

NOVEMBER 1970

TAPE

RECORDING MAGAZINE

3/-
15NP



LATEST VIDEO NEWS

Three Lectures
from Harrogate

TAPE WORKSHOP

Review: Sanyo MR-416

Cross Talk

Musicassette Reviews

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*New from
Bang & Olufsen!*

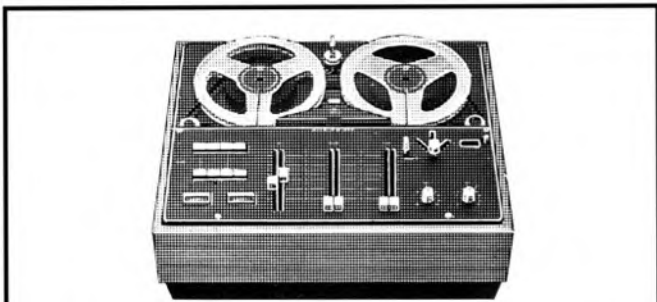
**The first name in Europe for
quality and design**

| | | |
|----------------|-------|---------|
| BEACORD 1800 | Price | £125.00 |
| BEACORD 2400 | Price | £175.00 |
| BEOLAB 5000 | Price | £125.00 |
| BEOMASTER 1600 | Price | £125.00 |
| BEOMIC 2000 | Price | £125.00 |
| BEOVOX 2600 | Price | £125.00 |
| BEOPHONO 1000 | Price | £125.00 |
| BEOPHONO 2000 | Price | £125.00 |
| BEOPHONO 3000 | Price | £125.00 |
| BEOPHONO 4000 | Price | £125.00 |
| BEOPHONO 5000 | Price | £125.00 |
| BEOPHONO 6000 | Price | £125.00 |
| BEOPHONO 7000 | Price | £125.00 |
| BEOPHONO 8000 | Price | £125.00 |
| BEOPHONO 9000 | Price | £125.00 |
| BEOPHONO 10000 | Price | £125.00 |

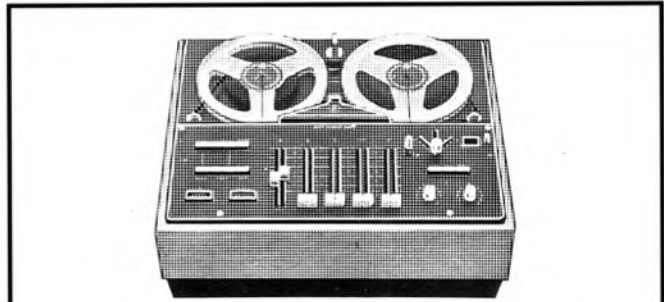


The Beocord 1800 and 2400 both exceed the minimum requirements of DIN 45 500 and have full mixing facilities for mike, radio/gram and line inputs. Foil operated auto stop plus thyristor controlled photo-stop for end of tape, tape break or programme scanning. Push button selection of A-B

monitoring, sound on sound, echo, syncroplay, mono left, mono right, mixed mono or stereo play. Hyperbolically ground tape heads give greatly improved contact between tape and tape head, less noise and less wear.

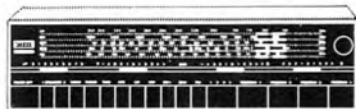


The Beocord 1800 — designed for use with a high fidelity amplifier such as the Beolab 5000 or Beomaster 1600. Available in two versions: ½ track record and replay with extra switched ¼ track replay head or ¼ track record and replay only. Sockets duplicated in DIN and phono types to simplify connection. Special amplifier and volume control for output to headphone sockets.



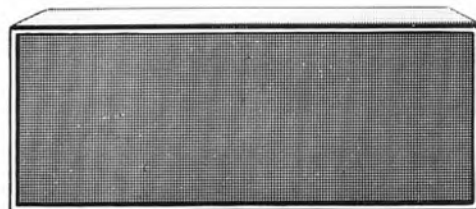
The Beocord 2400 — complete with its own stereo amplifier section giving 2 x 10 watts RMS output. ¼ track record and replay. 4 dual channel inputs in mixer section including a magnetic P.U. input. Bass, treble and split channel volume controls. Switched output for 2 pairs of speakers. The amplifier may be operated independent of the motor.

The Beomic 2000, the Beomaster 1600 and the Beovox 2600 — three brilliant new products to add to the range of superb tape recording equipment which has made Bang & Olufsen known and respected by professionals, enthusiasts and those amateurs who consider design and quality before price.



Beomaster 1600 — a multi-wave tuner/amplifier with integrated stereo decoder. Tape recorder input (DIN): 200 mV/1000 Hz — 500 KΩ; output (DIN): 100 mV/1000 Hz — 82 KΩ. Amplifier power output: 2 x 15 watts RMS, 2 x 20 watts music power. Frequency range: 30 Hz — 25 KHz ± 1 dB.

Beomic 2000 — dynamic mono microphone. Frequency response: 50 Hz — 15 KHz. Sensitivity: 0.1 mV/μ bar (-80 dB below 1 v/μ bar). Directional response: cardioid. An omni-directional capsule is available as an optional extra.



Beovox 2600 — matching speakers finished in teak or rosewood. Impedance: 4Ω. Maximum music power — 60 watts; max. RMS power — 30 watts. Frequency response: 35 Hz — 20 KHz.

Ask you appointed B & O Dealer or write for full details to:

Bang & Olufsen U.K. Limited, Eastbrook Road, Gloucester, GL4 7DE. Tel: 0452 21591

London Showrooms: 70/71, Welbeck Street, London, W.1. Tel: 01-486 2144



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14 TOP HITS with 14 STAR ACTS

BEACH BOYS: Cottonfields (from 'Beach Boys' Greatest Hits' TC-ST 21628)

LEE MARVIN: Wand'rin' Star (from 'Paint your Wagon' TC-SFPL 257)

BOOKER T & THE MG'S: Carry that weight (from 'McLemore Avenue' TC-SXATS 1031)

CILLA BLACK: Sweet Inspiration: (from 'Sweet Inspiration' TC-PCS 7103)

GLEN CAMPBELL: Honey come back (from 'Try a little kindness' TC-E-SW 389)

DEEP PURPLE: Into the fire (from 'Deep Purple in Rock' TC-SHVL 777)

ROGER WHITTAKER: I don't believe in If any more (from 'I don't believe in If any more' TC-SCX 6404)

THE PIPKINS: Gimme dat Ding (from 'Gimme dat Ding' TC-SCX 6418)

BOBBIE GENTRY: Raindrops keep fallin' on my head (from 'I'll never fall in love again' TC-ST 21609)

PRETTY THINGS: The Good Mr. Square (from 'Parachute' TC-SHVL 774)

RUFUS THOMAS: Do the Funky Chicken (from 'Funky Chicken' TC-SXATS 1033)

HOLLIES: Carrie Ann (from 'Hollies' Greatest' TC-PCS 7057)

MAMA CASS: It's getting better (from 'Bubble Gum, Lemonade and something for Mama' TC-SSL 5014)

STEPPEWOLF: Hey Lawdy Mama (from 'Steppenwolf "Live"' TC-SSL 5029)

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4 TRACK STEREO/MONO

| | Deposit | | 12 Monthly Instalments | | Cash Price | |
|------------------|---------|-------|------------------------|-------|------------|-------|
| | £ | s. d. | £ | s. d. | £ | s. d. |
| Philips N2400 | 23 | 0 0 | 3 15 | 0 | 68 | 0 0 |
| Philips N4404 | 28 | 0 0 | 4 11 | 8 | 83 | 0 0 |
| Ferguson 3232 | 33 | 5 0 | 5 1 10 | | 93 | 5 0 |
| Sony MR929 | 33 | 4 9 | 5 6 10 | | 97 | 4 9 |
| Sony TC252 | 33 | 5 0 | 5 10 10 | | 99 | 15 0 |
| Philips N4407 | 35 | 0 0 | 6 13 4 | | 105 | 0 0 |
| Akai 1710L | 36 | 6 8 | 6 1 2 | | 109 | 0 0 |
| Sony MR939 | 38 | 13 6 | 6 2 3 | | 112 | 0 2 |
| Grundig TK247 | 37 | 10 0 | 6 5 0 | | 112 | 10 0 |
| Sony TC630 | 66 | 15 0 | 11 18 0 | | 199 | 15 0 |
| Sony TC230 | 40 | 11 9 | 6 15 0 | | 121 | 11 9 |
| Telefunken 204TS | 41 | 19 0 | 6 13 4 | | 124 | 19 0 |
| Philips N4408 | 47 | 0 0 | 7 13 4 | | 139 | 0 0 |
| Tandberg 1241X | 49 | 0 0 | 8 6 8 | | 149 | 0 0 |
| Sony TC540 | 50 | 15 0 | 8 5 0 | | 149 | 15 0 |
| Akai 1800 | 53 | 0 0 | 8 13 0 | | 158 | 0 0 |
| Akai 1800SD | 66 | 6 8 | 11 1 2 | | 199 | 0 0 |
| Akai M9 | 65 | 0 0 | 10 16 8 | | 195 | 0 0 |
| Ferrograph 722/4 | 82 | 14 9 | 13 6 8 | | 242 | 10 9 |
| Philips Pro 12 | 83 | 10 0 | 13 16 8 | | 249 | 10 0 |
| Revox 1122/24 | 78 | 15 0 | 13 2 6 | | 236 | 5 0 |

4 TRACK MONAURAL

| | Deposit | | 12 Monthly Instalments | | Cash Price | |
|------------------|---------|-------|------------------------|-------|------------|-------|
| | £ | s. d. | £ | s. d. | £ | s. d. |
| Fidelity Braemar | 11 | 12 8 | 1 17 4 | | 34 | 4 8 |
| Fidelity Studio | 15 | 17 10 | 2 10 2 | | 46 | 0 10 |
| Grundig TK149 | 18 | 18 10 | 3 1 8 | | 55 | 18 10 |
| Philips 4307 | 16 | 15 3 | 2 13 1 | | 48 | 11 11 |
| Telefunken 201 | 17 | 3 0 | 2 17 2 | | 51 | 9 0 |
| Ferguson 3238 | 20 | 12 0 | 3 5 0 | | 59 | 12 0 |
| Philips 4308 | 22 | 9 2 | 3 5 7 | | 60 | 9 10 |
| Ferguson 3249 | 22 | 9 2 | 3 5 7 | | 62 | 9 10 |
| Ferguson 3216 | 22 | 16 0 | 3 12 2 | | 66 | 2 0 |
| Tandberg 1541 | 28 | 0 0 | 4 10 0 | | 82 | 0 0 |

STEREO TAPE UNITS

| | Deposit | | 12 Monthly Instalments | | Cash Price | |
|-----------------|---------|-------|------------------------|-------|------------|-------|
| | £ | s. d. | £ | s. d. | £ | s. d. |
| Sony MR801 | 24 | 3 0 | 4 0 6 | | 72 | 9 0 |
| Sony TC252D | 24 | 9 0 | 4 0 6 | | 72 | 15 0 |
| Sony TC355 | 34 | 2 6 | 5 10 0 | | 100 | 2 6 |
| Tandberg 1641-X | 30 | 0 0 | 4 19 2 | | 89 | 10 0 |
| Akai 4000D | 30 | 18 8 | 4 18 4 | | 89 | 18 8 |
| Tandberg 3000X | 33 | 18 0 | 5 10 0 | | 99 | 18 0 |

CASSETTES

| | Deposit | | 12 Monthly Instalments | | Cash Price | |
|-----------------------|---------|-------|------------------------|-------|------------|-------|
| | £ | s. d. | £ | s. d. | £ | s. d. |
| Sony M48M | 7 | 5 0 | 1 3 4 | | 21 | 5 0 |
| Sony M410G | 11 | 5 0 | 1 17 6 | | 33 | 15 0 |
| Mns/Bat... | 11 | 5 0 | 1 17 6 | | 33 | 15 0 |
| Philips RR290 + Radio | 11 | 10 0 | 1 17 6 | | 34 | 0 0 |
| Sony TC100A | 14 | 9 3 | 2 6 8 | | 42 | 9 6 |
| Mns/Bat... | 14 | 9 3 | 2 6 8 | | 42 | 9 6 |
| Sony MR411 | 16 | 15 0 | 2 15 0 | | 49 | 15 0 |
| Mns/Bat+FM/AM | 22 | 14 0 | 3 15 6 | | 68 | 0 0 |
| Philips 2400 Stereo | 22 | 14 0 | 3 15 6 | | 68 | 0 0 |
| Philips 2400 | 28 | 14 0 | 4 15 6 | | 86 | 0 0 |
| incl. L. Spkrs. | 28 | 14 0 | 4 15 6 | | 86 | 0 0 |
| Sony TC130 Stereo | 37 | 10 0 | 6 5 0 | | 112 | 10 0 |

BATTERY OPERATED

| | | | | | | |
|------------------|----|------|---------|--|-----|------|
| Philips RR290 | 11 | 10 0 | 1 17 6 | | 34 | 0 0 |
| Grundig C200 | 12 | 7 6 | 2 0 10 | | 37 | 17 6 |
| Philips RR482 | 18 | 4 0 | 3 0 8 | | 54 | 12 0 |
| Telefunken 302TS | 22 | 15 0 | 3 15 10 | | 68 | 5 0 |
| Uher 4000L | 48 | 10 0 | 8 1 8 | | 145 | 10 0 |
| Uher 4200/4400 | 62 | 10 0 | 10 7 11 | | 187 | 5 0 |

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OUR PRICE 95gns.
Deposit £33 15 0 12 Payments of £5 18 3. Total H.P. Price £104 14 0.

AKAI 1710L STEREO
3 Speeds, 4 Track, 2 Built-in speakers. Demonstration Tape, Black Leather with Carrying Handle.
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And an illuminated VU type meter for control of recording level. The machine can be used in a vertical or horizontal position and has its own two loudspeakers and moving coil mono microphone.

