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CORRESPONDENCE AND ARTICLES

All STUDIO SOUND *correspondence should be sent to the address printed on this page. Technical queries should be concise and must include a stamped addressed envelope. Matters relating to more than one department should occupy separate sheets of paper or delay will occur in replying.*

Articles or suggestions for features on all aspects of communications engineering and music will be received sympathetically. Manuscripts should be typed or clearly handwritten and submitted with rough drawings when appropriate. We are happy to advise potential authors on matters of style.

FEBRUARY 1973 VOLUME 15 NUMBER 2

SINCE ITS EARLIEST days as *The Tape Recorder* (February 1959), this journal has taken particular pride in the unbiased nature of its review columns. When title and content were changed to the STUDIO SOUND format, through 1970 and '71, review standards were further raised to match the higher quality expected of industrial equipment. We believe our equipment reviews, now predominantly in the hands of Hugh Ford, are second to none. Readers will no doubt correct us if we are wrong.

And now we face a problem. Throughout the years, we have accepted invitations to visit factories from South London to Tokyo. In many cases such invitations were casual, there being no obligation to publish 'A Visit to So-and-So'. Where a visit proved interesting, an appropriate article was both a duty and a pleasure to prepare. In a few cases, Studer for one, the writer's enthusiasm towards a company verged on sycophancy. More recently, a rot has set in. When a writer visited one firm shortly before their collapse, he was told not to photograph a particular lathe as it was unsuitable for close-tolerance cutting. He later photographed a chaotic workbench—a photo which, out of misguided sympathy, we chose not to publish.

On several occasions, staff and freelance contributors have visited companies on the clear assumption that an article would result. Where their impressions were mixed, the resultant report has been less than wholly enthusiastic. Some manufacturers or importers, 'checking the facts' of a draft, then registered their disappointment by offering to rewrite certain sections. Back came a total rewrite along the lines of . . . 'producing the most sophisticated and efficient recording equipment available' . . . 'Ingenius [sic], exciting and inventive' . . . and so on. These are precise quotes and would look bad enough in the Sunday supplements they emulate. They do a company no good at all in the pages of a technical journal.

The function of STUDIO SOUND is to communicate to the recording and broadcasting industry such technical, commercial and political developments as appear likely to affect it. To this end, our pages are open to any and all manufacturers prepared to discuss in print their particular technical claim, their approach to engineering problems, their reasons for regarding themselves unique. The industry is interested in ideas, not in the buildings where those ideas are generated.

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Annual subscription rates for STUDIO SOUND *are £3 (UK) or £3.30 ($8 or equivalent) overseas. Six monthly home subscriptions are £1.50. Our associate publication Hi-Fi News costs £3.24 per annum (UK) or £3.66 ($8.64 or equivalent) overseas.*
STUDIO SOUND *is published on the 14th of the preceding month unless that date falls on a Sunday, when it appears on the Saturday.*

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A small number of certain past issues may still be purchased from Link House, price 31p each including postage.
Photostat copies of any STUDIO SOUND *article are available at 25p including postage.*

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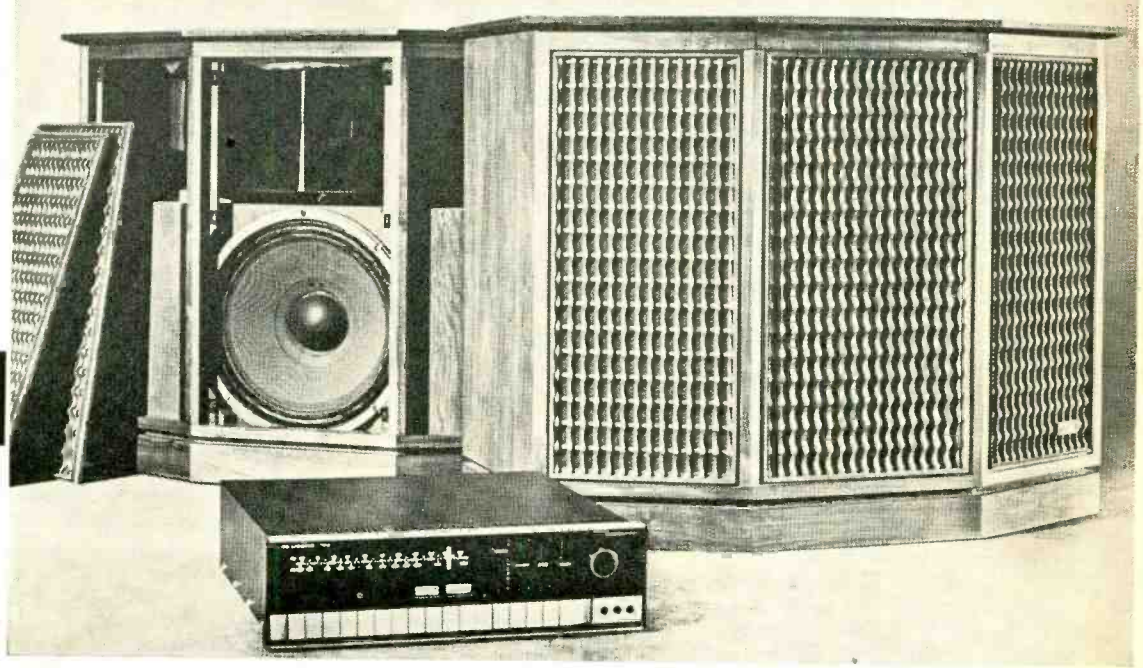

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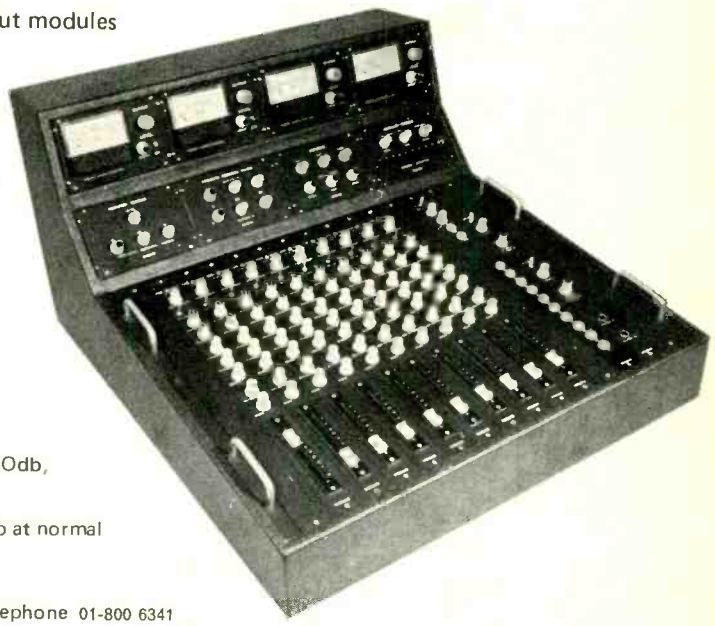

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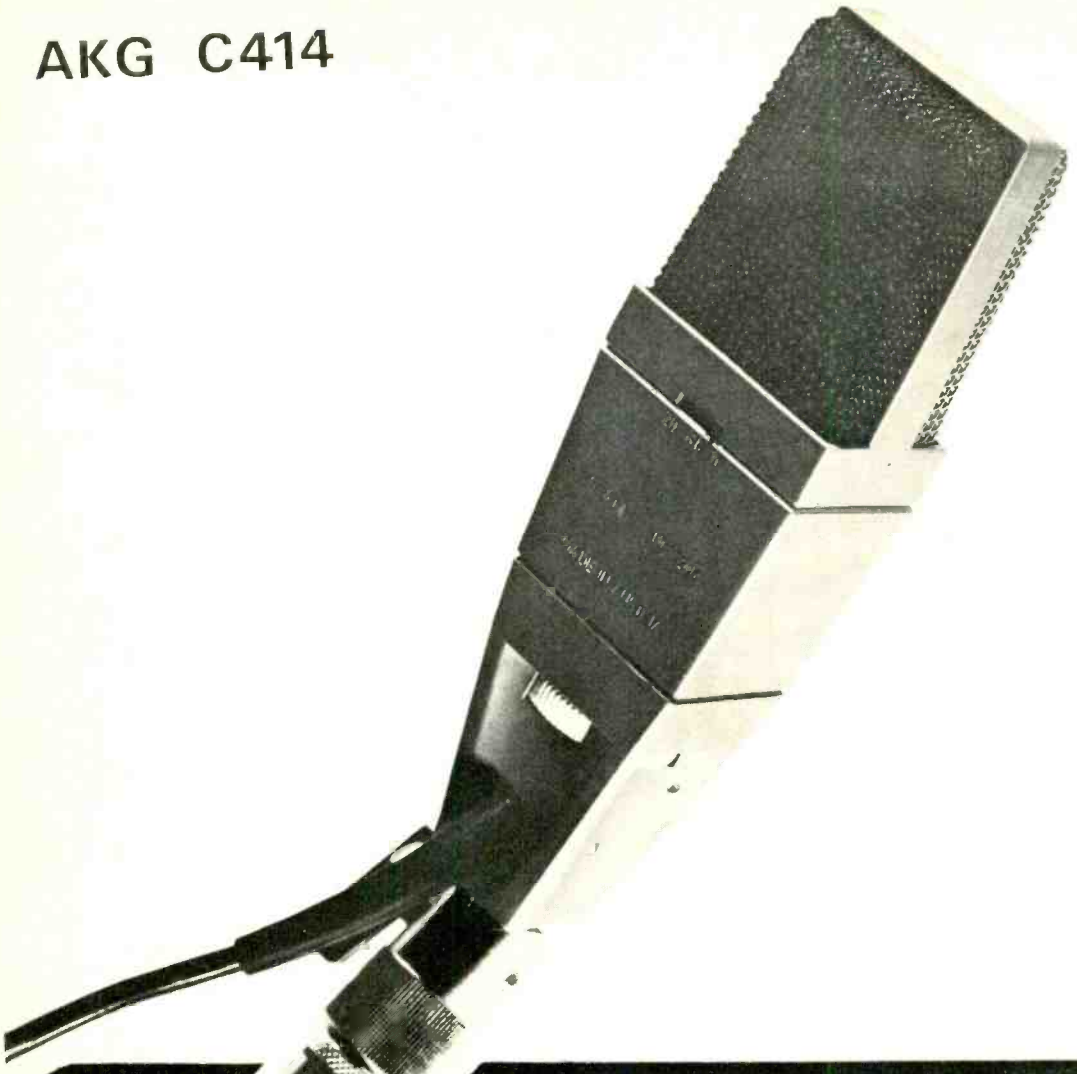

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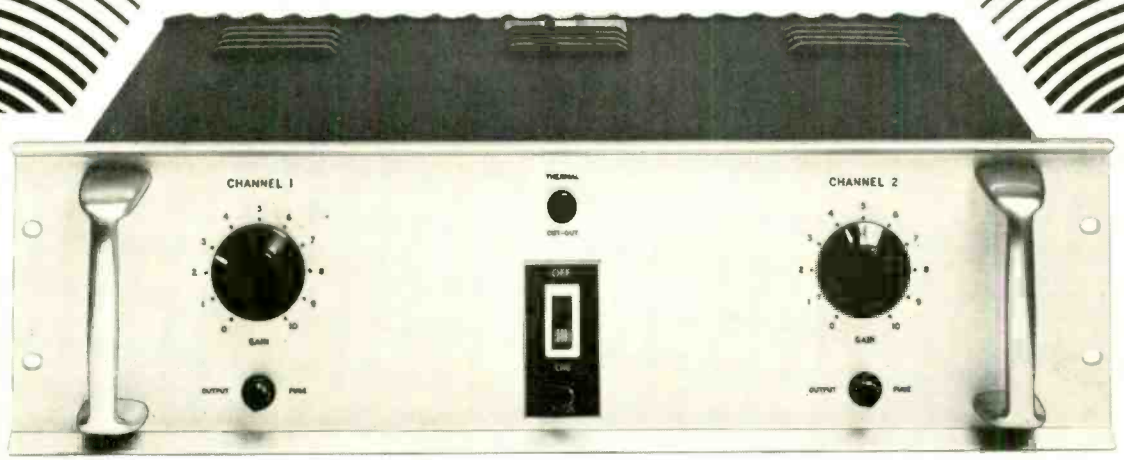

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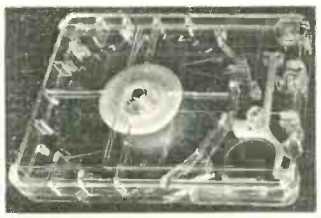

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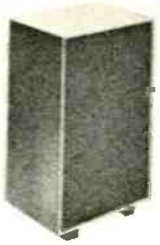

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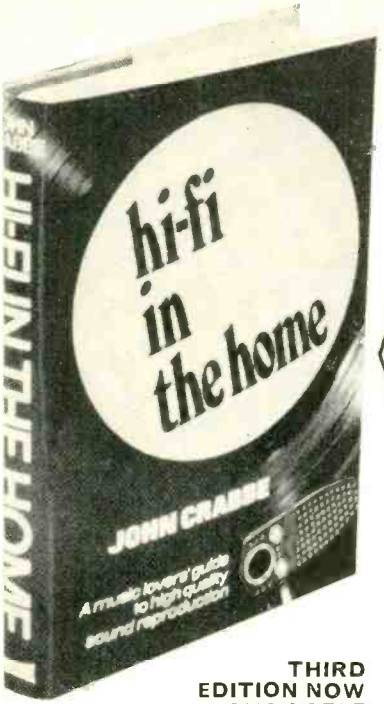

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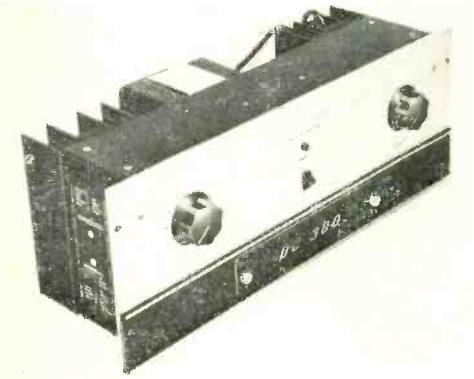

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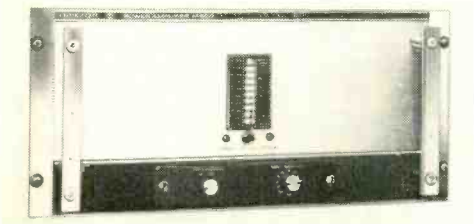

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APRS look at VAT

A TALK ON Value Added Tax by William Every (Customs & Excise) was given at a recent APRS meeting. Chaired by Jacques Levy, the meeting provided association members with the opportunity of discussing questions unanswered by the VAT guidebooks 700 (General Guide) and 701 (Scope and Coverage). The discussion was recorded verbatim and transcripts are available free to members (£1 to non-members) from the secretary: E. L. Masek, 23 Chestnut Avenue, Chorleywood, Herts WD3 4HA.

Technical courses

TWO TECHNICAL courses entitled *Video Recording* and *Time Sharing Computer Systems* commence in February at Norwood Technical College. The video course will cover monochrome and colour recording and transmission systems, tape, disc and electron beam techniques. Specialists from the BBC, EVR Partnership and Philips will contribute to the lectures. The course commences on February 12 and runs seven weeks, 18.30 to 20.30. Enrolment fee is £3. IBM specialists are contributing to the computer time sharing course, encompassing hardware, software, organisation and operation. This course runs over six weeks from February 13, again 18.30 to 20.30. Fee is £2.25.

Enrolment: Senior Administrative Officer, Norwood Technical College, Knight's Hill, London SE27 0TX.

Sound 73

DETAILS OF THE 1973 APAE exhibition have been announced by the Association of Public Address Engineers. 'Sound 73' is to be held from 10.00 to 18.00 March 13 and 14, through Thursday March 15 (10.00 to 17.00). Venue will again be the Bloomsbury Centre Hotel, Coram Street, London WC1, over a 745 m^2 floor area. Provisional list of exhibitors, as at December 5, comprised: Westrex, Shure, CTH, Hayden, Monks, Davenport, Midland Sound, Canadian Instruments & Electronics, PSP Electronics, AKG Equipment, Audac Marketing, Gulton Europe, Ling Dynamic, Astronic, Beyer Dynamic, KF Products, SNS Communications, Millbank Electronics, Grampian Reproducers, STC (Private Communications), Rola Celestion, Audix BB, Garland, Eagle International, Macinnes, Goldring, Lustraphone, Trusound, Son et Lumiere Equipment, and STUDIO SOUND. Further companies wishing to participate should contact the secretariat: 6 Conduit Street, London W1R 9TG.

Public address at Hanover

FOLLOWING LAST year's experimental venture, the Association of Public Address Engineers are participating with the Department of Trade & Industry in exhibiting at the 1973 Hanover Trade Fair. Ten companies will be involved this year, double the previous figure. These are Davenport, Monks, Lustraphone, Sykes & Hirsch, Son et Lumiere Equipment, Creative Engineering, Millbank Electronics, Sound Diffusion, SNS Communications and DJ Electronics. The Hanover Fair is scheduled for April 26 through May 4.

Electronic Component Show

TWO THIRDS of the available space at the 1973 London Electronic Component Show was allocated six months before the opening date, the organisers announced in November. Some 300 companies have applied, including 60 who will be making their first appearance at the event. Approximately 20 per cent of intending participants are based overseas, including exhibitors from Austria, Canada, France, West Germany, Holland, Hungary, Italy, Switzerland, the USA and the USSR. The exhibition will be held at Olympia from May 22 through 25, 09.30 to 17.30.

Neve merger

RUPERT NEVE have been taken over by Bonochord. According to a statement by Neve made just after the takeover, 'the direction and management of Rupert Neve & Co will remain unchanged. The benefits of this partnership to Neve include improved financial strength and the use of established sales outlets in Europe. Benefits to Bonochord are Neve's established sales organisations on the East and West coasts of the USA and in Canada'. The *Financial Times* of December 21 said that Bonochord's offer was 'for an initial consideration of £170,000 . . . satisfied by the issue of Bonochord shares valued at 17p, and a second payment in shares of 51 per cent of £4 for every £1 of pre-tax profits of Neve in excess of £100,000 for the 25 months ending December 31, 1973 . . . The second payment is limited to a maximum of £89,760'.

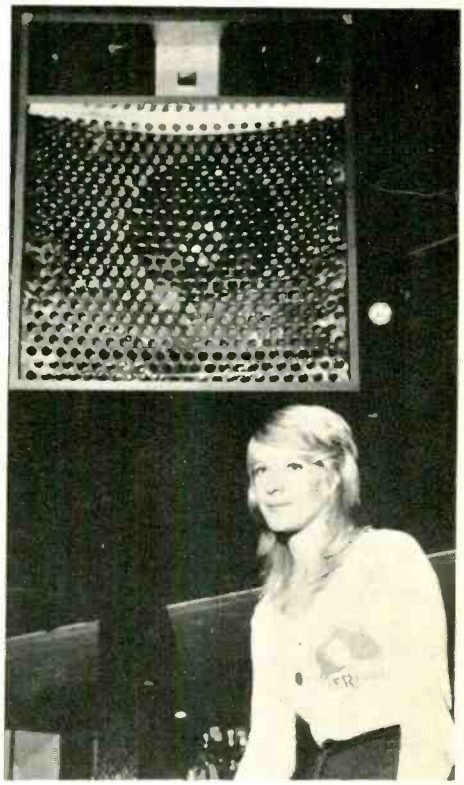
Sonifex 12/4 for Wood

ILLUSTRATED BELOW, one of two 12 input four-group film mixing desks recently designed and constructed by Sonifex for John Wood Studios, London. Features include a comprehensive talkback system covering commentary box, transfer bay, projector and sound camera areas.

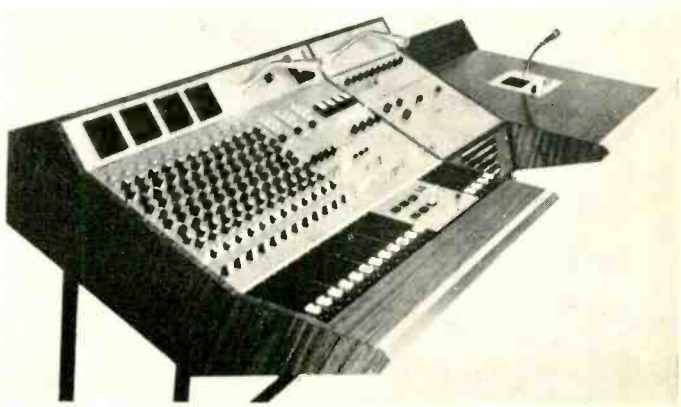
Quadraphonic discotheque

BELIEVED TO BE BRITAIN'S first quadraphonic discotheque, a 400W four channel system has been delivered by Millbank Electronics to 'Zero-6' in Southend-on-Sea. British Relay undertook the installation, which includes a Millbank *Disco 3* control unit, modified quadraphonic synthesiser, Revox *736* recorder, three Garrard *401* turntables with SME arms, and a Beyer microphone and headset. Four Millbank 100W speakers with integral amplifiers are suspended at head height round the circular stainless steel dance floor.

18 ▶



Above: One of the four Millbank speaker/amplifiers delivered to 'Zero-6'.



Right: The 12/4 group desk produced by Sonifex for John Wood Studios.

Take a QUAD 50E Amplifier (a good start for any installation)

plug it into your monitor system and it bridges 600Ω lines to drive your speakers.

Take that same amplifier and, without changing it in any way, plug it into another installation to deliver 50 watts into 100 volt line * from a 0.5 volt unbalanced source. This versatility and its attendant easing of stocking and maintenance problems is one reason why large organisations use the Quad 50E.

*or indeed any other impedance from 5 to 250 ohms.

Other advantages appropriate to users of all sizes include:

Excellent power and frequency response (—1dB).

Low distortion (0.1% at 1kHz at all power levels).

Low background (better than 83 dB referred to full output).

Pre-set level control adjustable from front panel.

Unconditionally stable with any load.

Proof against misuse including open or short circuited output.

Small size ($4\frac{3}{4}$" x $6\frac{1}{4}$" x $12\frac{3}{4}$")— (120 mm x 159 mm x 324 mm).

QUAD

for the closest approach to the original sound

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continued

Miniflux trademark

FOR SEVERAL years, some confusion existed between the German-registered 'Miniflux' and their one-time agents—the UK-registered 'Miniflux Electronics Ltd'. Bruno Woelke, Munich, have now finally relinquished their trademark and are henceforth operating as Woelke Magnetbandtechnik. UK agents remain Lennard Developments Ltd, 206 Chase Side, Enfield, Middlesex (Tel. 01-363 8238).

RCA order quadraphonic Cadac

A QUADRAPHONIC CADAC control console has been ordered by RCA Rome for their studio D. The desk is one of the new *Quadrapan* series, described as the first of its kind in Europe to be designed specifically for quadraphonic recording.

Marriott appoint US agent

INTER-TECHNICAL GROUP Inc of Irvington, Hudson, New York, have been appointed US representatives of Marriott Magnetics Ltd, Penryn, Cornwall. ITG are already experienced in the components industry, their concession including Thorn Radio Valves and Tubes, Telcon Metals, Telcon Magnetic Cores, and M & E Alloys. Marriott claim in turn to have developed a new process which radically reduces tape head manufacturing time without lowering quality. The resultant heads are 'far below the price of any other manufacturer in the world'.

AES discussion meeting

ON NOVEMBER 14, WHILE the BBC were celebrating their 50th anniversary, the British Section of the Audio Engineering Society held a discussion meeting at the IEE building in Savoy Place, London. This was originally planned to be one of a number of events occurring during a week's visit from a contingent of USA AES members but the latter was postponed until February. However, the meeting took place as an ordinary AES gathering with Frank Jones (AES/UK secretary) as chairman of a panel of five members of the audio industry.

Before the general discussion, each panel member spoke for a few minutes on some aspect of design or practice which they found of special interest, collectively covering most of the facets of audio engineering. Robert Berkovitz, head of advertising at Dolby Laboratories Inc, and formerly with Acoustic Research, reminded the audience that noise reduction had become mandatory in recording because of the great improvements in domestic audio standards. There were now over 10,000 recording chains employing 8, 16 or more tape tracks. He revealed that Dolby *B* encoding had recently been applied to CBS eight track cartridges. With vhf/fm broadcasting, similar encoding could offer the equivalent of increasing transmitter power by a factor of ten in terms of signal to noise improvement.

Angus McKenzie concentrated on tape recording and especially the difficulties of standardising levels, due to ambiguities arising from the use of dBm and dB(V) under differing impedance conditions. Following the article on this topic in the December 1972 issue, he proposed that the dBm be discarded and levels referred to dB(V).

John Mosely, technical consultant and formerly with Command Studios, has undertaken comprehensive testing of multichannel system formats together with the mixing and matrixing methods needed to reduce them to stereo and mono compatible form. He has also reviewed the four channel results currently available from disc, both discrete and matrixed. Although he conceded that the former could give good results, it was relatively expensive to both record and reproduce and was incompatible when played with the majority of stereo pick-ups in use at present, whereas the matrixed systems (now virtually available only in the *QS* or *SQ* form) raised no tracing problems. He also mentioned the 'pumping' effects that can arise with inferior matrixing configurations under certain conditions.

On acoustical matters, Kenneth Shearer, the acoustic consultant best known for his 'flying saucer' treatment of the Royal Albert Hall, was discouraged by the relative deadness of many studio monitoring rooms, some having reverberation times of only 150 ms as against the 500 ms typical of a domestic lounge. He looked forward to improved monitoring room design, in which more attention was paid to the reduction of resonances and spurious reflections. As for four channel reproduction, he generally preferred to listen at the back of concert halls so as to 'integrate' the direct musical sounds. He would be satisfied with mono together with a reverberation channel.

Peter Walker, founder and director of Acoustical Manufacturing and designer of their electrostatic speaker, brought forward some psychological anomalies that might arise from the use of loudness controls. He said that the human ear introduces some five per cent amplitude distortion for levels around 94 dB, falling to about one per cent at 74 dB. If, therefore, a loudness control was used for reproduction at 20 dB below the original sound level in the middle range, it should introduce an appropriate amplitude distortion to compensate for that not then originating within the hearing system!

