpretation of sound is often inefficient. It is not unusual to come across people who are "tone deaf." Their interpretation of sounds heard is so poor as to prevent them from distinguishing between sounds as far apart as a whole musical tone.

But even those of us who are pleased to believe that we have been endowed with fairly keen aural perception are quite lost when it comes to depending upon aural memory. This human weakness is very similar to the difficulty that most of us experience when trying to match colours visually. We might, perhaps, buy curtains believing them to be of exactly the same shade as an existing carpet: bring the two together and we find they are utterly different and clash horribly. Had we taken a sample of the carpet to the curtain shop we could have relied upon an immediate visual comparison to guide us in making a correct choice.

Much the same state of affairs exists in the world of sound. Most of us are incapable of carrying within our heads an accurate "sound memory." Valid opinions can only be based upon immediate comparisons by bringing the two different sounds together, and listening to the one against the other. Even in the simple task of matching two colours we would automatically take certain precautions; how many times have you walked out of the electric light of shop premises into the daylight so that you can be quite sure that your judgment is not being influenced by false coloration?

The close link between the visual and aural senses is underlined by our adoption of the word "coloration" into the audio vocabulary. Whenever we reproduce sound we inevitably subject it to coloration—when forming comparative judgments we have to go to great lengths to ensure that this coloration is, as nearly as possible, identical in both the sound

samples we are examining. So we do our best to precisely duplicate all the conditions present in one audio chain with the other, thus ensuring that the biggest difference will lie in the two items under test.

For instance, if we are comparing two different kinds of loudspeakers they should both be fed from identical sound sources via identical amplifiers, should be listened to at precisely the same volume level and should be placed as closely as possible together in the listening room. If we were to vary any one of these fixed conditions we should be introducing variables that would cloud our judgment. And even under the most perfect arrangement possible an unbiased assessment is never more than a subjective one, which may be valid only for the very fallible listener.



**The Shure V-15 Type II cartridge used in our comparative tests. Said to have been designed with the aid of a computer, the manufacturers refer to its performance in terms of "trackability" as a measure of total performance. High trackability is taken to mean that very heavily modulated records can be reproduced at low tracking forces without distortion**

So much for the basic difficulties of forming comparative judgments in audio matters. It was with some trepidation that we decided to investigate Musicassettes by comparison. A very interesting situation has arisen in the Musicassette world, of which readers might not perhaps be aware. Elsewhere in this issue we describe their manufacture by the multiple copying process from a master tape. But in a number of cases that master tape has not been used only to prepare Musicassettes—it has also been used

for the manufacture of gramophone records. Thus it is possible to obtain both a Musicassette and a gramophone record of the same work, both of which have originated from the same master tape. If we now wish to compare the cassette system with the conventional gramophone we can go right ahead and do it, merely by placing the record on the gramophone turntable, the Musicassette in the cassette machine, feeding the output from both into a common high quality amplifier to drive a full range speaker. If both programmes are started at precisely the same moment immediate comparisons can be made by switching between channels in the amplifier. The only difficulty likely to arise is in differences of volume; these must be carefully balanced up to match as nearly as possible.

As soon as we were aware of the existence of disc and cassette equivalents we began to assemble the necessary equipment to use in the tests. Concentrating first on the disc reproducing side, we determined to use some of the finest equipment available so that the gramophone records would be reproduced under as nearly ideal conditions as possible. The turntable used was the Thorens TD 124, together with an SME tone arm. This arm has been described in a previous issue. The cartridge used in the tone arm is obviously going to influence (or colour) the sound from the record, and so again we used one of the very finest obtainable; the newly designed Shure V-15 type II. This cartridge, costing £35 inclusive of purchase tax, has been widely acclaimed as the finest product yet from the famous house of Shure. Total cost of our disc reproducing equipment, without amplifiers or speakers—well over £100. We were determined to do justice to the records!

For cassette reproduction we simply used the Philips EL-3312 stereo machine, which costs 48 guineas. A Quad stereo amplifier and pair of really good speakers completed the set-up.

The items we had available for comparison are listed, with the disc equivalent reference numbers quoted in brackets:

*J. S. Bach, Suites Nos. 3 and 4, CPC 0007 (835 350 AY).*

*Tchaikovsky, Excerpts from Swan Lake, CPC 0003 (835 142 AY).*

*Vivaldi, The Four Seasons, CPC 0002 (SAL 3582).*

*Gerard Souzay Sings Operatic Arias, CPC 0006 (SAL 3574).*

*Petula Clark, I Couldn't Live Without Your Love, CYP 150 (NSPL 18148).*

*Nancy Sinatra, Nancy in London, CRP 354 (RSLP 6221).*

*Herb Alpert and the Tijuana Brass, Going Places, CYP 156 (NSPL 28065).*

We are indebted to both Philips Records Limited and Pye Records Limited for mak-

# THE MANY MOODS OF



THE GREATEST RECORDING ORGANISATION IN THE WORLD

# MUSIC CASSETTES

**Manfred Mann**

Instrumentally Great

H.M.V. TC-CSD3594

**Russ Conway**

Concerto For Dreamers

Columbia TC-SCX3435

**Zoot Money**

Zoot

Columbia TC-SCX6075

**Matt Monro**

Love Is The Same  
Anywhere

Parlophone TC-PCS3020

E.M.I. RECORDS (THE GRAMOPHONE CO. LTD.) E.M.I. HOUSE, 20 MANCHESTER SQUARE, LONDON W.1

ing the discs listed above available to us.

Now comes the most difficult part of the job—to pass on to you, in words, the impressions we received from these comparative tests. We say impressions deliberately, because we are dealing here with the abstract world of sound in which the impression upon the listener is, in itself, the end product. Let us be honest and confess that in an evaluation of this kind it is virtually impossible to start without having some bias, or preconceived ideas. In the present case we knew full well what we expected to find. From our experience it was anticipated that we should establish that the Musicassette is inferior to the disc on a number of counts, particularly in respect of frequency response, signal-to-noise ratio and dynamic range. The very best we hoped for was to be able to reveal that the comparison was not too invidious. To assist us we took the precaution of inviting a gentleman with a lifetime's knowledge of professional sound applications to sit in our listening room with us so that we could have the benefit of his opinions to add to our own. Starting with the Vivaldi, we placed the disc on the gramophone turntable, the Musicassette in the playback machine, synchronised the start of both sources and then switched between them at random on the amplifier.

We are bound to report events truthfully as they occurred, and to our surprise it soon became evident that none of the listeners could say with any certainty whether the sound from the speakers originated from the disc or the tape! We played a guessing game for several minutes, switching from one to the other without the listeners' knowledge. The result was mystification and confusion.