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Perfect complement to a good Hi-fi system

National designed their **RS-768US** tape deck for the connoisseur. It can be used with a stereo receiver, amplifier, FM/AM tuner, TV set or record player. There is a 3-tape head system, with separate heads for erasing, recording and playback, and a special tape cleaning device. Exclusive tape tension control. Wow and flutter are only 0.09% at 7½ in/sec, and the frequency range exceeds human audibility. The motor is a 4-pole hysteresis unit giving constant speed and accuracy, and there are twin VU meters on the control panel.

With perspex cover. Price £108.17.0



Abridged Specification - Model RS-768US

| | |
|-----------------|---|
| Circuits | 2 integrated circuits, 11 diodes |
| Track System | 4-track |
| Tape Speeds | 7½/3¾/1½ in/sec |
| Frequency Range | 7½ in/sec: 20-27,000 Hz 3¾ in/sec: 20-17,000 Hz 1½ in/sec: 20-10,000 Hz |
| Output | 2-line 100 kΩ-6 dB |
| Rewind/FF time | 135 sec approx. for standard 7" tape |
| Power Supply | AC 110/115/125/200/230/250V, 50-60 Hz |
| Cabinet Finish | Walnut |
| Dimensions | 18½" w x 8" h x 13½" d (472 x 202 x 339 mm) |
| | Weight: 24 lb 10 oz (11.2 kg) |



Model SA-420 is a 30-watt solid state FM/AM Stereo Tuner Amplifier embodying the advanced ITL-OTL-OCL circuitry for extra linearity over the full range of frequencies, giving distortion-free sound, and with automatic overload protection. Other features are an FM MPX circuit with automatic stereo/mono switching and a field strength meter to facilitate precise tuning. Price £96

Abridged Specification - Model SA-420

| | |
|------------------------|--|
| Frequency Range | FM: 88-108 MHz, AM: 525-1605 kHz (571-187 m) |
| Circuits | 38 transistors, 31 diodes |
| Music Power (IHC) | 30W at 4Ω, 20W at 8Ω |
| Continuous Power (RMS) | 11/11W at 4Ω, 8/8W at 8Ω |
| Frequency Response | 15-100,000 Hz-3 dB |
| Harmonic Distortion | .8% |
| Power Supply | AC 110/120/220/240V, 50-60 Hz |
| Dimensions | 16¾" w x 4¾" h x 13" d (419 x 121 x 330 mm) |
| | Weight: 15 lb 7 oz (7 kg) |

Full specifications and data will be sent gladly on request



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| | Retail Price | Our Price |
|-----------|--------------|-----------|
| AKAI X360 | £380 1 6 | £334 10 0 |
| X360D | £325 1 4 | £286 2 0 |
| X330 | £342 11 4 | £301 10 0 |
| X1800 | £199 8 4 | £175 10 0 |
| X-V | £187 10 9 | £165 1 0 |
| 150D | £138 15 6 | £122 3 0 |
| 1710LW | £109 0 0 | £95 19 0 |
| 4000D | £89 19 1 | £79 4 0 |
| 4000 | £124 18 0 | £110 9 0 |

| | | |
|------------------|------------|-----------|
| BRENELL | | |
| STB2/510/2 | £233 15 11 | £205 15 0 |
| Mk 5 M ser III | £145 11 10 | £128 3 0 |
| ST400 & ST200 | £145 0 0 | £127 12 0 |
| Mk 5 III Metered | £124 7 9 | £109 10 0 |
| Mk 5 III M/E | £116 15 6 | £102 16 0 |

| | | |
|----------------|-----------|-----------|
| CHILTON | | |
| 100S/CW/4 Tr. | £145 11 0 | £128 2 0 |
| 100S/CAP/4 Tr. | £161 14 5 | £142 7 0 |
| 100S/CW/2 Tr. | £157 19 9 | £139 1 0 |
| 100S/CAP/2 Tr. | £177 11 0 | £156 15 0 |

| | | |
|-------------------|-----------|-----------|
| FERROGRAPH | | |
| 713 | £188 10 0 | £165 18 0 |
| 713H | £197 5 11 | £173 13 0 |
| 702 | £207 7 0 | £182 10 0 |
| 702H | £216 2 11 | £190 5 0 |
| 722 | £242 10 9 | £213 9 0 |
| 722H | £251 6 8 | £221 4 0 |
| 704 | £207 7 0 | £182 10 0 |
| 724 | £242 10 9 | £213 9 0 |

| | | |
|--------------|----------|----------|
| REPS | | |
| HW10-2P | £75 7 0 | £66 7 0 |
| HW10-4P & 2T | £79 8 6 | £69 18 0 |
| HW10-4T | £83 10 0 | £73 11 0 |

| | | |
|--------------|-----------|-----------|
| REVOX | | |
| 1102/1104 | £204 15 0 | £189 8 0 |
| 1122/1124 | £236 15 0 | £218 11 0 |
| 1302 | £204 15 0 | £189 8 0 |
| 1322/1324 | £236 5 0 | £218 11 0 |
| 1222/1224 | £246 15 0 | £228 15 0 |

| | | |
|--------------|----------|----------|
| SANYO | | |
| MR990 | £132 5 0 | £116 8 0 |
| MR939 | £112 5 0 | £98 16 0 |
| MR929 | £97 5 0 | £85 12 0 |
| MR801 | £69 15 0 | £61 19 0 |
| MR910 | £84 15 0 | £74 12 0 |
| MR115 | £39 15 0 | £35 0 0 |
| 404A | £99 15 0 | £87 16 0 |
| 411F | £49 15 0 | £43 16 0 |
| 410 | £33 15 0 | £29 15 0 |
| 138 | £24 15 0 | £21 16 0 |
| 88 | £28 5 0 | £24 18 0 |
| 48M | £21 5 0 | £18 14 0 |

| | | |
|-----------------|-----------|-----------|
| TANDBERG | | |
| 3000X | £99 18 0 | £87 19 0 |
| 6000X | £193 10 0 | £170 6 0 |
| 62X/64X | £157 0 0 | £138 4 0 |
| 1600X | £89 10 0 | £78 16 0 |
| 12/12X & 12/41X | £154 0 0 | £135 11 0 |
| 15/21 | £79 0 0 | £69 11 0 |
| 15/22 | £89 10 0 | £78 16 0 |
| 15/41 | £85 0 0 | £74 16 0 |
| 15/42 | £96 0 0 | £84 10 0 |

Series II-I Prices on application

| | | |
|-------------------|-----------|-----------|
| TELEFUNKEN | | |
| M250 | £142 16 0 | £125 14 0 |
| 204TS | £124 19 0 | £110 0 0 |
| 207 | £114 9 0 | £100 15 0 |
| Studio 203 | £103 8 6 | £91 1 0 |
| 212A | £76 2 6 | £67 0 0 |
| 302 | £68 5 0 | £60 2 0 |
| 300TS | £60 7 6 | £53 3 0 |
| 201/D.L. | £54 1 3 | £47 12 0 |

| | | |
|-------------|-----------|-----------|
| UHER | | |
| 4000L | £145 10 0 | £128 1 0 |
| 4200 Stereo | £187 5 0 | £164 16 0 |
| 4400 Stereo | £187 5 0 | £164 16 0 |

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Are you sure you can handle it?

The 6000X is no ordinary tape deck. If you buy it you get the kind of gadgets and devices you'd expect from a professional machine.

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| | List Price | Cash Price |
|--------------------|------------|------------|
| Revox 1122/1124 | £236 5 0 | £208 10 0 |
| Revox 1302/1304 | £204 15 0 | £180 10 0 |
| Revox 1322/1324 | £236 5 0 | £208 0 0 |
| Revox 1222/1224 | £245 15 0 | £217 10 0 |
| Ferrograph 713 | £188 10 0 | £166 0 0 |
| Ferro. 702/704 | £207 7 0 | £180 10 0 |
| Ferro. 722/724 | £242 10 9 | £202 19 0 |
| Akai 40000 | £89 19 1 | £74 10 0 |
| Akai 1710L | £89 0 0 | £77 12 0 |
| Akai 4000 | £124 18 0 | £103 19 0 |
| Akai X5000L | £177 19 6 | £156 13 0 |
| Akai X5000W | £177 19 6 | £156 13 0 |
| Akai M10L | £245 1 0 | £215 13 0 |
| Tandberg 64X | £147 13 0 | £121 4 0 |
| Tand. 1221/1224 | £154 0 0 | £135 10 0 |
| Philips 4302 Auto | £35 17 6 | £30 16 0 |
| Philips 4307 | £49 10 0 | £42 10 0 |
| Philips 4404 | £83 0 0 | £71 5 0 |
| Philips 2401 | £81 0 0 | £71 5 0 |
| Philips 2502 Auto | | |
| Changer Cassette | £49 10 0 | £42 11 0 |
| Philips 2401 | | |
| Including Speakers | £99 0 0 | £87 0 0 |
| Philips EL3302 | £28 7 0 | £21 10 0 |
| Sanyo Cassette | | £20 19 6 |
| Telefunken M501 | £43 11 6 | £38 8 0 |
| Telefunken M204TS | £124 19 0 | £109 18 0 |
| Grundig TK120 | £39 5 0 | £28 18 0 |
| Grundig TK124 | £44 18 0 | £35 7 0 |
| Grundig TK144 | £49 19 0 | £42 5 0 |
| Grundig TK149 | £57 12 0 | £46 19 0 |
| Grundig TK121 | £54 15 7 | £45 19 0 |
| Grundig TK141 | £59 4 8 | £49 14 0 |
| Grundig TK146 | £68 2 10 | £57 3 0 |
| Truvox R44 | | £45 10 0 |
| Telefunken M501 | £34 15 0 | £30 10 0 |
| Telefunken 5L40 | £37 10 0 | £32 19 0 |
| Telefunken FXB510D | £62 0 0 | £52 15 0 |
| Crown CTR8750 | £32 11 0 | £24 19 0 |
| Marconiph. 4218 | £89 11 0 | £80 10 0 |
| Marconiph. 4248 | £52 14 0 | £47 7 0 |

Standard Cassettes

TANDBERG, UHER, VORTEXION, AIWA, SANSUI, PIONEER.

Send for lists of special discount prices.

HEADSETS

| | List Price | Cash Price |
|-----------------|------------|------------|
| Akai ASE 9 | £6 10 0 | £5 14 0 |
| Akai ASE 20 | £9 0 0 | £7 18 0 |
| Akai AEH 10 | £20 0 0 | £17 0 0 |
| Beyer DT 48 | £33 18 0 | £27 19 0 |
| Beyer DT 48S | £33 14 0 | £28 13 0 |
| Beyer DT 100 | £13 18 6 | £11 17 0 |
| Beyer DT 109 | £23 18 6 | £20 7 0 |
| Beyer DT 480 | £29 5 0 | £24 17 0 |
| Eagle SE 1 | £4 19 9 | £4 7 0 |
| Pioneer SE 50 | £19 3 8 | £16 6 0 |
| Pioneer SE 30 | £12 12 0 | £10 14 0 |
| Pioneer SE 20 | £7 2 11 | £6 2 0 |
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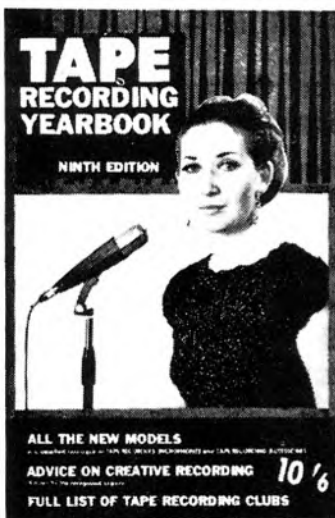
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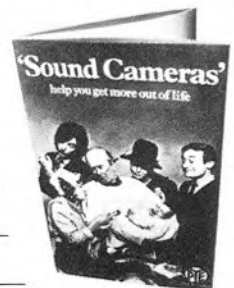
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Vol. 14 No. 11 November 1970

IN THIS ISSUE

| | |
|-------------------------------|-----|
| Tape Trends and tape talk | 356 |
| Douglas Brown | |
| HARROGATE TRILOGY | 358 |
| TRM Report | |
| TAPE WORKSHOP | 360 |
| Denys Killick | |
| LATEST VIDEO NEWS | 362 |
| Cross Talk | 365 |
| Test Bench — SANYO MR-416 | 367 |
| Nature Notes | 370 |
| Musicassette Reviews | 373 |
| New Products | 374 |
| Advertisement Inquiry Service | 377 |

Cover Photograph: Love birds? Well, parrots whose confidential "sweet nothings" were recorded on tape during an experimental test session with the Sanyo MR-416 portable stereo cassette machine reviewed in our Test Bench feature this month. The "satellite" speaker has been detached thus halving the bulk of the equipment. It is no coincidence that the bird on the left has a wicked look in his eye; before the assignment ended he lapsed into most ungentlemanly language (which had to be hastily erased!) and expressed his opinion of our microphone in a positive, but most unfortunate, manner!

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Tape trends and tape talk

By Douglas Brown

WITH QUIET AMUSEMENT I have been reading this past month of the excitement and drama in the board-rooms of the international commercial giants because of the "discovery" of the video-cassette. For years we have been writing in this magazine of the significance of magnetic recording and of the limitless potentialities of its future. Often, the reaction from the uninformed has been that we were unrealistically optimistic; almost always, those who knew little about the subject were indifferent to it because they considered it limited and esoteric.

How very different now! And why? Here are a few clues:

The Times – "In America estimates suggest that the new industry could be worth £420 millions in the next 10 years".

The Sunday Times – "Some of the optimists talk of a US market for teleplayers worth \$3,000 million a year by 1980. Philips expects to sell half a million teleplayers – worth £75 million – in the next five years."

The Financial Times – "Private companies are ready to go ahead into what is expected to become a multi-million dollar field."

And there have been some Jeremiahs who have been foretelling that the peak of popularity of tape recording is past!

Admittedly, the electronics revolution which is now upon us is something bigger than mere tape recording, as we have understood the term. The time is not far off when every affluent home is going to be linked by cable to an electronic entertainment and instruction complex.