Most of the subjects raised by the panel gave rise to discussion, especially the dBm versus dB(V) controversy; the general opinion was that both must be retained to cater for well established practices in different sections of the audio field. Four channel systems and their attendant advantages and weaknesses took up the majority of the discussion time. Mr Mosely, with the aid of slides, covered the results obtainable from current systems.

Although he frequently plays the flute with an orchestra, Mr Walker would not choose to listen to an ensemble from within and thought normal stereo from in front was mostly adequate, together (when appropriate) with suitably disposed ambience. Mr McKenzie emphasised that, in some reverberant recording situations, rear signals could approach the level of those from the forward sources; related to this, there was then some interchange of ideas as regards the placement of speakers for practical four channel reproduction.

Concerning dynamic range, there was some dissension as to the signal-to-noise ratio now obtainable from tape: 25 years ago the best equipment gave about 45 dB at 76 cm/s. The general consensus was that it was now about 65 dB under optimum conditions, which could be improved to 75 dB when using noise reduction techniques, so giving a residual background comparable with that of a lacquer disc although of different spectral distribution. Mr Mosely anticipated that digital recording techniques would in due course offer s/n ratios in the region of 90 to 100 dB.

Membership under one of several grades is open to anyone interested in joining the Audio Engineering Society, which was inaugurated in the USA and has sections in many countries. Information is available from The Secretary, AES (British Section), 10 Museum Street, London WC1.

Trade literature

A NEW BROCHURE detailing the *RTS 2* audio test unit is now available from The Ferrograph Co Ltd, 442 Bath Road, Cippenham, Slough, Bucks SL1 6BB. The test unit is aimed at recording studios and retail service departments. It is equipped to measure frequency response, noise level, distortion, crosstalk, wow and flutter, drift, erasure, input sensitivity, gain and output power.

Alice move

NEW ADDRESS for Alice (Stancoil Ltd). The company have moved to enlarged premises at 38 Alexandra Road, Windsor, Berkshire. Tel. 95 51056/61308.

AIR order 32/24 Neve

OPTIONAL QUADRAPHONIC panning on all channels is a feature of the 32 input 24 output control desk ordered from Neve by AIR Record Productions. The console also incorporates Neve's latest equaliser module giving independent lf and hf presence control over the range 200 Hz to 8.2 kHz. Pushbutton selection of wide or narrow presence bandwidth is incorporated in the module together with switches allowing a choice of peaking or shelving curves.

Goodsell joins Millbank

HAVING RESIGNED a directorship of Goodsell Ltd, makers of educational audio equipment, Keith Goodsell has joined Millbank Electronics. He is now responsible for production of Millbank audio equipment at their Uckfield (Sussex) factory. After completing an apprenticeship at AEI, Mr Goodsell worked with the company as a production engineer before joining Goodsell.

Sansui QS

'CHARACTERISTICS OF THE Sansui QS variomatrix based on a psycho-acoustic study of the localisation of sound sources in four-channel stereo.' This is the title of a data sheet series now available from Sansui. Part One ('Characteristics of the Sansui QS vario-matrix') was prepared by Ryousuke Itoh and Susumu Takahashi. Part Two is 'Localisation of sound sources in four-channel stereo' by Dr Masao Nishimaki and Kouichi Hirano. Copies may be obtained from Sansui Audio Europe SA, Vestingstraat 53-55, Antwerp B-2000, Belgium.

PATENTS

THE FOLLOWING list of Complete Specifications Accepted is quoted from the November issues of the Official Journal (Patents). Copies of specifications may be purchased at 25p each from The Patent Office, Orpington, Kent BR5 3RD.

November 1, 1972

1299208
Tokyo Denki Kagaku Kogyo KK
Endless tape cartridges

1299300
Bohler & Co AG, Gebr
Magnetic systems

1299349
International Business Machines Corporation
Optical deflection apparatus

1299383
Pennwalt Corporation
Transducer

1299409
Ferranti Ltd
Beamed-intensity control systems for cathode-ray tubes

1299465
EG & G Inc
Data comparator

1299485
GTE Sylvania Inc
Integral support and magnetic shielding means for cathode ray tubes

1299499
RCA Corporation
Endless loop tape cartridge

1299565
Schneider & Co Optische Werke, Jos
Device for connecting an electrically-operated variable focal length lens assembly to a television camera

1299602
British Aircraft Corporation Ltd
Electrical communication systems

1299636
Tokyo Keiki Seizosho Co Ltd
Multi-channel signal processing system

1299672
Philips Electronic & Associated Industries Ltd
Channel selector apparatus for the reception of electrical signals

1299705
Post Office
Synchronising satellite communication systems

1299721
Westinghouse Brake & Signal Co Ltd
Inductive signalling

1299765
International Standard Electric Corporation
Fm transmitter

1299782
Matsushita Electric Industrial Co Ltd
Information transmitting and receiving system

1299824
Texaco Development Corporation
Hydrophone streamer cable acoustic decoupler

1299838
Bosch Fernsehanlagen GmbH, Robert
Colour television arrangement

1299842
Philips Electronic & Associated Industries Ltd
Aperture correction circuits

1299871
EMI Ltd
Method of and an arrangement for reproducing images

1299896
Technology for Communications International
Extended aperture log-periodic and quasi log-periodic antenna

1299992
Polaroid Corporation
Motion picture film cassette-processor system

November 8, 1972

1300100
Licentia Patentverwaltungs GmbH
Aerial arrangements

1300154
Creutzer, T
Endless tape cassette

1300228
Learning Appliances Ltd
Amplifier switching means

1300246
Baldwin Co D H
Electrical stringed instruments especially electro-pianos

1300276
Libbey-Owens-Ford Co
Electrically - conductive glazing structures

1300297
International Computers Ltd
Magnetic transducing head assemblies

1300356
Chicago Musical Instrument Co
Musical instruments

1300392
Marconi Instruments Ltd
Adjustable frequency generator equipments and adaptors therefor

1300402
RCA Corporation
System for record medium control and editing

1300463
Philips Electronic & Associated Industries Ltd
Television display arrangement

1300492
Tokyo Shibaura Electric Co Ltd
Scanning signal generator

1300649
Tektronix Inc
Transmission line circuit

1300697/8
Siemens AG
Interrogation-reply systems

1300781
Philips Electronic & Associated Industries Ltd
Circuit arrangement for colour point adjustment

1300786
Motorola Inc
Colour television signal demodulation system

1300790
Matsushita Electric Industrial Co Ltd
Magnetic recording and reproducing apparatus

1300799
Shepperton Studios Ltd
Sound recording and reproducing apparatus

1300817
Hill & Son William and Norman & Beard Ltd
Slider soundboards for organs

1300824
Matsushita Electric Industrial Co Ltd
Method for manufacturing magnetic heads

1300826
Eastman Kodak Co
Motion picture and like reels

1300884
Bell & Howell Co
Projector control apparatus

November 15, 1972

1300939
Huber, O
Magnetic phonograph pick-up

1300960
International Standard Electric Corporation
System for controlling the transmit time of stations which are in communication with one another via a satellite

1300984
Ampex Corporation
Contact duplication of magnetic tapes

1301014
AKG Akustische U Kinogerate GmbH
Earphone

1301143
RCA Corporation
Binary light beam deflector using acoustic waves

13011206
International Standard Electric Corporation
System of time-division multiplex transmission via communications satellites

1301341
Viatron Computer Systems Corporation
Tape recording

1301357
International Standard Electric Corporation
Recognition system for pairs of pulses

1301379
Compagnie Generale D'Electricite
Switching circuit for changing the potential of a capacitive load

1301385
Bogen, W
Magnetic heads

1301388
Licentia Patent-verWaltungs-GmbH
Electromechanical transducers

1301553
Plessey Co Ltd
Dielectric waveguides

1301575
Toyama Gakki Seizo KK
Wind instrument mouthpiece

1301591
Hitachi Ltd
Chrominance signal generator having striped filter

November 22, 1972

1301641
Canadian Patents & Development Ltd
Vibratory energy generators

1301648
Nippon Kogaku KK
Motion-picture cameras

1301824
Blaupunkt-Werke GmbH
Colour television receivers

1301830
Westfalische Metall Industrie KG Hueck & Co
Acoustic signalling device

1301831
Armstrong Cork Co
Ceiling systems

1301870
Elmo Co Ltd
Motion-picture film cartridge and a motion-picture projector for projecting a film contained in the cartridge

1301995
Licentia Patentverwaltungs- GmbH
Colour picture tube

1301998
Ri-El Ricerche Elettroniche SRL
Cassette tape read out devices

1302078
Philips Electronic & Associated Industries Ltd
Apparatus for reducing spatial noise in a camera tube

1302110
Motorola Inc
Encoder-decoder device for selective signalling

1302121
Patehold Patentverwertungs-Und Elektro-Holding AG
Method of operating an address-coded wire or radio communication system using position modulation of successively transmitted signal packets

1302130
Matsushita Electric Industrial Co Ltd
Scanning apparatus for electroluminescent cross-grid panel

1302268
Ingenjorsfirman G A Sundqvist AB
Device for synchronous application of sound editing and printing of cine film

1302273
International Computers Ltd
Tape feeding apparatus

22 ▶

TEAC 4-channel

New matching mixer now available!
Write for details of our new 12 input/4 output mixer.

Sole U.K. Distributor
INDUSTRIAL TAPE APPLICATIONS
105 High Street, Eton, Windsor, Berks. Tel: (95) 52663

Specification:	
Heads	Three. Hyperbolic, 4-channel in line, with sel sync switch.
Reel size	10½" and 7".
Tape speed	7½/15 i.p.s.
Motors	Three.
Wow and flutter	0.04% @ 15 i.p.s. (weighted rms). 0.06% @ 7½ i.p.s. (weighted rms).
Frequency response	25-24,000 Hz (±1½dB, 37-22,000 Hz) at 15 i.p.s. 25-22,000 Hz (±3dB, 30-19,000 Hz) at 7½ i.p.s.
Signal to noise ratio	57dB unweighted. 64dB weighted A.S.A. curve.
Harmonic distortion	0.8% at 1,000 Hz normal operating level (Ampex).
Crosstalk	60dB at 1,000 Hz.
Inputs	Microphone: 0.25 mV/-72dB (600-10,000 ohms). Line: 100 mV at 100K ohms.
Outputs	Line: 0dBm: 0.77 V for load impedances of 10K ohm or more. Headphones: 8-600 ohms.
Input and Output configurations	Jack sockets
Dimensions	23" x 18" x 9".
Weight	60lb.
Rating	Continuous
Cabinet construction	¾" solid mahogany. Cast aluminium handles.
Price	£492.

PATENTS

continued

November 29, 1972

1302358
White, L G
Tape recording and playback apparatus

1302368
Battelle Development Corporation
Analog to digital to optical recording and playback system

1302369
Battelle Development Corporation
Digitally coded photographic record

1302370
Battelle Development Corporation
Optical scanner apparatus

1302372
Plessey Co Ltd
Radio aerials

1302373
Clarke & Smith Mfg Co Ltd
Tape recorders

1302388
Bell & Howell Co
Tape recorder with cassette inverter

1302399
Nippon Telegraph & Telephone Public Corporation
Antenna device

1302400
Compagnie Generale D'Electricite
Optical type assembly for transmitting electromagnetic radiation

1302402
Labgear Ltd
Aerials

1302408
Watanabe, K
Record players

1302430
Pioneer Electronic Corporation
Electrostatic electroacoustic transducer

1302469
Ampex Corporation
Cassette feeding apparatus

1302490
Sony Corporation
Noise cancellation circuit

1302491
Sony Corporation
Magnetic recording and reproducing apparatus

1302506
Ise Electronic Corporation
Pattern display apparatus

1302523
EMI Ltd
Aerial arrangements

1302534
Gabr, S Z M
Public address systems

1302568
Licentia Patent-verwaltungs GmbH
Apparatus for reproducing stored signals

1302605
Western Electric Co Inc
Electromagnetic wave amplifiers

1302644
GTE Sylvania Inc
Antennas

1302718
RCA Corporation
Eht voltage supply for television receivers

1302739
Garrett Corporation
Modulating circuit providing high signal gain

1302775
Deutsche Akademie Der Wissenschaften ZU Berlin
Device for generating continuous transport movements of storage media

1302797
Newell Industries Inc
Tape transport apparatus and cartridge therefor

1302798/9
Newell Industries Inc
Tape transport apparatus and cartridge thereof

1302839
Thermo-Bauelement AG
Building panels

1302843
Philips Electronic & Associated Industries Ltd
Record player

1302923
Thomson-CSF
Electronic scanning method for an antenna system

Flatter flat loudspeakers

MANY PEOPLE have tried designing a dynamic loudspeaker with a coil driving a diaphragm, as opposed to a loudspeaker with a cone and voice coil at its apex. Where space is at a premium, as in a small studio, an efficient flat dynamic loudspeaker would be a boon, especially if no large volume of air were required for loading.

Flat diaphragms have been made from expanded cellular plastics, such as polystyrene, with the voice coil mounted in a hole or on a 'mountain'. The hope is that the diaphragm will move in true piston-like manner. But in practice either the top or the bottom end of the frequencies pumped out lack punch. In other words, flat loudspeakers are not flat and they need air loading.

In BP 1,289,858, Jose Bertagni of Buenos Aires claims a flat diaphragm which does not require a mass of air in front or behind because it intentionally does not vibrate as a piston. A granular sheet of expanded polystyrene or polyurethane is used, of which the expanded granules are bonded together to produce a plate-like diaphragm with air cells between the granules. During the course of manufacture, this flat body is heated so that the granules (initially separate) become sticky and bond together. Thus, as shown in **fig. 1**, a number of layers of bonded granules will exist. Of course, in practice the layers and granules will not be so perfectly aligned.

To eliminate unwanted internal damping (which reduces output efficiency and introduces distortion) the moisture from the cells is removed by heating and the whole sheet then sealed with a thin resin coating. Tests have shown that the best transmission of sound is achieved if the audio signal is applied to the sheet at whichever face has the granules under the minimum tension, with the other layers exhibiting increased tension through to the other surface. During manufacture, the sheet is subjected first to a slight degree of curvature which compresses one surface layer of granules and puts the opposite surface layer under tension, **fig. 2**. The inner curved layer is then covered with a paper or fabric sheet which is adhered to it, and the whole diaphragm flattened out again, **fig. 3**. Because the paper sheet adheres to the front face, the compressed granules cannot rearrange themselves. So the final result is a sheet of reduced thickness with the granules tensioned in planes both parallel and perpendicular to the front face, this tension decreasing between the front and rear faces of the sheet.

FIG. 1

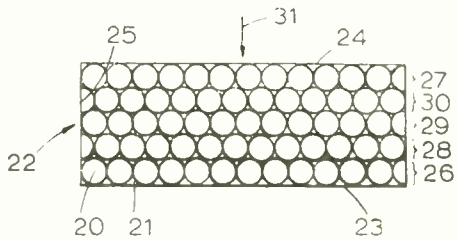


FIG. 2

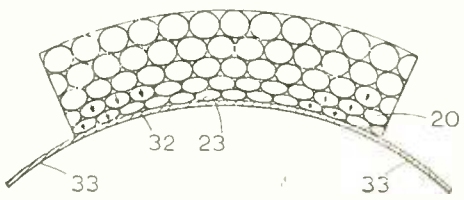
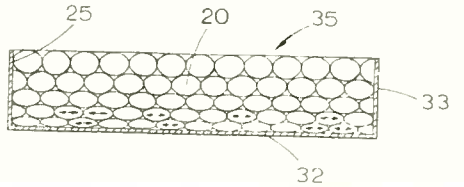


FIG. 3



Audio vibrations introduced by a voice coil at the rear face will create vibrations which emerge more or less parallel to the front face layer of the diaphragm (i.e. the diaphragm will vibrate in its own plane, not like a piston). Especially good fidelity is claimed if the edges of the diaphragm are rigidly clamped.

Whether the results in practice will live up to such claims, only time and tests will tell, but the patent is worded in a way that suggests a fair amount of practical research.

Incidentally, the theory behind the design is that the prestressed front layer will behave like a drum skin under tension. The layers under decreasing stress from front to back convert any vibrations applied to the rear face into vibrations perpendicular to their original direction by virtue of the high tension of the front layer. Thus the diaphragm will vibrate from its centre of vibration towards its edges. This is of course why a large air mass is not needed for efficient working.

Harpsichord jacks

A HARPSICHORD JACK is a member lifted by one key of a keyboard and carrying a quill which plucks an appropriate string. From the 15th century to date, jacks have incorporated a tongue attached to the jack body by a pivot, the 'quill' being mounted on one end of the tongue. A spring restores the tongue to its upright position ready for the next plucking stroke. In recent years, jacks have been made from plastics with separate tongues and springs.

In BP 1,289,589, W. J. Zuckermann (Winkleigh, Devon) and David Way (New York) suggest a plastics moulded jack (**fig. 4**) with a resilient tongue capable of allowing it to move backwards and forwards. The 'quill' is

25 ▶

TM 50 MK2 SERIES AUDIO MIXERS

Single or multi-output mixers with up to 100 input channels made to professional standards and incorporating the following features:

- ☐ 'XLR' input connectors
- ☐ Prefade listening
- ☐ 180° self-evident dials
- ☐ Back contacts
- ☐ 'Channel on' lamps
- ☐ Peak programme meter
- ☐ +12 dBm floating output
- ☐ 0-30-60 dB input attenuators
- ☐ 0-30 dB preset channel gain
- ☐ 30Hz-20kHz ±2 dB

OPTIONAL FEATURES INCLUDE:

- ☐ Tone controls
- ☐ Extra PPMs
- ☐ VU meters
- ☐ Disc and tape inputs
- ☐ Limiter/compressors
- ☐ Battery operation
- ☐ Portable field units
- ☐ Rack mounting units

TM 52/5
5 channel mixer

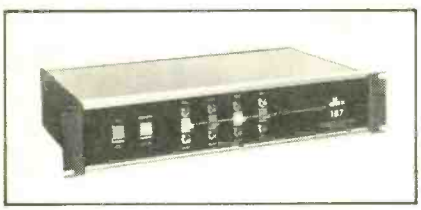
CTH also manufacture a range of modular mixing units, consoles, distribution amplifiers, studio disc player units, speaker amplifiers, cable drums and many other items of studio equipment.

CTH ELECTRONICS

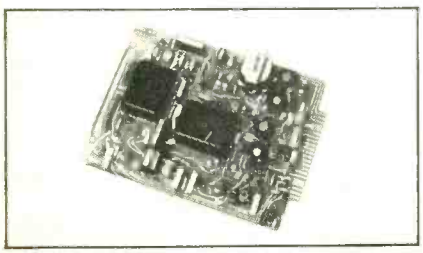
Industrial Estate, Somersham Road, St. Ives, Huntingdonshire, PE17 4LE. Telephone: St. Ives 64388 (0480 64388)

Tape noise reduction systems

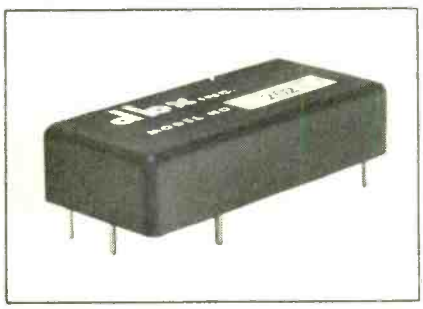
20 to 30 dB noise reduction and 10 dB headroom extension. No level match required. Excellent transient tracking.
Model 187 Four channel, record or play for each channel, remote control.
Model 177 Two channel, simultaneous record and playback.



Model 307 Single channel noise reduction card, record, playback, bypass, and input termination modes selectable by logic levels, balanced input and output without external transformers, requires + and −24 V unregulated supply.



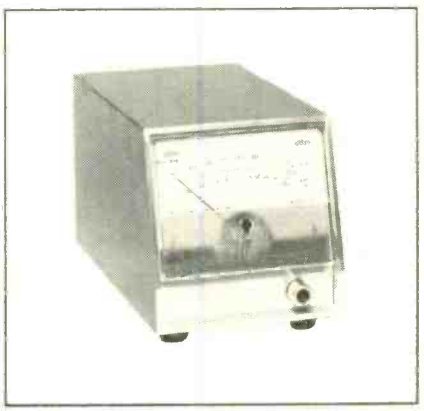
Voltage controlled amplifiers



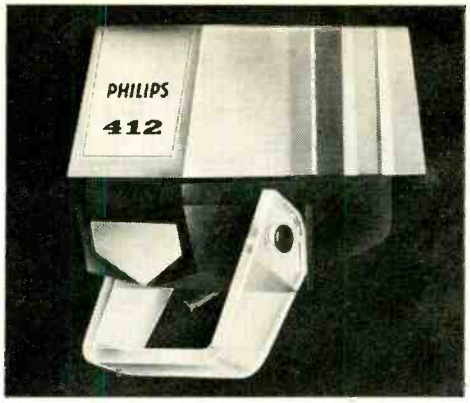
Model 202, linear dB gain vs. control voltage, −100 to +30 dB gain, noise 130 dB below peak level, low distortion.
Model 203, same but with lesser performance specifications on noise and distortion.
Model 204, similar, but with voltage gain proportional to control current, same gain and noise specs as Model 202.

Decibel meters

Model 81 covers range −70 to +10 dBM, true RMS, battery operated.
Model 81W same but covers range −70 to +50 dBm.
Model 82 has 5½" mirror scale, covers −50 to +10 dBm, with 0 dB = 0, +4, or +6 dBm selectable at input connector, power line operated.



dbx inc. **For full information write dbx, Incorporated, 296 Newton Street, Waltham, Massachusetts 02154, U.S.A.**



The experts put Philips magneto-dynamic cartridges in the top class.

Read what they say about the Philips GP412 Super M.

From the technical point of view, Philips may be cordially congratulated on this magnificent element, which certainly belongs to the top-five. The sound character proved beautifully transparent; sufficiently well balanced at very low frequencies, brisk in the middle, brilliant in the high notes and not too pronounced in the extremely high range.

Sinus
DISK

The Philips GP412 has an excellent frequency response, good crosstalk attenuation throughout the entire frequency range and combines excellent tracking with a pleasingly high sensitivity. Also when judged on tone it is to be placed among the best in the world.

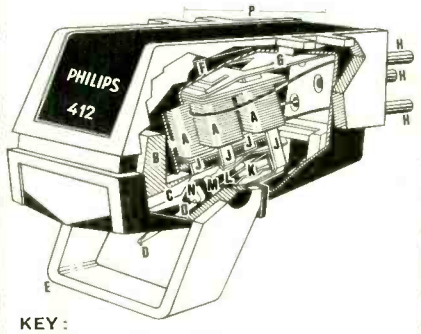
BR.
Hi-Fi Stereophonie

The overall sound quality was immediately impressive with plenty of bite and attack in the highs and extraordinarily clean, firm and extended bass. The first few hours of use were spent in listening to a wide variety of fairly serious, well recorded music. The very best of my records sounded first rate—as good as, if not better than I had ever heard them before.

John Wright
Hi-Fi Sound

The only fault I found with this cartridge was a loose stylus guard (which I would remove anyway!). Its performance is excellent and if you are seeking the best, hear this one for yourself before making a final choice.

Norman J. Clayton
S. A. World of Sound



KEY:
- A Pickup coils, 2,500 turns each, wire half as thick as human hair.
- B High precision moulding for accurate mounting of coils and stylus assembly.
- C Stylus assembly enclosed in precision-fitting square brass tube for exact positioning and easy replacement.
- D Accurately ground diamond stylus tip.
- E Stylus guard.
- F MU-metal casing prevents hum pickup.
- G Fixing jig and earth bar.
- H Five contacts.
- J Right and left channel MU-metal pole shoes.
- K Rubber damping block, precision moulded to 0.05 mm.
- L Guide wire of 0.08 mm CrNiFe for controlled compliance.
- M Suspension block.
- N Super M ticonal XX magnet, a high-energy magnet generating a strong field, so that only 7 mg need be used.
- O Stylus bar of thin-walled (0.05 mm) aluminium alloy tube.
- P ½" distance between mounting centres.

Technical measurements of the system produced on the whole good figures, among which the excellent crosstalk suppression (even at high audio frequencies) is particularly worthy of note. The tracking performance of the cartridge is also very good. Both in combination with the pick-up arm SME 3012 and with the Sony PUA 286 the stylus force did not have to be raised above 1 g. The sound produced by the GP412 was balanced and clear with strong low notes and brilliant high ones.

Stratos Tsebanglou
Fono forum

The sound quality was extremely pleasing, and the little extra brightness of tone in the upper-register compared with some other high quality moving magnets proved attractive to some listeners. The nature of the sound which it produces is slightly, subtly, different from that of other members of the same family and this cartridge is worth serious consideration and a careful listening test if the purchase of a new high quality pick-up is contemplated.

B. J. Webb
Hi-Fi News

There are three Philips Super M magneto-dynamic cartridges. The GP400, GP401 and GP412. Write now for a Super M Brochure to Philips Electrical Limited, Dept SP, Century House, Shaftesbury Avenue, London WC2H 8AS.

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continued

FIG. 4

attached to its free end. The tongue will usually be of the same material as the rest of the jack and integrally formed with it. This design eliminates the need for a separate axle pin and spring, and promises easier production and greater reliability.

Reverberation springs

REVERBERATION SPRING devices use a helical spring which functions as a delay element, one transducer applying mechanical (audio) vibrations to the spring and another one picking up the vibrations so transmitted. The transducers used to be arranged one at each end of the spring but more recently the tendency has been to use at least one transducer (usually the pickup) located part of the way along the spring. For good results, only minimal reflection should occur at the point where the transducer is coupled. Coupling between the spring and the transducer should be as close as possible but the one requirement tends to contradict the other.

In BP 1,289,055, AKG suggest abandoning the old principle (**fig. 5**) whereby the intermediate transducer interrupts the spring (with spring sections attached one to each side of the transducer). Instead they suggest leaving the spring uninterrupted, rigidly connecting the transducer inside the spring to at least one turn (**fig. 6**). Connection can be by adhesion or welding of the spring to the frame wound coil of the pickup transducer and the object of the exercise is to make the coupling as rigid as possible and so ensure that the frame is reliably driven. Where the transmission of high frequencies can be sacrificed in the interests of higher sensitivity, the frame can be coupled to more than one turn.