We now continued the comparative tests,

but deliberately named the sound source whenever a change was made at the amplifier. This enabled the listeners to fix in their minds the slight, but distinctive, differences between the two. In the light of this experience the listening panel were able to achieve more than 50 per cent accuracy in determining which sound source was playing back during subsequent random, unannounced switching. There was absolutely no doubt at all that in this first attempt the demonstrative differences between the two systems were small enough to mislead even experienced ears. If we had reproduced the disc on cheap, "radiogram" type of equipment, there is little doubt that the Musicassette would have come out on top as an obviously superior medium.

It was not possible to establish an unchanging pattern in the comparisons between the other items in the repertoire. Very briefly we found that the Bach Suites had more presence (high frequency?) on disc than on cassette, as did the Swan Lake Excerpts. Petula Clark on disc really came to life against a more leaden quality on cassette. On the other hand there was little detectable difference in the Souzay recital. Nancy Sinatra or Herb Alpert. In no case did we find that the cassette was superior to the disc—we should have been staggered if we had!

So what does all this mean? Summarising our experiments we can say that without doubt Musicassettes are capable of offering sound of a quality nearly as good as, and sometimes as good as, conventional gramophone records. But the overriding factor is that the records used were brand new and were reproduced on the very best equipment. We would like to extend the summary by adding that, in our opinion, the

sound quality obtained from Musicassettes will be better than that obtained from their disc equivalents if the discs are reproduced other than under the very best conditions.

Strictly speaking, we should have completed this evaluation by playing both a disc and a cassette for, say, 500 times, and then carried out further comparisons. However, this would have been rather pointless, since little change could be expected, if any at all, in the gramophone record under the controlled conditions in which it was being used (tracking force  $\frac{1}{2}$  gram!). We do however, have a statement from Philips relating to continuous use of Musicassettes. This is very interesting, because they have found that after 300 to 500 playings there is a very small, but just perceptible, increase in high frequency response. This is attributed to the lubricating effect of the tape. At 5,000 playings there is said to be no measurable loss of high frequency.

We in *TAPE Recording Magazine* might be expected to reach conclusions favourable to tape. Had our findings been otherwise we should not have hesitated to say so. As it is we can do no more than recommend discs for those who have the time, patience and money to reproduce them ideally, but for others Musicassettes would represent an excellent long term investment, assuring the owner of maintained quality standards over what must be regarded as an indefinite period of time.

At some future date we should like to carry out similar comparative tests between gramophone records and spool-to-spool, pre-recorded tapes, preferably quarter track stereo,  $7\frac{1}{2}$  ips. But perhaps the manufacturers might not be too keen—such a careful examination might just possibly be damaging to the sales of gramophone records. Would any record companies like to accept the challenge?

## MUSIC ON TAPE

A selection of some of the best Stereo Tapes

**RAVEL.** Complete orchestral works, volume 2. *Daphnis and Chloé*. Complete ballet with chorus. André Cluytens and the Paris Conservatoire Orchestra. Angel ZS36109, four-track stereo,  $7\frac{1}{2}$  ips. 75s.

This album forms the second volume of a collection of Ravel's complete orchestral works in four volumes. It is devoted entirely to the one act ballet, *Daphnis and Chloé*. Volume 1 of this series has already been reviewed.

In this work success or failure depends largely upon achieving a successful balance between chorus and orchestra. In this endeavour the engineers have, in my opinion, been entirely successful. This balance is of vital importance because the chorus is used to produce a blend of sound which fuses—at times with high drama—into the tonal structure of the musical instrumentation.

Exotic in concept, the work is a succession of dramatic episodes. At first hearing the continuity may not be obvious; with deeper consideration a delightfully logical pattern emerges to form an emotionally stirring experience. In particular, the chorus rises to heights of descriptive interpretation rarely equalled and never exceeded in other compositions.

Recorded quality is good and the album is a very worthy continuation of the series. Volumes 3 and 4 will be reviewed at later dates.

**CHOPIN.** Tamás Vásáry, piano with the Berlin Philharmonic Orchestra conducted by Jerzy Semkow. Piano Concerto No. 1 in E Minor, Opus 11; Four Mazurkas Nos. 5, 46, 47 and 54; Four Scherzi, No. 1 Opus 20, No. 2, Opus 31, No. 3, Opus 39, No. 4, Opus 54. Ampex DKG 6453, 4-track stereo  $7\frac{1}{2}$  ips. 119s. 4d.

This Ampex album contains the piano concerto and four mazurkas on side one, duration 48 minutes, 44 seconds, and the four scherzi, duration 38 minutes, 11 seconds on side two. Within this eighty-odd minutes of programme time I found some of the finest piano recording and performance it has ever been my pleasure to come across.

The least satisfactory item must be said to be the concerto. But the blame for this is the composer's and no-one else's. All Chopin's musical genius was focused on the piano; as soon as he turned to orchestration the divine fire was reduced to conventional cliché. So we have in the piano concerto a masterly score for the soloist with an uninspired orchestral accompaniment.

But all this is compensated by Vásáry's performance, which is excellent, and the recorded quality of the instrument upon which he plays. The scherzi on side two are really thrilling. I must repeat that these recordings are amongst the finest I have ever come across—I shall use this tape as a standard against which to evaluate other piano recordings.

This collection can be strongly recommended to all lovers of Chopin and the piano. One word of warning. To get the full benefit of the delicious tone of this instrument it is necessary to reproduce the tape at a reasonably high volume level. If the playback level is too low the rich, low frequency content will be lost and the instrument will sound almost tinny. So close the windows, turn up the volume and enjoy this superb recording.

**MENDELSSOHN.** Symphony No. 4 in A Major, Opus 90 (Italian) and Symphony No. 5 in D Major, Opus 107 (Reformation). Berlin Philharmonic Orchestra conducted by Lorin Maazel. Ampex C 8684 4-track stereo  $7\frac{1}{2}$  ips. 75s.

When this tape was received for review I settled myself comfortably down to enjoy the Italian Symphony, one of my firm favourites. The first couple of bars had me leaping out of my chair looking anxiously at the playback machine and amplifier to see what was wrong. My first rather foolish thought was that the tape must be running at the wrong speed. Obviously it wasn't, because the pitch was right. A glance at the amplifier confirmed that all the controls were in their normal, flat positions. Regrettably, I settled down to listen to this recording without any prospect of enjoyment.