Over the cable it will be possible to bring into the home any one of a number of live television programmes, including basic news programmes showing big events in every part of the world as they occur (using satellite communications systems); or it will be possible to dial libraries and institutions to "tap" stored audio-visual information and to relay it into the home; or it will be possible to have person-to-person or multi-link conferences between individuals who will see, as well as hear, one another; or it will be possible to transmit data which will be capable of transformation into printed matter.

The facility to "record" television programmes or live camera shots on to magnetic tape and then to replay instantly on a domestic TV screen will be one small part of this overall picture.

The number of people who will wish to use the new equipment to make creative recordings will be a small proportion of the population who own it; just as the creative recording enthusiasts of today are a small proportion of the total number of tape recorder owners. But nonetheless it will be a very big minority group, practising as sophisticated a hobby as anyone ever enjoyed.

The really exciting days of creative tape recording are only just beginning.

* * *

THE ELECTRONIC recording revolution is, of course, going to be dominated by the big boys. Look at what has happened to date. A couple of keen enthusiasts in Nottingham produced the first video

recorder seven years ago – remember the Telcan? They had plenty of orders, but the firm was soon in the hands of a receiver.

Now Sony, Philips and the American AVCO Corporation slug it out in the magnetic tape sector – though the signs are that they will get together – while giant rivals launch rival systems. The first advertisements have just appeared for "EVR", the system that uses 8.75 mm film in cassette for playback-only. Behind this system are Columbia Broadcasting System, their licensees Imperial Chemical Industries and CIBA, the international drugs firm, and Rank Bush Murphy. Yet another system, using a disc, is backed by Telefunken and Decca, while a fourth system, using a laser, is being pushed by R.C.A.

* * *

THE MOST SIGNIFICANT sign of what lies ahead is not to be found among those marketing recording or replay equipment, the so-called "hardware", but in the work now being done to prepare the "software" – the programme material that will be recorded on the tape (or film) in the video cassettes.

The EVR people are almost ready with their first catalogue of programmes – they are said to have about 3,000 titles lined up. The emphasis is on education, but that can (and does) include golf lessons as well as industrial or commercial training. Subjects range over adoption, sex education, music, science, history. At Basildon they plan to produce a million cassettes a year.

In America CBS has agreed with 20th Century Fox to transfer over a thousand of its films into video cassettes and has signed up book publishers for the rights to "how to do it" texts.

Those who put their faith in magnetic tape are similarly active. AVCO in the United States promises 250 to 300 feature films in tape cassettes and the same number of instructional and academic programmes, within a year. The films will be hired out at three dollars a time. Another American concern, Optronics Library Inc., has bought the cassette rights to 4,000 films.

Where on earth is all the programme material going to come from? The big international concerns are alive to that opportunity, too. From Stockholm the other day came the report that "there is a recently-formed group of six major European publishing houses which have set up a concern called European Audio Visual group who will produce software – cassettes or their equivalent, depending on the system used – for both the entertainment and educational sectors."

So what a bonanza is all this! So many big concerns do not miscalculate. This time the tape revolution is for sure.

And what, my friends, about the programmes *you* are going to put on tape – in sound and vision? It may be two to three years yet before you can afford the equipment, but now's the time to think about it if you want to be a pioneer.

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HARROGATE TRILOGY

YET ANOTHER SUCCESSFUL audio exhibition was held in Harrogate last month: Audio 70 at the Cairn Hotel. Once again members of the public flocked in to see and to hear. At the week-end the corridors and demonstration rooms of the hotel were reminiscent of bargain time in the London stores. All were eager to experience that rare phenomenon of good quality recorded sound. Some achieved their goal.

Audio 70 differed from other events of this kind in the variety of other functions that were provided. Fashion shows for the ladies — attended by as many interested gentlemen; performances of live music including jazz, solo soprano and classical ensembles as well as electronic organs; lectures on subjects of common interest; all these were taking place at regular intervals throughout the period of the show, and attendance was so great that seats had to be limited by the issue of tickets although these were, of course, free of charge.

There's no doubt that the public got a great deal — not "for their money" because it didn't cost them anything. All these facilities, as well as the traditional static stands and demonstrations, were there to be taken advantage of. Our Northern friends certainly did just that.

Instead of reporting in detail on the equipment shown by the exhibitors — much of which will be seen again at the Olympia Audio & Music Fair — we would like to comment and report on three of the lectures that were given at Harrogate. These are: *With Knobs On* by Frank Jones of *Hi-Fi News*, *Cassettes in the Seventies* by John Collinson and Ken Russell of Rank Wharfedale Ltd. and *Sound and Cine* by Arthur Dakin of Farnell-Tandberg Ltd. Other equally informative talks were given, notably by Donald Aldous on *Humour and High Fidelity on Record* and by Arthur Dakin again on live recording. We are omitting these only because the former does not directly relate to our subject and



The Farnell-Tandberg sound system for the precise synchronisation of sound tracks with cine films has now reached the final production stage. At the heart of the system is the Tandberg series II battery portable tape recorder which is used in conjunction with the Farnell-Tandberg Tone Generator (not shown above) and the Synchroniser Unit. This latter instrument is claimed to give a visual indication of synchronisation accuracy that is correct to within better than a fiftieth part of a frame. The system permits the use of all the editing techniques that are essential to creative work, although the latter is very much in our field it was primarily a demonstration rather than a lecture and so would lose much of its impact in the printed page.

With Knobs On was Frank Jones' highly original, and sometimes humorous, thought on the design and purpose of the audio amplifier. He suggested that many consumers appear to assess the value of the amplifier by reference to the equation:

$$N^2 \times T + C = Q$$

In the above N equals the number of knobs, T equals the depth of the gold trim, C equals the advertiser's cant and Q the quality. A light-hearted evaluation that is all too often followed, quite literally, to the letter.

Instead Frank believes one should look at an amplifier dispassionately as a functional piece of equipment which should be designed and made in accordance with the jobs it has to do. He claims that many amplifiers adopt the lay-out, circuitry and form that is traditional rather than functional or economic rather than efficient.

Every control and every facility within the control unit should be looked at closely. There are many ways of dealing with the "simple" mains On/Off switch; Frank believes there is only one *right* way. Where a separate mains switch is

provided the appliance can be switched on and off without altering the setting of the volume control. This is bad for two reasons: power could be accidentally applied with an inordinately high listening level (or faulty connection at the rear) that could cause damage to the loudspeakers; with such a method the volume control potentiometer is rarely turned — such pots. are usually "self-cleaning" but they need to be regularly rotated to clean the track. So the best mains On/Off switch would be incorporated in the volume control.

Similarly there are a number of "protective" devices used to prevent gross overload harming output transistors. They work in different ways and those described as "non-latching" (requiring only volume adjustment) are to be preferred.

Balance controls rarely fade the signal to nothing on either channel. They all should. Tone controls have a much wider bandwidth than is really needed and in any case they rarely perform the tasks that they are traditionally supposed to accomplish. For instance, a treble control cannot remove tape hiss or surface noise from a record without also removing a substantial proportion of recorded programme material. Instead a properly designed slope filter is required. Similarly every amplifier should have a "high pass filter" to remove unwanted noise of 20 Hz. and under.

These are all valid and fresh thoughts. We have perhaps become mesmerised by the formula quoted at the beginning of his talk. It's time the consumer, and the manufacturer, took a more balanced view of that very necessary appliance, the domestic audio amplifier.

Cassettes in the Seventies was the subject of John Collinson and Ken Russell. John first made clear that he was speaking personally, not as a representative of Rank Wharfedale Ltd., and the purpose of his lecture was to trace the history of magnetic recording from its inception to the cassette and beyond. In

HARROGATE TRILOGY CONT.

particular he was concerned to establish the relationship between cassettes and disc gramophone records.

To open his talk he looked back to his war-time days in the Royal Navy. He referred to captured German recording equipment and played a tape made in the forties on a machine based on such an appliance. Its frequency response extended only as far as 12,000 Hz. at a tape speed of 30 ips. Running costs were in the region of 15s per minute. Quality was startlingly good; in fact the Germans had used tape recording techniques as a strategic weapon during the war by broadcasting recordings of events that our engineers believed must have been "live". In that way the enemy was able to confuse our intelligence on the whereabouts of important personages within the Third Reich.

By contrast the Compact Cassette runs at 1 7/8 ips and costs about 15s per hour instead of 15s per minute. That is one measure of the progress that has been made. But, contrary to popular opinion, miniaturisation does not mean lower costs. The old 30 ips machine was a heavy chunk of machinery with engineering tolerances that would be quite unacceptable in a modern cassette player. For instance, if a cassette machine is to reproduce frequencies of 15,000 Hz. at 1 7/8 ips then the length of tape on which a single waveform is recorded will be as tiny as one-tenthousandth of an inch. The length of the gap in the record/playback head *must* be "shorter". To work to such parameters calls for critical engineering of the highest calibre. Similarly the war-time recorder had a fly-wheel of massive proportions to iron out speed irregularities; a modern machine must have better wow and flutter figures at a fraction of that weight. All of which is the reason why a good cassette recorder is likely to be relatively expensive. We must not expect too much from the portable "toys" selling at some £20.

John Collinson said he believed that there will be two key words relative to

cassettes in the future. These will be "Dolby B" and "chromium dioxide". The former is the noise reduction system about which we have been talking at some length in recent issues; the latter is a new kind of recording tape developed by the American firm of Du Pont and whose existence we reported some eighteen months ago.

Thanks to the courtesy of Agfa John had been able to obtain a sample of their chromium tape on which he carried out a technical investigation and in fact used it for his subsequent demonstration. He found that the new coating required approximately 50% more bias current than the familiar iron oxide. When this was applied there was a considerably increased frequency response (sensibly flat to 15,000 Hz.) but it was necessary to modify the pre-emphasis in the circuit to take advantage of this capability.

To prove the point he had copied a second generation master tape (of Bert Kampfert's *Swinging Safari*) on to tape and then gave us an A/B comparison between the commercial disc and his cassette copy. Such differences that were there were so slight as to be insignificant. It was a truly brilliant demonstration of the ultimate potential of the Compact Cassette system. Perhaps it is dangerous to use the word "ultimate" in connection with any audio matters nowadays!

The vital question John Collinson asked was: will the cassette replace the disc record? His forecast was that classical repertoire, such as is normally marketed in the form of 33 1/3rpm discs, could shortly find a more ready acceptance as pre-recorded cassettes. He quoted the extreme convenience and almost total indestructibility of cassettes as arguments that could well influence the public in their favour.

The 45 rpm "single" disc is in a different position. Production costs of cassettes are very much higher than those of records so he reasoned that the longer playing time of the full cassette – which can be up to one hour per side – will

favour circumstances where the price is spread over the longest programme. He therefore does not see the cassette competing with the single, and the conventional gramophone could well dominate in that field. Which is surprising, even if logical, because most of the record companies have been complaining about the decline in their sales of the shorter repertoire records. But they will have no reason to grumble because they are all – to a man – entrenched in the cassette business.

Resounding applause rewarded John and Ken for what can only be called a brilliantly lucid exposition of the present state of the art.

Lastly we come to Arthur Dakin of Farnell-Tandberg with his *Sound and Cine* lecture. This, too, was a demonstration because it included the showing of two amateur films, each with perfect lip-synchronisation.

Lip-synch. has been the bane of the home film-maker ever since the days of 9.5 m.m. An elusive will-o'-the-wisp it has driven many an otherwise sane cine man right around the bend. It just doesn't happen of its own accord. It is impossible to record sound whilst filming a scene and then play the two back absolutely and precisely together – unless one uses some fiendishly clever device to "lock" the two programmes irrevocably into synchronisation.

Of course the professionals have been doing this for years. Had they not we should have no talking films, nor would the sounds appear to come out of people's mouths as they speak on the television screen. The equipment such projects require is so costly as to be hopelessly out of reach of the amateur. But now the enthusiast has a choice of two fool-proof methods, one developed by Bell and Howell called Filmosound and the other by Farnell-Tandberg. Both were dealt with at some length in a recent issue of *TAPE Recording Magazine* (July 1970) but the Farnell-Tandberg Sound

Please turn to Page 361.

TAPE WORKSHOP

SO FAR in Tape Workshop we have dealt with single sound sources, one microphone or one radio tuner. This month we shall take a look at what happens when we attempt to combine more than one sound source together. We shall be considering the art of mixing and balancing.

These techniques are referred to as an "art" because that is truly what they are. And because they are an art no-one has the right to imagine that ability in this field is acquired without long practice or sensitive appreciation. Just as with any other art form, the artist has to learn, to study and to work before he has even begun to master his chosen medium. On the other hand, just as the "Sunday painter" has made a name for himself in graphic art there is no reason why the "Sunday mixer" should not do the same. In these days of free expression anything goes — the accidental effect can legitimately be called artistic — form is secondary to subjective impression — anyone is allowed to join in the fun and try his hand at creating masterpieces.

But this basic difference between professional artist and amateur experimenter must be understood and appreciated. The former has a job to do; his efforts must meet with success every time. It is what he is paid to do. The latter, the amateur, has time on his side and he lacks the compulsion of financial necessity. If his efforts should not quite come off he can either abandon the project (with a smile!) or try again another day. He has absolute release from commercial pressures. In many ways he is the more fortunate of the two.

I believe there is little effective difference between the two words mixing and balancing. To balance we mix. To mix we balance. Usually mixing infers the use of an extra piece of equipment, a mixer, into which separate signals are fed so that they can be combined in any

desired strength or proportion to create a completely new blend of sound that did not before exist in its own right. Some tape recorders have simple mixing facilities built into them, usually in the form of a circuit that permits independent levels to be set for the microphone and radio or gram inputs whilst recording. Such an arrangement is extremely useful for initial experiments, but for flexible mixing one of the many proprietary mixers sold as accessories is desirable.

Let us first think about some of the simplest applications where mixing or balancing has to be carried out. Consider the single voice recordings detailed in earlier experiments. Think of the complications involved when we increase the number of voices from one to two.