FIG. 5

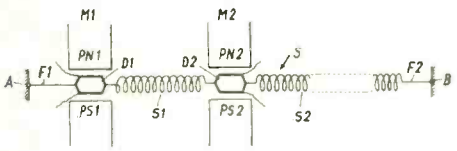
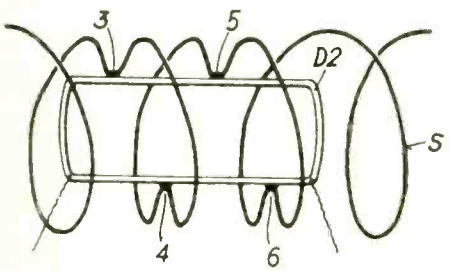


FIG. 6



Audio cassettes

BP 1,292,502 FROM FUJI Photo Film, Japan, also takes up the point about tape being abrasive. Compact cassettes can be internally worn by the edges of the tape rolls grinding the plastic away and causing rough surfaces which may jam the cassette. So ptfe sheet is used as a low friction buffer. But this also eventually tends to become rough and cause jamming. Fuji say this is due to the high surface resistivity of the ptfe sheet so the use of a carbonaceous material impregnated into the ptfe has been tried to reduce sensitivity but this is difficult and expensive.

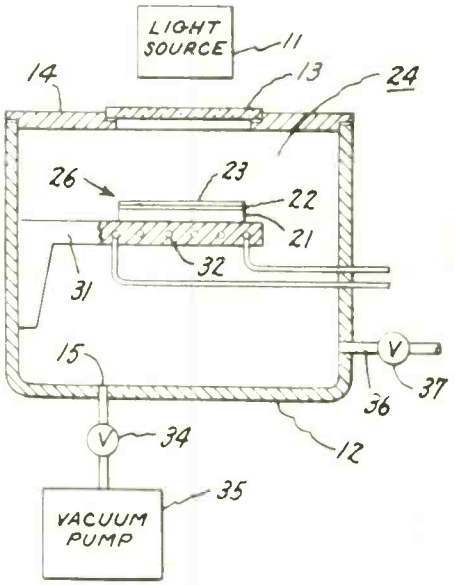
What Fuji suggest is a plastics or paper support sheet with one surface containing a layer of graphite, molybdenum disulphide or tungsten disulphide, and the other surface having a layer of aluminium, copper or carbon. The graphite layer has a very low friction coefficient and a low electrical resistance; the aluminium or copper lowers the resistivity of the support sheet surface. If the patent claims are to be believed, runs of 1,000 upwards can be achieved without jamming, whereas untreated sheets of Teflon may last only 300 runs before giving trouble.

Protecting magnetic surfaces

IN BP 1,291,465, GEC USA explain the need to protect equipment coming into contact with magnetic media to prevent wear—for most magnetic materials make wonderful abrasives. Lubricants are incorporated in the oxide binder to the substrate in the hope that this will afford a degree of protection to the mutually moving surfaces. But the lubricant may tend to leak out and clog up the recording heads.

GEC suggest depositing (on either a magnetic head, the magnetic recording medium, or both) a protective film with a thickness of as little as 2 μm. This film will be formed by the ultraviolet photopolymerisation of a monomer gas such as tetrafluoroethylene. Details are given of various techniques for passing the item through a coating vapour and irradiating it with ultraviolet light (**fig. 7**) so as to produce the polymerised film. Details are also given of tests involving crashing coated heads on a magnetic disc. Despite what sounds like gruesome ill-treatment, all the coated articles seem to have come through successfully.

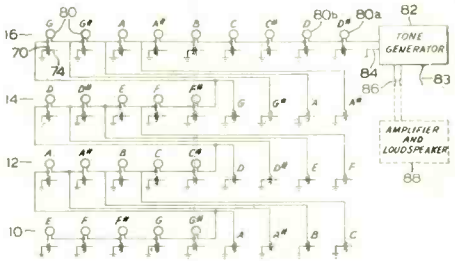
FIG. 7



Foot-operated 'guitar'

BP 1,292,117 FROM JOHN Arseneault of Canada is something of a curate's egg. He suggests that pop groups could save the cost of hiring a bass guitarist by giving some other member of the band an instrument which can be played with the feet but which will make the same sound as a bass guitar. The Canadian invention can be described briefly as a foot 'keyboard' with pedals which switch frequency-control potentiometers into and out of a tone generator circuit (**fig. 8**). In this way the generator may be 'played' although only one note at a time. The interesting part of the invention is the suggestion that the pedals be arranged to resemble a bass guitar neck. Four rows of pedals are employed, each row containing the successive notes of a chromatic scale, and each row a musical fourth above the one below.

FIG. 8



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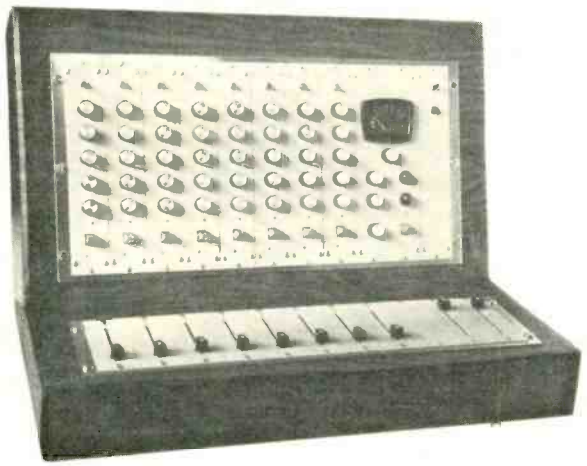

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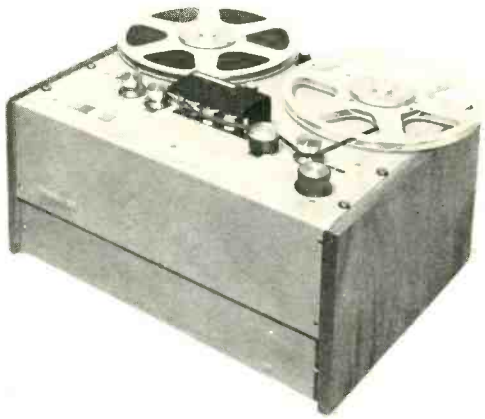

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DIARY

By John Dwyer

WHEN THE IBA hand out the commercial radio contracts two of the boniest elbows in the scrimmage are likely to belong to one John Bentley. He is a member of a consortium who are after a franchise and who include Maurice Macmillan's son, Alexander, and one of Edward Heath's biographers, George Hutchinson. Mr Bentley is famed for his aggression. As chairman of his property group, Barclay Securities, he has made a string of property deals and, in April 1972, Barclay took over Shepperton film studios.

In 1966 Mr Bentley had teamed up with Jim Slater, the financial phenomenon of the sixties, whose partner, Peter Walker, is now the Secretary of State for Trade and Industry. Slater Walker have spent the last few years taking firms over on a large scale and, in 1969, had over 500 subsidiaries and £900 million of assets. Bentley was an assistant to Slater until 1968 and, in 1969, Slater sold Bentley part of Barclay and Sons, a pharmaceutical firm. After that, Bentley retitled the company Barclay Securities and went out on his own, although all the financing for his takeover operations, including the takeover of Shepperton, has been provided by Slater Walker. His share of Barclay is now worth an estimated £2.7 million.

In a recent House of Commons debate about asset stripping, Mr Bentley's name cropped up more than once. Mr Maurice Edelman, Labour Member for Coventry North, said that in the Shepperton film studio transaction the whole object was ultimately to strip the major assets of the company and to make a killing out of the result. The battle, he said, was not yet over to prevent what some MPs regarded as squalid exploitation, for commercial and financial advantage, of something which was pledged and entailed to the nation and which now resulted in so large a part of a major studio being diverted from its proper purpose.

Another speaker in the debate was Miss Janet Fookes, Conservative Member for Merton and Morden. She described what had happened in her own constituency when John Bentley had taken over Lines Brothers, the makers of Triang toys, in 1971. In June, six months after the takeover, she said, there was a shock announcement that the whole of the Merton complex was to be shut and 1,200 people were thrown out of work. A fortnight before the announcement, vacancies were advertised in the local press indicating, among other things, the security of the jobs.

Miss Fookes then told of a visit to Mr Bentley's 'luxurious lair in Curzon Street'. She said that during her discussion with Mr Bentley he told her that the redundancy payments at Lines Brothers were two and a half times the legal limit. She said she judged that the Merton site and another property in Birmingham were bought by Mr Bentley for £1.68 million and that the Merton site alone was being sold for £3.3 million.

Miss Fookes did not mention that, in April 1970, Mr Bentley had bought a toy firm called D. Sebel Ltd in Erith, Kent. After the takeover Mr Bentley urged production up from an expected loss of £100,000 to a profit of £98,000. The number of staff was then increased by a fifth. A year later the factory was closed despite increased orders and profits. Five hundred lost their jobs, the Erith property was sold, and the Sebel factory's machinery was moved to the Merton factory that was to close not long after.

It is an indication of the one time prosperity of British Lion, the company who owned Shepperton before the takeover, that most of the older British films you see now on television were made there. Even now British Lion's main income is from its film library of over 300 titles, including *The Third Man*, *The Guns of Navarone*, *Oliver*, *Scrooge*, *The Victors*, *Half a Sixpence*, *I'm All Right Jack* and *Till Death Us Do Part*. The company have a current contract with the BBC for the showing of 136 films, a contract which gives Lion an income of £210,000 a year. It expires in 1975.

In the mid-fifties the film industry was hit by more and better television broadcasts and the introduction of commercial television. Shepperton were taken over by the National Film Finance Corporation and, in 1958, the Boulting brothers bought an option to buy British Lion if the studio became profitable again. After six years of being run on public money, British Lion did pick up again and in 1964 were sold to a consortium for £1.75 million.

Heath's pledge

The consortium comprised the Boulting brothers, Lord Goodman, Sir Max Rayne, Sidney Launder, Frank Gilliatt, Hambros Bank and Edinburgh Investment Trust. The new chairman was Sir Michael Balcon. There were certain conditions attached to the sale; Mr Heath, then Secretary for Trade and Industry, said that these conditions would ensure that no future buyer of British Lion shares could strip the company of their assets. He also said that the provision would be permanently effective.

Sir Michael Balcon resigned soon after the sale because, it is said, he disagreed with the consortium's film policy. Profits sank and, on April 25, 1972, the directors of British Lion said that they had agreed to sell the company to Barclay. The blow to the Boulting brothers and their associates was a little softened by the share dealings involved; all that prevented the deal from making them rich was that they were loaded already. The *Daily Telegraph* of September 30 gave the following estimates of what each of the principals had made: John Boulting £455,000; Roy Boulting £455,000; Lord Goodman £240,000.

British Lion cost Bentley £5.5 million. Shepperton itself was a 24 hectare site in prime development land. The studio had nine sound stages—one of which was the largest silent stage in Europe, 50 cutting rooms, two dubbing theatres, a small silent stage, three television stages and two smaller commercial stages. It employed nearly 400 people.

From the start, Bentley's intention was to sell as much of the site as he could persuade the National Film Finance Corporation to let him have. His first plan was to sell 85 per cent of the land and transfer film production to Rank's Pinewood studios. This would have meant that the film studios would have been kept on a care and maintenance basis only. The NFFC, however, would not allow him to sell more than two-thirds of the land.

Bentley's first move was to reconstitute British Lion and make it profitable. The new operation, called Lion International, comprised the old British Lion plus two new companies. One of these was Mills and Allen, a lucrative poster distribution concern which claimed nearly a third of all the poster sites in the UK, and the other was a poster printing firm. These two concerns would transform Lion's last annual loss of £260,000 into an expected profit of well over £1 million. In return for the companies, Bentley acquired nearly £10 million worth of Lion shares.

Before Bentley could release any of his stake in Lion, however, he had to make a deal with the NFFC and the old British Lion board. After long talks—during which none of the Shepperton staff was consulted—the NFFC and Lion International announced that five of the sound stages would be closed and two-thirds of the site would be redeveloped. The following day Bentley offered 1,560,000 Lion shares at 160p per 25p share. According to the financial press the shares were considered over-priced and, at the end of the first day's dealings, the price had dropped to 155.5p; by the end of November, three weeks later, the price had slumped to 144p.

In their announcement that five of the stages would be closed, the NFFC and Lion said: 'The *initial* (my italics) staff to be employed at Shepperton under the new arrangements would be no fewer than 200 . . .'. This means that 180 will lose their jobs. Alan Sapper, general secretary of the Association of Cinematograph, Television and Allied Technicians, says that even that figure is unrealistic. He has been quoted as saying that the closures could lead to the loss of up to 1,000 jobs in the industry.

Whatever the final figure, Alan Sapper is reasonably bitter about the film workers being unrepresented at the talks that decided Shepperton's future. Before the talks began, the Federation of Film Unions made repeated attempts to get a say in what was to happen at

28 ▶

continued

Shepperton, without any success. The result of the talks was announced a week before the management met the Joint Works Committee. The Federation of Film Unions now plan to stage a sit-in at the studios should Lion International try to close any of the stages.

Meanwhile, Lion International have become the entertainment division of Barclay Securities. The managing director of Lion International, Jeremy Arnold, is thinking even now of starting record production companies, managing pop artists and providing services for commercial radio stations. As I said at the beginning, John Bentley himself has already joined a consortium of commercial radio contractors and, in mid-December, was appointed chairman of Lion International. British Lion Television have been sold to Trident Studios, who have taken over four outside broadcast vans and cameras as well as all the gear for video recording on 50 mm tape. The 19 staff of the company will be kept on.

This is only the story as it affects British Lion; as revealed in the Commons debate, in 1969 Bentley acquired four companies, in 1970 another four, in 1971 he acquired nine and in 1972, a poor year, only two, including British Lion. If you had invested 15p in Bentley's company in 1968, you would now have £1.82 if you could live with your conscience.

This year's low number of Barclay takeovers could be explained by Mr Bentley's increasing interest in politics; he has already indicated that he would like to enter Parliament and one report says that he is already on the list of prospective Conservative candidates to contest, by a brutal irony, the constituency of Havant.

CTS story

Even nearer home, for most readers of STUDIO SOUND, is the story of CTS studios, which I mentioned last month. CTS were taken over in April 1972 by a property company called Eastern & General Holdings. Eastern & General had started with a small oil concession in Bahrein which brought them in a modest but useful £150,000 a year. Their other investments were a flop; for the two years following the firm's going public in 1968 the chairman's report contained such phrases as 'a difficult year' and 'a difficult and disappointing year'. So at the beginning the money from the oil concession was their main income.

Eastern & General's fortunes changed with the arrival of two new directors early in 1971. David Bryans and Ronald Reeves, still in their late twenties, already had quite a reputation for smart dealing; they were described, for example, as 'investment gunslingers' (*Daily Express*) who indulged in 'wheeler dealing' (*Financial Times*). When they joined Eastern & General they said their reason was 'to have more fun and make more money'. With Slater Walker as their financial advisers, they took over a firm called Settle Speakman and immediately sold two of its five subsidiaries for £1.35 million.

Next they invited Mr Trevor Chinn on to the board. Mr Chinn, so moved by an eight-week course he once did at the Harvard Business School that thereafter he affected an American accent, has driven his family's Lex garage group up from a profit of £1 million in 1968 to £4.4 million last year. During 1971 he bought the Carlton Towers Hotel in London. Mr Chinn's importance to Eastern & General was that, at the end of 1971, he sold a large amount of property to Eastern in return for 1,850,000 Eastern shares, a deal which literally put Eastern on the map. Lex now hold about 20 per cent of Eastern.

At the end of that first year under the influence of Bryans and Reeves the chairman, Mr Jonothan Janson, said in his report: 'A decision was taken to expand by acquiring interest outside the traditional areas of investment . . . and to develop a financially oriented holding and investment company with a strong property base'.

Expand they did. In the spring of 1972 Eastern & General acquired the property of Frederick Lawrence and Company, a large furniture store in Westbourne Grove, Bayswater. The site was an obvious one for redevelopment and cost Eastern £4.5 million by the time they had beaten Amalgamated Investment Properties to it. The price included Lawrence's other property in Bristol.

In the same building as Lawrence's store, and just around the corner in Kensington Gardens Square, were Cine Tele Sound Studios, which Eastern bought at the same time. As in the case of Shepperton, Eastern & General did not consider it necessary to consult the staff of CTS at any time during the transaction. The staff were merely told, the day after the takeover, that it was hoped there would be at least another year's work, maybe two, before the studio would have to close for redevelopment.

CTS had had more than ten successful years in the recording business during which they had engineered sessions for Frank Sinatra, Burt Bacharach, Bob Hope, Bing Crosby, Sammy Davis, Errol Garner and Lena Horne. On one photograph I saw in the deserted lobby, just after the closure, was inscribed in faded ink: 'To all at CTS, warmest thanks for a lovely sound—Henry Mancini'.

Most of those at CTS were of the opinion that Eastern & General knew nothing about recording and cared even less. Many of them, too, had been at CTS for between five and ten years. The studio had never been busier. Peter Harris and John Richards began to look for a way to avoid the company's disappearance.

All kinds of plans were considered, including, at one point, building a new studio complex. The final solution that was adopted, to reincarnate CTS in the De Lane Lea building at Wembley, now seems both brilliant and obvious. It meant, though, that the closure date for the Bayswater studio had to be brought forward and that CTS employees were faced with redundancy much sooner than they had thought they would be.

Thriving again

Less than two-thirds of the staff could be taken to Wembley but the rest, with one or two exceptions, were found jobs elsewhere. With the sale of the old equipment and the better facilities at De Lane Lea CTS are thriving again. By the beginning of December they had worked on music for four feature films as well as jingles and music for television series. The films were: *Digby, the Biggest Dog in the World*, which is a Walter Shenson production directed by Joseph McGrath for which the music was composed by Edwin Ashley; *A Touch of Class*, produced by and directed by Melvin Frank for Brute Productions/Faberge, music by John Cameron; *Marco Polo*, the Lisa Minelli musical, was produced jointly by Arthur Rankin, Jnr and Jules Bass for Rankin Bass productions, directed by Seymour Robbie, scored by Maury Laws with lyrics by Romeo Muller; and *Theatre of Blood*, which involved recording two possible title tracks sung by Diana Rigg and called *Anything at All* and *Now*. Whichever is chosen for the title will be released as a single.

Eastern & General, chops barely wiped, have moved on since they took over the Bayswater site. Bryans and Reeves have resigned, presumably having had their fun and made their money, and the new driving force in the company is David Lewis. Mr Lewis has a £58 million property empire, four-fifths of which is privately owned. He has about 30 per cent of Eastern, having bought himself into the company in the same way as Trevor Chinn did, and does all his public property dealing through them. A new development of 1.2 hectares around the Gloucester Road recently took Eastern's assets up from £46 million to £80 million, making them bigger property dealers than anyone except the infamous Harry Hyams. In September they abandoned their original source of income, the Bahrein oil concession, for £1.3 million and a couple of chunks of the North Sea. In mid-December Eastern & General changed their name to the Cavendish Land Company 'to reflect more closely the current activities of the company'.

You may or may not find the way these two companies were taken over disturbing. But nothing either Barclay Securities or Eastern & General have done is even remotely illegal. I'm also sure that there must be grubbier ways of turning an honest coin—it's just that I can't think what any of them might be.

This month I called round to **Kaleidophon** studios in Camden High Street. David Vorhaus and two friends set up the studio four years ago to make an lp called *White Noise*, which was subsequently released on the Island label and sold 25,000 copies in the UK without, David tells me, any of the usual publicity. Mr Vorhaus is a synthesiser nut. 'I'm especially interested in giving a chance to people who are doing something new in pop or any other field,' he said. 'People who are experimenting seriously will be able to do things here they couldn't do elsewhere.'

David has worked with Tony Richardson, Mikis Theodorakis, John Peel, Orson Welles, the National Film Theatre, Diana Rigg and Mark Wilkinson (director of music at the Old Vic). The latest White Noise album, *Electric Storm*, was heard in the film *Dracula AD 1972*.

There are four Studer two track machines, a TRD two track and a 16 track machine I haven't seen before, based on an Epsylon computer tape deck. It uses 25 mm tape. David says the signal-to-noise ratio is about 61 dB unweighted. In about six months he intends to get a 50 mm tape machine. He has linked together two EMS synthesisers with his own electronics and says he is now able to make them sound like other instruments. 'With this set-up,' he said, 'I can make a sound like a spinet; a normal *VCS3* won't do that. I

can make a real sound from a normal instrument into anything else and I can lock the synthesiser to automatically follow the playing of a real instrument using an envelope follower and trigger.'

David tells me his overheads are low and so he can afford to charge only £12.50 an hour for 16 track and £8.50 for two track.

Earlier this year Adrian Ibbetson left Wessex to go to Nova studios. Now he has joined **Radio Fleet,** a commercial broadcasting set-up owned by United Newspapers. Although United will probably apply for a contract to run a station, Radio Fleet are more concerned at the moment with offering studio facilities for those who wish to record commercial programs. Already the Tudor Street studio has been used for talk programs by Basil Boothroyd and John Snagge. Radio Fleet will retain ownership of any tapes made at the studio and hire them out to whatever station wants the material. As regards ordinary demo work, bookings are gladly accepted though at the moment Fleet only offer two track. The studio has a piano available and Adrian intends to encourage voiceover work.

The studio measures 2.2 x 2.8 x 3.1m and has a reverberation time of 150 ms. The microphones are all AKG capacitor types. In the control room are a Neve ten channel console, a Gates *GB77* disc console and KEF *Concerto* monitor speakers. Clients can record either on a *Rapid Q* cartridge tape machine or a Studer *B62* stereo mono machine, as they prefer. There is access to an EMT plate and Radio Fleet also have outside broadcast facilities.

All the equipment was put in by Mr Norman Davey, a freelance technical consultant. Mrs Gania Wyndham, wife of BBC announcer John Wyndham, is in charge of bookings and the number is 01-583 9199 extension 344 or 366.

Advision—26.5 minute promotional film for Joseph Shaftel movie production *Alice's Adventures in Wonderland*, produced by Pacesetter productions. The film has been made for UK and US tv audiences. Two versions were made, one with English, one with American spoken commentary. Eric Masters of Pacesetter produced and Andy Whetstone was the dubbing engineer. The film will be distributed by Twentieth Century Fox and has already been distributed to Australia, New Zealand, Canada and South Africa. Press release, by the way, was titled *Alice's Adventures at Advision*—has a ring, doesn't it.

Pye mobile

Pye—Mobile recording unit now equipped for 16 track recording; desk is a Neve, tape machine is a 16 track Studer, convertible to eight track; 16 track Dolby system, Tannoy speakers and cctv. Charges: 16 track in London, first day £280 plus tape, second day £210 plus tape, third day £180 plus tape, and £180 thereafter; outside London, first day £385 plus tape, second day £250 plus tape, third day £200 plus tape, and £200 a day thereafter. Other rates from Pat Goodwin at Pye, 01-262 5502. List of places that Pye have done mobiles at is 35 venues long for the UK plus clubs and theatres in Frankfurt, Amsterdam, Paris, Cannes and 'Wijk Bij Duurstede Castle Holland'. The list of name bands who've been recorded by Pye mobile is nearly 70 names long.

Marquee—Phil Dunne engineered a Tom Paxton single. Nat Kipner has just produced an album on which each track is dedicated to an American state capital; title is 'Tour of the States'. Other artists at Marquee were ex-Yardbird Jim McCarthy, Monkton Mead and Jerry Morris, who worked on a new solo album. Robert Kirby produced and arranged David Rees Band album; Mick Audsley album finished; Strider and Gordon Haskell albums produced by Martin Saville; other work by Mike Redway and Jerry Morris. Marquee have bought what they describe as 'a revolutionary new phasing device'. It 'produces effects far superior to former methods in a fraction of the time'. More next month.

The Village, Los Angeles—last month's deliberate error, which most of you spotted, was that I said The Village Recorder were in New York; many thanks to those who wrote postcards and letters and made phone calls to put me right, and even more thanks to those who didn't. News this month is that Ken Klinger has developed an electronic box which allows a bass, piano or guitar, provided it's electronic, to be plugged straight into the console. Tests have been so successful that they intend to market the gadget. The price, says studio manager Dick LaPalm, will be within easy reach of all studio operators. The box is battery operated, has its own amplifier, and provides a high impedance load for the instrument plugged into the console. More than one instrument can be plugged into one box.

Ultra-Sonic, New York, and I mean New York—Music pop concerts, sponsored by fizzy pop makers, continue with Black Kangeroo, a Grunt Records group. It was the 57th concert in the weekly series broadcast in stereo over WLIR.

Finally I must point out that the **Phonogram** studio mixer mentioned last month was manufactured by Phonogram International bv and has nothing whatever to do with the Philips *MM* series which are, of course, still marketed by Pye TVT of Cambridge.

John Turner of Neve's test department shows Ray Prickett of Pye, seated, the new 26 input 16 track desk which has been installed in Pye's Studio One at Great Cumberland Place.