My complaints are two-fold: the tempo

is taken at a pace that to me seems to be ridiculously fast and, secondly, the sound quality is not what we expect from either Ampex or Deutsche Gramophon. Perhaps the criticism of sound quality is unfair. When the ear is thoroughly disturbed by other factors, in this case an "I-must-fight-the-clock" desperation, it is exceedingly difficult to preserve one's objectivity in other respects. There are many better versions of Mendelssohn's Fourth, which, after all, he had described himself as one of the jolliest symphonies he had ever written. I suggest that the reader acquires a version where the jolliness is not degraded into a game of catch-as-catch-can.

Symphony No. 5 on the other side is quite a different matter. The performance is as acceptable as the other was objectionable. There is a most interesting apparent improvement in sound quality, which I suspect is really the same in both works, thus proving the difficulty of preserving pure objectivity. The Reformation is heard rather less frequently than the Italian, but it is an equally perfect example of composition in the symphonic form.

Good as the performance and recording on this side might be, my listening was completely overshadowed by resentment against the rendering of the Fourth, and so I find it difficult to be enthusiastic. This tape could only be recommended where the purchaser already has an exemplary Fourth but badly needs a copy of the Fifth. Only under these circumstances could it be regarded as a good investment.

**DVORAK. Symphony No. 5 in E Minor. "From the New World." The London Philharmonic Orchestra conducted by Hugo Rignold. Phonoband C 3206. 4-track stereo 7½ ips. 56s.**

The Swedish firm of Studioproducter have recently been advertising Phonoband tapes in this magazine, and I was very intrigued to hear what quality this label offers and also to see how the tapes are presented. The tape box itself is very similar to other well-known brands, being beautifully illustrated and provided with brief sleeve notes on the reverse side. We could complain that the tape itself is not equipped with leaders, but then neither are Ampex or E.M.I. imported. One feature the Phonoband tape does lack is an adequate label on the spool itself. All it has is a small stick-on quoting the reference number of the tape.

The price structure of Phonoband recordings is interesting. 75s. has come to be regarded as a standard price for L.P. record equivalents, having a duration of about 20 minutes per side. In the Phonoband list there are five graduated prices ranging from 83s. to 48s. covering approximate programme times of from 70 to 20 minutes. The tape now being reviewed has a duration of 37 minutes and thus comes within the 30 to 40 minute group at 56s. All their 7-inch 7½ ips, 4-track stereo tapes are also available, at rather lower cost, in 3¼ ips versions. For instance, the 3¼ ips version of the review tape would cost 46s. instead of 56s. The price reduction on a 70-minute tape would be as much as 24s. This represents a sensible saving and would be of interest to those not concerned with the advantages of the faster speed.

With regard to recorded quality I have no complaints at all. Although perhaps not amongst the select few of the very best recordings, this is a wholly acceptable version of an extremely well-known work. The performance is workmanlike, if not inspired. Taken all round this recording is undoubtedly good value for money. If the

other items in the Phonoband catalogue are equally good then it will provide an interesting addition to the lists of music on tape already available in this country.

**ROMANTIC INSTRUMENTALS OF THE ISLANDS. Hawaii Calls. Capitol ZT 1987, 4-track stereo 7½ ips. 75s.**

This album is volume No. 5 in the series, "Favourite Instrumentals of the Islands." We are told in the record notes that it was actually recorded in Hawaii, and the claim for Hawaii Calls is that this is the authentic music of the island. "And this time," we are told, "there's a touch of Hawaiian organ too, adding its own lingering colour of romance. The sound of this wonderful instrument has been cherished by islanders since the musical instruments of the outside world first came to them."

Really! How naïve can one get? No sooner does one ask oneself this question than it is at once answered the moment the tape is reproduced. At first I thought it had an appallingly loud and obtrusive background noise. A second or two later the truth dawned—I was listening, not to background noise, but to the sound of the sea. Undoubtedly it was genuine, bluer than blue, Pacific rollers as they broke over the coral strands and lapped the burning yellow beaches of the Island of Peace.

The popular selection includes, on side one: *Hawaiian Wedding Song, Lovely Hula Hands, Maui Chimes, Ports of Paradise, Tiare O Tahiti* and *Aloha Sunset Land*. On side two we find: *Moonlight and Shadows, Little Brown Gal, Ua Like No A Like, Pagan Love Song, Isa Lei, A Medley Farewell to the Islands and Aloha Oe*. If we could filter out the organ (I'd hate to try to filter out the entire Pacific Ocean!) what would be left would not be bad—not bad at all. The haunting melodies of the South Seas have a peculiarly fascinating sweetness. Unfortunately clever people seem to find it impossible to resist the temptation to improve on perfection. I get the feeling that this is what has happened here. A pity, because sweetness can so easily turn to sourness.

**ARTISTRY IN BOSSA NOVA. Stan Kenton. Capitol ZT 1931, 4-track stereo 7½ ips. 75s.**

This album is described as originating "from the creative world" of Stan Kenton. The sleeve notes refer to subtle rhythms and power-house orchestra. If sheer sound output represents value for money, then on that count alone this tape must be one of the very best. The power-house produces umpteen decibels of rhythmically alternating current in the highest of Hi-fi traditions.

The album includes: *Artistry in Rhythm, Opus in Chartreuse, Interlude, Kentonova, Eager Beaver, Concerto to end all Concertos, Brasilia, Painted Rhythm, Opus in Pastels, Jump for Joe, Loco-Nova* and *Artistry in Bossa Nova*. Both performance and recording are to an equally high standard: they need to be to adequately handle the Kenton technique. Long influenced by the Latin American idiom, Stan Kenton himself scored these twelve numbers in Bossa Nova rhythms. The success of this album therefore depends mainly upon Stan's arranging. Does it come off?

Frankly, I think it does. Undoubtedly assisted by the excellent recorded quality, the pieces have a refreshing novelty that justifies the Kenton finger in the pie. If you are after quiet relaxing music then give this tape the widest possible berth—but if it's Kenton you want then this is pure Stan through and through and through.

## YOUR LOCAL DEALER

### LONDON

## Lee Electronics

THE TAPE RECORDER & HI-FI AUDIO SPECIALISTS  
400, EDGWARE RD., LONDON, W.2 (PAD 5521)

London's leading Stockists of High-Fidelity and Audio Equipment. Many bargains in new and reconditioned equipment.

SEND FOR FREE LISTS OF RECORDING TAPES, RECORDERS, AMPLIFIERS, ETC.