A great deal of time was spent investigating local acoustics in the recording room (studio) in order to achieve optimum results in our spoken word tapes. If we now find ourselves in a situation where we have to record two voices instead of one we have a choice of methods. Two separate microphones might be used, in which case the signals from each would have to be fed to a mixer, blended together (balanced so that each is equal) and then recorded as though a single sound source, or alternatively we could arrange the two speakers in such a way around a single microphone that the one instrument effectively does the work of two. Since this last method requires the use of the minimum of equipment it is the one to start with.

Before attempting to begin balancing we must also think of the listening end of the task as well as recording requirements. One cannot use a pair of scales to balance the weight of commodities if the eyes are kept firmly closed. To attempt to balance sounds without proper monitoring facilities amounts to the same thing. We *must* be able to hear what we are mixing, even if the "mixing" refers to

voices over a single microphone rather than a number of signals via an accessory appliance. To balance means to assess, to weigh. As our medium is sound we must hear to form judgments.

The best monitoring facilities are provided by loudspeakers, and to avoid feedback or direct noise interference on the live microphones it is essential for them to be in another room. Should this be impossible it will be necessary to use a time-consuming routine of trial and error, recording a short section, stopping, playing back, adjusting, recording and so on. Another, simpler way is to use a pair of headphones taking the signal from the monitoring socket at the tape recorder. At a pinch the operator can even be in the recording room, provided he keeps very quiet indeed. The better the quality of the headset the better will be the accuracy of the blend of sound. Good headsets are easier to use than inferior ones because they give a more realistic impression of the sound. Very cheap sets can sound little better than telephone earpieces and as such are quite useless.

Having fixed up our monitoring equipment we have to decide on the disposition of the two speakers in relation to the particular microphone being used with regard to the acoustic qualities of the recording room. Since these factors will vary one cannot be specific.

Where a ribbon microphone is available it is possible to place the two speakers equidistant from the two faces (back and front) of the microphone. This method has been successfully used by the BBC for many years in their interview studios on sound radio. We have already seen how small differences in source to microphone distance will produce disproportionate changes in the resultant recording. When two sound sources are present great care is needed to ensure that each (voice) is correctly placed in relation to the peculiarities of the speaker. No two

voices are *just* the same and differences must be compensated for. In fact, they must be *balanced*.

Poor balancing will result in one speaker appearing to be right in the foreground in the final recording with the other in the background. When working stereo we also have to think of spatial position as well. If two voices having an ordinary conversation should be "out of perspective" then the result is absurd. Assessments of balance are carried out by listening via whatever monitoring system has been installed and alterations are made by changing relative sound source to microphone distances.

If the only microphone available has a cardioid directional pattern (live on the front face but relatively dead on the two sides and rear) then both speakers will have to be placed in front of the single instrument. This is an unnatural arrangement — people do not normally hold a conversation sitting beside each other and looking straight ahead — and is to be avoided if possible. Should the microphone be omni-directional (live to sound from all directions) we can either adopt the more natural ribbon arrangement with the speakers facing each other across the head of the microphone, or where it is more convenient the microphone can be suspended from above.

Throughout this series we have taken our examples from voice recording

techniques because every reader has access to human voices to use as sound sources. But the same kind of rules apply when working with musical performers. Suppose now we had to deal with an instrumentalist, guitarist or pianist, and a singer. Although all voices have their differences they also have much in common; when trying to cope with a singing voice and an instrument we have two utterly dissimilar sources and the problems are bound to be far more complex.

The best solution generally would be to use two separate microphones with a mixer. We should then be concerned only with getting each sound source to sound "right" in the first place followed by adjustment to balance to give the desired blend and relative strengths. Simple? The last project of this kind with which I was involved required weeks of experiment including physical adjustment of the recording room acoustic before we were satisfied. When the result was finally heard respected critics spoke of the "unsympathetic recording technique"! But that's all part of the interest and the fun of mixing and balancing. There are no rules, only judgments. We are in the realm of aesthetics, not science, where there are no longer facts but only opinions. It's a good place to be.

It is possible to undertake this imaginary recording using only a single

microphone. I have mentioned my own troubles when dealing with work of this kind simply to underline the fact that a full set of equipment does not mean that the task is necessarily easier. Often in this business the more complex the technical set-up the more difficult the task. So after having carried out a preliminary investigation using two speaking voices why not take the plunge and attempt a musical item for a change?

Results will depend entirely upon personal judgement. The piano is capable of an enormous sound output compared to the delicate vibrations of guitar strings. Assuming the latter to be non-electronic, of course. Precise positioning of the performers will depend upon the kind of accompanying instrument and the nature of the work to be recorded. Usually a guitar will have to be brought up fairly closely to the microphone. The singer will have to be withdrawn away until the recorded balance is right. With a piano the reverse is often the case. The microphone level is set to suit the singer's voice and then withdrawn away from the piano until the two sources are harmoniously blended. And the time taken can be a few minutes, a few days, a few months depending on how critically one appraises and on what quality standard one wants. In the end such an arrangement is bound to be a compromise. Every sound recording is, one way or other.

HARROGATE TRILOGY

From Page 359

System was then only in the prototype stage. Now its final design has been evolved and the equipment is in production.

In its commercial form it is much simpler and more convenient to use than we had previously reported. There is now no longer any need to dub the sound recording on to perforated Cinetape; instead the sound track can be transferred straight to magnetic stripe (via a suitable sound projector) through the use of the Farnell-Tandberg Synchroniser Unit FT-1 costing £58 inclusive of purchase tax. The other items required are a Farnell-Tandberg Tone Generator FT-2 at £11 8s and the Tandberg portable tape recorder model 11-2M at £191 10s. Owners of existing Series 11 machines can have them modified to suit the Farnell-Tandberg Sound System at a cost equal to the difference in price between an ordinary half-track machine and the special model 2M, so nothing will be lost.

Arthur explained how the tone generator is coupled to the camera and the tape recorder when shooting takes place. The speed of the camera is recorded on the lower track of the tape in the form of a sequence of 1,000 Hz. pulses, one for every frame. When the

film has been processed it is only necessary to couple the recorder to the Synchronizer Unit and then to the projector when, by following the deflection of the needle across a 4½-inch scale, the tiniest deviation from absolute synchronisation can be seen and immediately corrected. To use Arthur's own words: "it's so easy we could train a monkey to do it!"

To emphasise the point he showed us two Super-8 films, one made by a local cine club and the other by himself. In the first the enthusiasts had purposely scripted the film so as to make synchronisation as difficult as possible. They were determined to catch him out if they could. There were many shots of car doors being slammed (so deliberate it was really quite funny) croquet balls being struck and sudden exclamations. Obviously a good time had been had by all — not least Arthur Dakin because his synchronisation was 100 per cent perfect throughout. The other was an equally difficult project, in colour this time, with long sequences of very young children singing and performing. This is the kind of material that is so transparently honest — it just couldn't be faked, not that anyone would suggest that our demonstrator would ever attempt such subterfuge. Of course it worked. And that

is the highest praise that can be given to the Farnell-Tandberg Sound System. It works. Perfectly. Every time.

We are sorry not to have space to cover Donald Aldous' amusing and instructive lecture, but we will mention that he had to complete with the Fashion Show held on a lower floor at the same time and of the two events we preferred Donald to the undeniable attractions of the ladies

Yes, Harrogate was a great success. There was a sensibly broad approach to the subject of sound reproduction and efforts were made to relate the equipment and its use to practical domestic conditions. As such it was thought that audio should interest the ladies as well as the men. It did, just as the models displaying their gowns appealed to the males. And why not?

By the time this article is in print we shall be in the midst of the Olympia Audio and Music Fair. This we shall report from the equipment and exhibitors' point of view to keep readers up to date with the latest products that are available to them. Our guess is that the most interesting products will be Dolby B cassette machines of which very few — if any — will be readily available, so there will be no rush. See you at Olympia!

DURING PAST years we have reported on the latest developments in video recording. Now we have a firm statement of policy and fact from the EVR Partnership, a consortium of three major industrial organisations: ICI, CIBA and CBS. Some twelve months ago they promised that the first EVR players, designed to reproduce monochrome programme material, would be available early in 1971. They announce that full-scale production will be under way in April next and the machines then made will have by-passed the monochrome stage and be suitable for playing in full colour when colour programmes are available.

First the cost of the equipment has been increased to £360. Second the policy of Rank Bush Murphy, the sole licensee to manufacture outside America, will be to confine their present activities to the direct sale of equipment to educational and industrial users. To quote James Collis, their Managing Director: "we have no plans at this stage for marketing EVR players as a consumer product". So much for the analogue to the gramophone record!

In America the situation is rather different. There the ordinary man-in-the-street can buy a player and recorded entertainment material is available. In Great Britain all the resources of the

LATEST VIDEO NEWS

using RBM colour sets, the quality of both the picture and its colour was quite outstanding. As if to add insult to injury a popular television programme was also reproduced — presumably to give us an idea of the entertainment we shall *not* be getting.

EVR is a strictly non-creative system. It is not possible to make any alterations whatsoever to the "film" in the cartridge. Unlike video tape recorders it does not employ a magnetic recording device; instead it is a combination of photographic and electronic techniques. It will have to compete with a number of other devices, in particular the Sony and the Philips magnetic record/playback cassette machines, both of which are promised to us in the near future.

We believe that the greatest advantage of EVR lies either in its acceptance as a home entertainment medium (which would call for a radical change of policy on the part of the manufacturers) or as a highly specialised aid to higher education where the type of instructional material required is not being broadcast because of its limited interest. In this category come the medical schools, universities and technical colleges as well as the larger commercial firms who need to instruct their staffs or their customers in matters concerning their own products.

If a simple record/playback machine should become available we imagine that the secondary or grammar school would be quite capable of recording television transmissions for subsequent classroom use. Initially it should be less costly because the video tape in the cassette could be erased and used again. However this question of relative costs is by no means clear; an EVR cartridge does not suffer the wear of a video tape and so has a longer playing life. Final cost is likely to depend on the kind of use to which the programmes are put.

So far as entertainment is concerned one has to admit that the art of producing such material is best undertaken by the experts. The amateur home cine film that could compete with commercial cinema has yet to be made.



Electronic Video Recording equipment, EVR for short, will be available early next year. It has been announced by Rank Bush Murphy Ltd. that initially at least the use of the "Teleplayer" will be confined to educational and commercial institutions for whom a wide range of programme material is in course of preparation.

To recapitulate. EVR is a system for converting existing programme material, on film or video tape, into a new photographic medium based on a "cartridge" about the size of a seven-inch tape spool which, when inserted into an EVR player, will give a picture on the domestic-type television set into which it is connected. It is *not* a record/playback system; all EVR cartridges have to be specially made at the new multi-million pound plant that has just been opened by Lord Hill at Basildon in Essex. Here customers can send their films, 8 m.m., 16 m.m., 35 m.m., or video tapes, and have them processed into EVR cassettes. This is a mass-production operation — the more copies that are made the cheaper each unit will be.

When first announced we were told that EVR could be regarded as "the analogue to the gramophone" because it would at last enable viewers to see recordings of their own choice on their own television sets. At last "selectivity" would be brought to the television audiences of the world. As such we considered it to be a development of the greatest importance. That was a year ago. And at that time the approximate cost of a player was estimated to be around the £200 mark. Things have changed during the ensuing twelve months.

copying plant at Basildon will be devoted exclusively to educational material of one kind or another. When used as an educational aid the EVR player has many advantages over the 16 m.m. film projector which is the usual alternative. It is easy to use — as easy as a cassette tape recorder. The programmes can be disseminated over as many as twelve separate television sets; these could either cover a very large single lecture hall or could be placed in different rooms within the same building.

Unlike cine film it is possible to hold a single frame for fixed periods of time. The playback machine has a timer built in giving "hold" for one, three or five minutes. At present many authorities are preparing educational material, amongst them BBC TV and ITA. When transmitted in the normal manner these very excellent and costly programmes are either seen or lost. Now there is the possibility of converting the material to EVR cassette, filing it in a library and then using it as often or whenever required.

Playing time of a single cassette is one hour for monochrome or thirty minutes for full colour. When reproducing colour it will, of course, be necessary to connect the playback appliance to a colour television set. At a recent demonstration

LATEST VIDEO NEWS

continued...

So the advantage of EVR in this field lies in the fact that the film-makers and television producers would be left to get on with their jobs, supplying the results of their labours to the copying plant for conversion to EVR cassettes. Many copies would be needed and unit costs would be reduced. Because the practical life of a cartridge is long it could be *hired* to the consumer for a small fee. One could easily imagine a state of affairs where even that cost could be subsidised by the inclusion of advertising material within the programme. Just as one borrows books from the lending library so one would borrow cassettes for home viewing.

Perhaps one day we shall see television sets being marketed with their own EVR players built in. It could come in the future. On the other hand it might be a cassette record/playback mechanism that finds its way into the television cabinet. We shall have to wait and see.

One firm who has developed the magnetic record/playback approach within a cassette format is Sony Corporation of Japan. The Sony Colour Videocassette System was recently demonstrated in London when it was introduced by Akio Morita, Executive Vice-President and co-founder of the company.

We saw colour programmes successfully reproduced on three television sets and learned a great deal about the system itself and Sony's plans for future marketing. At present the only (prototype) models existing are for use with the NTSC colour TV system adopted by America and Japan. The European PAL system is not compatible and would require a specially designed player. This matter is now under discussion but we have no statement of any forecast date when patent negotiations will have been completed and equipment suitable for use with PAL colour TV sets produced.

Wisely Sony have gone to some lengths to ensure the compatibility of their videocassettes with machines made by other manufacturers, and they say they are in close touch with Philips of Holland

and other European firms to ensure that when domestic equipment is available it will conform to generally accepted standards.

The videocassette is roughly book-sized and it contains magnetic tape $\frac{3}{4}$ -inch wide. Operating on the helical scan principle each cassette has a playing time of 60 minutes colour or black-and-white; it carries the video frequency signals together with *two* audio channels so that the user can have stereophonic sound to accompany his visual programmes.