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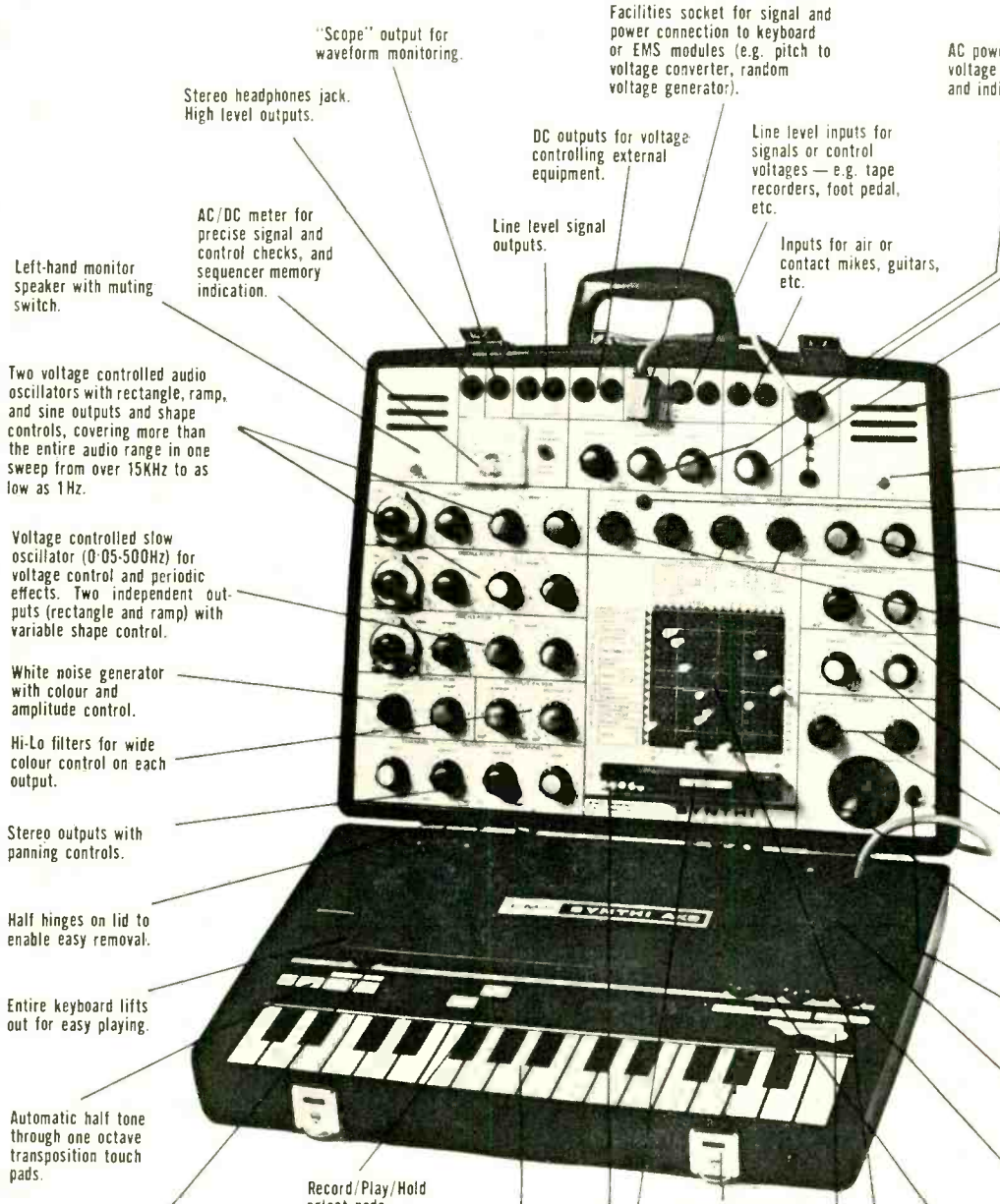
Ten green apples on the tree; Good for you, good for me
Good for everybody round the tree



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VIDEO

By Roderick Snell

SANYO 1100SL

AT FIRST GLANCE the Sanyo *1100SL* vtr might appear to be just another medium-price mains transportable of the type we expect from Japan but this superficial estimate would overlook several features that make its appearance on the British cctv scene a welcome event. For a start, it was the first machine available in the UK to the new EIAJ/1 format. Secondly, its still frame and slow motion performance is far superior to any other vtr available, be it broadcast or industrial.

The EIAJ/1 format

Non-interchangeability of tapes recorded on different makes of machine has long been a major criticism of all video tape recording systems except the 50 mm broadcast models, not just because one was thereby prevented from exchanging material with other establishments but because one was bound to a single manufacturer's products. For example, when looking for a slow motion recorder some 18 months ago, we had to reject the earlier Sanyo *100SL* because it could not play tapes recorded on our Shibaden machines. It is therefore a credit to the Electrical Industries Association of Japan that they could agree on a format for 12.5 mm video recorders which has such wide acceptance, in Japan at least, that it could easily become an international standard for the next few years.

The EIAJ/1 specification is as follows:

Tape width: 12.5 mm
Drum diameter: 115.82 mm
Video pitch: 173 μm
Video track angle with tape stationary: 3°11'
Carrier range: sync tip 2.9 MHz, peak white 4.3 MHz
Audio track width: 1 mm, control track 0.8 mm
Linear tape speed: 19 cm/s for 60 Hz field rates

It will be seen that this specification is for Japanese and American television standards, with their 60 Hz mains frequency. A different linear speed is necessary to keep the same video track pitch on European 50 Hz systems. Failure to correct for this results in several problems, one of which is a poor still frame performance. The correct linear speed works out around 16.3 cm/s. The reduction of head drum speed from 30 to 25 Hz reduces the horizontal resolution from 280 to 240 lines on a typical machine but the 11.5 per cent decrease in linear tape speed gives a worthwhile increase in playing time. A standard 19 cm reel of tape plays for 76 minutes on European standards.

At this moment, equipment from Sanyo, Shibaden, Ikegami and Nivico is actually available in the UK (as opposed to being promised for tomorrow, next week or next month) and many more very useful variations are promised for early 1973. Although Sony have 525 line EIAJ/1 battery portable and mains recorders available here and in the USA, they are carrying on with their *CV2100* format models for 50 Hz 625 line use.

Compatibility

A test tape recorded on the first Sanyo *1100SL* offered for review played back perfectly on a second machine, which is to be expected of two models from the same stable. But far more impressive was the fact that the same tape gave equally good results a couple of months later when played on a preproduction Ikegami *TVR-321E*.

Good resolution, reliable interchangeability, and tape economy are the three factors between which some compromise has to be engineered. The 115 mm drum diameter and 173 μm pitch of this format errs on the safe side. Some resolution is lost when compared with the best of the earlier generation of 12.5 mm vtrs but these new machines are very economical in tape and likely to remain compatible throughout their life. The writing speed of 910 cm/s is lower than either the Sony *CV2100* or the Shibaden *SV700* series recorders (which, being the best known low cost vtrs, represent good standards for comparison). Neglecting tape and head improvements for the moment, the carrier frequency range of 3.1 to 4.2 MHz for the Sony and 3.3 to 4.8 MHz for the Shibaden *must* give better resolution. This is borne out by visual inspection and measurement of reproduced test cards from recorders of each type.

FIG. 1

The **fig. 1** photograph shows the recorder with 19 cm reels and it can be seen to be larger than average, being 474 x 433 x 260 mm. At 26 kg, it is correspondingly heavy and the slim profile handle on one side makes it uncomfortable to carry for any distance. The deck has a neat and uncluttered appearance due to the drum, transport and guides being set below the control panel. This made tape loading less easy as it had to be lowered on to the guides. Seven large pushbuttons replace the single control lever common to this class of machine. Mechanically coupled, they need fairly heavy pressure but give smooth tape handling with little risk of tape damage.

It will be noticed that there are no level indicators, both sound and vision agc being permanently 'in'.

The recorder was supplied with a Sanyo *VM120E* 250 mm uhf receiver/monitor and the first test recording gave disappointing results with black-crushed and streaky pictures. A few checks showed the recorder to be working correctly so a Shibaden *TU12BL* receiver/monitor was used for recording a section of BBC Testcard *F* on to the Sanyo tape supplied with the machine. The reproduced picture was stable, with lower than average jitter, making this recorder particularly suitable for playback on monitors not specially designed for vtr use. Resolution was slightly below specification at about 225 lines, **fig. 2** giving an idea of the sharpness. The second set of frequency bars from the top, on the right of the circle, correspond to 2.5 MHz or 200 lines. They are 15 dB below the recorded modulation level but easily visible. Using a Marconi test wedge, the limiting resolution was 225 lines. Video noise level was dependent on both the signal amplitude and the high frequency content of the recorded signal. Recording carrier frequency only gave an excellent 42 dB p-p video to rms noise. Mid-grey levels on the testcard were just under −40 dB which is satisfactory, but the grey area corresponding to the 3.5 MHz bars on testcard *F* was only −35 dB which suggests some intermodulation between these frequencies and the recorder's fm carrier.

The head drum took 1.5 to 2s to stabilise fully at the start of a new recording or playback, which is satisfactory. Playback output remained constant at 1V p-p for recorded inputs between 0.5 and 1.6V, which is as great a variation as is likely from a camera. Sound measurements were difficult to make without disabling the agc, as the pre-emphasis overloaded the tape above 4 kHz. On listening tests, the response clearly extended to 10 kHz and the *measured* −3 dB point at low frequencies was 70 Hz.

Roderick Snell:
Senior Technician, University of Sussex.

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	310	210
Music Power (IHF)	44W at 4Ω	34W at 4Ω
THD (at rated output)	less than 1%	less than 1%
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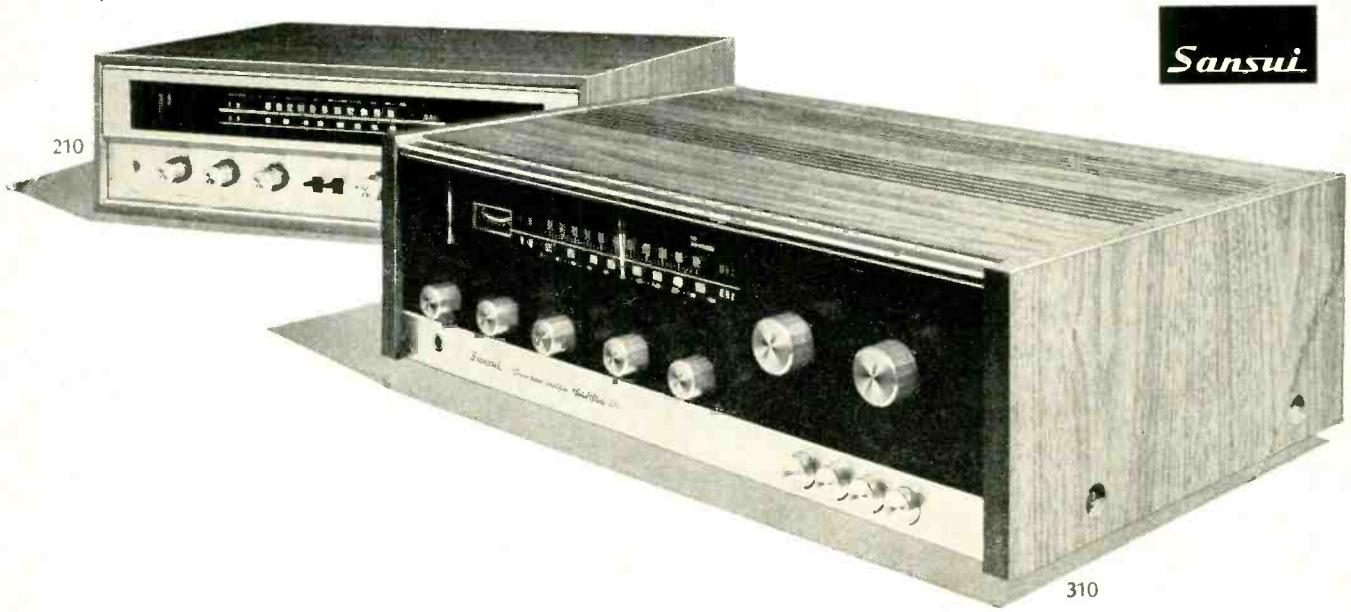
Channel Separation (AUX)	better than 55dB	better than 45dB
Hum and Noise (IHF) AUX	better than 75dB	better than 70dB
FM Sensitivity (IHF)	2.8μV	5.5μV
S/N Ratio	better than 60dB	better than 50dB

Sansui



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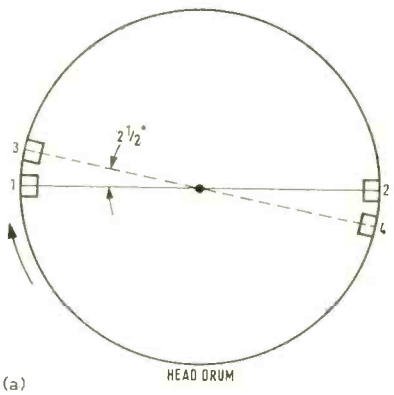
continued

Unweighted noise was 44 dB below ten per cent harmonic distortion at 1 kHz, which for video tape is equivalent to about 40 dB below three per cent. It consisted of equal amplitudes of high frequency noise and 50 Hz hum. Wow and flutter were very good at 0.08 per cent DIN peak weighted throughout most of the reel, rising to 0.15 per cent during the last few minutes of the tape. This increase is probably due to the absence of any kind of back tension servo but is still good. As the same motor is used for driving the head drum and the capstan, servo instability could in theory contribute wow. In this case a poor video edit or other disturbance only added 0.05 per cent, an insignificant figure.

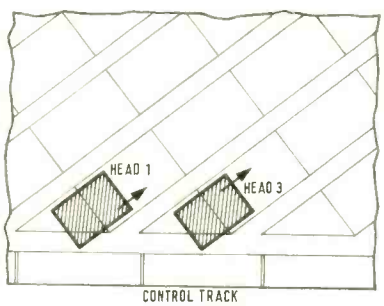
Slow motion and still frame

The slow motion and still frame facility is unique, complex to engineer and beautiful in performance. If the slow motion key is pressed during replay, the tape motion runs down from 16.32 cm/s to 3.26 cm/s, at which speed the drum servo locks in to give clear and stable pictures at exactly one-fifth normal speed. This is achieved within 2 or 3s. The still frame knob, which is interlocked in normal replay, may now be moved over to effect equally good still frame picture but this time without any delay. If needed, the still frame knob can now be turned to give a frame-by-frame examination of the recording with pictures as solid and stable as those from a cine film editor. In theory one is not supposed to leave the recorder on still-frame for more than a few minutes but several runs of up to an hour did not seem to produce any dropout on the tape.

FIG. 3



(a)



(b) HEADS 1 & 3 AT START OF TWO ADJACENT RECORDED TRACKS

The slow motion technique

Those who noticed the description of a method of improving slow motion helical scan performance in the Patents column of August 1972 may remember it was attributed to Sony. In fact it is part of the Sanyo patent (Apologies —Ed) which is realised in this machine. Recognising that the tracking angle differs between still frame and normal playback, two movable drum guides are arranged to lift the tape by 115 μm on still frame. In a normal vtr this tiny tracking error (not more than 0.05°) accounts for the wide band of noise which is visible over the area where the heads change from one track to the next and where the carrier frequencies interfere destructively. By raising the end tape guide, this tracking error is eliminated and we are left with a narrow noise band. The remaining problem is that, whereas this head switching noise is normally fitted into the frame blanking period (where it is invisible), on still frame it may appear randomly at any part of the screen. Sanyo's earlier patent (BP 1273749, May 1969) covers a clever method of using two additional heads to fill in this missing information. In fig. 3a the normal heads are One and Two. On still frame playback, the noise band occurs where, for example, head One is just leaving the end of a track and head Two is just starting at the beginning of the same track. Heads Three and Four are arranged to be forward by one horizontal track pitch and vertically displaced by one track width. Thus the missing information is replaced with that from the next tv frame. All four heads are factory installed with the correct alignment on to a metal bar for ease of replacement and a head exchange costs about 30 per cent more than that of a two head 12.5 mm recorder.

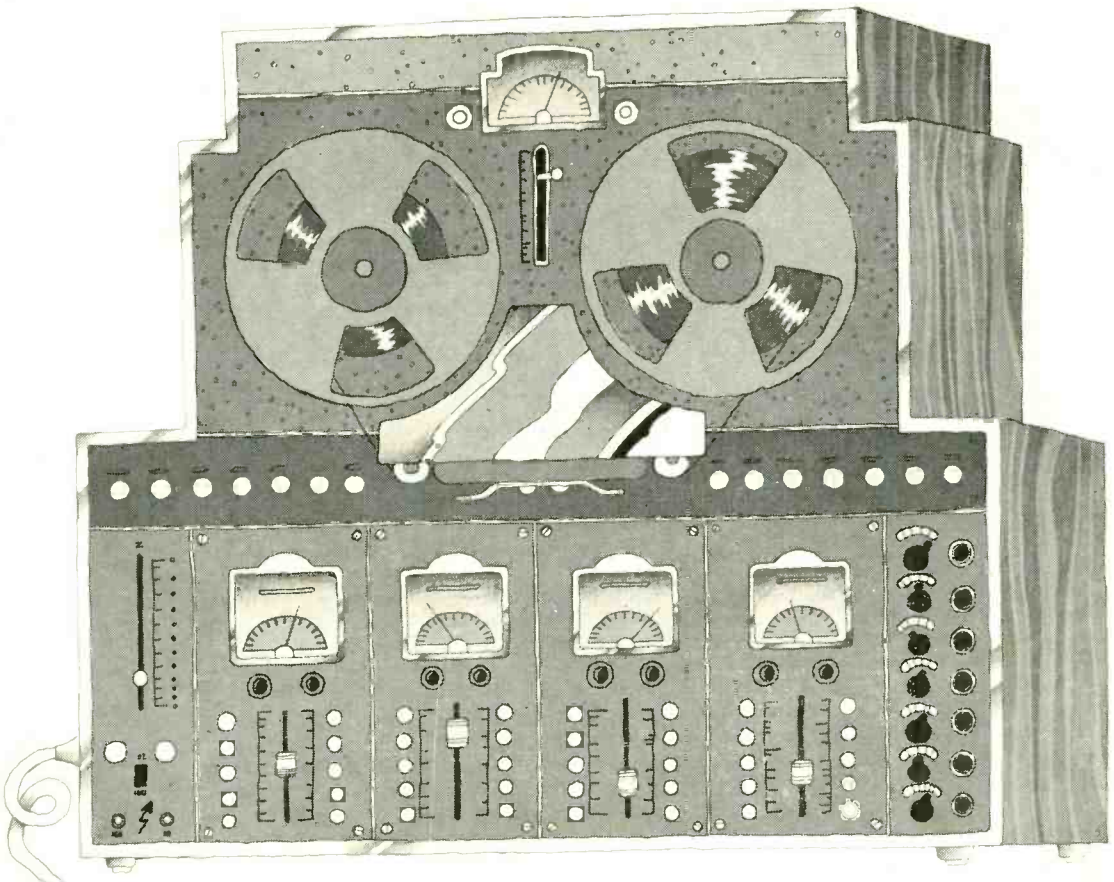
Video editing

In addition to the extra electronics needed for slow-motion, the Sanyo *1100SL* includes an interlaced sync-pulse generator which is always field-synchronised to the control track pulses on playback. It produces horizontal and vertical drive pulses suitable for Sanyo's own vidicon camera but could probably be coupled to other types. As no camera was supplied for review, the insert editing feature made possible by this pulse generator was tested at the importer's showrooms.

Here several camera sections were inserted into the middle of an off-air recording. Results were adequate, though not as stable as those made on an electronic edit machine, there being slight mistracking for 1s or so after the edit. Nonetheless this built-in pulse generator could be very useful for gen-locking a simple camera system. As such a device on its own would cost upwards of £120, it is surprising that it is scarcely mentioned in the instruction manual.

The Sanyo *1100SL* must be welcomed for its excellent slow motion and still frame performance. So far as I know there is no other vtr with these features, be it broadcast or industrial. This being a member of the rapidly increasing family of EIAJ/1 format machines, one is in no way limited by choosing this recorder where good slow motion reproduction is essential. The best features of other Japanese makes can be used when, for example, battery operation, electronic editing, remote control or colour is needed.

A 3-head, 30-20,000 Hz, 24 Watt, 4-track stereo, semi-professional, £95 let-down.



Specifications. Price. Performance. These are the factors you compare before you buy audio equipment, aren't they? But there's seldom any way of checking reliability. Which is why too many enthusiasts, who should know better, end up less than enthusiastic about the 'bargain' they've made.

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What is a Tonmeister?

JOHN BORWICK

'Soundmen will be trained in music, acoustics, physics, mechanics and related fields to a degree enabling them to control and improve the sonority of recordings, radio broadcasts and sound films.' This suggestion, put forward in 1946 by Arnold Schönberg, has already been realised on the European mainland as the Tonmeister concept. John Borwick, senior lecturer in recording techniques, University of Surrey, describes recent progress in establishing a Tonmeister course in the UK.

WHEN THE Department of Music at Surrey University recruited its first students to commence studies in October 1970, it did not only establish a conventional Bachelor of Music degree course. Alongside the three-year B.Mus. course was inaugurated a four-year course qualifying for an entirely new type of degree to be dubbed B. Mus. (Tonmeister).

This word 'tonmeister' takes a bit of explaining to British and American studio personnel, though it is well enough understood in recording and broadcasting studios all over the Continent of Europe. A literal translation from the German produces 'sound-master', not very helpful, but at least implying that a tonmeister is someone skilled in the arts of sound recording, transmission and reproduction. The complication, and the special delight, of the time-honoured sound studio profession is that it calls for a strange mixture of artistic flair and technical knowledge.

How you combine the seemingly incompatible aptitudes of art and technology in a single individual, and in what proportions, has always been a matter for discussion—and even of heated argument. It is easy to point to some of this country's ace balance engineers who are just that—engineers who position microphones and operate control consoles like angels, yet make no claim to musical knowledge. By contrast, there are equally famous sound balancers who know more about the way Wagner, for example, should be played and interpreted than most performing musicians, yet will confess to an almost total ignorance of what goes on behind the knobs and faders that they perform on with such consummate skill.

It seems that you can make a balance engineer, tape editor or producer from individuals possessing a wide range of art-to-science ratios. The one common factor, since all studio work entails a continuous succession of aural decisions, is what we might call a 'golden ear'.

A bit of history

In the beginning, the high priests of the recording studio were pretty obviously technicians (though hopefully possessing a keen ear for aural imperfections). They performed mysterious rites with enormous horn microphones and temperamental wax discs, sometimes rotated by Emmet-like gravity motors. They were often keen musicians (they would need to be slightly mad to take up such a trade) but their most needed qualities were the skills of a general handyman plus a gift for improvisation.

The BBC similarly began with a handful of engineering types, recruited from Marconi and elsewhere. Even when Broadcasting House was built around 1932, all amplifying gear and the main control of levels, routing, etc. was centralised in the engineering control room. If the studios had a 'control room' at all, it simply comprised a cubby-hole with a couple of knobs, a program meter (fed back from the remote control room) and a tiny loudspeaker. The incumbent of this room was a junior engineer, usually chosen because he wore suede shoes or gave other evidence of being an 'arty type'. Sometimes, and I hope some of my old friends will forgive me for mentioning it, he was chosen because he would plainly never make a decent control room engineer, being more interested in the programs than the plugboards.

When I joined the BBC as a 'program engineer' in 1947, there was a general state of restiveness. Program engineers felt that their artistic contribution to the program outweighed their engineering capability. Shortly afterwards, this feeling was officially recognised. Program engineers were transferred from the Engineering Division to Program Operations Department and they were redesignated 'studio managers'. Recruitment, training and the ladder of promotion were all re-orientated to take account of this change to a more artistic standpoint. We were witnessing the first manifestations of the tonmeister idea in this country and the trend has continued. The name has again been changed—to 'program operations assistants'—and there is a clear line of promotion up to studio production. New recruits tend to be looked at closely for their producer potential. It is generally easier to take an artistic personality and teach him enough basic electronics and physics to operate studio equipment than to take an engineer and graft on a sense of program timing, drama and music.

Training tonmeisters

As long ago as June 1946, the composer Arnold Schönberg, in a letter to the Chancellor of the University of Chicago, was suggesting that the music department should offer classes for 'soundmen' (a near translation of tonmeisters): 'Soundmen will be trained in music, acoustics, physics, mechanics and related fields to a degree enabling them to control and improve the sonority of recordings, radio broadcasts and sound films. I want to mention here only my program for their musical training:

'The student should become able to produce an image in his mind of the manner in which music should sound when perfectly played. In order to produce this image he should not use the corrupting influence of an instrument. Merely reading the score must suffice. He will be trained to notice all the differences between his image and the real playing; he will be able to name these differences and to tell how to correct them if the fault results from the playing. His training in the mechanical fields should help him to correct such acoustic shortcomings as, for example, missing basses, unclear harmony, shrill high notes, etc.

'This can be done and would mean a great advantage over present methods where engineers have no idea of music and musicians have no idea of the technique of mechanics.'

It was in that same year, 1946, that the very first Tonmeister Institute was formed at the Hochschüle fur Musik at Detmold in North Germany. Others followed in Berlin, Düsseldorf, Warsaw and Stockholm. While the same basic philosophy inspires these colleges (and indeed the Tonmeister degree course at Surrey University) the style of training, and in particular the relative importance attached to the musical and scientific sides, varies considerably.