APPOINTED B. & O. AGENTS

- ★ TAPE RECORDER HIRE
- ★ TAPE TO DISC 78 & LP
- ★ RECORDING STUDIO
- ★ TAPE RECORDER REPAIRS
- ★ SALES—EXCHANGES

## MAGNEGRAPH

1, Hanway Place, London, W.1.  
Tel.: LANgham 2156

## Masseys Centre of Sound

West London's Hi-Fi Tape Recorder Specialist  
—Demonstration Room with Comparator  
APPOINTED FERROGRAPH DEALER

AT

### CHISWICK, W.4

Accessories, All Kinds—Servicing—Pre-Recorded  
Tapes Mono/Stereo  
121-123 High Road—10 a.m.—7 p.m.

◀ TEL: CHI 2082 ▶

(not closed for lunch)

## TAPE RECORDER HI-FI CENTRE (SHEEN) LTD.

— The Centre for —  
FRIENDLY HELP—SALES—SERVICE  
DEMONSTRATIONS ANY TIME—ALL PRE-RECORDED TAPES—STEREO—MONO  
LANGUAGES—DANCE—JAZZ—SHOWS  
CLASSICS, etc.—2 and 4 TRACK—STOCKISTS  
OF ALL MAKES AND MODELS OF RECORDERS  
AND HI-FI—Add sound to your movies with  
Synchronode—WE ARE STOCKISTS OF  
SYNCHRODEK  
TERMS—EXCHANGES, ETC.

3/4 STATION PARADE, SHEEN LANE,  
SHEEN, LONDON, S.W.14  
(Opposite Mortlake Station, S.R.)

Showroom: PROspect 0985

9 a.m.—6 p.m.; Fridays 9 a.m.—8 p.m.

**YOUR LOCAL DEALER**

**LONDON**

**WIMBLEDON'S TAPE RECORDER CENTRE**

**ALL LEADING MAKES IN STOCK**

Ferrograph - Telefunken - Loewe Opta - Saba - Wyndor  
Philips - Grundig - Ferguson - Brenell - Truvox - etc.  
P.e-Recorded Tapes: Mono & Stereo - Microphones -  
Accessories.

● **BARGAIN OF THE MONTH**  
**FI-CORD 202A ONLY 39 GNS.**

**TEL-LEE-RADIO**

**220 THE BROADWAY,  
Wimbledon, S.W.19. LIBerty 4946**

**THE SOUTH**

**SOUTHAMPTON**

**Tape Recorder Specialists**

**APPROVED AGENTS FOR—  
PHILIPS - GRUNDIG - FERROGRAPH  
VORTEXION, ETC.**

- ALL MAKES OF TAPE RECORDERS SUPPLIED
- ACCESSORIES AND HI-FI EQUIPMENT
- PART EXCHANGES AND SECOND-HAND MACHINES
- PROMPT AND SKILLED SERVICING

**RECORDING MACHINES LTD.**

**79 Queensway, Southampton  
Telephone: 27092**

**THE SOUTH WEST**

**TOM MOLLAND LTD.**

**Invite you to visit their  
well-equipped  
Demonstration Theatre and  
compare all the leading makes of  
Hi-Fi and Tape Equipment at**

**102 CORNWALL ST., PLYMOUTH  
Telephone 69282/3  
Immediate delivery to ALL Areas**

**WORTHING  
Tape Recorder  
Centre**

- Tape and Hi-Fi Experts
- Agents for all types of machines and equipment
- SERVICING & REPAIRS

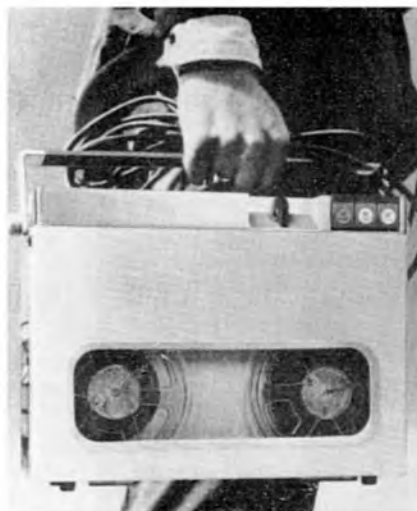
**THE MUSIC SHOP**

**22 NEW BROADWAY,  
Tarring Road, Worthing, Sussex.  
Telephone: Worthing 3630**

**NEW PRODUCTS**

**ALL-BRITISH  
DESIGN IN NEW  
AMPEX PORTABLE**

A NEW, battery-operated, portable professional tape recorder is announced by Ampex Corporation. The new model, AG-20, was developed by Ampex Electronics Limited, Reading, and will be shown for the first time at the Montreux Television Exhibition, May 22-26, in Switzerland.



The AG-20 is the Company's first battery-operated audio model. Weighing only 12 lb., less batteries, it is designed for professional recording applications in broadcasting, education, government, news reporting or other fields and studio applications where professional quality, light weight and ruggedness are essential. Designed around solid state electronics and a precision-milled, diecast, top plate, a unique closed loop DC servo system is said to maintain capstan speed over wide ranges of temperature and humidity, regardless of either reel size or battery conditions.

Said to be international in design concept, either NAB or CCIR equalisations are available. Users may select either XL type or DIN input/output connectors, and use U2 or D size batteries, any eleven to twenty-four volt external power source or a rechargeable battery pack. Three tape speed combinations can be provided on the AG-20, 1½ and 3½ ips, 3½ and 7½ ips, or 7½ and 15 ips. Seven-inch reels can be accommodated when the recorder lid is open, or five-inch when closed.

The claimed frequency response is from 50 to 16,000 Hertz, plus or minus 1.5 dB at 15 ips and 50 to 12,000 Hertz plus or minus 1.5 dB at 7½ ips. With slightly greater tolerances the frequency range is limited to 50-9,000 Hertz and 50-7,000 Hertz at 3½ and 1½ ips respectively. Signal-to-noise ratio is claimed at both 15 and 7½ ips as 60 dB for the full-track version and 55 dB half-

track. The quoted figures at 3½ ips are 55 dB full-track, 50 dB half-track, and at 1½ ips 50 dB full-track and 45 dB half-track. At 7½ ips tape acceleration to full speed occurs in less than half a second, and the tape is said to move less than one inch after depressing the stop key under the same conditions. A wide range of accessories will be available, and the price will be approximately £320.

Ampex International, 72, Berkeley Avenue, Reading, Berks.

**SWISS IMPORTS  
FROM  
DENHAM & MORLEY**

A NEW import from Switzerland is the Fidela range of 4-track tape decks, recorders, amplifiers and speakers. Manufactured by the Waltham Electronic Company, of Geneva, this equipment is now available in the UK through Denham & Morley Limited.