It is claimed that each videocassette has a potential life of some two-hundred playings. We queried this with Mr Morita as many helical scan VTR systems claim a much shorter tape life; in fact this has been regarded as one of the disadvantages of a technique which requires a rapidly revolving head assembly. In reply he stated that at present Sony are producing some 4,000 VTR machines every month and these are precisely matched to the video tape which they also make themselves. As a result they are already getting a useful life of at least 200 runs from the tape and he forecast that this is likely to be improved for the videocassette.



The Sony Colour Videocassette System will be marketed to consumers but it is not known when it will be available in Europe.

In use the Sony equipment is no more difficult to handle than an ordinary audio cassette machine; the tape can be fast wound, started, stopped, removed, re-inserted and stored in much the same way as existing audio cassettes, although the video ones are naturally larger. Connection to the TV set is via the aerial co-axial socket and no modification will be required to existing equipment. A play-only machine will cost in the region of £200 but a record adaptor with its own tuner could be added for another £50. This would operate in either colour or black-and-white and could be linked to a time-switch so that TV programmes could be recorded in the owner's absence for playback later. It is assumed that these prices do not take into account the possibility of purchase tax in the U.K.

Sony look forward to the time when films will be copied on to videocassettes (they already have the duplicating facilities) and then hired out to the

private consumer. In this way it is claimed that video cassette machines will revolutionise home entertainment. With the advantages of stereo audio channels it looks as if the enthusiast is going to be offered an extremely versatile instrument whilst the man-in-the-street, whose primary interest is probably visual, will find himself equipped with stereo, perhaps for the first time. Proper audio reproduction will, of course, require the use of an amplifier and pair of loudspeakers, although the programme can be heard (monophonically) through the ordinary loudspeaker in the television set if so desired.

In educational applications, particularly in the teaching of foreign languages, the two audio channels add considerably to the usefulness of the machine. The student will be able to watch the instructor's face and lip movements whilst listening to tutorial sound on one track and recording his own efforts on the other. In the same way tapes can be made in two languages, either of which can be selected by merely throwing a switch.

It is said that the first (NTSC) machines will be retailing in Japan by the Autumn of 1971. These would not be suitable for use with the European PAL colour television system and so the release date in this country is likely to be considerably later; but, unlike EVR, it will be regarded as a consumer product from the outset.

We feel that EVR and videocassettes are in many ways complementary to each other. They do different jobs in different ways, although in both cases the end product is a visual image on the television screen. As time passes it will undoubtedly be found that each has its own peculiar advantages and areas in which it will operate with greatest efficiency and economy. As neither will be offered to the public for quite a long time – years, by the look of it – we can all afford to sit on the fence and remain quite open-minded on the matter.

With all this burst of activity in video it would perhaps be relevant to ask how many British consumers yet own a colour television set anyway? At current prices we ourselves are still content with "dated" monochrome pictures and will probably stay that way for some time. The set manufacturers inform us that, contrary to popular opinion, TV costs are likely to increase as a result of our inflationary economic situation rather than decrease through greater production. At a conservative estimate it would seem that a complete colour record/playback installation, including the necessary TV set, is going to cost around £600. More if a stereo amplifier and loudspeakers are also to be purchased.

SONY

Model TC-630—the complete stereo sound control centre. Echo and sound-on-sound recording at the flick of a switch. Multiple inputs for stereo tuner, microphone, auxiliary speakers and optional turntable. Further refinements include three heads, three speeds, dual VU meters, retractable pinch roller, noise suppressor, and scrape filter.

Compact and superbly built, the TC-630 has a built-in stereo amplifier delivering a full 15 watts per channel rated output. Two lid-integrated speakers open up a world of stereo sound... **What more can we add?**

Model TC-630, recommended retail price £199:15:0

Specification

Recording system 4-track stereo/mono recording and playback.

Power requirements AC 100, 110, 117, 125, 220 or 240V, 50/60 Hz.

Power consumption 40 watts.

Tape speed 7½ ips (19 cm/s), 3¾ ips (9.5 cm/s) 1⅞ ips (4.8 cm/s).

Reel capacity 7 in. (18 cm) or smaller.

Frequency response 30 Hz–22 kHz at 7½ ips; 30 Hz–13 kHz at 3¾ ips; 30 Hz–10kHz at 1⅞ ips.

Bias frequency 160k Hz.

Wow and flutter 0.09% at 7½ ips; 0.12% at 3¾ ips; 0.16% at 1⅞ ips.

Power output 15 watts per channel.

Signal-to-noise ratio 50 dB.

Harmonic distortion 1.2% at rated output (overall); 0.5% at rated output (amplifier).

Level indication Two VU meters.

Inputs Microphone: sensitivity –72 dB (0.2 mV), impedance 250 ohms.

Tuner: sensitivity –22 dB (0.06V), impedance 100k ohms.

Auxiliary: sensitivity –22 dB (0.06V), impedance 560k ohms,

Phono input (MM or MC cartridge): sensitivity –53 dB (2 mV), impedance 14k ohms.

Outputs Line: output level 0 dB (0.775V), impedance 100k ohms.

Headphone: output level –28 dB (30 mV), impedance 8 ohms.

External speaker: impedance 8 ohms.

Lid speaker: impedance 8 ohms.

Rec/PB connector Input: sensitivity –40 dB (7.75 mV), impedance 10k ohms.

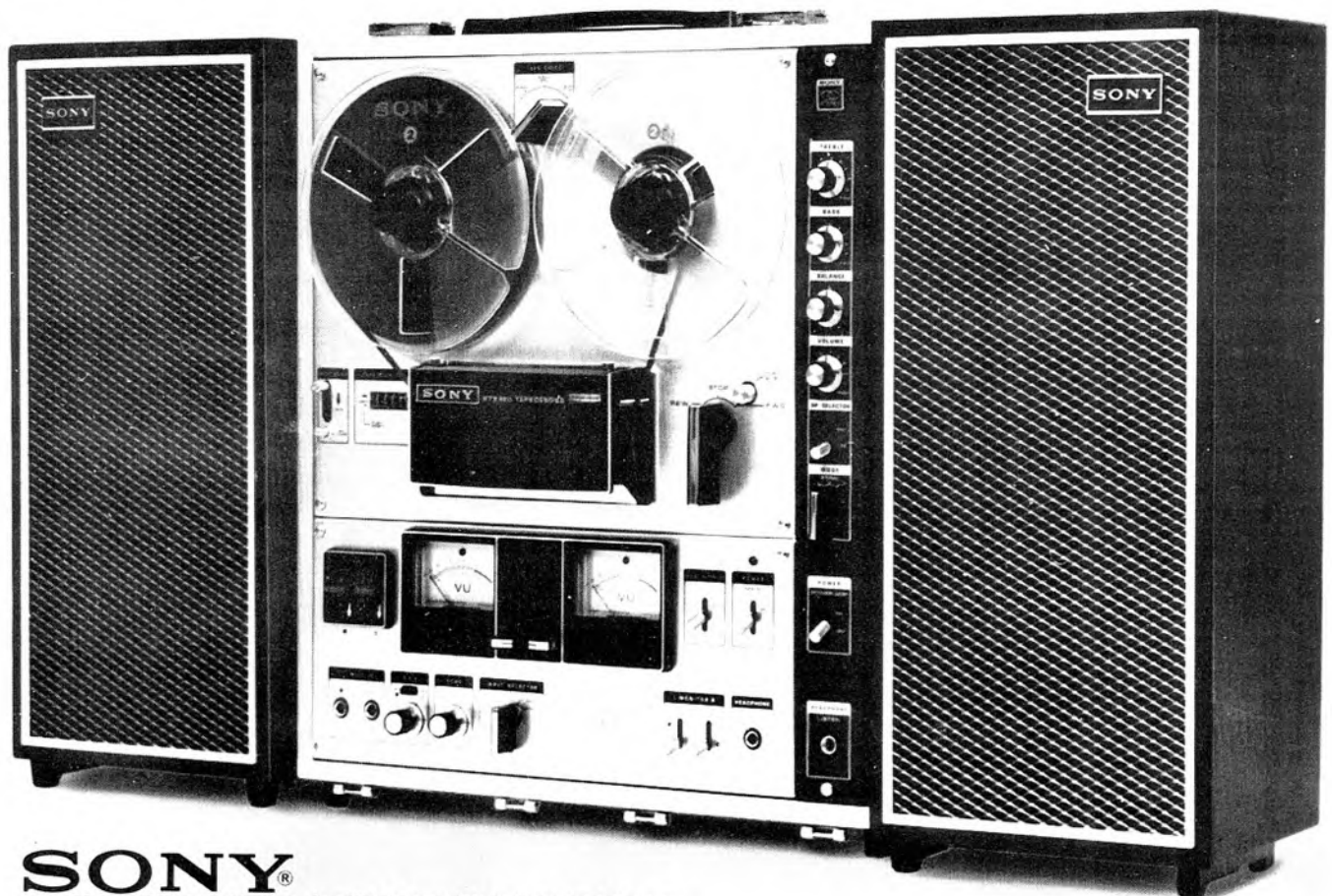
Output: output level 0 dB (0.775V) impedance 100k ohms.

Dimensions 17¼ in. (w) x 20 in. (h) x 11⅞ in. (d).

Weight 46 lb. 3 oz.

Supplied accessories Microphone (F-45) (x2), Sony pre-recorded 5 in. tape, Sony empty reel (R-7A), connection cord (RK-74), head cleaning ribbon, reel cap (x2).

Optional accessories Speaker system (SS-3000), telephone pick-up (TP-4), stereo headset (DR-5A) (8 ohms), microphone mixer (MX-6S).



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I HAVE ALWAYS found the subject of loudspeakers to be fascinating. This is the weakest link in the audio chain, the least efficient component and the one that will colour the actual sound heard more than any other. And yet when we listen to equipment at fairs and exhibitions we all have to accept the impression given by the loudspeakers as a valid representation of the performance of the tape recorder, amplifier, tuner or other appliance. Which, of course, it isn't. At least, not necessarily.

Many firms go to a great deal of trouble to test their loudspeakers scientifically and then to publish the results of their investigations. This usually implies the use of specially designed acoustic environments such as the anechoic chamber (which is completely dead) and a reflective chamber (opposite to aechoic where maximum sound reflection is obtained, often from metal-lined walls).

All very interesting, but none of us listen to equipment under either of these extreme conditions and so one can ask what real value there might be in such work? Surely the final arbiter should be the sound heard? Is subjective opinion not more valuable than all the laboratory evaluations?

One firm who would answer with an emphatic "No!" is Acoustic Research of America whose products are now being distributed in the U.K. by Bell & Howell Ltd. A.R. have always taken the lead in establishing methods of measuring loudspeaker performance, going to such lengths as digging holes in open fields, burying the enclosure flush with the ground and then taking measurements by suspending a microphone in the air immediately above. By such techniques it is possible to be quite sure that the signals reproduced and emitted from the enclosure are unaffected by any other acoustic complication. It does seem a little crude, though – heaven help the engineers if it should suddenly pour with rain!

But now A.R. have devoted many weeks of work to relate their laboratory findings with practical results under "average" user conditions. There is no such thing as a truly average home, so they contacted a number of owners of their equipment in America and asked for their co-operation. Measuring microphones were installed at pre-determined positions within these living - rooms and response graphs were charted. These have been published together with details of the dimensions and lay-outs of each listening situation. These in turn are related back to the response curves obtained from the same equipment in the laboratory and from this mass of data the general conclusion is

CROSS TALK

By Audios

drawn that *properly conducted* laboratory tests can positively indicate the performance potential of a loudspeaker enclosure operating under a wide range of domestic living conditions.

The inspiration for this monumental work came from Martin Borish, A.R.'s technical director, and his findings have been made public at a seminar held recently in Amsterdam, a function I was delighted to attend. The paper he read comprised some fifty type-written pages accompanied by as many graphs, diagrams and sketches. The whole represents a very serious endeavour to take loudspeaker evaluation out of the realm of subjective opinion into the controlled environment of the laboratory. When reviewing enclosures most "experts" have to rely on the simple statement: "I like it", or "I don't like it". The basis of this opinion is long experience of listening to both live and recorded sounds. Because it is nothing more than an opinion it is likely to be fallible, influenced by personal preferences, local acoustic aberrations, recording imperfections, external equipment variations etc. etc. It's very much a "hit and miss" affair. If we could use a scientifically-based formula to replace such highly personal methods of evaluation we should have made substantial progress in the much-needed improvement of the quality of loudspeaker equipment.

However important it might be for the magazine reviewer to have some definite technique at his disposal for deciding on the relative merits of any loudspeaker system it is even more important for the manufacturer to know with positive conviction whether or not his latest design is good or bad. Having evolved an enclosure it is often the case that performance is judged solely on the impressions received by members of the staff whose listening capabilities might be good or bad. From the sounds produced by some systems now being made in large numbers there would seem to be more people around with defective hearing than one would have imagined!

Acoustic Research take a more balanced and more serious view of their

products. And they are prepared to devote the time and energy required to pursue and publish the results of their investigations. Not pretending to fully understand all the implications of what Martin Borish is telling us I can at least pay tribute to their sincerity and the honesty of their endeavour. Even if, as a die-hard traditionalist, I have to finally come back to the personal likes and dislikes approach to the subject. The rub is that whatever the laboratory equipment might say or not say the consumer is primarily interested in his personal impression of what he hears, and if he doesn't like it all the graphs in the world won't change matters. Perhaps the trouble really lies in the basic awkwardness of human nature, and not even Martin Borish or Acoustic Research can change that!

* * *

TALKING OF SOUNDS and the impressions of sounds heard I spent some time at Harrogate observing audience reactions to the various demonstrations. How, I wondered, do these people decide whether what they are hearing is good or bad? The fact is that any new-comer to "good quality" sound is undergoing a traumatic experience. He is thrilled with what he hears. He had no idea that such exquisitely thrilling noises could ever be made at his command within his own home. And that goes for most of the equipment on show, whether "good" good quality or "bad" good quality. I believe that there can be such a distinction and its existence is at the root of much of the misunderstanding and confusion within the audio world.