I was able to check this in October 1972 when I attended the Ninth Triennial Conference of the Association of German Tonmeisters. I took part in a panel session on 'The Training of Tonmeisters' and soon discovered that, whereas Detmold continues to set itself the

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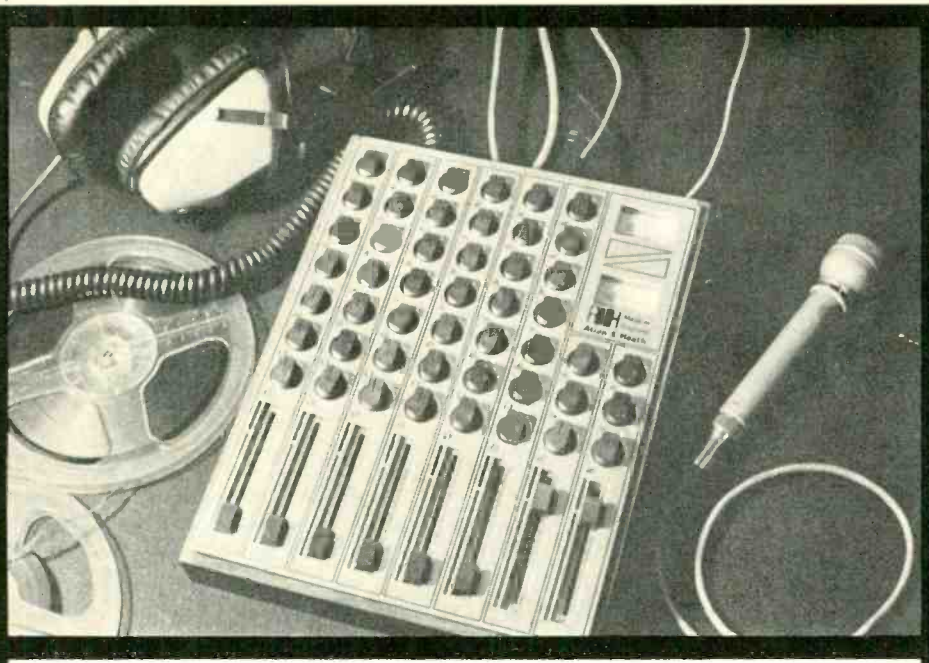

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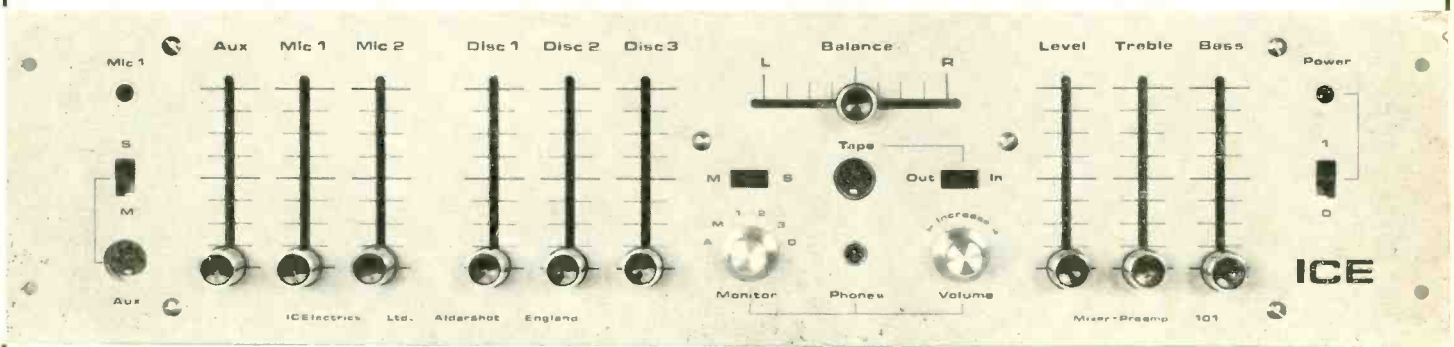

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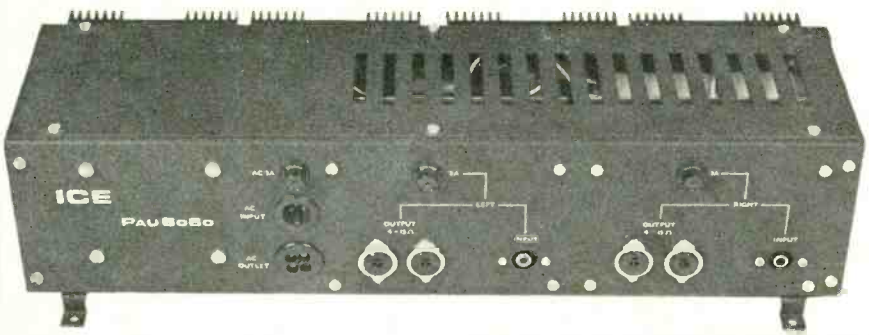

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TRADE INQUIRIES WELCOME

highest possible standards concentrating on the technical subjects, our Polish and Swedish colleagues in particular seemed to share our view that the tonmeister is first a musician and second an engineer. My main surprise at the Conference was its enormous size. There were some 800 delegates, filling the huge concert studio at the Cologne Radio Centre. The Association handbook listed over 400 tonmeister members, most of them graduates from Detmold and now employed in every corner of the German sound industry. This question of employment is vital, of course. A high proportion of tonmeisters on the Continent do follow the expected line and go into studio work on microphone balance, recording or production. But almost as many develop special interests in electro-acoustic research, for example, or musicology. User/development liaison is thus greatly enhanced because a studio man may find that he has a former classmate working in microphone or mixer development and vice versa.

In the same way, the tonmeister students at Surrey are encouraged to develop their own specialist interests and will most certainly not emerge as stereotypes.

The Surrey course

Recruitment for the degree course at Surrey follows the normal University pattern. Applicants should offer good pass grades at A level in Music and Physics, with Mathematics as a preferred third subject. At interview, selected applicants are expected to cope well with musical performance (in their chosen instruments which will often include piano because the ability to read a musical score at the keyboard is a useful part of a tonmeister's skills), aural harmony, and tests relating to knowledge of basic physics and electronics. Entry is highly competitive because work on sound recording and reproduction is attractive to today's young people. Yet, for reasons of space and staff limitations, only some half-dozen students are admitted each year.

An equivalent number are recruited to the normal music degree course which runs alongside the tonmeister course. Thus, through a wide variety of musical activities, opportunity exists for students to acquire competence in the practical side of recording as well as the musical and artistic responsibilities of a recording producer.

It is the aim of the course (which is run in collaboration with the Physics Department) that each student should not only practice and develop his own skills, from the technical point of view, but that he should also be thoroughly conversant with music of every period. The Department of Music contains a music studio fully equipped with modern professional recording gear, including mobile equipment.

We have a 16 input, four output Neve control console with up to eight channel monitoring and a comprehensive Calrec mobile mixer. Our tape recorders include a Scully four track machine, Studer *A80* and *B62*, a stereo Nagra, and Revox types. We also have a stereo EMT reverberation plate, Dolby *A* units and several first class Neumann, AKG and other microphones.

Music-making is a daily part of the life of the Department. As well as student performances, the tonmeisters can record concerts by visiting professional musicians who come every week to the University. We also record in the beautiful Guildford Cathedral, which adjoins the University, and other outside locations.

Subjects of study

Included in the range of subjects studied are the following:

- History of music
- Medieval, Renaissance, Baroque, Classical, Romantic and 20th-century techniques
- Free composition
- Mathematics
- Acoustics
- Electronics and electro-acoustics
- Keyboard harmony
- Aural training
- Knowledge of instruments
- General musicianship
- Instrumental studies (including score reading at the piano)
- Rehearsal techniques
- Sound recording techniques.

The Industrial Stage

In the latter stages of the course, tonmeister students pay visits to recording sessions, disc cutting channels, the BBC Research Department, etc, and receive lectures from visiting specialists. In this way, they learn the latest thinking on studio techniques and equipment development and become able to assess several viewpoints rather than that of a single expert.

As an integral and vitally important part of the course, students spend a period of six months in selected recording or broadcasting studios or establishments. This Industrial Stage will normally extend from April to September in the Third Year. Thus the students will already have completed two years and two terms of their four-year course. They will therefore be able to make themselves useful in the studio situation and develop their knowledge and basic skills, particularly on activities which can best be learnt alongside professionals rather than in the University environment.

The main objective of the Industrial Stage is to enable students to relate their University studies to the world of industry. As a by-product, of course, it affords the industry an opportunity to assess at first hand the calibre of students and to participate in this new aspect of sound recording training.

The first batch of students will be taking up their six months' employment in April 1973. Although most of the posts have already been arranged, any studio which has not been approached and would like to receive full details of the scheme is invited to contact the Music Department as soon as possible. The address to write to is: Industrial Tutor (Tonmeister Course), The Department of Music, The University of Surrey, Guildford, Surrey.

Postscript

In conclusion, it may be helpful to reiterate what the B. Mus. (Tonmeister) course is and what it is not. It is an academic degree course but carefully tailored to cater for the requirements of the recording and broadcasting industries where musical talents combined with a detailed understanding of technical matters are continually in demand. It is not a kind of super-engineer course. Nor does it seek to replace any of the traditional modes of entry to studio employment. Music is becoming increasingly a technical art. From June 1974 onwards, tonmeister graduates from Surrey will be playing an important part in the realisation of this art in direct performance and in each of the mass communication media.

Left: Dr H. Heimler, lecturer in music, plays a Steinway specially set up in the BBC Research Department anechoic room.

Below: View of the control room at Surrey University with Neve desk, four track Scully, Dolby A units and Spendor speakers.

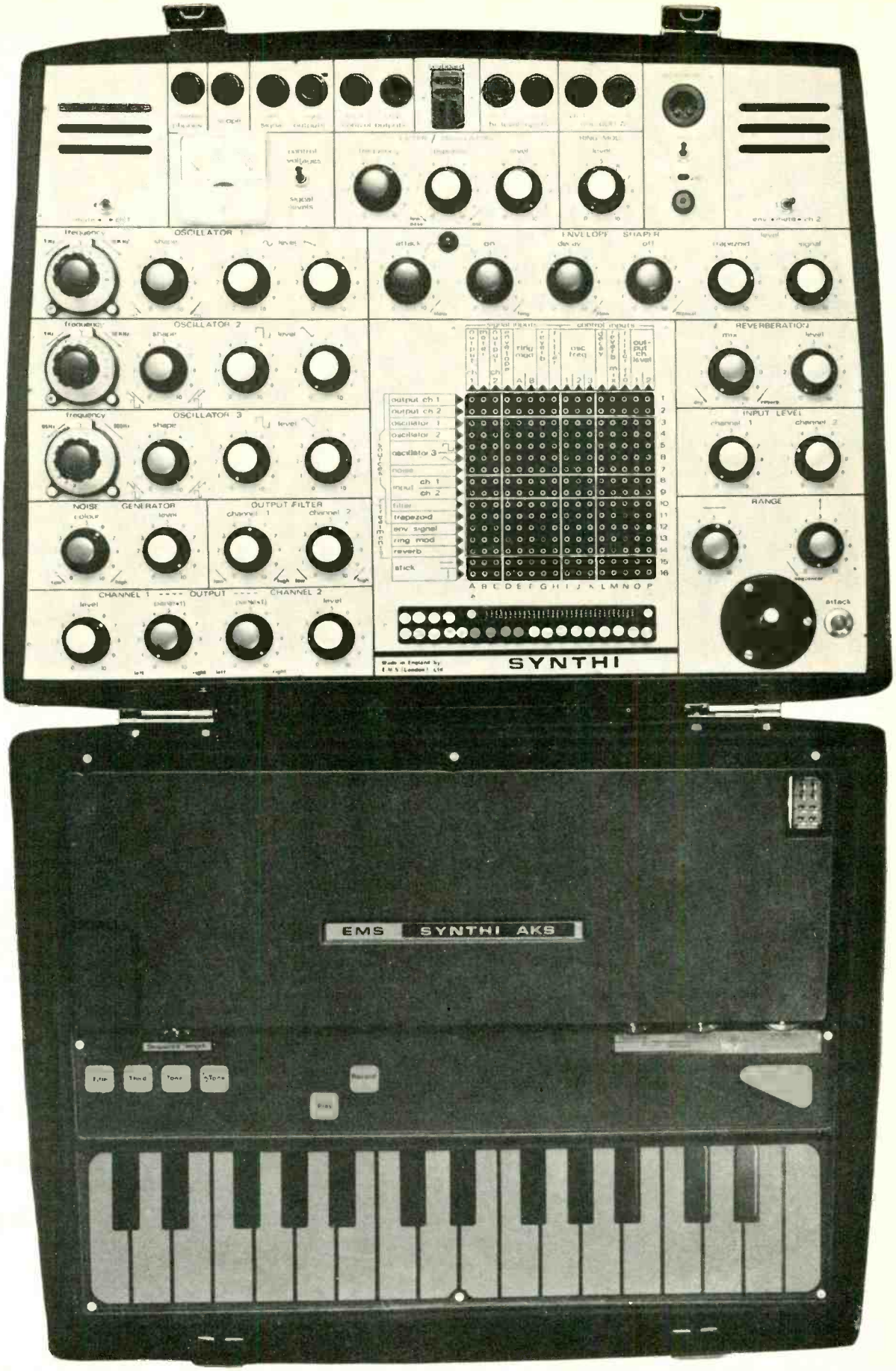

FIG. 1

SYNTHI AKS ELECTRONIC MUSIC SYNTHESISER

MANUFACTURERS' SPECIFICATION
Voltage controlled audio synthesiser incorporating 256-event sequencer with digital memory, independent control of speed and pitch, instant transposition, random note generation and independent 'spread' controls, plug-in patch facility.
Internal sources: Three oscillators and noise generator.
Internal treatments: Envelope generator, filter/oscillator, ring modulator and spring reverb.
Price: £420.
Manufacturers: EMS LTD, 49 Deodar Road, London SW15.

IN THE APRIL 1971 issue, I had the pleasure of field-testing the *VCS3* audio synthesiser, manufactured by Electronic Music Studios Ltd. The more recent *Synthi AKS* displays a close functional resemblance to the *VCS3*, being a suitcase version (albeit considerably more versatile) of the latter. Like its predecessor, the *AKS* presents the operator with two control panels: one more or less horizontal and one steeply sloping. Virtually all the *VCS3* controls have been compacted on to the vertical panel of the *AKS*, leaving the horizontal panel to take a 30-note electronic keyboard and 256-event sequencer. A third addition to the *VCS3* concept is a *Prestopatch* (fig. 2) socket.

Routing in all EMS synthesisers is accomplished through one or more patch boards, in this instance with 16² sockets. One prewired (to your own or an EMS specification) *Prestopatch* gives instant access to the most complex pin array, leaving the operator only to set the control positions according to printed or written markings on the multipin plug case. Another major facility: the *AKS* is small enough and light enough to be truly portable. If it is heavier than a cased guitar, it is more convenient in shape and therefore comparably easy to carry.

Basic facilities

Thirty-six rotary controls, four switches, one joystick, the 16² routing panel, two loudspeakers, one meter and 12 sockets occupy the upright panel of the *AKS* (kept upright either by the metal stand supplied or the back of a chair). The controls are grouped according to their function (fig. 1).

Oscillator One appears as a frequency vernier, sinewave level, sawtooth level, and 'shape' (governing the mark-space ratio of the two waveforms).

Oscillator Two covers the same frequency range (1 Hz to 10 kHz) but produces either a square wave, triangular wave, or a mixture of the two. So again we find a frequency vernier, shape control and two waveform amplitude controls.

Oscillator Three is almost identical to oscillator Two except in frequency range: .05 Hz to 500 Hz. Another difference: square and triangular wave outputs are channelled to separate outputs rather than merged to one output row. All three oscillators may be frequency modulated by applying a fluctuating voltage to their control input. A 1 Hz sinewave routed from oscillator One output to oscillator Two frequency-control inputs will produce a continuous 1 Hz swing in the pitch of oscillator Two. This is achieved simply by pushing a pin into patch socket 3J. You don't actually hear anything unless you route the output of oscillator Two to a loudspeaker—accomplished by a pin in 4A. A low level control voltage can produce a pitch swing of less than one semitone. A higher level will swing the pitch across a full octave or more. You adjust for the desired effect (fig. 4).

Below oscillator Three is the noise generator panel, two controls governing colour and loudness respectively. The colour may be varied from a predominately bass hiss, through 'white' to predominantly treble.

The output filter comprises one control for each of the two audio output channels. These provide low-pass (control anticlockwise) and high-pass (control clockwise) characteristics. Bottom left of the upright panel are two output level controls (doubling as internal volume) and two pan pots. The pan facility is not present on the internal monitor.

Output level may be gain modulated from any signal source. For example, a slow square wave from oscillator Three would modulate the amplitude of output Two if routed via a pin at 4P. High up the panel is a filter/oscillator with separate cutoff frequency, response (Q) and output level controls. Any signal source routed to row N can be adjusted to modulate the cutoff

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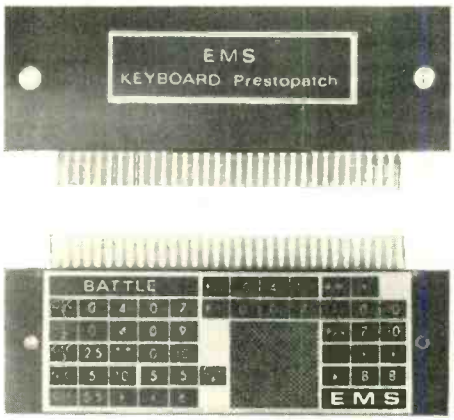


FIG. 2

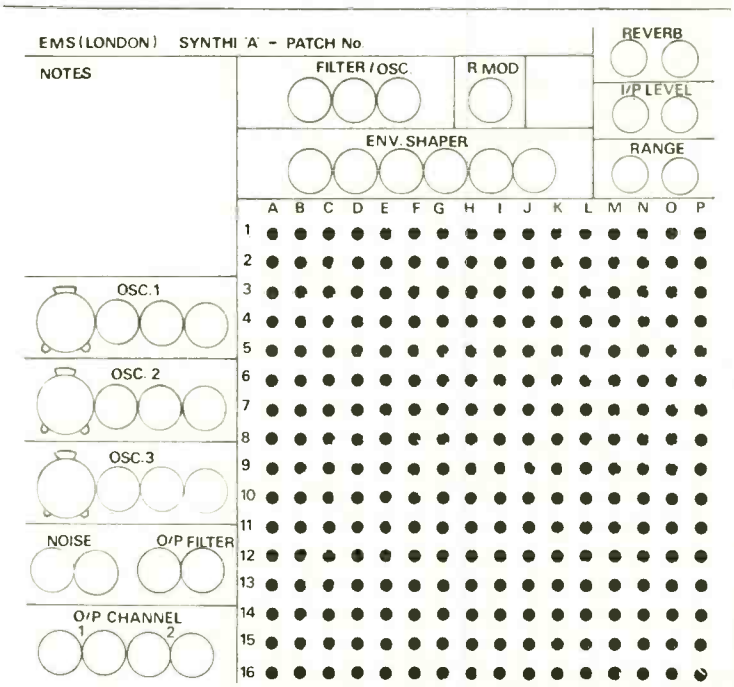
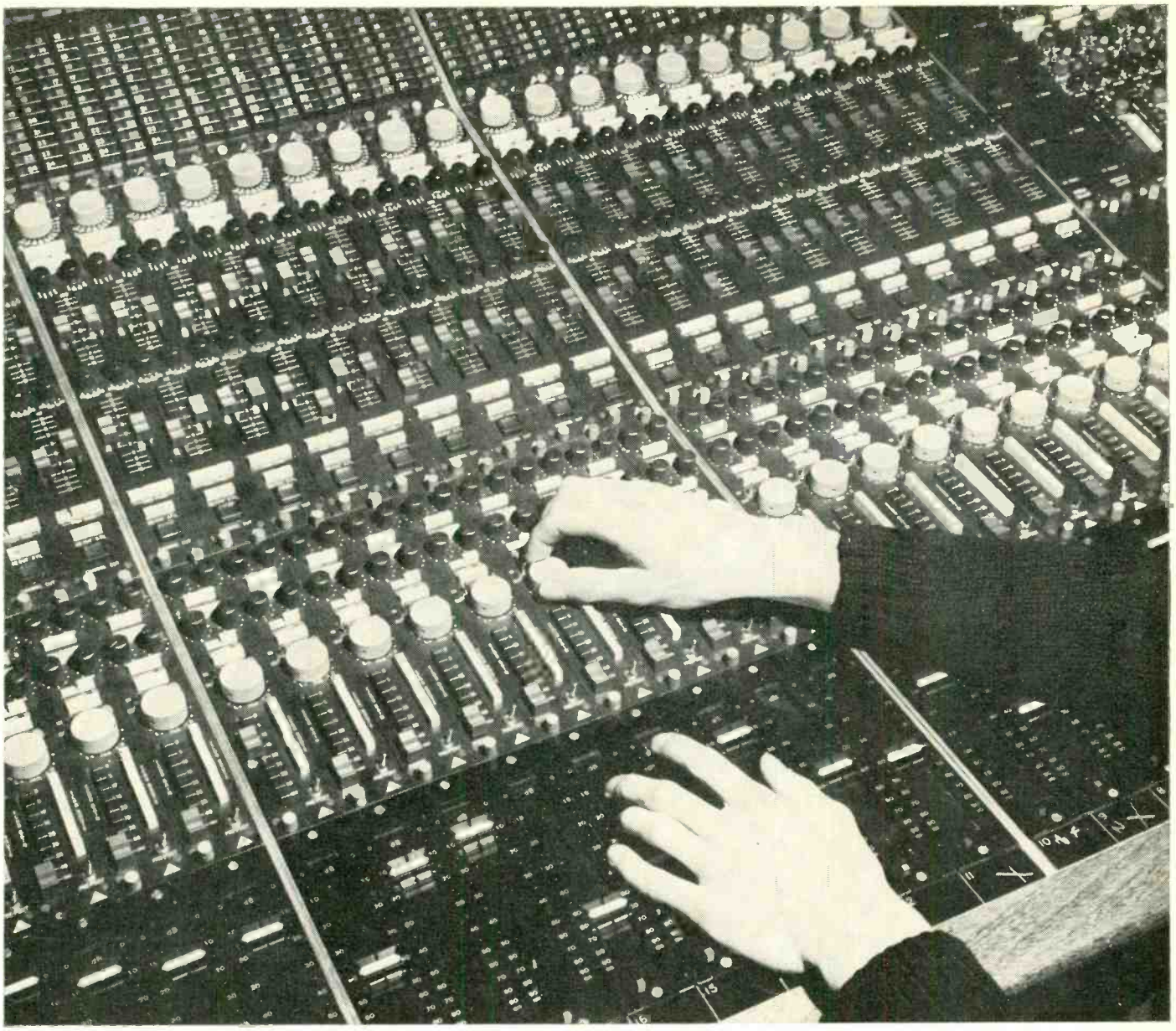


FIG. 3



Ergonomic bliss !

Only one pair of hands are needed to operate the 3440 controls on the 28 input, 24 group TRIAD 'A' Series console, thanks to the logical layout and functional design.

The number of facilities offered enables the most to be made of todays' multi-track techniques. Each input channel has four variable equalizer controls, with a choice of four frequencies for each, plus three position high and low pass filters, two inserts, compatible pan po' four fold back and six echo sends plus completely free routing that allows the channel to be assigned to, or panned across any number or combination of groups. Monitoring facilities are equally comprehensive, with equalization and full fold back plus echo facilities. Metering is by dual V.U. and P.P.M. meters.

Performance as one would expect is beyond reproach. Distortion of a typical channel is less than 0.01% (line in to output, 1 KH_2 at + 20dbm with channel fader at maximum) and noise at a group output with ten channels selected to that group will be less than— 75dbm. Maximum output is + 24dbm with a 20db overload capability at all settings.

So, if you've only got two hands and need 3440 controls, contact us. Barry Porter or Malcolm Toft at,

TRIAD

CREATED FOR ENGINEERS BY ENGINEERS

Trident Audio Developments Limited
4-10 North Road, London N7 9HG
Telephone 01-609 0087
Telex, 27782

continued

frequency. The response control determines the sharpness of a resonant hump at the top of the passband. Too high a Q setting places the filter into oscillation (sinewave), still governed in pitch by the frequency control.

A single potentiometer determines the output level from the ring modulator—nowadays synonymous with the voltage controlled amplifier. This has two inputs (rows **E** and **F**, designated *A* and *B*) and one output (level 13). Placing a pin in 7E connects the noise generator

FIG. 4

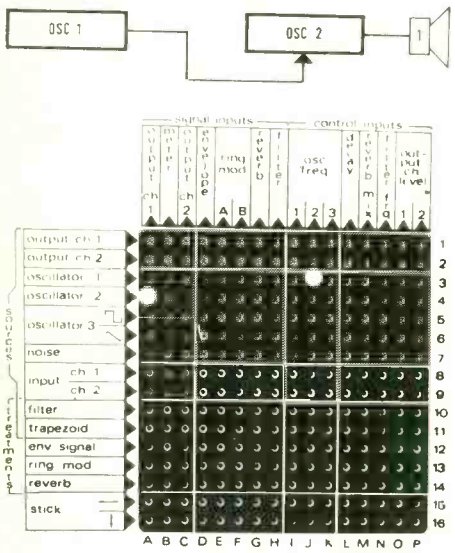
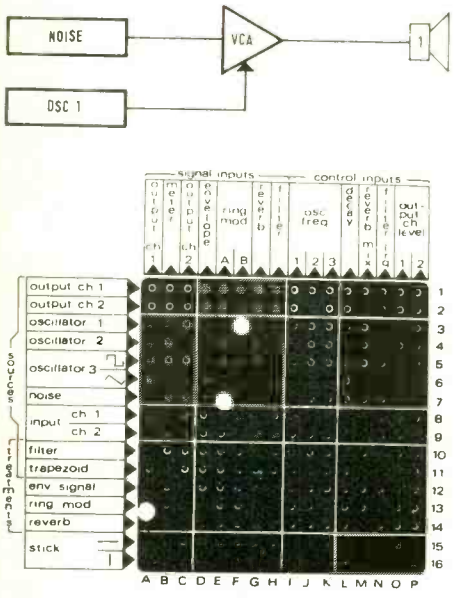


FIG. 5



to input *A* of the ring modulator. A second pin at 3F routes the output of oscillator One to input *B*. Setting a 1 Hz sinewave from oscillator One (fig. 5), the vca integrates this with the noise signal to produce a 1 Hz rise and fall in noise amplitude: a very approximate steam engine. Tones may be similarly interacted, perhaps the greatest value of the ring modulator being its ability to produce relatively complex waveforms from the three basic shapes generated by the oscillators.

In the envelope shaper, we have a means of converting continuous tones into separate dynamic entities, four controls determining attack time, sustain time, decay time and off time. Off time? If the *AKS* is played from its keyboard, the off time will probably be set at or near maximum since a lower setting would cause the note to repeat itself after a few seconds delay. Maximum off time and zero attack, on and decay times produce the virtually instantaneous on/off characteristic of an electronic organ. Raising the 'on' time prolongs a note for up to 5s after the key has been released. Resetting the 'on' time to zero and raising the decay time gives the dynamic quality associated with a plucked string. Raising the attack time as well approaches the dynamics of a bowed string or an accordion. (Sorry to drag acoustic instruments into this account but they provide familiar examples.) The dynamic control voltage produced by the envelope generator may be extracted independently of the processed audio signal and used to control, for example, the filter cutoff frequency.

The envelope shaper, like the reverberation generator below it, incorporates a level control independent of the output gain controls. The second potentiometer on the reverberation subpanel provides adjustment between pure incoming signal (dry), pure spring output (reverb), or a mixture of the two. Care must be taken to avoid exciting the spring accidentally and against mechanical feedback; one feature that isn't foolproof.