Representative of the range of tape recorders is Model 715, a 4-track, solid state, stereo recorder suitable for vertical or horizontal operation. A single, four-pole hysteresis motor drives the tape transport system; the machine is equipped with a VU meter and is capable of handling tape spools up to 7 inches in diameter. The claimed frequency response is 40 to 15,000 Hertz, dimensions 12 x 12 x 6½ inches and weight 15½ lb. Finished in a grained wood cabinet, with carrying handle and deck cover, the price is 75 guineas.

Model 707 is described as the world's most compact, 4-track, professional quality, stereo tape deck. Separate record and playback amplifiers are provided, together with three heads, three speeds and the possibility of vertical or horizontal operation. Frequency response is quoted as from 30 to 22,000 Hz, dimensions are 11½ x 8½ x 6 inches and the weight is 16 lb. Cabinet work is finished in matt walnut and the price is 119 guineas.



Model 780, shown above, comprises a tape deck of the highest quality similar in specification to Model 707 for vertical or horizontal operation. The bias is adjustable for optimum performance with different types of tape. Housed in a matt walnut cabinet the dimensions are 15½ x 14 x 8 inches, the weight is 22 lb., and the cost 145 guineas.

Denham & Morley Limited, Denmore House, 173/175, Cleveland Street, London, W.1.

## LOOK — NO CABLES!

FOR very many years the Audac Group of Companies has produced a range of quality audio and ancillary equipment for marketing solely under the brand name of other manufacturers. Consequently the name Audac is relatively little known amongst consumers.

However, following a move to a specially-designed factory at Wareham, Dorset, the company has decided that as a matter of future sales policy the majority of their products will be sold under their own brand name of AUDAC. Wholesale and retail sales outlets are being established for this purpose.



One of the latest additions to their range of VHF and UHF communications equipment is a cordless radio microphone system, to be known as "Hike-Mike." This system features the use of an exclusive integrated microphone/transmitter incorporating a microphone capsule complete with cavity transmitter unit and rechargeable power supply. The whole unit is no larger and weighs no more than the average studio quality microphone. Another exclusive feature is said to be the electronic switching unit which effectively mutes the receiver when the transmitter is switched off.

The microphone/transmitter, illustrated above, is available in four to five weeks, but since it forms only one part of a complete system which includes the essential receiving apparatus individual prices are not quoted. Prices for a complete system may be obtained upon application.

*Audac Marketing Company Limited,  
Forest Works, Carey Road, Wareham,  
Dorset.*

## A SMALL NEED IS MET

SOME portable battery machines will only accept very small-sized spools. To meet this demand Synchronotape announce the introduction of new 2½-inch reels in long and double play lengths.



The long-play 2½ Synchronotape has 250 feet of PVC tape and costs 5s. 9d., whilst the 350-foot double-play version retails at 8s. 9d. Both reels are in a new "see-through" plastic pack with colour-coded leaders. The Synchronotape "Free Insurance up to £25" scheme given with every 5-inch, 5½-inch and 7-inch reel as introduced last autumn will continue for at least the rest of 1967.

*Adastra Electronics Limited, 167, Finchley Road, London, NW3.*

## VERTICAL DECKS FOR HOME CONSTRUCTORS

VAN DER MOLEN are now marketing the well-known vertical tape deck mechanism as used in their VR4 and VR7 tape recorders. There have been a large number of requests, both from Hi-fi dealers and home constructors, for this deck as a separate unit since vertical mounting provides greater flexibility in the design of associated cabinets.



Accepting seven-inch spools complete with fast wind and rewind facilities and rev counter, the quoted wow and flutter at 7½ ips is 0.15 per cent, 0.25 per cent at 3½ ips and 0.35 per cent at 1½ ips. Normally supplied with quarter-track record/playback head and ferrite erase head, the price is 15 guineas.

*Van Der Molen Limited, 42, Mawney Road, Romford, Essex.*

## PHONOBAND TAPE RECORDS

THE Swedish firm, Studioprodukter of Stockholm, are introducing their catalogue of Phonoband tape records. All tastes are catered for in the classical, light classical and popular sections of the list. All tapes are 4-track stereo with rather lower prices for 3½ ips versions than for 7½ ips. Prices are graded according to programme length.

In addition, the Phono-Pop catalogue features half-track mono 3½ ips recordings, all at a single price of 38s.

*UK agent D. L. J. Seward, 47, Salisbury Road, Newton Hall Estate, Brasside, Framwell Gate Moor, County Durham.*

## YOUR LOCAL DEALER

### THE NORTH

CHESHIRE

**CHARLESWORTH'S**  
OF CREWE LTD.

Tape Recorder  
and Hi-Fi Specialists

Head Office: 14 Hightown, Crewe, Tel. 3327

Hi-Fi CENTRE: 28 HIGHTOWN, CREWE.

Technical Division: 19 Ludford St., Crewe.

## TAPE RECORDER CENTRE (Halifax)

stock all the best tape recorders and hi-fi equipment. Agents for Revox, Tandberg, Ferrograph, etc. Demonstrations by expert staff. Two years' free service on recorders over £35.

30 King Cross St., Halifax. Phone 66832

## CUSSINS & LIGHT LTD.

YORK'S LEADING RADIO  
TV & ELECTRICAL STORE

Visit our First Floor  
TAPE RECORDER  
CENTRE

LARGEST RANGE  
OF RECORDERS  
& ACCESSORIES  
IN THE NORTH

KING'S SQ.  
YORK



# CLASSIFIED ADVERTISEMENTS

Rate.—One shilling per word; box numbers, 2s. 6d. extra. Payment with copy, which should be sent to Advertising Department, "TAPE Recording Magazine," Prestige House, 14-18, Holborn, London, E.C.1.

## NEW EQUIPMENT

TAPE RECORDERS. SAVE FROM 30 per cent to 60 per cent on the original price. Large stocks of second-hand, new, shop-soiled machines. All guaranteed. Obtainable on our **NO INTEREST TERMS**. Best part exchange allowances on your existing equipment. CALL, WRITE, PHONE today for free list. Quotation and details. Our Mail Order covers the whole Country.—R. E. W. Earlsfield Ltd., 266, Upper Tooting Road, London, S.W.17. BALHAM 9174-5.

20 per cent CASH DISCOUNT on most famous makes of Tape Recorders, Hi-Fi equipment, Cameras and Type-writers. Join England's largest Mail Order Club now and enjoy the advantages of bulk buying. Send 5s. for membership card, catalogues, price lists or s.a.c. for free quotations and leaflets. C.B.A. (Dept. A5), 370, St. Albans Road, Watford, Herts.

W.H.M. WOW AND FLUTTER METER MODEL 3, £48. Literature and specification on request. 35, Villiers Road, WATFORD, Herts.