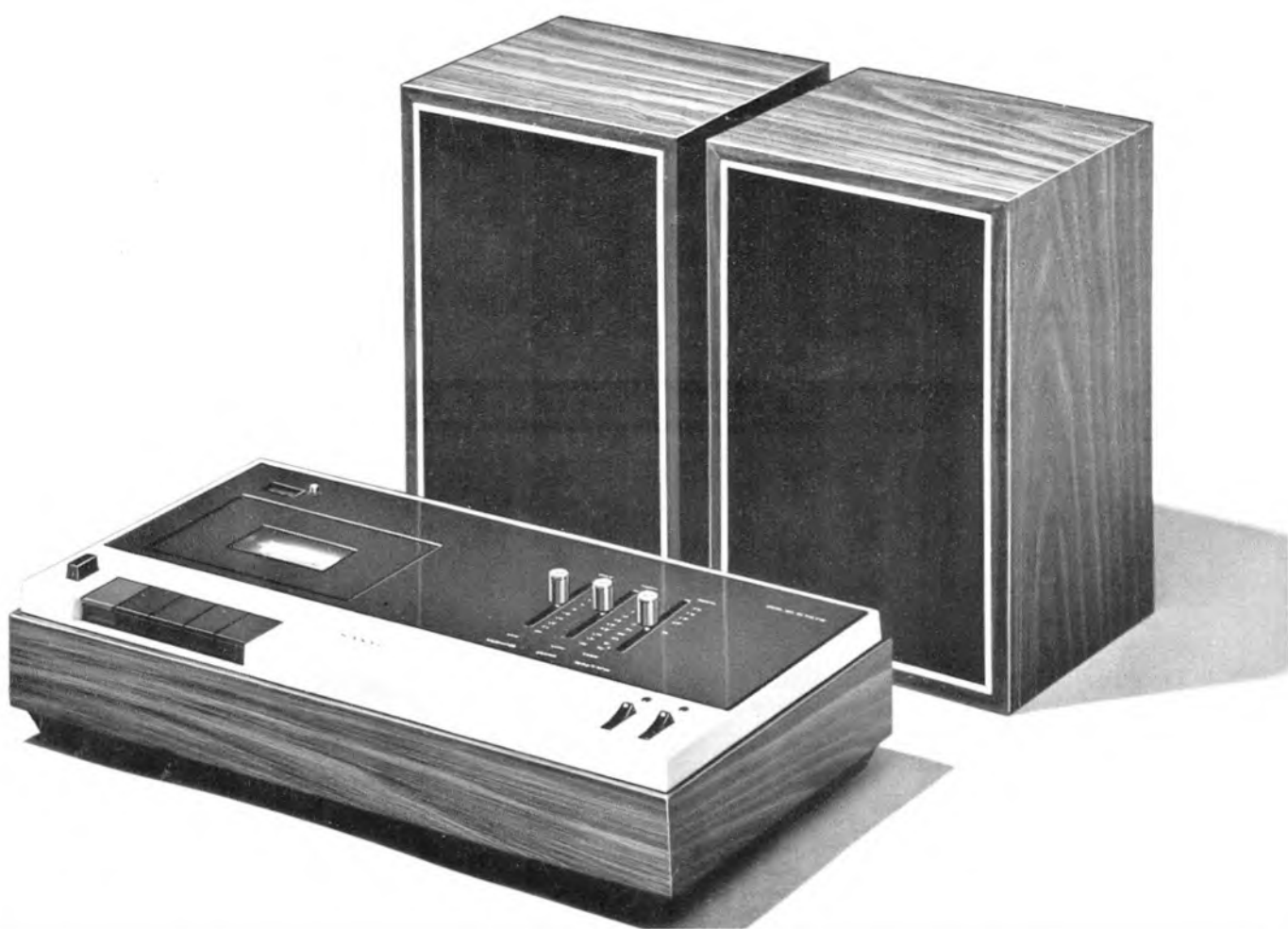
To the unsophisticated listener almost any amplifier coupled to a pair of boxes of any kind is going to give a sound that will send him into transports of delight. Why, then, is there all this hoo-ha about quality and why should one exhibitor tell him he should spend as much on a single loudspeaker as another charges for a complete outfit? This is the question that is so difficult to answer satisfactorily when the enquirer can discern no practical difference between the two. I wonder how many consumers have been persuaded to buy expensive items of audio equipment, the benefits of which they will never be able to appreciate because of natural defects in their own hearing?

This is a subject that the demonstrators never mention. They dare not. It would be most revealing if every customer at the hi-fi shop first underwent a hearing test to reveal to him and to the salesman the limits of hearing with which they are dealing. I suspect that in at least fifty per cent of cases the customer would save a great deal of money if he was to select on the basis of medical fact rather than selling jargon.

* * *

CHROMIUM DIOXIDE tape is coming back into the news. John Collinson of Rank Wharfedale Ltd. has conducted some revealing experiments with it using a cassette machine (reported in *Harrogate Trilogy* this month). One snag with this new material is the cost. It is going to be dearer than ordinary tape.

This might not matter too much for home recording applications; if one can use a slower speed in conjunction with a dearer tape then the end cost might well be either the same or even cheaper. The people it will hit are those in the pre-recorded music business. If they have to pay more for their raw material they might find they have to increase costs.



Where does the record go?

The answer is — it doesn't

This is a stereo system which plays convenient standard cassettes. In their pre-recorded form, called Musicassettes, these protected tape packs reproduce a high quality performance. Cost LP prices. And give you no worries about scratching or other damage.

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Above you can see the MR440G which is a perfect model to introduce you to cassette stereo. It is neat, elegant and simple to use with it's slide and pushbutton controls. You can buy it for just £84.15.0 including speakers (recommended retail price).

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Model MR410G
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Recorder
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retail price)



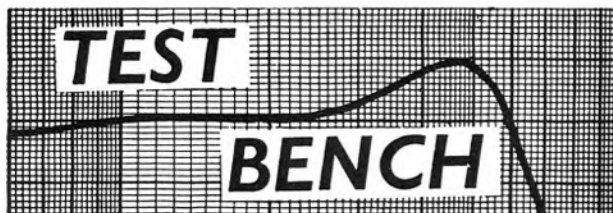
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Telephone: Watford 25355



SANYO MR-416

INVESTIGATED BY D. KILLICK
WITH HUGH FORD (of H. F. Engineering)

MANUFACTURERS' SPECIFICATION

Sanyo MR-416

Recording System: AC Bias.
Erasing System: AC Erase.
Tape Speed: 1 7/8 ips
Frequency Response: 50 to 10,000 Hz.
Wow & Flutter: 0.25%.
Signal to Noise: 45 dB.
Power Output: 1.2 Watts per channel undistorted.

Frequency Range: AM 530 to 1605 kHz. FM 88 to 108 MHz.

Sensitivity: AM 50 microvolts/m maximum. FM 2 microvolts maximum.

Inputs: Microphones 50 kOhms. Aux. 470 kOhms.

Output: Speakers 4 Ohms.

Speakers: 4-inch diameter x 2.

Power Source: AC 120V/200V/240V 50/60 Hz. DC 9V, 1.5V x 6.

Dimensions: 12 1/2 in x 6 in x 8 in (Approx.)

Weight: 9.47 lbs.

Included Accessories: Microphone with stand and remote switch x 1; ditto without remote switch x 1; patch cord x 2; AC power cord x 1; cassette x 1.

Recommended Price: £89.15s. including purchase tax.

Distributors: Sanyo-Marubeni (UK) Ltd., Sanyo House, Mill Lane, Watford, Herts.

SANYO MR-416 TEST CHART

| Frequency Hz | Playback Only | Overall Response | Signal/Noise Ratio | | Distortion % |
|---------------|---------------|------------------|--------------------|----------|--------------|
| | dB | | Battery dB | Mains dB | |
| 40 | -18.0 | -14.0 | 53.0 | 46.5 | 3% |
| 63 | -2.5 | | | | |
| 125 | +0.5 | | | | |
| 250 | 0 | | | | |
| 500 | 0 | | | | |
| 1000 | 0 | | | | |
| 2000 | +2.0 | | | | |
| 4000 | +3.5 | | | | |
| 6300 | +3.0 | | | | |
| 8000 | +2.5 | | | | |
| 10000 | +2.0 | -5.0 | | | |
| Wow & Flutter | 0.17% | | | | |

NOTES: The Overall Response figures relate to record and playback using a Scotch C60 cassette, Playback Only relates to the reproduction of a standard Philips calibration cassette, reference TC-FR.

For Signal-to-Noise Ratio the tape was recorded at standard reference level and then the signal was removed from the record amplifier. With the tape still in motion the (bulk-erased) tape noise in relation to signal level is quoted for best battery and worst mains results, but see text for further information.

Distortion is quoted against a 333 Hz. signal recorded at the same reference level and alternative measurements are given in the text.

Wow and Flutter is total RMS, the test frequency being 3,000 Hz. Test equipment used included: Bruel and Kjaer Signal Generator, B & K Frequency Analyser Tape 2107, B & K Level Recorder Type 2305 and Gaumont-Kalee Wow and Flutter Meter.

SINCE THE IMPOSITION of purchase tax on tape recording equipment we have seen the arrival of a number of combined radio and recording devices. These had not been marketed previously in the U.K. because the integration of the recorder (which had been tax-free) with a receiver (which was taxable) would have attracted tax to the whole. Now that the recorder is itself liable to purchase tax there is no longer any reason for separating two appliances which, logically, should be associated together.

With the convenience of the Compact Cassette as one of its great advantages

over open spool machines it is not surprising to find that cassette equipments have dominated the radio/recorder market. Given the accepted portability of the modern radio receiver (commonly, but wrongly, dubbed simply "transistor") plus the miniaturisation of the cassette system the two come naturally together in the happiest of marriages. This month we are looking at one of the newest models in this field, the Sanyo MR-416.

There is one significant difference between MR-416 and any other appliance of the kind that we have examined. The machine we are now investigating is fully stereo in all respects; it includes stereo record and playback on the cassette side plus AM/FM radio with stereo decoder and automatic beacon. One half of the case swings open and may

be detached to form the second loudspeaker so that the stereophonic effect can be heard under reasonable conditions and the whole outfit is completely portable, running off either dry cells housed internally or from AC mains by merely plugging the lead provided in to a domestic power socket. And all this comes to us for a total inclusive price of a few shillings under £90 with a full complement of accessories including a pair of microphones. When it is considered that a really good portable stereo radio alone can cost something approaching that figure the value of the MR-416 will be properly appreciated. In fact one dealer to whom we spoke at "Audio 70" said he had refused to stock the machine because, at that price, the radio facility could be no more than rudimentary. The results of our

laboratory tests should tell us whether he was right or wrong in his assumption.

Following our usual formula we started by checking the various record/playback parameters, first noting that the equipment does not provide a "line out" connection. On reflection this is not unreasonable since the whole is a self-contained unit that will operate very happily on its own without the use of any additional equipment; nevertheless we should have liked to find a facility for connecting into a main amplifier should the user so desire (we later established that its quality fully justifies such a provision). As it is the only outlet provided is a pair of sockets giving a feed to external loudspeakers and so it was from these (across a 4 Ohm load) that our measurements were taken.

There is a single tone control marked High in one position and Low in the other. As this affects the signal at the external speaker sockets we checked to establish its function and found it be the usual simple top cut with "flat" at the High setting. Before running calibration tapes we always take care to de-magnetise the heads of any machine to ensure that the costly reference tapes do not suffer any damage. In this case it was found that the heads were tucked away in such a manner as to make the application of the degausser difficult; in the same way head cleaning on this appliance is not the easiest of tasks, although it is of course essential to carry out this routine at regular intervals in order to maintain optimum performance.

Taking the reproduction of a standard Philips calibration cassette we find that the machine cannot give us any sounds at all in the very lowest register. This is interesting because the same phenomenon was repeated in the tuner section later. In practical terms this would seem to mean that the designers have "tailored" the equipment to suit the loudspeakers with which it will be used. The truth is that only costly enclosures of some size will properly reproduce signals below 100 Hz. so there could be said to be little point in providing a capability in that area. Had it been present we should not have been able to hear it.

Our response curve rises steeply between 40 and 63 Hz. to give a very satisfactory -2.5 dB at the latter frequency. Even at that point the loudspeakers will be doing nothing for us at all, so it could be said that the performance at the lower end exceeds minimum requirements for all applications other than the most critical high fidelity listening - which is only possible through the use of the very best loudspeaker enclosures.

Taking the curve on upwards from 63 Hz. the playback performance of the

MR-416 is exemplary. The only deviation from absolute flat is a gentle rise to +3.5 dB at 4,000 Hz. with a falling away to +2.0 dB at 10,000 Hz. Delicate adjustment of the tone control could give us a curve that would be sensibly flat, plus or minus 2.0 dB, over the full range of from 53 to 10,000 Hz. For a Compact Cassette machine this can be regarded as a noteworthy achievement; it is not unusual to find the graph taking a sharp nose-dive at around 6,000 Hz., ending way down at 8,000 Hz followed by an empty nothingness. Not so with this model.

As might be expected the record-to-playback curve is rather less perfect with the effective lower response coming in an octave higher at 125 Hz. but usefully extending all the way up to 10,000 Hz. once again. The peak is a little higher, both in terms of frequency and level, showing +5.0 dB at 6,300 Hz., but we still regard this as quite a creditable performance. Figures for both playback only and overall response are quoted for one channel only. Measurements were taken on both of the stereo channels but it was found that the variation between the two was so small - around 1 dB at the most - that there was no point in duplicating our findings. This, in itself, speaks very highly of the care that must have gone into the design and manufacture of the appliance, and it also ensures that the first requirement for "real stereo" has been more than adequately met.