Bottom right of the main control panel are two input level controls—for a tape machine perhaps, second synthesiser, microphone or instrument pickup. And below these, a joystick control of the kind now becoming common for quadraphonic panning. The stick might be considered uncomfortably recessed and EMS therefore provide a clip-on extension rod. Two parameters may be governed from a single hand, leaving another hand free for perhaps the keyboard. Pins inserted at L15 and N16 would place the envelope decay time and filter cutoff frequency under joystick control. In practice, the characteristics you require may occupy only a fraction of the joystick angle. This angle, more precisely this control voltage range, may be adjusted by presetting the horizontal and vertical range controls adjacent to the joystick. Just right of the stick is a button ominously marked 'attack'. Useful in the *VCS3* (for which the keyboard was an optional extra), this is largely redundant in the *AKS*. Like each note on the keyboard, the attack button triggers a fresh cycle of the envelope generator.

Adjacent to the left (channel One) loudspeaker is a meter switchable between internal control voltages (centre zero) and nominal output signal level (left hand zero). When the keyboard umbilical is connected, the meter also serves as a clock, in the plain temporal sense, which brings us to the horizontal half of the *AKS*.

The keyboard

A 30-note keyboard is laid out over two and a half chromatic octaves (C to F), across the near end of the opened lid. All resemblance to a conventional keyboard ends here. The naturals are blue instead of white. The keyboard depth is foreshortened, rather like that of a clavichord. The sharps, though the usual black, are on the same plane as the naturals—not raised above them. And the keys do not pivot. You have only to *touch* the key surface and the selected note is triggered. Like the joystick, this keyboard is solely a manual means of altering a control voltage. It only becomes a pitch control device if routed to the frequency control of one or more oscillators. Fine, but where on the patchboard does the keyboard control voltage emerge? In fact row eight, designated 'input (channel One)' gives the output corresponding to lateral (i.e. sideways) finger movement. Pins inserted at 8I and 8J connect oscillators One and Two to the keyboard pitch control output (fig. 6). By adjusting the channel One input level potentiometer, an octave keyboard spacing may be tuned to produce an octave change in oscillator frequency. Fine adjustment is made easier by a separate 'realtime' tuning thumbwheel on the keyboard panel. Considerable adjustment range is provided and an octave pitch change may be compacted across say C to E of the *AKS* keyboard. Conversely it may be expanded beyond the point where a single semitone pitch change is spread across the keyboard's entire 30 notes. It is one drawback to the *AKS* that

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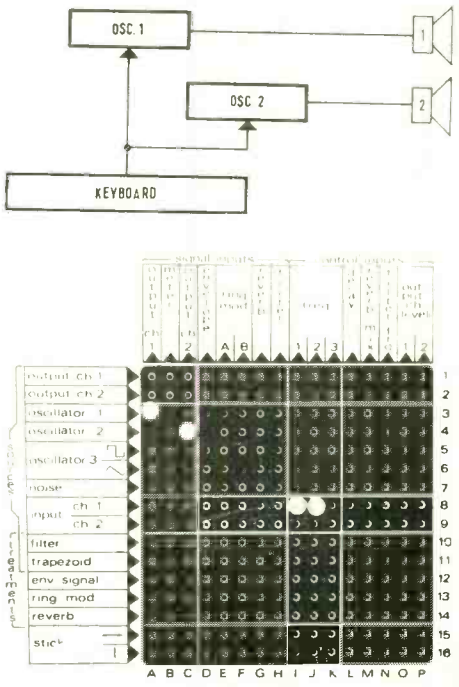
FIG. 6



continued

you must master the relatively easy task of tuning octaves. Some other synthesisers spoon-feed you in this respect, though in so doing they lose much of the versatility of the *AKS* and *VCS3*. Another important operational point: if you alter the loading seen by the keyboard control voltage (perhaps by connecting another oscillator), it may be found necessary to retune the octave slightly by routing. For many purposes, this need to retune can be eliminated by preplugging the frequency controls of all three oscillators and the filter to the relevant control voltage output, in this instance row eight.

The *AKS* keyboard offers a second control voltage source in addition to the lateral or 'pitch' voltage described above. Equally nominally, the second source might be called the 'dynamic' control voltage since its obvious application is to determine the loudness of each note. In addition to being touch sensitive, each key is responsive to vertical striking force. The harder a key is thumped, the higher the output control voltage. Like a piano, the *AKS* keyboard reacts to the intensity of the *initial* strike, not to subsequent variations in pressure. The dynamic control voltage arrives at row nine of the patchboard, input (channel Two), via the channel Two input level potentiometer. A pin inserted at 9P routes this voltage (fast attack, fairly slow decay) to the amplitude control input of a voltage control amplifier preceding the channel Two output. An additional pin in 9O produces virtually identical amplitude modulation of both channels. There is, of course, no technical objection to using the 'dynamic' waveform to control pitch (pin 9I) and the 'pitch' waveform to control dynamic (pin 8O).

I found the dynamic properties of the *AKS* preferable to those of the mechanical keyboard supplied as an accessory to the *VCS3*. Without the physical sensation of an independent key, however, playing from music became rather more difficult than improvising. Unless a close watch is kept on the keyboard, a performer's fingers may drift from the key centres. Would it help to glue positive dividing strips alongside each note? Perhaps. It might also help to rehearse into the sequencer, depending on the length of the music and the degree of treatment planned for the tone structure.

But before proceeding to the sequencer, one further feature of the keyboard warrants description. At the extreme right, behind the top E and F, is a three-sided panel marked 'Random'. This presents, literally at your fingertip, a 'sample and hold' facility. In principle this may be regarded as a noise generator producing pulses of random amplitude. Whenever the 'Random' panel is touched, the pulse amplitude at that instant is sustained (as a keyboard 'pitch' control voltage), changing only when the panel is touched again.

The sequencer

If you shop around, you can buy for about £6,000 a very large synthesiser with a ten-note sequencer; just enough for the first line of *Colonel Bogey*. Ten potentiometers protrude from that device, each being adjusted in turn to tune one or more oscillators to the desired pitches. This takes perhaps a minute: 6s for each note. Given another minute, you can set another ten potentiometers governing the duration of each note. Total: two minutes for a 5s sequence. The *AKS* sequencer can be programmed with the same melody in just 5s; the time it takes to play the piece on the keyboard. Up to 256 events may be recorded in its semiconductor memory until such time as the sequence is no longer wanted (having perhaps been taped) or until the power supply is switched off. Like most tape machines, the sequencer will function at a high or low speed depending on the desired recording quality. Maximum measured sequence time was 55s, continuously variable to a minimal 1s. For many purposes a 20s cycle proved a practical compromise between duration and definition. Longer durations could lead to occasional timing inaccuracy or the complete omission of a note. Trial and error quickly found the optimum duration for a given complexity of sequence, typically 30s for a slow hymn to 9s for a fast staccato.

To program a sequence, the operator switches the joystick vertical range control to its fully anticlockwise off position. This routes the sequencer output to row 16 of the patchboard. A pin at 16J locks the frequency of oscillator Two to the sequencer output. With this arrangement the keyboard functions through row 16 exactly as it did through row 8 except that tuning is now preset through the 'sequence' thumbwheel.

Just three pins (12A, 3D and 16I) provide the basic patch needed to record and reproduce a musical sequence. A touch sensitive switch marked 'record' sets the sequencer to its starting point. The control voltage meter sits at zero (extreme left of scale) until the first note is played. The pointer moves gradually over to the right of scale (calibration 10), arriving precisely at the end of the sequence. This speed is dictated by the 'sequence length' thumbwheel near the bass end of the keyboard. If the chosen setting is too fast for your music sequence, the sequencer automatically reverts to start—probably chopping off the first few notes of your program. No problem. You reset to 'record' again and either reduce the sequence rate, choose a shorter piece of music, or simply play faster. You also take care to press the 'play' button before the pointer whips back to zero. This button alone stores the sequence until such time as pressing 'record' again erases the memory pattern. A silent gap can be left between playback cycles or, where appropriate, the last note of one cycle may lead uninterrupted into the first note of another.

An entire sequence may be temporarily raised a semitone, tone, third or fifth, simply by touching the relevant button in the group near the 'sequence length' thumbwheel. This innovation is the more remarkable in permitting addition: pressing a third, a fifth, and a semitone gives a rise of—you guessed—an octave.

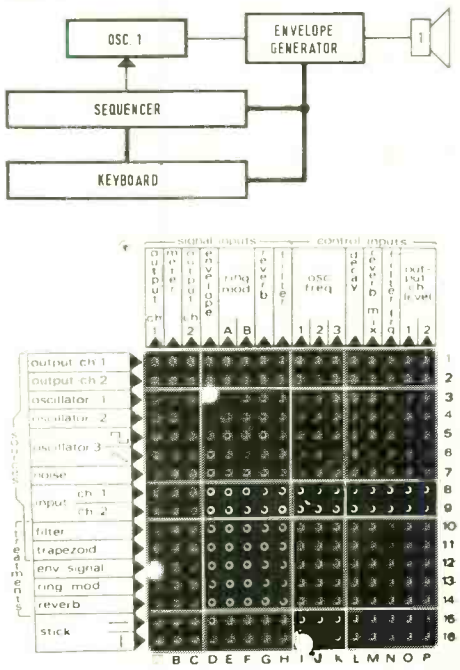
Since the sequencer and keyboard outputs occupy separate matrix rows, it is quite practical to play to a stored accompaniment. This form of polyphony is amusing though it should not be considered a substitute for multitrack tape facilities. A less obvious sequencer application is to store a cyclic control voltage modulation, for example the filtration characteristic applied to the keyboard performance. Suitably programmed, the sequencer may also be used as a means of assembling highly complex wave cycles. These may be accelerated into a continuous oscillation. In this respect, a much higher memory scanning rate would be of value, together with voltage controllable rate.

There is a strong temptation, when field testing synthesisers, to suggest that manufacturer A lift ideas from company B and vice versa. Where I have done this in the past, EMS have usually been the source of my ideas. Considering the comparatively low price of the *AKS*, however, I am reluctant to suggest EMS include a voltage inverter and a means of pulse-triggering the 'random' and 'attack' facilities. For a start, I have no idea where they could find the necessary panel space.

The physical execution of the *AKS* is excellent. I was initially worried by the heat produced near to the right of the sequencer cover since this was clearly not the power supply. Since the synthesiser performed perfectly throughout some six weeks of frequent use, however, this heat is presumed inconsequential. Electronic performance? Oscilloscope examination showed slight impurities in certain basic waveforms—minimised by careful setting of the oscillator shape controls. This aspect of a synthesiser is of minor importance, however, since a prime object in electronic music is to move away from pure tones as these rapidly become tiresome. Slight breakthrough was noticed when monitoring a non-patched matrix at high volume but again this was of no practical significance. Like the *VCS3* before it, I consider the *AKS* first-rate value for money to experimental musicians and limited-budget recording studios.

David Kirk

FIG. 7



Ten per cent from you too, or a studio guide to VAT

TONY EDEN

There is no shortage of guides to value added tax. Only problem is that most seem unreadable unless you have a mind for the convoluted terminology of finance. Tony Eden outlines the basic VAT system, with particular reference to its effects on service industries and small companies. He answers the two dominant questions:
Why should I register?
and
Ten per cent of what?

FROM APRIL 1, over 2,000,000 businesses throughout the country will be required to make tax returns when the 1972 Finance Act comes into effect. This sets out the working of Value Added Tax (VAT). Until now, only about 75,000 firms have had to make returns to Customs & Excise and this new tax system will therefore involve many organisations that until now have not had to keep detailed records of their purchases and sales. This article explains the basic way in which the tax operates and then goes on to examine how prices are likely to be affected by VAT.

With a few exceptions, all goods and services will in future be subject to VAT. At present the rate has been fixed at ten per cent but can vary between 7.5 per cent and 12.5 per cent before April 1. The rate can also rise to 20 per cent without the necessity for new legislation. The tax is levied at every stage of a transaction but the tax of the preceding stage is claimed back. In this way, only the gross margin or 'value added' is taxed until the goods are sold to the final consumer who has to bear the full value of the tax.

Tax invoices

Every business will therefore have to keep two 'tax invoices' as they are to be known, one relating to the 'inputs' or purchases made by the business and one relating to the 'outputs' or sales from the business. When a business receives or issues an invoice that is greater than £10, it will have to state the basic price plus the ten per cent added tax. At the end of each accounting period, which will usually be at three-monthly intervals, all the input and output taxes will be totalled. The input tax may be reclaimed from Customs & Excise while the output tax is owing to them. Taking one from the other yields the net tax owed or the tax to be paid (see fig. 1).

Zero rating

There are two special cases that require some explanation. Certain goods and services which are basic to the community are not taxed at present. This is called 'zero rating' and the goods affected include:

1. Food.
2. Water.
3. Books, newspapers, periodicals and music.
4. Talking books for the blind.
5. Newspaper advertisements.
6. News services.
7. Fuel and power, in particular coal, gas and electricity.
8. Construction of buildings.
9. Overseas traders and services.
10. Transport.
11. Drugs, medicines and prescriptions.

Those firms who supply the above goods or services can still claim back all taxable inputs, assuming they have registered, and therefore these firms will in general be owed money by Customs & Excise.

The second class of business which is treated in a special manner is said to provide exempted goods and services. This means that no tax is attached to the sales and that tax is not recoverable from taxable inputs. These services include:

1. Land.
2. Insurance.
3. Postal services.
4. Finance.
5. Education.
6. Health.

Registering a small business

There is another important type of exempted business and this occurs where turnover is less than £5,000 per annum. However, small businesses who think they might benefit from registration can apply to the Commissioners. Quite a large number of self-employed and part-time people will come into this exempt category. Since such people cannot claim the input tax back (unless they decide to register), the additional cost will either have to be passed on to the customer or alternatively drawn from the gross profit margin. Under certain conditions where there are many taxable inputs to such a business, it may therefore be advantageous to register.

April 1

One area in which there has recently been a change of plan is concerned with stock held on April 1. Originally it was claimed that stock-holding firms would be out of pocket when they had to pay tax on their output while unable to claim the tax back from goods purchased before VAT came into operation on April 1. To overcome this objection, Customs & Excise had proposed having a free tax period but this did not help those firms with a slow turnover. However the revised system will be to value all stock on April 1 and claim back the purchase tax as a credit. How the stock is valued is one of the problems that has troubled Customs & Excise all along. The valuation itself will probably be left to individual businesses.

Significant benefit

One of the most significant benefits of VAT to the smaller firm is that it will compel businesses to keep records of purchases and sales which in turn will be extremely useful in making a rapid assessment of the financial standing of a firm. It will bring liquidity problems to light earlier and can be used to assess and control expenditure. For the first time, many firms will have an up-to-date record of their current account.

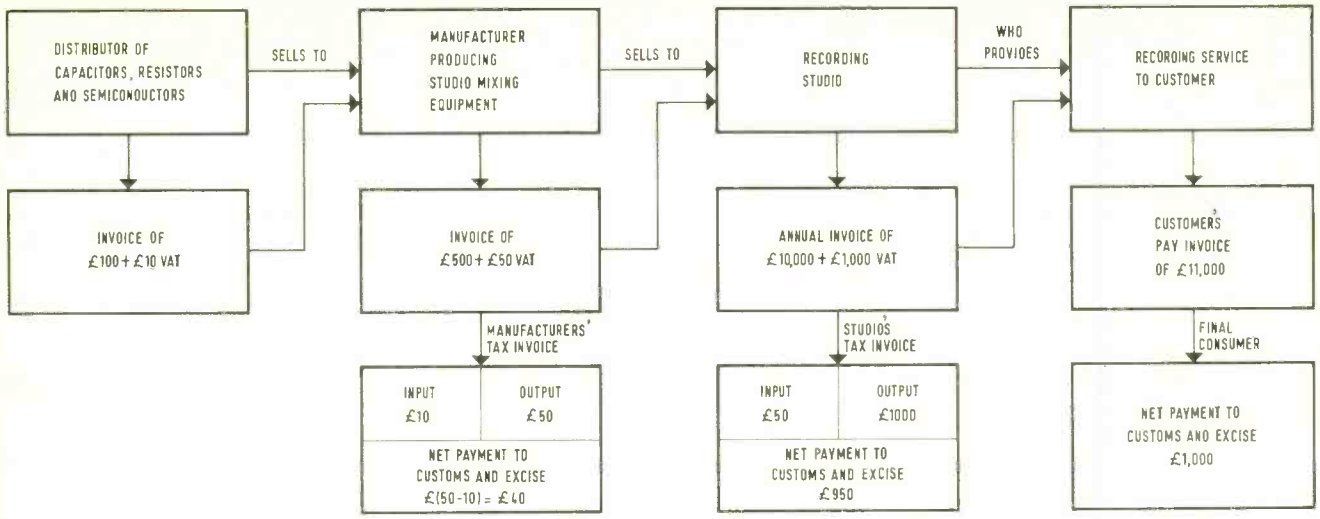
Discounts

Where a discount is offered for early payment of an invoice (say 2.5 per cent discount for payment within seven days), VAT will be levied on the discount price whether or not the invoice is paid taking advantage of the discount. Another benefit to the discount supplier is that VAT is only levied on the discount price, whereas with purchase tax a flat rate is levied regardless of the supplier's discount. This will enable the discount houses to cut their prices further since the value added is low so the tax will be low.

Effect on prices

Let us consider now how prices will change with VAT, and take the case of a retailer buying an article from a manufacturer and selling it to a final consumer. Assume that the dealer is honest and merely wishes to preserve his gross profit margins. If he formerly bought an amplifier (bearing no purchase tax) for £100 and his gross margin was £50, he would sell the amplifier for £150. Under the VAT system he will now pay £100 basic plus £10 VAT, thus

FIG. 1 SHOWING THE VAT SYSTEM IN OPERATION FOR A MANUFACTURER OF STUDIO EQUIPMENT WHO SELLS TO A STUDIO



his total input cost is £110. He wishes to preserve his £50 gross margin but he now has to pay ten per cent tax on this gross margin. Therefore the amplifier will now sell at £100+10+50+5=£165. This is of course equal to a straight price increase of ten per cent on the old price and this increase can be expected on all goods that did not previously carry purchase tax but are subject to a ten per cent tax levy. This will be the effect on the final consumer but, if the amplifier was being supplied to another registered organisation, there will be no real price increase since they can claim £15 VAT back on the 'input' tax invoice.

If, instead of an amplifier, the article had been a tape recorder carrying 25 per cent purchase tax then the dealer would have paid £100 plus £25 to the manufacturer, the £25 being paid to Customs & Excise. The selling price would thus be £(100+25+50)=£175. Under the VAT system, the dealer will pay exactly the same as before and sell at £165. Therefore one would expect a price reduction of £10 representing a cut of about 5.7 per cent. If the dealer calculates his gross margin as a percentage of the cost price, say 25 per cent, the old selling price would be £156 and the new price about £143, representing a reduction of about eight per cent. This should be a typical reduction to the consumer on goods which previously carried 25 per cent purchase tax. The exact reduction will be dependent upon his gross margin. Only if his margin were zero would the full 15 per cent reduction be passed on to the final consumer.

Services

As far as services are concerned, the position will vary far more. The real cost of services to a registered organisation should be zero unless the person providing the services is exempt from tax. In that case the cost of those services may well increase. However, to the final consumer the registered organisation will pass on a straight ten per cent increase. But there are many self-employed people who, if their input costs are low and turnover is less than £5,000 per annum, may well decide to opt out of registration. For in this way they can offer a service without a significant increase in the price. For example, a decorator might well consume £15 worth of paint in painting a house. His charge might be £100. If he did not opt for registration his only increase in cost would be £1.50 VAT on the paint. He might well decide that it was preferable to charge his customer £101.50 rather than risk losing the job by opting for registration and having to charge £110. Also, if he is in a highly competitive market it would be much easier for him to absorb £1.50 than £10 so it can be envisaged that a number of small traders will opt out of registration.

Unfortunately, on services there will now be a double incentive to avoid tax. Jobs done on a 'cash only' basis could be undertaken to avoid paying income tax as well as to avoid charging VAT to the customer.

Problems

To the organisation that keeps good records of sales and purchases, VAT is not likely to present many problems and the new system will merely entail a slight extension of their existing procedures. Unfortunately for the consumer, there are too many ways for retailers to increase prices either out of ignorance or deliberately to increase gross margins. For example, the article a retailer buys for £100+£10 VAT. In making a 25 per cent mark up, the 25 per cent should not be based on the £110 since he can claim £10 VAT back. The 25 per cent should be based on his real cost of £100+10 per cent of the 25 per cent mark up, i.e. about £103. Depending upon which way the pricing is undertaken, the selling prices could differ by £9. It remains to be seen what the final effect will be.

From the Government's point of view, it has the task of raising from VAT about the same revenue as it used to derive from purchase tax and selective employment tax. At best only rather crude estimates of VAT revenue can be made and it is likely that the tax rate will change when the exact revenue is known. A change in VAT will have an effect very quickly on revenue and this is claimed to be an advantage over the method of adjusting purchase tax rates. Already politicians are talking of introducing multiple rates. This will destroy the present simplicity of VAT and it is to be hoped that multiple rates will not be introduced, otherwise the system will very quickly look like an extended purchase tax system. Some European countries employ multiple rates and this practice has brought the system into some disrepute. The ten per cent rate is the lowest in Europe at present and in France the standard rate is as high as 23 per cent.

When an increase is made to a single VAT rate, it applies to all goods and services. In this sense VAT has been called a 'neutral' tax which avoids the past problems of penalising one industry at the expense of another. In the electronics industry, the present system of purchase tax is most unsatisfactory and unfair. For example, amplifiers do not carry tax but tape recorders and certain loudspeakers do. The electronics industry should therefore welcome the changes since, for the first time, a uniform taxation system will be applied to all goods sold to the final consumer.

We shall be pleased to advise readers with individual queries. By letter, please, not telephone. **Ed.**

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Manufacturing magnetic tape

H. J. HUTCHINGS*

Magnetic tape has improved considerably since the '50s era of cellulose acetate. The benefits may not be visually obvious but their effects on noise, dropout, tensile strength, abrasion and batch uniformity are undeniable. H. J. Hutchings outlines the basic production process and the manner in which this has evolved.

THE MAGNETIC recording tape manufacturing process has changed, visually, very little for over a decade. On the surface, the 'art' rather than 'science' adage still applies. Largely unseen is the underlying system of controls and automation derived since the '50s from millions of manhours of research, development and quality control.

Early magnetic tapes were typically derived from fairly simple formulae based on modified polyvinyl chloride polymers as binder, gamma iron oxide, and a carrier solvent. These formulae were deficient in many ways, becoming more apparent as recording equipment itself evolved and began to place more stringent demands on the recording media. The growth of additives to the basic formula, such as lubricants, adhesion promoters, and stabilisers, created a complex situation. Such complexity often led to product failure or erratic batch to batch performance. This was primarily due to the lack of scientific background defining the inter-reaction of the various ingredients, which had now grown to number around 12. Manufacturers who have kept their technical staff close to both the market and production line have, with support from the past decade of research and development expenditure, now defined the majority of these variables.

As a result, present-day products reach levels of consistency and reliability which are quite astounding if one considers that most recording is based on the inter-reaction of a very thin plastic strip and a metal head for kilometre upon kilometre. All this, while demanding that the tape should not pick up dirt, generate wear products, or create wear on the apparatus.

System control

With such a background, it is easy to see that setting the basic manufacturing parameters and controls is a highly expensive, complex and challenging task, despite the fact that the basic processes appear simple enough. The enforcement of rigid control disciplines is obviously desirable in any industry but nowhere is this principle more essential than in the manufacture of reliable magnetic media if we are to run the thin line between the compromises and optimisations of product and process formulation. With the help of electronic and mechanical in-line controls, we are no longer so dependent on the watchful but sometimes deflected eye.

The support

As most people are aware, a magnetic recording tape is basically a magnetic layer coated on to a flexible plastic support.

In the '50s, cellulose acetate was a popular support, with pvc and polyester also available. There was an emergent predominance of pvc in Europe although North America preferred polyester. The present generation of users and both equipment and tape manufacturers prefer the polyester support (which is similar to the polyester fibres used in modern clothing). There

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*H. J. Hutchings joined Zonal in the late '50s. As the company's first chief chemist, he has been involved in the creation and production of magnetic media for audio, computer, instrumentation and video applications. He is presently joint managing director of Racal-Zonal Ltd, Redhill, Surrey.