## FOR SALE

BLACKBURN has Lancashire's leading Hi-Fidelity / Tape Recorder stockists and Electronic Engineers at HOLDINGS AUDIO CENTRE, MINCING LANE/DARWIN STREET, BLACKBURN (Tel. 59595).

GEVAERT new boxed Recording Tapes: 600 ft. (5½ in. spool) at 9s. each or 6 for 50s. GRUNDIG 2-transistor Pre-amplifiers suitable for boosting microphones and tape head monitoring—listed at 4½ gns.—OFFERED NEW and boxed at 57s. 6d. each. LEE ELECTRONICS, 400, Edgware Road, W.2, PADDINGTON 5521.

VORTEXION WV8 4, ½ track, 7½ and 15 ips. A SUPERB INSTRUMENT capable of highest quality recording work. Seen S.W. London, £60 cash. No offers. Box No. 478.

30 PER CENT OFF BASF TAPE L.P. 7-in. reel, 1,800 ft., 33s. 3d.; D.P. 7-in. reel, 2,400 ft., 52s. 6d.; P. & P. 2s. per reel (4 post free). W.S.L., 104, NORWOOD HIGH ST., S.E.27.

## TAPE EXCHANGES

FRIENDLY FOLK ASSOCIATION, Torquay (Est. 1943). Social introductions, Pen-friends, Book-lovers, Stamps, Photography, Tapesponding. Members 100 countries.

Join TAPEMATES INTERNATIONAL and exchange tapes with friends throughout the World. Club and recording booths 6 p.m.-10.30 p.m. Tuesdays, Thursdays and Saturdays. 6, Holland Park Avenue, London, W.11.

Make interesting new friends UK and overseas, all ages. Join VICTORY CLUB, 34, Honeywell Road, London, S.W.11. Details free. Established 20 years.

LANGUAGES NO OBSTACLE TO ESPERANTO TAPE FRIENDS. Send Tape and Stamp to: THE ESPERANTO CENTRE, 1a, Graigs Avenue, Edinburgh 12.

## REPAIRS

OUR MODERN SERVICE DEPARTMENT equipped with the latest test equipment including a wow and flutter meter and multiplex Stereo Signal Generator is able to repair Hi Fi and Tape Recording Equipment to manufacturer's standard. TELESONIC LTD., 92 Tottenham Court Road, London, W.1. 01-636 8177.

## TAPE DUBBING

E.R.S. RECORDS: TAPE/DISC Vari-groove High Level Recordings with WIDE FREQUENCY RANGE. Top quality pressings. 162, SHIRLAND ROAD, LONDON, W.9.

J. & B. RECORDINGS. Tape/disc. Mobile unit. Quality recording. 14, Willows Avenue, Morden, Surrey. Mitcham 9952.

JOHN HASSELL RECORDINGS. Tape-to-Disc Service using latest high level disc-cutting system. Quality pressings made. Studio with Bechstein Grand, Mobile unit. 21, Nassau Road, London, S.W.13. RIVerside 7150.

TAPE-TO-DISC RECORDING. Finest professional quality. 10-inch LP—42s. (32 mins.), 12-inch LP—48s. (45 mins.), 7-inch EP—21s.

40ft. RECORDING STUDIO S.A.E. for leaflet to DEROY Sound Service, High Bank, Hawk Street, CARNFORTH, Lancs.

RAPID Recording Service. Records made from your own tapes (48-hour service). Master discs and pressings. Recording Studio—Demo discs. Mobile recordings, any distance. Brochure from: 21, Bishops Close, E.17.

## MISCELLANEOUS

HIGHEST CASH PRICES offered for good quality Tape Recorders and Hi-fi. See our advert., page 220 this issue. R.E.W., 266-8, Upper Tooting Road, London, S.W.17.

HI-FI and STEREO by modern CONTINENTAL manufacturers, and also latest Tape Recorders. Write to us for introductory leaflets and lists. Part-exchanges arranged. From WALLACE HEATON (CITY SALE) LTD., 93, Fleet Street, London, E.C.4.

YOU WILL BE GLAD to have contacted AUDIO SUPPLY ASSOCIATION before your next purchase of quality equipment. 65-page illustrated catalogue 5s. Unbiased advisory service, preferential terms. High quality records manufactured from suitable tapes. Bulk prices on pressings (choirs). 18, Blenheim Road, W.4. Tel.: 995 1661.

Anyone interested in exchanging MUSICASSETTES instead of buying new ones, please write enclosing stamp to: BROWN, BM/JCCB, LONDON, W.C.1.

## TAPE RECORDS

Every pre-recorded tape available in Britain is listed in the complete TELETAPE catalogue at 1s. 6d. post free.

Vast selection of Mono and Stereo tapes. Send now for your copy by return to: Mail Order Dept., TELETAPE Ltd., 11, Redvers Road, London, N.22, or call at our Marble Arch or Shaftesbury Avenue Showrooms.

Four-track Stereo Tapes are expensive! Join the W.S.L. Stereo Tape Library and enjoy every tape for only a few pence per day. **Worldwide Service**. Send 9d. postage for full details to: 104, Norwood High Street, London, S.E.27.

AMERICAN 4-TRACK STEREO TAPES ARE CHEAPER from DUBLIN—e.g. 9 Beethoven Symphonies complete J. Krips and L.S.O. £7 10s. Complete and up-to-date catalogue of all releases, prices, etc., 3s. MUSIC U.S.A., 201, Pearse Street, Dublin 2, IRELAND.

## PUBLICATIONS

YOU OUGHT TO send for a copy of "Psychology and Whisper Teaching" to York House, New North Road, Huddersfield (5s. 9d. post free).

NOW IN ITS SECOND REPRINT, Alan Beeby's informative handbook SOUND EFFECTS ON TAPE. Invaluable to all dramatists and recording enthusiasts. Tells in practical terms not only what to do but also how and why. 3s. 6d. post free. Remittance with order to Print & Press Services, Prestige House, 14-18, Holborn, London, E.C.1.

THE LAW and Your Tape Recorder by Andrew Phelan, Barrister-at-Law. Excellent NEW booklet which interprets many aspects of UK Law for tape recorder owners. 3s. 6d. post free. Remittance with order to: PRINT & PRESS SERVICES LTD., Prestige House, 14-18, Holborn, London, E.C.1.

A CURIOSITY? A COLLECTOR'S PIECE? Now available limited reprint edition of very first issue of TAPE Recording Magazine (Feb., 1957). 2s. 6d. (USA \$0.65) POST FREE. Cheque or postal order to TAPE, Prestige House, 14-18, Holborn, London, E.C.1.