Noise levels in cassette equipments are receiving a great deal of attention at the moment with the advent of the Dolby B noise reduction system so we took a large number of noise measurements under various conditions. First we established a difference in noise levels between the two channels; in every case the noise on the right-hand channel was two to three dBs. lower than that on the left. All our figures therefore relate to the worst (left-hand) channel and can be improved slightly for the other (right-hand).

Basic machine noise was 54.2 dB RMS, with 53 dB for the playback of bulk-erased tape. Noise after erase within the machine amounted to 50 dB. All the above are RMS readings against the level of the reference tone on the calibration tape and were taken whilst operating on internal dry cells. When run from the mains it was found that the noise deteriorated by about 6 dB. This is usual on mains/battery equipment; we have found similar results on all such machines we have investigated and this is the price one has to pay for the convenience of dual operation. All it means is that when taking important recordings the user would be well advised to run on dry cells using mains for the long periods of

household use when radio listening or cassette playback is not critical. In the battery mode the noise figures we have reported are amongst the very best that can be obtained on this class of equipment.

Since noise relates directly to distortion we next investigated this factor. In view of the fact that the noise measurements were related to reference level on the calibration tape (the only datum that can be usefully employed where, as in this case, record control is fully automatic) we treated our distortion investigation in the same way to establish that at approximately 3 dB below reference level the record/playback distortion content amounted to approximately 3%. It must be remembered that we were tapping the external loudspeaker sockets and so this includes any distortion present in the main amplifier stage. As such it can be regarded as an outstandingly good result.

Looking at speed stability we arrived at a total RMS figure for wow and flutter of 0.17%. Many cassette machines quote levels as high as 0.4% in their specifications and this can be quite disastrous for listening to classical music. Not so very long ago one of our top British-made open spool machines quoted "under 0.2% at 7½ ips" as their wow and flutter claim. Here we have that adequately met at 1⅞ ips on Compact Cassette. How times change!

Long term speed stability was not quite so good. The MR-416 was running consistently 3% fast on either batteries or mains. This was measured on an electronic counter and the readings were taken from the middle to the end of a cassette. We should have liked to have been able to note greater accuracy than was found.

The last part of this investigation was to check on the power output and this was shown to be around 0.6 Watts per channel RMS with the waveform on the point of clipping. In the specification the manufacturer refers to 1.2 Watts undistorted without mentioning whether this is an RMS or a Music Power measurement. If he is measuring to the latter standard then his figure is about right.

We can summarise the cassette side of the equipment by saying that the performance comes up to some of the best standards that have yet been produced in portable machines with certain parameters showing up extremely well in comparison to mains machines. At this state of the art we could hardly expect to get better results, apart from the tendency to run fast on either mains or batteries. From here we began to look at the radio facility.

Before going into the details of our

technical findings we should perhaps quote verbatim from the laboratory. It was said that: "the MR-416 operates as a radio receiver rather more efficiently than a number of radio sets costing approximately its total purchase price." Which is all very surprising.

The frequency response of the FM tuner was shown to be plus or minus 2 dB over the range of 60 to 12,000 Hz., sensibly flat on both channels from 100 to 10,000 Hz. De-emphasis is in accordance with the European standard of 50 microseconds and the noise level on mono operation is 68 dB for 1 millivolt in. The standard for a good "hi-fi" tuner in this respect is 70 dB, yet we closely approached that figure.

In the stereo mode the same input signal gave 30 dB on the left-hand channel and 39 dB on the right. Third harmonic distortion of a 1,000 Hz. tone to maximum modulation was 0.26% when operating mono, but this fell to 0.9% when the signal was reduced by 20 dB.

FM sensitivity was found to be 5 microvolts IHF for 30 dB signal-to-noise and when working stereo there was a 15 dB channel separation at 1,000 Hz. with 20 microvolts in. The stereo beacon glows at 100 microvolts but in fact the set is receiving and operating stereo before that point.

Tuning was found to be positive with the required station flipping cleanly in and out as the scale is traversed. Since the radio does not have a signal strength indicator this ability to accept and then reject without drift is essential to good listening. There is no provision for the connection of an external aerial and so our reception report refers to the use of the telescopic antenna provided.

On the AM side a 1 millivolt signal gave us a response that was flat, plus or minus 3 dB, from 75 to 4,000 Hz. Tuning here, too, was clean and responsive.

Whilst writing these notes the radio of the MR-416 is providing some delightful background entertainment. With its two loudspeakers operating on monophonic broadcasts the quality is outstandingly good; as soon as stereo is being transmitted the beacon dutifully glows and all the benefits of stereophony can be enjoyed. There is no need for us to summarise the performance of the radio in the MR-416, other than to say that we could spend as much on a less efficient radio without a record facility. Congratulations to Sanyo on a very remarkable product.

The general appearance and lay-out of the MR-416 leaves little to be desired. Because the second detachable stereo speaker is included it takes on a rather more bulky shape than might be expected, but the lid speaker (which is

nearly as large as the machine itself) may be removed completely to aid portability. In this condition the full stereo record facility is still available; one would only lack stereo playback.

The case is fabricated from a shiny black plastic with simulated wood on one side. This is the internal face when the two halves are clipped together. All controls and the tuning scale are positioned along the upper edge and these comprise five rotary knobs with the following functions: first a selector marked AM, FM and Tape (the latter position switches off power unless the cassette section is operating), a Tone control, a Volume control, a Balance control and lastly the Tuning control. To their left is an edge-type battery condition meter with the Stereo Beacon (a small pilot light that glows when a stereo broadcast is being received) immediately below, and beneath that a red button marked "Light" which illuminates the tuning scale when depressed. This latter is very useful if the radio is in use under poor lighting conditions, but to conserve battery strength the button is so designed that it must be kept depressed whilst illumination is required; as soon as it is released the light will go out.

The tuning scale is clearly marked with white figures on a black ground and it is traversed by a red-coloured cursor. To the right of the scale are five square-shaped push keys controlling the tape transport and functions in the cassette side of the machine. These push keys are marked: Stop, Forward, Rewind, Play and (with a red insert in the top) Record. Next to this array is an Eject push key which causes the trap-door enclosing the cassette to fly open; it does not fire the cassette into the air as some other versions are wont to do.

Recessed in the rear panel we find two miniature jack sockets for the connection of external loudspeakers, a pair of phono sockets labelled "Aux" for line in and the two microphone sockets with their remote control facilities. There is also a special three-pin receptacle for the mains lead provided with a slide switch for selecting AC or DC operation. The latter implies running from the six 1.5 volt batteries housed internally. Battery storage is on the underside, and as with many machines of this type we found the insertion and removal of cells to be just a little awkward. The whole is equipped with a sensible carrying handle and, of course, the telescopic antenna previously mentioned.

The arrangement of the second loudspeaker is rather clever. A clip on the side enables it to swing back to open up in a conventional box-like manner. Used in that way the speaker is fully

operational with the two hinges providing the connections. For better stereo separation it is merely lifted off and placed in the desired position and a connection is made into the appropriate external speaker socket via the lead provided. All very simple and efficient.

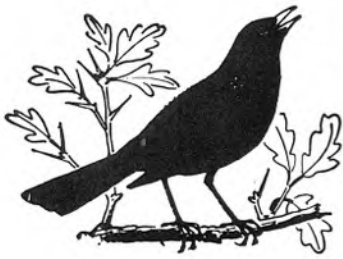
In view of the undoubted enthusiasm from the laboratory we were anxious to put this machine through its paces and so lost no time in switching on. Radio reception lived up to our expectations with the one proviso that we would have liked to find a Mono/Stereo selector control. As it is one cannot switch stereo reception to mono, a change that is sometimes to be desired when reception conditions are difficult for stereo programmes. The hiss level when working stereo is higher than that experienced in the mono mode, so an ability to change from stereo to mono would have improved the quality of some recordings. However, the great thing is that this little giant really does pick up – and deliver to the listener – stereo transmissions without the need for any external aerial equipment at all. The amount of hiss present will depend on the signal strength, which in turn will depend on the location in which the receiver is used; if it should be obtrusive it could always be reduced by applying a little top cut via the tone control.

But what impressed us at least as much was the undeniable quality from the two loudspeakers. They do not pretend to be high fidelity enclosures, and yet they give a sound that is acceptable to critical ears. Let us be honest – we would *prefer* to hear programmes reproduced on our own full-range transducers, but considering that each one of these costs more than the full price of the complete MR-416 we have to make sensible allowances.

With the volume control in the "2 o'clock" position we had a comfortable listening level for an average-sized domestic room; at maximum the sound was too loud to be pleasant.

Recording off the air is simplicity itself. One merely inserts a cassette and depresses the Play and Record keys together. Level control is automatic and there are no external connections to make. To play back the tape is rewind and the function switch changed to Tape. When the Play key is then depressed we are listening to the programme just recorded. Nothing could be easier. And remember, when a stereo broadcast is being received we shall be recording in stereo; if the transmission is monophonic then the two stereo tracks on the tape will each carry identical mono signals, which, of course, will be reproduced by the two loudspeakers. This "double mono" as it is called gives a much more "solid"

Please turn to Page 374



NATURE NOTES FOR NOVEMBER

BY RICHARD MARGOSCHIS

NOVEMBER, like any other month, is an unknown quantity so far as weather conditions are concerned. It can bring snow and frost, coupled with fog, or it can produce pleasant sunshine. Quite often such conditions are good for outdoor recording work because winds are slack but much will depend on the part of the country in which you live. Certainly it is a month during which, if you are keen enough, you should make the best use of prevailing conditions. There is always a chance of finding something to record because nature is never quiet for long, and the more time you spend in the countryside the greater are your chances of capturing some unusual sound.

Summer visitors have long since moved south but they will be replaced by winter visiting birds from the north. Around the meadows you will hear the "chack chack" of the gregarious Fieldfare and, if you are out on a calm still and starlight night you might be lucky enough to pick up the "seeip seeip" of Redwing as they pass over on migration. These are contact calls to keep the flock together and a real challenge to any recordist. During the months they are here these birds set up roosts to which they return each evening; if you can locate such a site then there should be some good opportunities for recordings, either by using a reflector or an open microphone placed in the roost some time before the birds are due to arrive.

From now, through the winter months, visits to inland waters, reservoirs, etc. can be very rewarding if you are interested in duck and geese; they might not be particularly vociferous but you would be very

unlucky not to hear something. Recording is not always easy because so many of these waters are open to every bit of wind that is likely to blow; it is usually a case of finding the best shelter that you can, followed by a long wait in the hope not only that the birds will come close enough to you but also that they will call when they arrive!

At the same time, you should not forget our resident birds. This is a month in which you are likely to hear quite a lot of calls from the various finches, contact and conversational calls rather than song, but they can in themselves make a subject for study. Song will not be completely absent however, for you are quite likely to hear the odd phrase from a wren, a dunnock or even a thrush; a recording of this latter would surely be of interest to compare with the full song of springtime.

Then there are the pheasants; I always find it fascinating to stand on the edge of a wood at dusk to hear the cackling call of the cocks as they go up to roost, mingled with the agitated 'chack' of the blackbirds. A friend of mine, whose job makes him particularly interested in pheasants, once asked me to help him by replaying the call of a roosting bird at a certain spot in the woods. I discovered that the purpose was not to attract other birds but to attract another person who should not have had an interest in these birds at all. Having agreed to do this 'job' I was scared stiff that if I didn't get my head blown off by a twelvebore I might, at least, see my recorder blown to pieces! We met on the night arranged. It was pouring with rain. I was saved.

To return to weather conditions which can help in a different way. The next three months is the time to listen for the mating call of the fox and any snow lying on the ground can be used to good advantage, by daytime, to indicate the runs they are using and so give you an idea of likely spots to wait at night.

On the other hand, if the weather is so bad that recording is impossible, why not use a few evenings to listen to all the recordings you have made in the past year. Be critical about them and compare them with recordings from previous years. If there is a considerable improvement try to assess the reason; is it improved equipment or technique? Try, also, to work out how you might have improved the recordings which do not sound so good now.

When you are replaying natural history recordings do not attempt to listen at too high a level; I am sure this is a mistake which is all too common. You should listen to them sitting quietly in your room, just as you sat quietly in the open when you made them — they will sound much more natural then. Turn the volume up too much and it will sound as if the bird is sitting on your shoulder which, unless you were uncommonly lucky, it certainly wasn't. In addition the inevitable background noise will become more noticeable, and possibly offensive.

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| Down Argentina Way with Dorita y Pepe | Dorita y Pepe | ZCMA 1137 Y8MA 1137 |
| Stan Reynolds plays a Stereo Salute to James Last. Vol. 1. | Stan Reynolds & His Orchestra | ZCMA 1135 Y8MA 1135 |
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**Ingrid Haebler (piano), Arthur Grumiaux
(violin) etc. Schubert "The Trout" Quintet CPC 0011**

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Amsterdam/Christoph von Dohnanyi**
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VSO/Wolfgang Sawallisch Strauss Waltzes
CPC 0051

**Concertgebouw Orchestra,
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Tchaikovsky Nutcracker Suite, Op. 71a CPC 0038

Henryk Szeryng (violin), LSO/Antal Dorati
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Wes Montgomery A Day in the Life CYP 185

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Val Doonican Val CYP 196

**Sergio Mendes & Brasil '66 Fool on the Hill
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Petula Clark Portrait of Petula CYP 1110

Herb Alpert & the Tijuana Brass Warm CYP 1111

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PHILIPS

Music

Musicassette Reviews

Consultant Critic Katinka Seiner

THE EXQUISITE NANA MOUSKOURI.
Fontana 7103 004. 47s 6d including
purchase tax.

Do you remember when it used to be said that "fellows never make passes at girls wearing glasses?" Nana's glasses must be amongst the most famous in the world, and there they are on the sleeve of this cassette (full colour) and again inside (black-and-white this time). Well, this is a pair of glasses that we have all taken to our hearts. The popularity of her television appearances and her recordings has been something of a phenomenon. From the land of grapes, sunshine, white houses and militant colonels she has taken us by storm.