FIG. 1

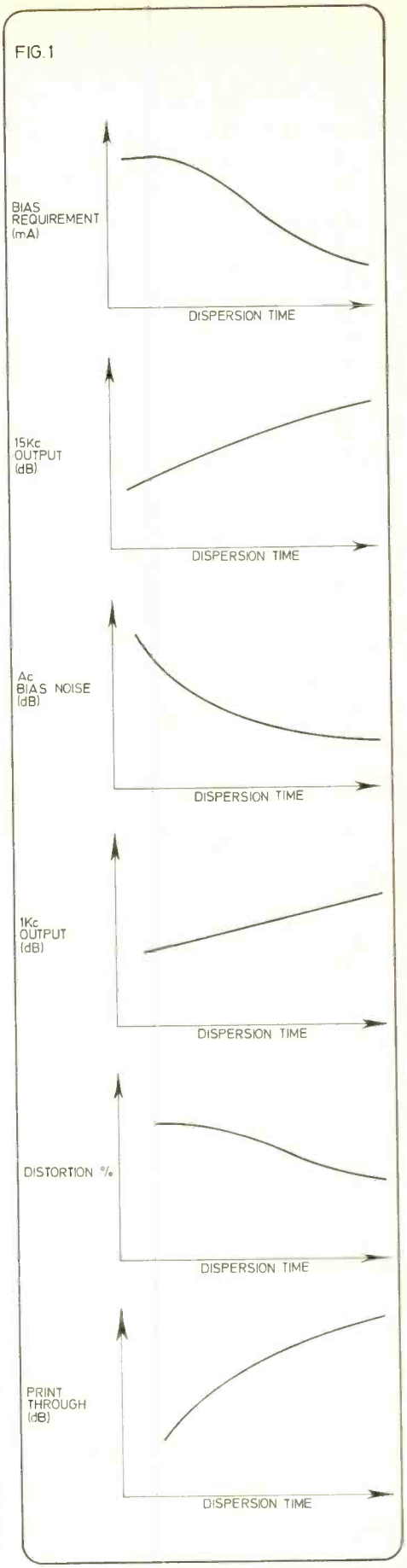


FIG.5 A TYPICAL ZONAL TAPE PRODUCTION LINE

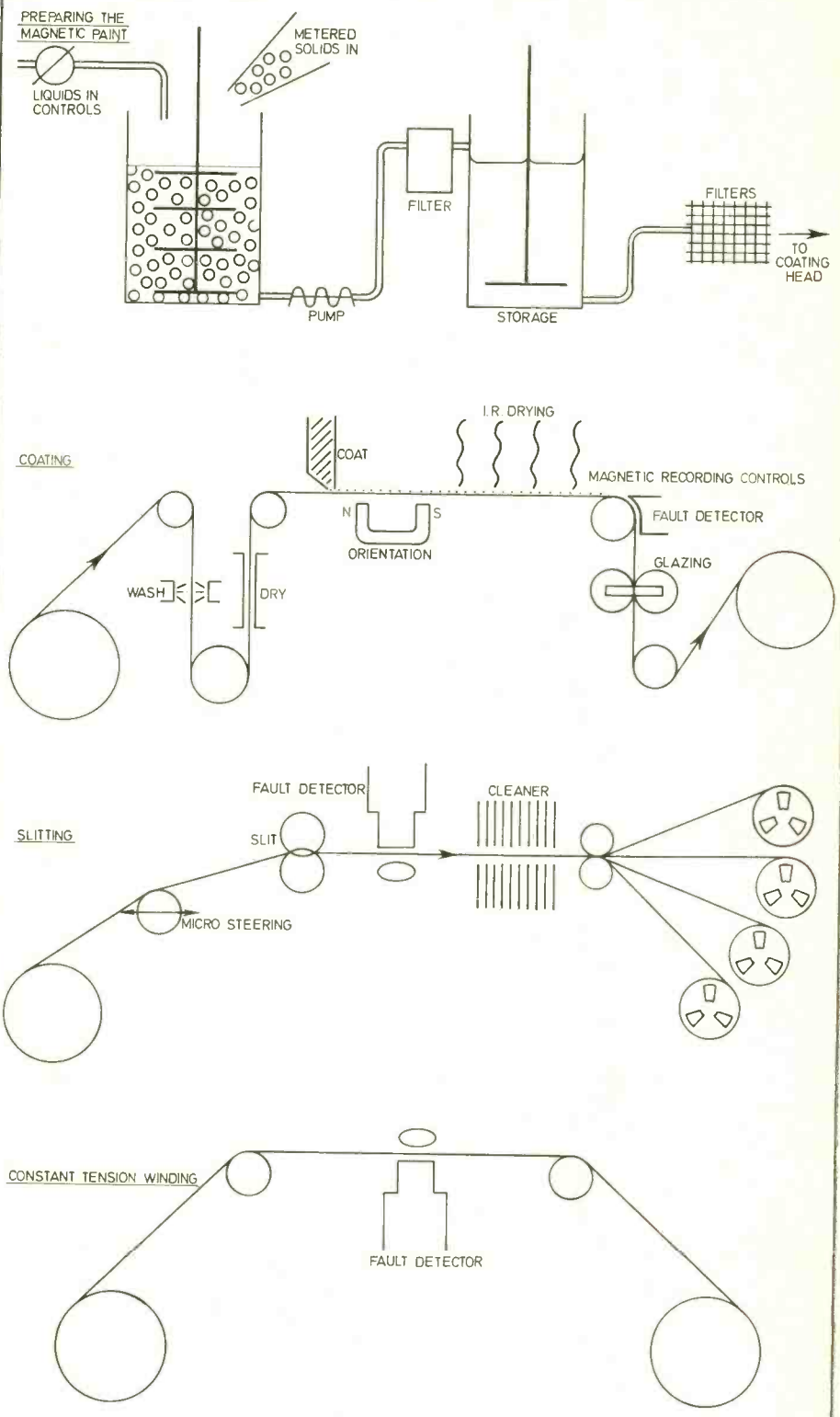


FIG. 2

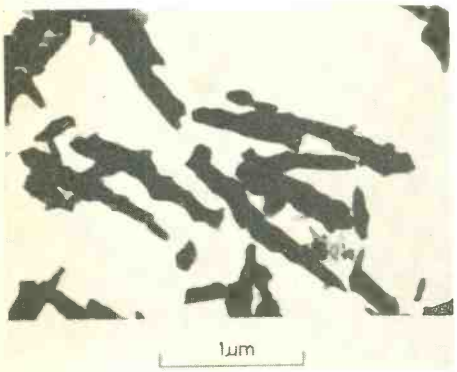
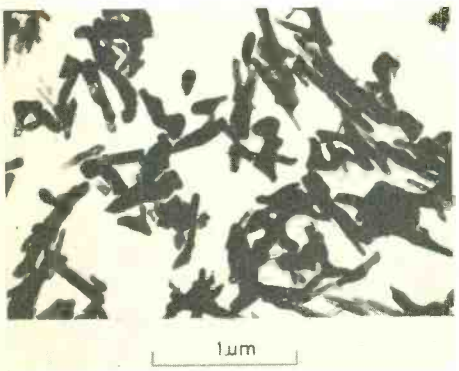


FIG. 3



are 12 different polyester bases from which to choose, the most commonly used being *Mylar* (Dupont trade mark).

Polyester support material is usually supplied in widths from 152 to 609 mm and lengths between 1.1 and 3.3 km at thicknesses of 37 down to 6 μm. Surface roughness, tensile modulus, cleanliness and freedom from dirt, pimples and distortions are all parameters subjected to thorough incoming quality control checks.

The support material is the foundation upon which the tape is built and imperfections at this stage could follow through and create product failure. By the development of high energy jet washing, hot ironing and surface modification (to increase or reduce roughness), the manufacturer has obtained more control over the essential specification of the substrate on to which he coats.

The magnetic layer

The 'lifeblood' of the tape manufacturer is the magnetic lacquer, created from the dirty coarse ingredients: iron oxide (cobalt doped and chromium dioxide are now beginning to gain ground), carbon and resins. The final lacquer must achieve a degree of purity not expected of the finest paints in existence. The manufacture of magnetic paint appears simply a matter of grinding the magnetic pigment into the resin-solvent solution until a regular dispersion is obtained. In fact, however, the dispersion operation is probably the most difficult process in the manufacturing cycle if the end point is high quality tape. Poor dispersion will lead to objectionable tape noise, bad signal stability, low hf response, and excessive headwear. Fortunately, the print-through effect of the finished tape will be good but this is little compensation.

Typical curves indicating the effects of dispersion time variables on the finished product are shown in **fig. 1**. The reader will appreciate better the critical nature of 'magnetic paint' manufacture. Naturally, there is a complete series of curves for each oxide/binder specification. The selection of the magnetic oxide depends on the specification required in the finished tape. Generally, as magnetic coercivity increases, so the bias demand increases and noise improves at the expense of print-through. The other important consideration in the choice of oxide is the size and shape of the individual crystals. Crystals with long rod-like shape are favoured and ideally need to be well below 1 μm in the longest crystal axis for really good low noise performance.

The electron microscope photographs, **figs. 2** and **3**, illustrate the difference between two oxides of similar coercivities but with very different crystal structure.

The coating process

From large vats of the filtered dispersion, coatings are accurately applied to the washed and surface treated support, dried carefully and wound under controlled tension. We now have a wide coated web (often referred to as the Jumbo reel) awaiting slitting to size. Coating thickness can range from 2.5 to 20 μm. The effects of varying thickness for audio applications are shown in **fig. 4**.

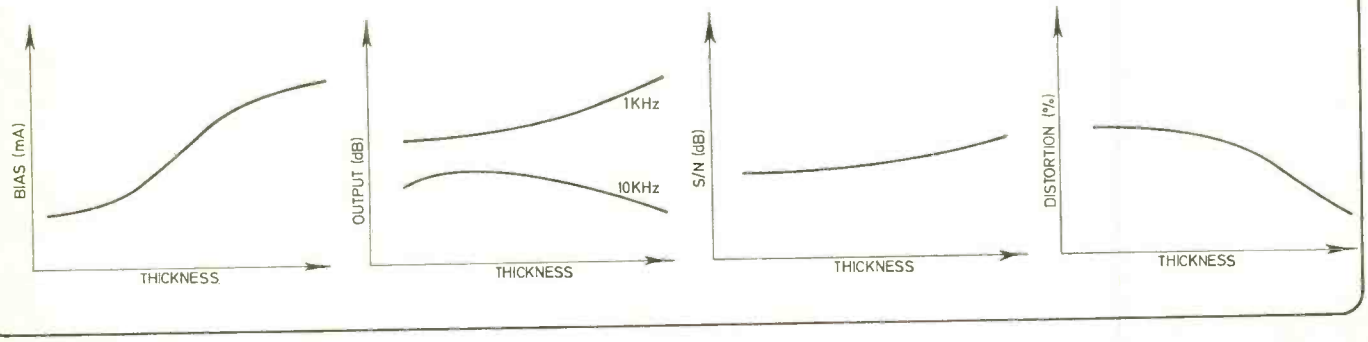
The manufacturer is left with his final variable: surface polishing. By 'glazing' the oxide surface to a greater or lesser degree, the manufacturer can alter frequency response, bias requirement, sensitivity, noise, print-through, signal stability, headwear, tape wear, tape friction, and winding properties—not all positively! Considerable research has been devoted to surface finishing and this is one area where the effects on product performance have become more clearly defined during the last few years. With the combination of formulation, coating and surface treatment, we can obtain a product for a specific application but the complexity of most manufacturing specifications makes automatic production control essential. Without modern in-line quality controls, a satisfactory level of conformity on such products could not be maintained.

The finishing operations

Modern slitting machines would now hardly be recognised against their earlier counterparts, with the addition of tension controls, micro-steering, cleaning and inspection stations. The continuous movement to more recording tracks of narrower size, slower speeds, and higher frequencies place new demands on slitting technology if skew and cyclic output variations are to be contained and edge track stability maintained. Additionally, magnetic sound-track film needs to be accurately perforated to 16 or 35 mm sprocket pitch.

Finally the product, with or without its coloured leaders and trailers, is carefully wound under controlled tension (60 gm/6.25 mm) on its spool, wrapped in a dustproof bag and tucked into its box.

FIG.4



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197 Knightsbridge,
London SW7 1SA
Telephone: 01-584 5080

Survey: industrial audio tape

The following list of currently available magnetic tapes includes all brands generally considered of high enough standard for use in recording studios. In marginal cases, a domestic tape has been included where there is reason to believe it suitable for industrial audio applications.

AGFA

Agfa-Gevaert Ltd, Unity House, Great West Road, Brentford, Middlesex
Tel: 01-560 2121

PER 525
Electroacoustic properties measured at a recording speed of 38 cm/s.

Frequency response at 10 kHz related to reference tape: ±0 dB

	mono	stereo
Harmonic distortion (3rd) at reference level (1 kHz):	0.5 per cent	1.2 per cent
Maximum output level above reference level (k_3=3 per cent):	8.5 dB	4.4 dB
Signal to noise ratio (per channel):	47 dB	48 dB
Weighted signal to noise ratio (per channel):		
a. related to reference level	57 dB	57.5 dB
b. related to max output level (k_3=3 per cent)	65.5 dB	62 dB

Print through ratio: 58 dB
Signal to erase ratio: 70 dB

Magnetic properties
Coercivity: 23,900 A/m
Retentivity: 0.1T
Remanent tape flux at saturation per mm track width: 1,300 pWb/mm

Mechanical properties
Base: 30 µm
Total thickness: 50 µm
Thickness of coating: 13 µm
Tensile strength: 30 kp/mm²
Coefficient of thermal expansion: 2×10^{-5} per °C
Coefficient of humidity expansion: 1×10^{-5} per cent RH

Measuring conditions
Recording speed: 38 cm/s
Reproducing head track width: 6.3 mm
Reproducing head gap length: 6 µm
Reference level 1 kHz mono/stereo: 320/514 nWb/m
Reproduction equalisation: 35 µS
Record head track width: 6.3 mm
gap length: 20 µm

Price: (6.25 mm)
13 cm spool (180m): £0.55
18 cm spool (360m): £1.05
NAB Core or EH (730m): £2.10
26 cm NAB spool (730m): £2.60
European Hub (1000m): £2.60
European Hub with backing plate (1000m): £3.00
12.5 mm:
26 cm NAB spool (730m): £4.75
25mm:
26 cm NAB spool (730m): £10.00
50mm:
26 cm NAB spool (730m): £20.00

PER 555
Electroacoustic properties measured at a recording speed of 38 cm/s.

Frequency response at 10 kHz related to reference tape: −1 dB

	mono	stereo
Harmonic distortion (3rd) at reference level (1 kHz):	0.4 per cent	0.8 per cent
Maximum output level above reference level (k_3=3 per cent):	10.5 dB	6.4 dB
Signal to noise ratio (per channel):	48 dB	48 dB
Weighted signal to noise ratio (per channel):		
a. related to reference level	57 dB	57.5 dB
b. related to maximum output level (k_3=3 per cent)	67.5 dB	64 dB

Print-through ratio: 56 dB
Signal to erase ratio: 70 dB

Magnetic properties
Coercivity: 23,900 A/m
Retentivity: 0.1T
Remanent tape flux at saturation per mm track width: 1800 nWb/m

Mechanical properties
Base: 30 µm
Total thickness: 56 µm
Thickness of coating: 18µm
Tensile strength: 30 kp/mm²
Coefficient of thermal expansion: 2×10^{-5} per °C
Coefficient of humidity expansion: 1×10^{-5} per cent RH

Measuring conditions
Recording speed: 38 cm/s
Reproducing head track width: 6.3 mm
gap length: 6 µm
Reference level 1 kHz mono/stereo: 320/514 nWb/m
Reproduction equalisation: 35 µS
Record head track width: 6.3 mm
gap length: 20 µm
Price (6.25 mm):
NAB core (730m): £2.40
26 cm NAB spool (730m): £2.90
European Hub (1000m): £2.90
(1.27 cm):
26 cm NAB spool (730m): £5.20
(2.54 cm):
26 cm NAB spool (730m): £11.00

AMPEX

Ampex (GB) Ltd, Acre Road, Reading RG2 0QR
Tel: Reading 84411

406, series backcoated, low noise, high output mastering tape

Physical properties
Base material: Polyester
Base thickness (1): 36 µm
Oxide coating: 12.7 µm
Back coating: 1.27 µm
Colour: Oxide coating Dark brown
Back coating Black
Resistivity back coating (ohms/square) (2): 0.5×10^4
Standard widths: 6.25 mm
12.5 mm
25 mm
50 mm
Width tolerance:
6.25 mm: ±25 µm
12.5 mm, 25 mm, 50 mm: +50 µm

Intrinsic magnetic properties
Coercivity (Hci) (3): 22,750 A/m
Retentivity (Brs) (3): 0.1050T
Erasure 79,700 A/m field in dB (4): −60

Electro-magnetic properties
Reference bias (5): 100 per cent
Optimum bias (5): 100 per cent
Maximum undistorted output (6): +3.5
Sensitivity (7):
38.0 µm wavelength +2.0
25.4 µm wavelength +1.0

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continued

12.7 μm wavelength ±1.0
Uniformity at 38 μm wavelength in dB (8):
within roll ±0.25
between roll ±1.0
Relative weighted noise level in dB (9): 0.0

1 Thickness measurements are made on a Pratt and Whitney Sigmatic mechanical comparator.

2 Specially formulated backcoating reduces static generation and provides greatly improved handling characteristics in all operational modes. Provides excellent bin loop mastering characteristics.

3 Coercivity and retentivity characteristics are those intrinsic magnetic oxide properties which are dependent upon the nature of the oxide formulation. Coercivity of a magnetic tape is a measure of the magnetising field that is necessary to record or erase signals on the tape. Retentivity is a measure of magnetic efficiency, which is the magnetic strength retained in the tape oxide just after it leaves the magnetic field of the record head. All coercivity and retentivity values are obtained from a 60 Hz B-H loop tracer with Oersted field calibrated to that maintained by the National Bureau of Standards.

4 Erasure values are obtained by employing a 60 Hz alternating field applied to the tape under test, which causes a reduction of at least 60 dB to the recorded signal. All test conditions performed with optimum bias and the record level adjusted to the standard record level.

5 Reference bias is that value of bias current which provides maximum signal output at 380 μm wavelength on the Ampex 434 reference tape. All bias current values are expressed in per cent with respect to the Ampex 434 reference tape, which has been taken as 100 per cent. Optimum bias or peak bias is that bias current which offers a maximum signal output at 380 μm wavelength for the tape under test, and is given in per cent with respect to reference bias. All tests were performed on a professional Ampex AG-350 Recorder/Reproducer with an input frequency of 500 Hz at which is a wavelength of 380 μm.

6 Relative output at wavelength with the record level adjusted to obtain 1 per cent third harmonic distortion, gives a comparison of the output level capability of the tape under test. Bias is set to reference or to optimum and the comparison is made with respect to the 434 reference tape, which has been tested under identical conditions and normalised to zero.

7 Sensitivity or oxide performance provides a comparison of the output performance from one tape to another. Bias is set to reference or to optimum and the record level is adjusted 10 dB below reference record level. The comparison is made with respect to the 434 reference tape, which has been normalised to zero. Reference record level is that input level producing 1 per cent third harmonic distortion on the reference tape.

8 Uniformity is a measure of signal variations in the output. Bias is set to optimum and the record level is adjusted to the reference record level. All measurements are made on a strip chart recorder and are peak-to-peak values.

9 Relative weighted noise level is measured through a noise filter which offers those characteristics of the human ear as specified in the NAB Manual. Noise levels below that of the 434 reference tape are reported as negative values; those above as positive values.

BASF

BASF (UK) Ltd, Knightsbridge House, 197 Knightsbridge, London SW7
Tel: 01-584 5080

SP 52 standard tape, without matt back coating, low print-through

Base: PVC
Total thickness: approx 48.3 μm
Maximum recording level at 1 kHz at 38 cm/s: 320 nWb/m +6.0 dB at three per cent
Harmonic distortion for 9.5, 19 and 38 cm/s speeds

Type of spool	Length	Width
13 cm plastic	180m	6.25 mm
15 cm plastic	270m	6.25 mm
18 cm plastic	360m	6.25 mm
NARTB reel/hub	730m	6.25 mm
NARTB reel	730m	12.5 mm
NARTB reel	730m	25 mm

LR 56

A special high output tape for recordings requiring extra wide dynamic range. Matt back coating for use on hubs. Excellent winding behaviour.
Base: PVC
Total thickness: about 53.4 μm
Maximum recording level at 1 kHz: 320 nWb/m +9.5 dB at three per cent harmonic distortion
For speed of 38 cm/s

Type of spool	Length	Width
NARTB reel/hub	730m	6.25 mm
European hub	1 km	6.25 mm
NARTB reel	730m	12.5 mm
NARTB reel	730m	25 mm
NARTB reel	730m	50 mm

LGR 30

Corresponds to the requirements for German Broadcasting. Produced for half track (2 mm) width, ie stereo and multitrack recording. Matt back coating for use on hubs.
Base: PVC
Total thickness: about 50.8 μm
Recording level at 1 kHz: 320 nWb/m +6.5 dB at three per cent harmonic distortion
For 38 cm/s speed

Type of spool	Length	Width
NARTB reel/hub	730m	6.25 mm
NARTB reel	730m	12.5 mm
NARTB reel	730m	25 mm
NARTB reel	730m	50 mm

LGR 40

A matt back long play tape especially designed for professional portable recorders (Nagra, Uher). The mechanical strength is sufficiently high to ensure safe use on normal studio equipment.
Base: Polyester
Total thickness: about 38 μm
Maximum recording level at 1 kHz at 19 cm/s: 320 nWb/m +4 dB at three per cent harmonic distortion
For speeds of 19 and 38 cm/s

Type of spool	Length	Width
13 cm plastic spool	250m	6.25 mm
18 cm plastic spool	360m	6.25 mm
27 cm NARTB reel/hub	—	6.25 mm

LP 36

Single oxide coated tape with lubricant coating for continuous loop cartridges.
Base: Polyester
Total thickness: about 33 μm
Width: 6.25 mm
Available in the following sizes:
540m on 18 cm plastic spool
1.1 km on hub
Prices: available on application

EMI

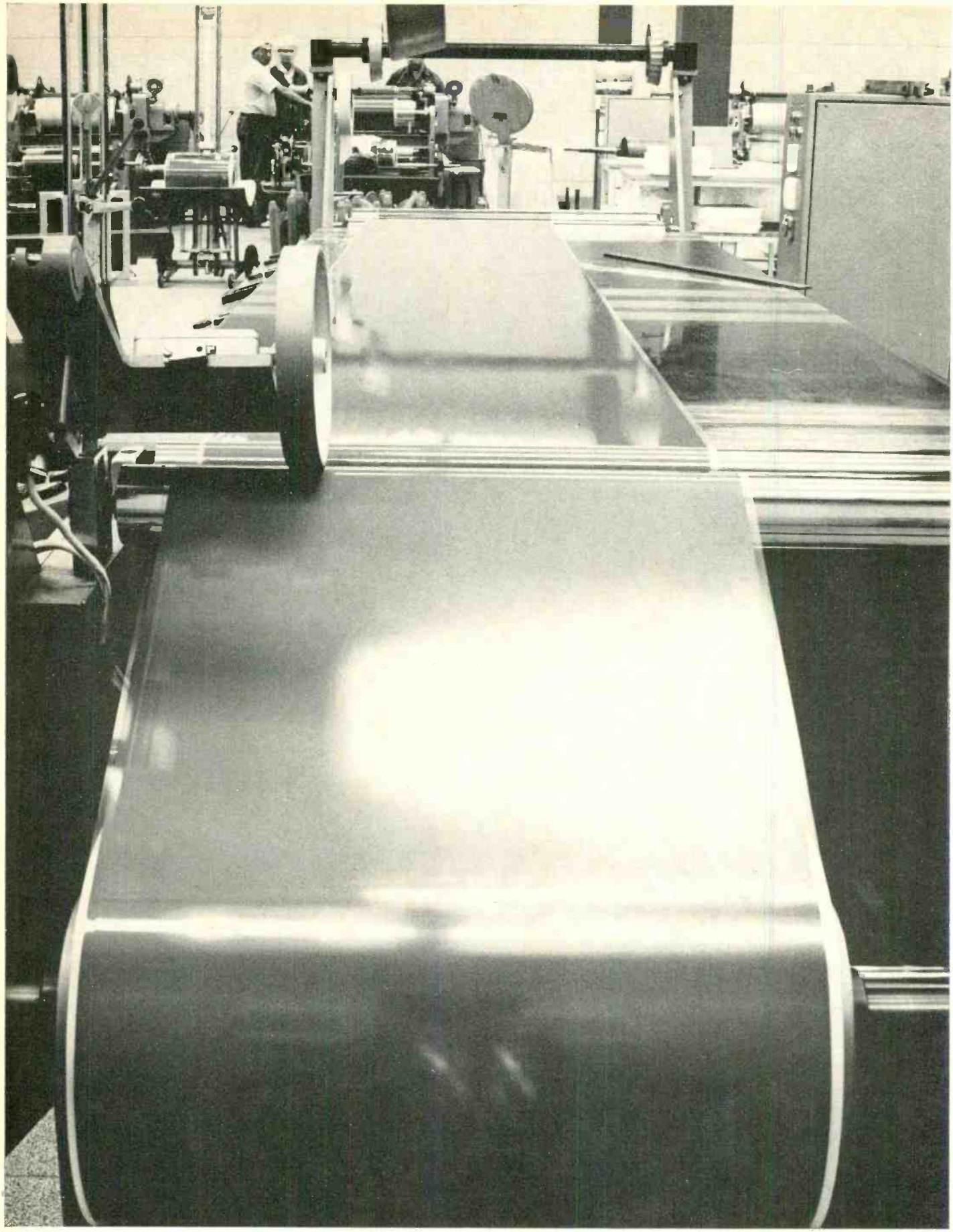
EMI Tape Ltd, Blyth Road, Hayes, Middlesex
Tel: 01-573 3888

EMI tape 816 matt backed professional audio tape.

Standard play, low noise audio tape. Polyester base with a specially treated coating and backing which result in low modulation noise and reduced head wear.