## EDUCATIONAL

LEARN WHILE YOU SLEEP: GCF and Professional subjects. Languages, etc. Free booklet from THE SLEEP LEARNING ASSOCIATION, 14 Belzies Crescent, London, N.W.3. Tel.: SWI 6160.

## MAGNETIC TAPE

ILFORD ZONATAPE — guaranteed shop quality sealed—Polyester Long Play—5in. 900 ft. (list 28s.), one 18s., two 34s., three 50s. 5½in. 1200 ft. (list 35s.), one 24s., two 46s., three 66s. ALL POST FREE. HAYWOOD & SONS, 2, Edinburgh Avenue, Leeds 12.

## THE INSTITUTE OF SLEEP-LEARNING

is pleased to announce

### A MAJOR BREAKTHROUGH IN SLEEP-LEARNING ECONOMICS

At last we are able to offer a recorder which is not only ideal for Sleep-Learning and Therapy and gives excellent results on music but is at the same time at a sensationally low price—only 25 gns.

Send now for our latest free catalogue of Complete Sleep-Learning Kits and accessories including our special Induction Tapes, Pillow Speakers, Time Switches, etc., etc., together with latest Press Reports on this Vital New Subject.

THE INSTITUTE OF SLEEP-LEARNING  
Dept. TRM, 153, FELLOWS ROAD, SWISS COTTAGE, LON. O4, N.W.3.

01-722 3314

When you are  
ready for  
better equipment  
move up to  
LUSTRAPHONE  
quality

## LUSTRAPHONE

microphones : audio equipment  
accessories : components : fitments  
send for illustrated information

## LUSTRAPHONE LTD

St. George's Works, Regents Park Road,  
London, N.W.1 Telephone: 01-722 8844



## GLOBAL PRODUCTS

Global Mk. 2 Speed Erase. £5 16s. 0d. including postage.  
**PRE-RECORDED THEATRE ORGAN TAPES**  
 An interesting selection of Organs and organists, for the music lover and organ enthusiasts.  
 "Intermission" Global Tape 6531  
 "Tango Bolero," "Blaze Away" etc., on the Compton Organ, £1 1s. 0d. including postage.  
**Traditional Jazz.** "Steve Lane's" Southern Stompers  
 "King Porter Stomp," "Snake Hips," etc. Global Tape 6591. £1 1s. 0d.  
 "Vic Hammett" Wurlitzer Organ  
 "Brazil," "If I Had You," "Birth of the Blues," etc. 12in. Mono L.P. Saga-Society 1037.  
 10s. plus 2s. 6d. P. and P.

S.A.E. for Leaflets and Catalogue

P.O. BOX No. 1, ROTHWELL, KETTERING, NORTHANTS

## The Berean Forward Movement

(NON-DENOMINATIONAL)

Loan of over 1,000 reliable expositions of the Bible available on tape (3½ ips) for cost of postage only. For Bible Study groups or private meditation. Supporting literature also available. Details from: Miss R. Hammond, (TRM), Burwood, Blofield, NORWICH, Norfolk. NOR 84Z.

## LEDA RECORDING TAPE

THE ULTIMATE IN TAPE VALUE! Made to full specification. Leaders and trailers on all types 5" and above. Strong, attractive hinge-lid boxes.

**GUARANTEE.** If you do not agree that the quality of this tape is as high as any you have ever bought (irrespective of price!) we will immediately refund your money and return postage costs.

Standard Play (P.V.C.)	Long Play (P.V.C.)	Double Play (Polyester)	Triple Play (Polyester)
3" 150' 2/3	3" 225' 3/-	3" 300' 4/3	3" 600' 8/9
4" 300' 3/9	4" 450' 5/-	4" 600' 8/3	4" 900' 12/6
5" 600' 8/3	5" 900' 9/9	5" 1200' 15/3	5" 1800' 22/6
5½" 900' 10/-	5½" 1200' 12/3	5½" 1800' 19/3	5½" 2400' 28/6
7" 1200' 12/3	7" 1800' 17/3	7" 2400' 21/9	7" 3600' 38/6

P. & P. 2/6 per order. We also stock a wide range of accessories, all at lowest-ever prices.  
 S.A.E. list.

LEDA TAPES (T), 30 BAKER STREET, LONDON, W.1

## "PIONEERS IN SLEEP-LEARNING" THE COMPLETE PORTABLE SLEEP-O-MATIC UNIT

Comprising two speed transistorised tape recorder, auto time switch, under pillow speaker and microphone Price £27 10s., p. & p. 7s. 6d. Batteries 5s. extra. Mains Power Pack 50s. extra.

Specialists in Sleep-Learning and Audio Learning, tapes on Mind Management; Positive Personality; Memory Training; How to Pass Examinations, etc.

Free booklet on the above equipment, list of tapes and discs sent on receipt of postcard.

### EDUCATIONAL RECORDINGS LTD.

Dept. T.R.M., 21 Bishops Close, Church Lane, London, E.17

## ADVERTISEMENT INQUIRIES

### SERVICE

I should like further information about  
 Messrs ..... 's advertisement

on page..... of TAPE Recording Magazine  
 about..... (product)

NAME.....

ADDRESS.....

July 1967

*This is a special service for readers of "TAPE Recording Magazine." It enables you without cost to get fuller information about those products in which you are particularly interested. Fill in one coupon below for each inquiry, with your name and address in block capitals in each case. Then cut out the whole of this section, following the dotted line, fold as indicated overleaf and post to us.*

I should like further information about  
 Messrs ..... 's advertisement

on page..... of TAPE Recording Magazine  
 about..... (product)

NAME.....

ADDRESS.....

July 1967

I should like further information about  
 Messrs ..... 's advertisement

on page..... of TAPE Recording Magazine  
 about..... (product)

NAME.....

ADDRESS.....

July 1967

I should like further information about  
 Messrs ..... 's advertisement

on page..... of TAPE Recording Magazine  
 about..... (product)

NAME.....

ADDRESS.....

July 1967

I should like further information about  
 Messrs ..... 's advertisement

on page..... of TAPE Recording Magazine  
 about..... (product)

NAME.....

ADDRESS.....