In this collection she gives us: *Hello love, The last rose of summer, The 59th Street Bridge song (Feelin' groovy), Oh I had a golden thread, Il n'est jamais trop tard pour vivre, Day is done (Mon enfant), Prelude, Love minus zero/No limit, Les parapluies de Cherbourg, Dance till your shoes fall off, From both sides now* and *Kathe trello pedi*.

Recorded quality is first-class with a reasonable level of background noise and realistic presence. Mouskouri is right there, singing to us, as she should be. Pity we have to rely on the illustrations for a sight of those famous glasses! Much of Nana's success can be attributed to her charming personality and in the close microphone techniques employed here the listener feels the nearness of that colourful and vibrant young lady.

At first I thought I preferred her rendering of the foreign language items rather than her treatment of the English numbers, but *Day is done* changed all that. An exciting arrangement with heavy choral backing turns a rather slight number into a full-scale feature. However this is an exception and on the whole I feel happier, and I'm sure she does too, when she's singing in her own tongue – perhaps with French as the next favourite. *Prelude* (Calabria/Massey) is disappointingly weak; this is the one number where the voice is swamped by the accompaniment. But there are many compensations within this album. I enjoyed it greatly and I hope you will too.

LET IT BE. The Beatles. E.M.I. TC-PCS 7096.
47s 6d including purchase tax.

This album is, of course, taken from the film of the same name where, as an essential part of the action, The Beatles performed live for many of the tracks. As the sleeve notes say, we have here all the warmth and freshness of live music. For a proper understanding of the repertoire one should really have seen the film; I must confess that I have not. So my opinion will be based on my feelings about the collection as pure musical entertainment divorced from any visual images or impressions.

The collection comprises: *Two of us, I me mine, One after 909, Across the universe, Dig it, Let it be, Maggie Mae, Dig a pony, The long and winding road, I got a feeling, For you blue and Get back*.

As we all know this project could mark the apotheosis of The Beatles into that higher realm of separate deification, each going his own way and taking with him all the mysteries of his own particular cult. The unified whole is fragmented and the sum of the separate parts could well be greater than that of the group. So this could be regarded as an historic album and as such will be acquired and treasured by all Beatle addicts.

Fortunately recorded quality meets this sense of occasion with some really fine sounds. It is, incidentally, the very first cassette to come off the new EMI production lines at the new high-speed copying plant at Hayes.

What did I really think of it? Well, I'm not a great Beatles fan myself (which, according to some, makes me something less than human – a judgement I can only accept with bowed head and contrite heart in view of the sheer weight of numbers behind it), although, let me hasten to add, some of their items have an enduring quality that can only be equated with "greatness". All I mean is that I am not prepared to accept everything they put out with blind faith and childish adulation.

Take this collection, for instance. Why, oh why does it have to be presented in a finished form that would disgrace any group of amateur schoolboys entertaining their parents? Adolescent tomfoolery can be fun. It is rarely funny. No-one is going to convince me that it has anything at all to do with music. Certainly not great music. Don't misunderstand me. Music itself is fun, but of quite a different kind.

So, having taken my life in my hands and registered my one small protest (which will worry no-one, The Beatles least of all!) let me conclude by saying that enjoyment can be found for the ordinary (non-fan) listener if he is prepared to tolerate a record that would have been laughed out of court had any other name been associated with it.

SENTIMENTAL JOURNEY. Ringo Starr.
E.M.I. TC-PCS 7101. 47s 6d including
purchase tax.

Here is an album I never thought I'd live to see. Ringo Starr singing the popular numbers of fifty or more years ago. Well, well, well. There are certainly more things in heaven and earth than I have ever dreamed of!

The route taken for this sentimental journey covers: *Sentimental journey, Bye bye blackbird, Let the rest of the world go by, Night and day, I'm a fool to care, Stardust, Blue turning grey over you, You always hurt the one you love, Have I told you lately that I love you?, Whispering grass, Love is a many splendored thing and Dream*.

There's only one valid question that can be asked about such a traditionally sung album of traditional numbers: how does it compare with other, earlier versions by other (more traditional) singers? And there's only one answer to that. Badly.

With an unimpressive voice and lack of vocal control this is just not the material for Ringo

Starr. He's often hopelessly out of tune. There's not a shred of personality coming over. It's more dull and uninteresting than yesterday's news.

Perhaps the right word is "decadent". Starr should be looking forward and outward, not cashing in on his reputation by producing mediocre palliatives of this kind. Where is the originality? Where is the fire of inspiration? Where is the dash and the daring? Where is the revolutionary? Alas, not here. I couldn't bear to listen to it again.

McCARTNEY. Paul McCartney. E.M.I. TC-PCS 7102. 47s 6d including purchase tax.

Here we have another offering from a member of that exclusive club, the ex-Beatles. Paul McCartney is now "doing his thing" and he's doing it on his own. It's very much a personal effort, written and produced by the maestro himself. So all the credit – or the blame – must go to him and him alone.

McCartney gives us: *The lovely Linda, Momma Miss America, Maybe I'm amazed, That would be something, Man we was lonely, Oo you, Valentine Day, Every night, Junk, Singalong junk, Hot as sun, Glasses, Teddy Boy and Kreen-akrore*.

Unlike Ringo Starr, McCartney has his sights firmly fixed on the pop scene and he works hard both vocally and instrumentally. The album contains some good entertainment value as well as a few numbers that send shudders down my back. Very much a mixed bag but so much more worthwhile than Ringo's "Sentimental Journey".

By the way, The Beatles is one of the few subjects on which I receive abusive letters. If I attack them a multitude of readers instantly rise up in their defence and, in turn, attack me. May I please explain that the function of the critic is to express personal opinions. The good critic is not influenced by any outside consideration, whether it be other people's opinions or pressures from manufacturers (from which, by the way, I don't suffer). And if you should hold a directly contrary opinion to mine then surely that is very useful. Just buy what I dislike and shun like the very devil anything I might praise! Why not?

So to continue doing *my* thing I must add that two titles here worry me considerably. The third and fourth items on track 2. *Junk and Singalong junk*. There was a time when that word conjured visions of quaint Chinese sailing boats; now a much more sinister picture immediately springs to mind. The first of these two numbers is, ostensibly at least, about yet another kind of junk – the rubbish found in a junk-shop. Yet the implications are only too obvious. To most young people junk means one thing and one thing only. And what it means I hate and loathe. Equally I hate and loathe anything or anyone that could be interpreted as encouraging the adoption of a filthy, degrading and often fatal habit. Do I make myself clear McCartney?

NEW PRODUCTS

ON SEPTEMBER 2 JVC Nivico (Victor Company of Japan Ltd.) announced their newly developed four-channel gramophone disc and also the reproducing system called CD-4. The letter "C" stands for "compatibility" and the letter "D" for "discreetness" and it is claimed that the new CD-4 system is provided with five qualities that are considered essential in a four-channel record. These are: genuineness, discreetness, compatibility, economy and high fidelity.

In the disc four independent sound channels are reproduced separately from respective channels in unison, and therefore reproduction of the disc does not in any way affect other four-channel music sources. The tone quality of the newly introduced four-channel disc is said to be the same as that of a current stereo record and it can be played as a two-channel record on conventional disc reproducers.

Four-channel Stereo-8 is also being produced by Nivico and three types of domestic players will be available on the domestic market shortly.

First demonstrations in the U.K. are being given at the Olympia Audio Fair when prices will be announced.

Denham & Morley (Overseas) Ltd., Denmore House, 453 Caledonian Road, London, N.7.

WHAT IS BOLDLY CLAIMED to be a "revolutionary" new product is announced by Sansui of Japan. The QS-1 Sound Reproducing System is said to create a "sound field" instead of the conventional two-channel stereo imagine; it is claimed that the QS-1 will give the listener a four-channel sound field from ordinary two-channel sound sources and, theoretically at least, could convert four-channel signals into six or more channels.

The letters "QS" stand for "Quadphonic Synthesizer" and through its use it is said that stereo enthusiasts will be able to take advantage of their existing stereo equipment, tapes, records and FM stereo broadcasting to obtain four-channel sound inexpensively. First demonstrated in Tokyo on June 25, the development programme had been carried out under conditions of the tightest security and secrecy. The breakthrough is said to be due to

the fact that Sansui engineers discovered that conventional stereo records and tapes invariably contain certain sounds and effects that were not being utilised; effects that when added to the direct sounds achieved the creation of the "sound field". By employing a special "phase modulation" circuit in the QS-1 indirect sounds are picked up and synthesized with direct sounds to give what is described as "concert hall presence".

In reply to the suggestion that such four-channel listening would only be "quasi" quadphonic, the manufacturer agrees that such is the case when using two-channel tapes or records; but they add that had such material been recorded with the use of the QS-1 in mind from the outset then the listener would have all the benefits of absolutely authentic four-channel reproduction.

The system is said to be inexpensive because in addition to acquiring the relatively low cost QS-1 (U.K. price to be announced) the stereo enthusiast need only add a second set of speaker systems and a second power amplifier in order to enjoy four-channel sound. It is reported that with speakers placed so that two are in front of the listener and two at the rear a jazz concert recording gives the exceptionally life-like feeling of sitting in the midst of the audience watching the performance. For classical music Sansui recommends placing all four enclosures in two ranks in front, thus exploiting the physical depth of the orchestra.

Brush Cleveite Co. Ltd., Thornhill, Southampton SO9 1QX.

THE JAPANESE firm of Sanyo claim to be the world's largest producers of cassette recorders and they now announce five new Compact Cassette combinations.

M508 is said to be the smallest cassette machine on the market, measuring only 3½-inches by 1⅞-inches by 5½-inches. It is equipped with one-touch finger controls, battery indicator light, automatic level control, tape counter, cassette ejection and a built-in microphone.

The machine is said to have 250 mW of audio power and a frequency range of from 150 to 6,000 Hz. It runs on three size HP7 penlight cells and costs £54 15s.

MR408 is a versatile stereo cassette recorder with a detachable "satellite" loudspeaker. Tape transport is controlled by interlocking push buttons and the machine has automatic level control, cassette ejection and a battery condition indicator.

Total Music Power output is said to be 3.6 Watts and frequency range 50 to 10,000 Hz. Powered by 6 size U2 batteries or directly from AC mains the price of the MR408 is £64 15s.

Model MR416 differs from the above only in the inclusion of an AM/FM radio complete with stereo multiplex decoder. This machine is reviewed in our Test Bench feature this month and is shown on our front cover photograph.

MR414 is complete cassette stereo and AM/FM system with stereo decoder. It will record and play mono or stereo cassettes and is provided with twin VU-type meters, slide controls, cassette ejection, tape counter and an AFC switch for the radio.

Supplied in walnut finished cabinet it has a claimed 10 Watts total Music Power output through two satellite loudspeakers and frequency range said to be from 30 to 12,000 Hz.

Running from AC mains only the price of the MR414 is £128 15s.

Last of the new equipments is the MR605, an automatic cassette changer deck designed to accept up to six pre-recorded cassettes. Any cassette or side may be rejected at the push of a button and the equipment has automatic tape reverse.

Claimed frequency response is 30 to 10,000 Hz and the price is £99 15s.

Sanyo Marubeni (UK) Ltd., Sanyo House, Bushey Mill Lane, Watford, Herts.

PRICES OF SCOTCH cassettes manufactured by the 3M Company were reduced from the 1st October. The new prices (with the old ones in brackets) are: C60 15s 2d (17s 6d); C90 20s 6d (25s 0d); C120 30s 6d (33s 6d).

These cassettes are all designed for use in Philips Compact Cassette system equipment and contain low-noise Dynarange tape, a recording medium which is claimed to give maximum performance at slow tape speeds.

3M Company, 3M House, Wigmore Street, London, W.1.

A COMPLETE CATALOGUE of all pre-recorded cassettes and Stereo-8 cartridges is now obtainable from Lind-Air. Costing 2s 6d the catalogue contains 128 pages and is available only from Lind-Air who also have a direct mail ordering service.

Lind-Air Audio Centre, 18/19 Tottenham Court Road, London, W.1.

TEST BENCH — from Page 369

impression than would a single speaker and we suspect that this is one of the reasons why the sound from the MR-416 appears to be so good — certainly better than one might have expected from such simple loudspeakers.

In the reproduction of pre-recorded Musiccassettes we get the full advantage of this system. The sound heard is superior to anything we have experienced before from portable cassette machines using their own loudspeakers.

As a final plus we have the facility to record in stereo using the pair of microphones provided. All the accessories, by the way, are neatly housed in a compartment in the rear of the second loudspeaker enclosure. With this machine live stereo recording is not only possible,

it is quite feasible. Each microphone has a small table stand of its own and there is no reason why the user should not have a great deal of fun and pleasure out of producing his own stereophonic tapes. There is not space to deal here with all the techniques involved, but these have all been covered at different times in various issues of *TAPE Recording Magazine*. Sufficient to say that there is nothing to be frightened or scared of in working stereo. What we have previously lacked has been equipment at reasonable cost on which the amateur could experiment. Now, with the arrival of the Sanyo MR-416, we at last have a comprehensive appliance that will fulfil many roles, not least of which is that of the stereo recorder without the need to spend so much as another penny.

If this review appears to indicate enthusiasm for this machine then that is our honest feeling about it. We believe that at its price it is offering exceptional value for money. It will be used within the home as a first-class radio when it will bring in stereo programmes with ease and clarity. It can be used in kitchen or bedroom as a versatile portable. It can record and play back in mono or stereo and it can be taken out "on location" to produce live recordings with that personal touch that makes them unique. This machine marks one of the significant steps forward in the general improvement of the quality and the facilities provided in portable Compact Cassette mechanisms, and as such we feel sure it will meet with a well-deserved success in Great Britain.

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Telephone 01-568 9222

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 Akai 3000D, Stereo Tape Deck, 4-track, 2-speeds, Record/Playback/erase Heads, complete in wood cabinet £82 0s 0d.
 Sanyo MR 800, Stereo Tape Deck, 4-track, 3-speeds, complete in wood cabinet. £72 0s 0d.
 Sloman & Pettitt, Pudding Lane, Maidstone - Tel: 54124-51478.

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