July 1967

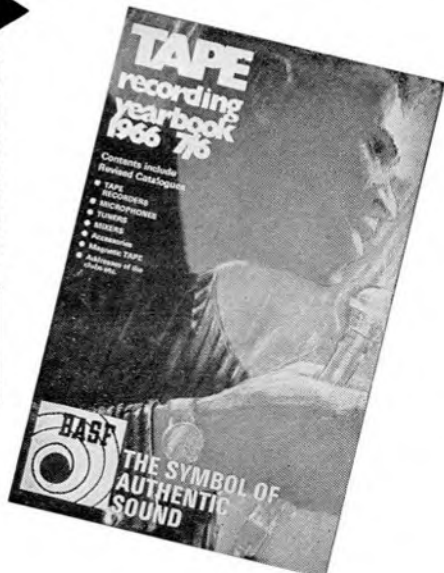
# ONLY ENGLISH ANNUAL TO DEAL EXCLUSIVELY WITH TAPE RECORDING SEND NOW FOR USEFUL 1966 EDITION

Fill-in & Post this Coupon with Remittance Today! ▶

To: TAPE Recording Magazine, 7 TUDOR STREET, LONDON, E.C.4  
 Please send me.....copy(ies) of TAPE Recording YEAR BOOK 1966, at 7s. 6d.  
 (U.S.A. \$1.25) per copy POST FREE. I enclose remittance.

NAME .....

ADDRESS.....



## TAPE YEAR BOOK the Recordist's Reference

PRICE  
**7/6**

- ★ The only available up-to-date comprehensive catalogue of TAPE RECORDERS on the market with full specifications, price, etc., plus photographs.
- ★ Review of tape developments during the past year.
- ★ Manufacturers, dealers and Club Secretaries' addresses.
- ★ GLOSSARY of technical terms, "at-a-glance" tabulated catalogues of microphones, tuners, mixers, and associated accessories; Magnetic Tape Charts, etc.

*On sale at bookstalls or direct from publishers using coupon above*

..... CUT ALONG DOTTED LINE .....

POSTAGE  
WILL BE  
PAID BY  
PRINT AND  
PRESS  
SERVICES  
LIMITED

THIRD FOLD HERE

TAPE RECORDING MAGAZINE,  
7, TUDOR STREET,  
LONDON, E.C.4

BUSINESS REPLY FOLDER  
Licence No. ND 922

SECOND FOLD HERE

NO POSTAGE  
STAMP  
NECESSARY  
IF POSTED  
IN GREAT  
BRITAIN OR  
NORTHERN  
IRELAND

FIRST FOLD ALONG THIS LINE

FLAP A

FLAP B

Fold along lines as indicated and then tuck Flap A into Flap B



**ONE FINE  
STRAND  
TO CATCH  
THE FLY**

**One fine ribbon to catch the sound**

**in the...**

**GRAMPIAN - RIBBON MICROPHONE**

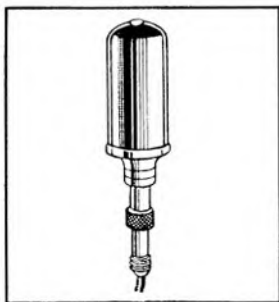
Perfection of reproduction is assured when you use this quality engineered microphone. The exceptionally wide flat frequency response, virtually level from 40 c/s to 15Kc/s combined with the excellent transient response make these microphones ideal for studio and similar work where a high standard of fidelity is always essential.

*Available in two models:*

**Model GR1**, has a semi-cardioid response giving a suppression of approximately 10dB to the higher frequencies at the rear of the microphone.

**Model GR2**, has a bi-directional "figure-of-eight" sensitivity pattern and is free from front-to-back frequency discrimination over the audible frequency range, in both the horizontal and vertical planes.

Both microphones are available in four different impedances 25/30, 200, 600 and 50,000 ohms.



A  
**Grampian**  
MICROPHONE

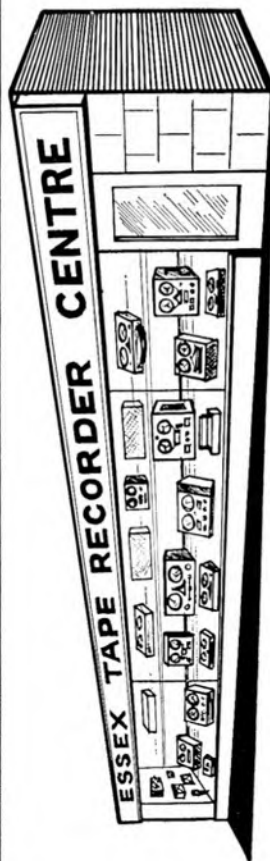
*Send for a technical data sheet to:*

**GRAMPIAN REPRODUCERS LTD.**  
Hanworth Trading Estate, Feltham, Middlesex. 01-894 9141.

**STOCKISTS OF EVERY LEADING MAKE**

AKAI, SONY, B & O, VORTEXION, TANDBERG, WYNDSOR, FERROGRAPH, AMPEX, REVOX, BRENNELL, PHILIPS, UHER, TELEFUNKEN, TRUVOX, ELTRA, REPS, GRUNDIG, VAN DER MOLEN, FERGUSON, SANYO, NATIONAL, DANSETTE, E.M.I., ETC.

- **GENEROUS PART EXCHANGES**
- **NO FUSS HIRE PURCHASE TERMS**
- **100% AFTER SALES SERVICE**



**IF YOU LIVE IN OR NEAR:**

**SOUTHEND, BRENTWOOD, COLCHESTER, ROMFORD, CHELMSFORD, GLACTON,  
BISHOPS STORTFORD, HARLOW, EPPING, LOUGHTON, ETC. ETC.**

**THEN THE ESSEX TAPE RECORDER CENTRE MUST BE YOUR AUTOMATIC CHOICE**

**2, MARYLAND STATION, STRATFORD, E.15 (ADJACENT MARYLAND POINT STATION) TEL: 01-534 5879**

*Parking facilities: Ample, unrestricted, free parking at rear of premises*

**ESSEX TAPE RECORDER CENTRE**

# cassettes go HI-FI



-with <sup>Trade Mark</sup> Scotch  
magnetic tape

It's the very latest 'Scotch' magnetic tape development and it means that hi-fi enthusiasts will want to take another look at cassette recorders. Now, for the first time ever, you can get cassettes containing the brilliant 'Scotch' magnetic tape with 'Superlife' coating. This tape has a flawless mirror-smooth coating that gives improved frequency response and less wear on the delicate recording heads—so it keeps its high quality far longer. With 'Scotch' magnetic tape the cassette recorder becomes a serious possibility as a second, portable machine—and with these new cassettes, the recordings you make will merit playing on your full-scale home set-up.

**Scotch** **Compact  
Cassette**



MINNESOTA MINING & MANUFACTURING CO. LTD.  
3M House, Wigmore Street, London W1. Telephone: HUNter 5522

*'3M' and 'SCOTCH' are trademarks of Minnesota Mining & Manufacturing Company*