Widths: 3.25 mm, 12.5 mm, 25 mm and 50 mm; available in 730m lengths on standard 27 cm reels
Base film thickness (nominal): 37 μm
Overall thickness: (nominal): 56 μm
Standard widths: 6.25 ±0.05 mm
12.70 +0 mm/–0.1 mm
25.4 +0 mm/–0.1 mm
50.8 +0 mm/–0.1 mm
Ultimate tensile load (per 6.25 mm width): 4.53 kg
Yield point (per 6.25 mm width): 2.72 kg
Elastic elongation (per 6.25 mm width): not greater than 1 per cent
Plastic elongation (per 6.25 mm width): 0.02 per cent
Coefficient of humidity expansion: 1.1×10^{-5} per 1 per cent RH
Coercivity (Hv): 23,900 A/m
Retentivity (Br): 0.090T
Audio performance (tape speed 38.1 cm/s):
Track width: one track monophonic 6.55 mm, two track stereophonic 2.35 mm
Record head gap length: 6 to 7 μm
Replay head gap length: 3 to 4 μm
Replay amplifier characteristic: 35 μS
Bias and sensitivity reference tape: EMI standard tape S8

Right: Part of the BASF tape production process. Here the newly coated magnetic film is inspected before being slit on cutters accurate to a few tens of microns.



continued

Recommended bias: 1 dB over bias at 1 kHz (this condition is that with increase of bias current the 1 kHz replay level has fallen by 1 dB from its maximum value)
Sensitivity: 1 kHz, 0 dB; 4 kHz, 0 dB; 10 kHz, 0 dB; 16 kHz, 0 dB
Maximum replay level for 3 per cent third harmonic distortion at 1 kHz: +6 dB
Maximum replay level for saturation at 10 kHz: +4.5 dB
The ratio of the 1 kHz maximum replay level to amplitude modulation noise: –38.5 dB (6.55 mm track width)
The ratio of the 1 kHz maximum replay level to dc noise: –49 dB (6.55 mm track width)
The ratio of the 1 kHz maximum replay level to bias noise: –65 dB (6.55 mm track width)
The ratio of the 1 kHz maximum replay level to print (first pre-echo after storage for 72 hours at +20° C): –58 dB
Output uniformity variations at 1 kHz (6.55 mm track width):
within a reel: less than ±0.25 dB
reel to reel: less than ±1 dB
Output uniformity variations at 1 kHz (2.35 mm track width)
within a reel: less than ±0.25 dB
reel to reel: less than ±1 dB
Output uniformity variations at 16 kHz (6.55 mm track width)
within a reel: less than ±0.5 dB
reel to reel: less than ±1.5 dB
Output uniformity variations at 16 kHz (2.35 mm track width)
within a reel: less than ±0.75 dB
reel to reel: less than ±1.5 dB

Audio performance (tape speed 19. 05 cm/s)
Track width: one track monophonic 6.55 mm, two track stereophonic 2.35 mm
Record head gap length: 6 to 7 μm
Replay head gap length: 3 to 4 μm
Replay amplifier characteristic: 70 μS
Bias and sensitivity reference tape: EMI standard tape S8
Recommended bias: 1 dB over bias at 1 kHz (this condition is that with increase of bias current the 1 kHz replay level has fallen by 1 dB from its maximum value)
Sensitivity: 1 kHz, 0 dB; 4 kHz, 0 dB; 10 kHz, 0 dB; 16 kHz, 0 dB
Bias current ratio at 1 dB over bias (at frequency of 1 kHz): 1.0
Maximum replay level for 3 per cent third harmonic distortion at 1 kHz: +6.75 dB
Maximum replay level for saturation at 10 kHz: –3.25 dB
The ratio of the 1 kHz maximum replay level to amplitude modulation noise: –38.5 dB (6.55 mm track width)
The ratio of the 1 kHz maximum replay level to dc noise: –49 dB (6.55 mm track width)
The ratio of the 1 kHz maximum replay level to bias noise: –72 dB (6.55 mm track width); –68.5 dB (2.35 mm track width)
The ratio of the 1 kHz maximum replay level to bias noise: –62.5 dB (6.55 mm track width); –58.5 dB (2.35 mm track width)
The ratio of the 1 kHz maximum replay level to print (first pre-echo after storage for 72 hours at +20° C): –58 dB
Output uniformity variations at 1 kHz (6.55 mm):
within a reel: less than ±0.25 dB
reel to reel: less than ±1 dB
Output uniformity variations at 1 kHz (2.35 mm):
within a reel: less than ±0.25 dB
reel to reel: less than ±1 dB
Output uniformity variations at 16 kHz (6.55 mm):
within a reel: less than ±0.5 dB
reel to reel: less than ±1.5 dB
Output uniformity variations at 16 kHz (2.35 mm):
within a reel: ±4 dB
reel to reel: less than ±1.5 dB

EMI 815 professional tape—
as above but without matt backing.

MEMOREX

Memorex Inc, Freight House, Long Lane, Stanwell, Middlesex
Tel: Ashford (Middx) 42177

Memorex low noise, high output, open reel tapes.

The quoted data are statistical averages obtained from testing many Memorex samples. The technical data relates typical, rather than minimum, performance and, therefore, should not be regarded as a product specification.

Bias compatibility:
The bias requirement of Memorex low noise, high output open reel tape has been selected so that optimum performance will be obtained on recording equipment adjusted according to accepted industry practice.

Test methods

Recording properties

Bias adjustment:
Bias is adjusted individually for each type of tape so that maximum output is obtained at 500 Hz. This bias is used in measuring all recording properties.

Data reference:
Output, response and noise data are given relative to the data obtained from Memorex laboratory reference tape.

Output and response:
The output for two per cent third harmonic distortion at 500 Hz is used to define standard record level. Response measurements are carried out at a level 20 dB below the standard record level.

Relative signal to noise ratio:
Signal to noise ratios are measured using standard record level and the noise (with peak bias applied) is measured using the ANSI 'A' weighting characteristic. The values are shown normalsed to the laboratory reference.

Uniformity:
Uniformity is measured using a level 20 dB below standard record level.

Recording properties

	Standard play 38 μm
Output for 2 per cent distortion, 500 Hz 9.5 cm/s, dB:	+1.5
Frequency response 10 kHz, dB:	+2.0
Frequency response 15 kHz, dB:	+2.0
Relative signal/noise ratio, dB:	+1.5
Uniformity 500 Hz, dB:	±0.25
Uniformity 10 kHz, dB:	±1.0

Magnetic properties

Coercive force, A/m:	23,000
Residual flux density:	0.14
Squareness ratio:	0.8
Erasing field, A/m:	71,600

Physical properties

Base material:	polyester
Base thickness, μm:	36
Tape width, mm:	6.3
Width tolerance, μm:	+0 −50.8
Coating thickness:, μm:	10.2
Tensile strength, kg/mm:	2.6
Yield strength:	1.44

Prices:

Description	R.R.P.
Standard play 13 cm 183m	£1.34
Standard play 18 cm 368m	£2.26
Long play 13 cm 274m	£1.89
Long play 18 cm 550m	£3.21
Double play 13 cm 368m	£2.26
Double play 18 cm 730m	£4.01
On metal NARTB reels:	
Standard play 27 cm, 760m	£5.00
Long play 27 cm 1.1 km	£6.00

SCOTCH

3M (UK) Ltd, 3M House, Wigmore Street, London W1
Tel: 01-486 5522

DYNARANGE 202

Physical properties

Colour:
Oxide side shiny black
Backing side shiny black
Backing material: polyester
Standard widths: 6.25 mm, 12.5 mm, 19 mm, 25 mm, 50 mm
Width tolerance: +0.000, −0.1 mm
Thickness:
Backing (inc CW treatment) 35 μm
Oxide coating 13 μm
Total 49 μm
Static tensile:
Yield strength 1.7 kg/mm
Breaking strength 2.6 kg/mm
Residual elongation 0.1 per cent

Intrinsic magnetic properties

Coercivity: 25,000 A/m
Retentivity: 0.0790T
Erasing field required: 7,970 A/m

Electromagnetic properties

Standard bias: 100 per cent
Peak bias: 100 per cent
Maximum undistorted output (380 μm wavelength): 0.0 dB
Sensitivity:
380 μm wavelength 0.0 dB
25.4 μm wavelength 0.0 dB
12.7 μm wavelength 0.0 dB
Uniformity at 38 μm wavelength
within a roll: ±0.25 VU
roll to roll: ±1.0 VU
Weighted noise level: 0.0 dB

MASTER 206

Physical properties

Colour:
Oxide side shiny black
Backing side dull black
Backing material: polyester with special controlled wind treatment
Standard widths: 6.3 mm, 12.7 mm, 19 mm, 25.4 mm, 50.8 mm
Width tolerance: +0.000 −0.1 mm

Electro-magnetic properties

Standard bias: 100 per cent
Peak bias: 100 per cent
Maximum undistorted output (380 μm wavelength): +3.0 dB
Sensitivity:
380 μm wavelength +2.0 dB
25.4 μm wavelength +2.0 dB
12.7 μm wavelength +2.0 dB
Uniformity at 380 μm wavelength:
within a roll ±0.25 VU
roll to roll ±1.0 VU
Weighted noise level: 0.0 dB

MASTER 207

Physical properties

Colour:
Oxide side shiny black
Backing side dull black
Backing material: polyester with special controlled wind treatment
Standard widths: 6.3 mm, 12.7 mm, 19 mm, 25.4 mm, 50.8 mm
Width tolerance: +0, −0.1 mm
Thickness:
Backing (inc CW treatment) 24.2 μm
Oxide coating 14.2 μm
Total 38.4 μm
Static tensile:
Yield strength 1.15 kg/mm
Breaking strength 1.74 kg/mm
Residual elongation 0.2 per cent

Intrinsic magnetic properties

Coercivity: 25,400 A/m
Retentivity: 0.1050T
Erasing field required: 7,970 A/m

Electro-magnetic properties

Standard bias: 100 per cent
Peak bias: 100 per cent
Maximum undistorted output (380 μm wavelength): +3.0 dB
Sensitivity:
280 μm wavelength +2.0 dB
25.4 μm wavelength +2.0 dB
12.7 μm wavelength +2.0 dB
Uniformity at 380 μm wavelength:
within a roll ±0.25 VU
roll to roll ±1.0 VU
Weighted noise level: 0.0 dB

Prices: available on application

TDK

Agent: Primary Contact Ltd, 57/61 Mortimer Street, London W1N 7TD
Tel: 01-580 9724

SUPER DYNAMIC (SD) TAPE

SD tape was engineered for use with professional studio-type recorders, and is compatible with the improved performance capabilities of future, 'next generation' recorders and players.

The most important contribution to SD's performance is TDK's gamma ferric (SD) oxide magnetic coating, a high-resolution, high-efficiency, high-coercivity formula developed by TDK, consisting of ultra-fine magnetic particles that provide high-frequency response above that of conventional tape.

At 19 cm/s TDK SD tape provides high-frequency response beyond human hearing capability. And even at 9.5 cm/s SD tape provides fidelity as good or better than other tapes offer at 19 cm/s.

Sensitivity: 0 dB at 400 Hz
Frequency response: +4.5 dB at 7 kHz
+6 dB at 12.5 kHz
Signal to noise ratio: 61 dB
Print-through: 54 dB
Erase effect: 70 dB
Distortion: 2.5 per cent

DE LUXE LOW NOISE TAPE

A moderately-priced tape superior in construction and performance quality to the best premium-grade tapes available from other manufacturers. TDK deluxe low-noise tape is made to the same rigid quality-control standards as SD tape and shares many of its characteristics, but does not offer the same superior sound reproduction properties. Ideal for less demanding recordings.

Sensitivity: −1 dB at 400 Hz
Frequency response: +1 dB at 7 kHz
0 dB at 12.5 kHz
Signal to noise ratio: 59 dB
Print-through: 52 dB
Erase effect: 70 dB
Distortion: 3 per cent

59 ▶

3M announce a double-sided in the quality of professional recordings

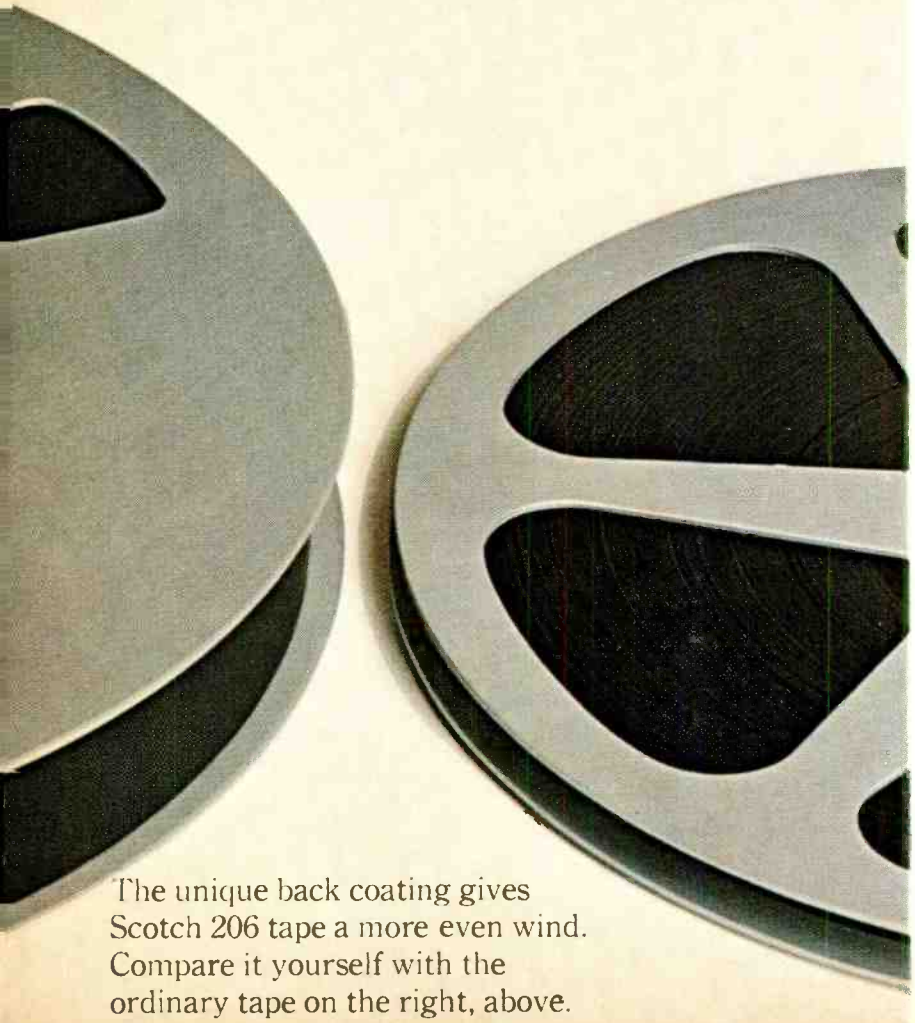
New Scotch® 206

1. A new oxide coating that gives a 3 db increase in signal-to-noise ratio.

mprovement

ape.

2. A new matt back coating which ensures better handling and reduces head wear.



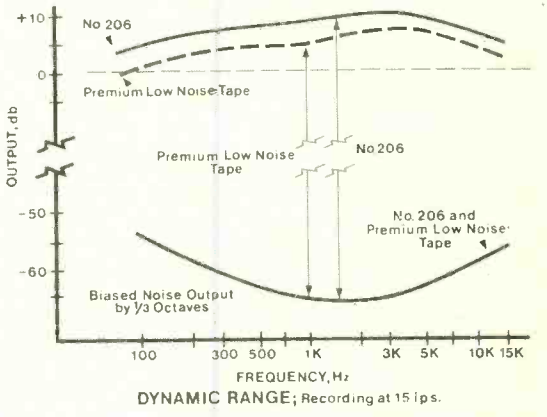
The unique back coating gives Scotch 206 tape a more even wind. Compare it yourself with the ordinary tape on the right, above.

3M have been at the forefront of recording tape development for many years. Now they offer a new dimension in recording perfection with their new Scotch 206 professional tape.

This remarkable product is the result of technological breakthroughs in the coatings on the recording and backing surfaces.

1. A new oxide recording surface

After several years of laboratory research 3M have developed a proprietary oxide which makes possible a 3 db increase in signal-to-noise ratio. This means you have the latitude to capture the extremes of frequency and output without sacrificing any pure sound quality.



DYNAMIC RANGE; Recording at 15 ips.

Scotch 206 tape also considerably reduces accumulated noise on multitrack recordings – a major problem up to now.

It is also very tough, resists scratching and prevents drop outs caused by tape debris.

2. A new matt back coating

The new back coating improves the tape's handling characteristics, prevents slipping and ensures more uniform winding.

It also helps to guide the tape more accurately across the recording heads, reducing expensive head wear.

The backing is tougher, more scratch-resistant than its rivals. And since it is electrically conductive, dust and dirt are not attracted and held to it.

Scotch 206 tape is compatible with any professional recording system and is available in $\frac{1}{4}$", $\frac{1}{2}$", 1" and 2" widths.

For further details fill in the coupon below.

To: Mr. R. Haworth, Magnetic Products, SS/2/73
3M United Kingdom Limited,
3M House, Wigmore Street, London, W1A 1ET.

Please send me further details about Scotch 206 professional recording tape.

Name .....

Position .....

Address .....

.....

.....

Tel. No. .....

3M

3M 2040

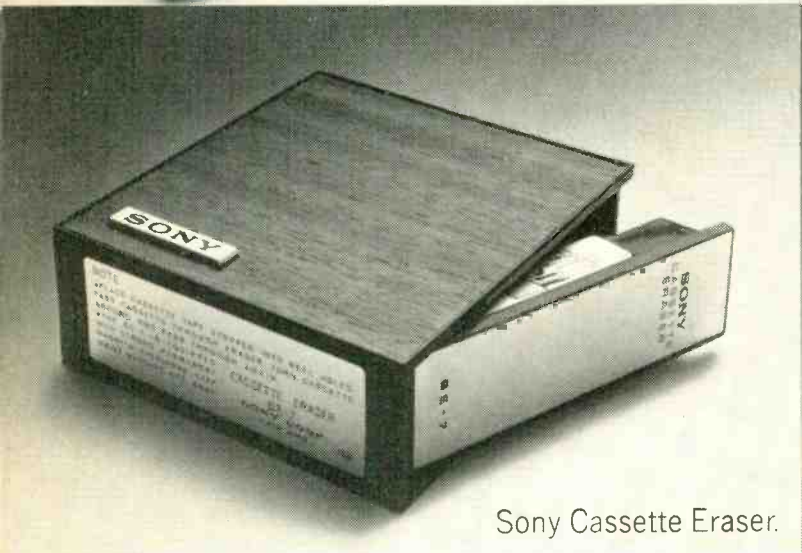
Scotch is a trademark of 3M Company

Sony Stereo Mixer.

Sony Tapes.

Sony Cassettes.

Sony Microphones.



Sony Cassette Eraser.

Sony Stereo Headphones.

EVEN IF YOUR TAPE RECORDER ISN'T A SONY, ALL IS NOT LOST.

You can improve on the results you get from most tape recorders if you buy these Sony accessories.

But there again you can improve on the results you get from these Sony accessories if you buy a Sony tape recorder. SONY®

For details of all Sony audio accessories, write to: Sony (UK) Ltd, Pyrene House, Sunbury Cross, Sunbury-on-Thames, Middlesex.

continued

SONY

Sony (UK) Ltd, Pyrene House, Sunbury Cross, Sunbury on Thames
Tel: Sunbury on Thames 87644/7

SLH tape and New SLH Tape

	SLH	New SLH	
	SLH-370		SLH-72-370-BL
	SLH-550	SLH-11-740B	SLH-7-550-BL
Recording time:	60 minutes *'SLH-370'* 90 minutes *'SLH-550'* (19 cm/s on both sides)	120 minutes (19 cm/s on both sides)	60 minutes *'SLH-72-370-BL'* 90 minutes *'SLH-7-550-BL'* (19 cm/s on both sides)
Base material:	Polyester	Polyester with special treatment	Polyester with special treatment
Tape width:	36 µm	44 µm	36 µm
Tensile strength:	3.5 kg	4.3 kg	3.5 kg
Retentivity:	0.1100T	0.1100T	0.1100T
Intrinsic coercivity:	23,900 Nm	23,900 Nm	23,090 Nm
Bias current sensitivity (1 kHz, 0.5 dB over bias):	108 per cent	108 per cent	108 per cent
Frequency response:			
10 kHz:	+4.5 dB	+4.5 dB	+4.5 dB
16 kHz	+7 dB	+7 dB	+7 dB
Harmonic distortion:	3 per cent	3 per cent	3 per cent
Maximum output*:	+3 dB	+3 dB	+3 dB
Linearity 16 kHz*:	+10 dB	+10 dB	+10 dB
Dynamic range:	+6.5 dB	+6.5 dB	+6.5 dB
Modulation noise level:	-5 dB	-5 dB	-5 dB
Bias noise level*:	-3.5 dB	-3.5 dB	-3.5 dB
Signal to noise ratio:	62 dB	62 dB	62 dB
Signal reduction by erasing:	68 dB	68 dB	68 dB
Reel size:	18 cm *'SLH-370'* 18 cm *'SLH-550'*	26.7 cm	18 cm
Tape length:	370m *'SLH-370'* 560m *'SLH-550'*	740m	370m *'SLH-72-370-BL'* 550m *'SLH-7-550-BL'*
Prices:	Available on application		

*compared with SONY standard tape

Intrinsic Magnetic Properties

	Low noise
Coercivity:	23,900 ±10 per cent A/m
Retentivity:	0.095T
Erasure field:	79,700 A/m
Audio performance	
Tape speed:	19 cm/s
Track width:	full track
Reference tape:	Racal-Zonal 063 standard
Replay amplifier characteristic:	100 µS
Bias ratio:	1.3 to 1
Maximum replay level for two per cent distortion:	at 1 kHz +5 dB
Maximum record level for two per cent distortion:	at 1 kHz +4 dB
Sensitivity:	at 1 kHz +2 dB at 10 kHz +1 dB at 15 kHz 0 dB
Signal to bias noise ratio:	70 dB
Signal to print ratio:	at 1 kHz 55 dB
Output uniformity at 1 kHz:	
within a reel:	±0.25 dB
reel to reel:	±1 dB
Output uniformity at 1 kHz:	
within a reel	±0.75 dB
reel to reel:	±2 dB

	Low print
Coercivity:	24,700 ±10 per cent A/m
Retentivity:	0.05T
Erasure field:	79,700
Audio performance	
Tape speed:	19 cm/s
Track width:	full track
Reference tape:	Racal-Zonal 063 standard
Replay amplifier characteristic:	100 µS
Bias ratio:	1.3 to 1
Maximum replay level for two per cent distortion:	+3 dB
Maximum record level for two per cent distortion:	+4 dB
Sensitivity:	+0 dB −1 dB −2 dB
Signal to bias noise ratio:	67 dB
Signal to print ratio:	60 dB
Output uniformity at 1 kHz:	
within a reel:	±0.5 dB
reel to reel:	±1 dB
Output uniformity at 1 kHz	
within a reel:	±1 dB
reel to reel:	±2 dB

ZONAL

Racal Zonal Ltd, Holmethorpe Avenue, Redhill, Surrey
Tel: Redhill 67171

Spectrum 1

Low noise gives outstanding signal to noise ratio and *low print* provides low print-through across all the audio frequencies. In other respects specifications for both tapes are almost interchangeable. *Spectrum 1* tapes, compared with Zonal's standard tape, show an input/output improvement, at two per cent distortion, of 4 dB or better. Low noise is coated on high quality, polyester base, giving high breaking strength and low stretch and resistance to temperature and humidity variations. Low print is coated on high quality acetate, polyester or high tensile vinyl base.
Low noise and low print are available in a comprehensive range of widths and lengths.

Physical parameters (low noise and low print)

Colour: black
Base material: *polyester
Base thickness: standard play 0.037 mm
extra play 0.025 mm
Standard width: 6.25 mm, 12.70 mm, 25.40 mm, 50.80 mm. To BS 1568 and IEC 94
Coating thickness: 0.015 mm
Backing thickness: 0.0025 mm
Overall thickness: 0.055 mm
Base properties: conforms to manufacturer's published specification
Lengths: standard play: 190m 13 cm spool; 381m 18 cm spool; 763m 272 cm spool
extra play: 274m 13 cm spool; 550m 18 cm spool; 1100m 27 cm spool
*Low print has no back coating and is also available on PVC and acetate base

Zonal recently introduced versions of their Spectrum tape without a matt backing. To identify these tapes they have put a 1 in front of the relevant type numbers, for example:

		backed	unbacked
Low noise 763m	6.25 mm	Z.317P	Z.1317P
	12.5 mm	Z.319P	Z.1319P
	2.. mm	Z.321P	Z.1321P
	50 mm	Z.361P	Z.1361P

Prices: available on application

Survey: test tapes and discs

The following lists comprise only those test tapes and discs known to be available in the UK as of January 1973. Inclusion does not necessarily imply studio standards though a number of recordings clearly aimed at 'hi-fi' and 'public address' markets have been omitted.

AGFA

Agfa-Gevaert Ltd, Unity House, Great West Road, Brentford, Middlesex
Tel: 01-560 2121

DIN REFERENCE TAPE 76

Full track recording. Tape speed 76 cm/s 6.25 mm magneton tape *PER 525*. Wound on to AEG core (=CCIR core=European core), magnetic coating out (=emulsion out=EO).

Tape speed: 76 cm/s
Reference frequency:
Frequency: 1 kHz
Tape flux: 160 nWb/m
Recording for the adjustment of the gap: 1 and 10 kHz
Frequency response:
Equalisation (µS): 35
Single frequency (note 3): 31.5 Hz to 18 kHz
Empty section in accordance with DIN 45 513: *PER 525*

REFERENCE TAPE 38-25

Full track recording. Tape speed 38 cm/s 25 mm magneton tape *PER 525*. Wound on to NARTB core, magnetic coating out (=emulsion out=EO).

Tape speed: 38 cm/s
Reference frequency:
Frequency: 1 kHz
Tape flux: 150 nWb/m
Recording for the adjustment of the gap: 1 and 10 kHz
Frequency response:
Equalisation (µS): 35
Single frequency (Hz) (note 3): 31, 5 to 18k
Empty section in accordance with DIN 45 513: *PER 525*

REFERENCE TAPE 38-12

Full track recording. Tape speed 38 cm/s 12.5 mm magneton tape *PER 525*. Wound on to NARTB core, magnetic coating out (=emulsion out=EO).

Tape speed: 38 cm/s
Reference frequency:
Frequency: 1 kHz
Tape flux: 320 nWb/m
Recording for the adjustment of the gap: 1 and 10 kHz
Frequency response:
Equalisation (µS): 35
Single frequency (Hz) (note 3): 31.5 to 18k
Empty section in accordance with DIN 45 513: *PER 525*

DIN REFERENCE TAPE 38

Full track recording. Tape speed 38 cm/s 6.25 mm magneton tape *PER 525*. Wound to AEG core (=CCIR core=European core), magnetic coating out (=emulsion out=EO).

Tape speed: 38 cm/s
Reference frequency:
Frequency: 1 kHz
Tape flux: 320 nWb/m
Recording for the adjustment of the gap (kHz): 1 and 10 kHz
Frequency response:
Equalisation (µS): 35
Single frequency (Hz) (note 3): 31, 5 to 18000+G
Empty section in accordance with DIN 45 513: *PER 525*

SHORT REFERENCE TAPE 38 (Kurztestband=KTB 38, note 1)

Abbreviated version of the DIN reference tape 38. Full track recording. Tape speed 38 cm/s 6.25 mm magneton tape *PER 525*. Wound on to AEG core (=CCIR core=European core), magnetic coating out (=emulsion out=EO).

Tape speed: 38 cm/s
Reference frequency:
Frequency: 1 kHz
Tape flux: 320 nWb/m
Recording for the adjustment of the gap: 10 kHz
Frequency response:
Equalisation (µS): 35
Single frequency (Hz) (note 3): 63-14000
Empty section in accordance with DIN 45 513: no empty section

STEREO REFERENCE TAPE 38 (note 2)

Recordings for both stereo channels and the separation track at 38 cm/s 6.25 mm magneton tape *PER 525*. Wound on to AEG core (=CCIR core=European core) magnetic coating out (=emulsion out=EO).

Tape speed: 38 cm/s
Reference frequency:
Frequency: 1 kHz
Tape flux: 510 nWb/m
Recording for the adjustment of the gap (kHz): random noise
Frequency response:
Equalisation (µS): 35
Single frequency (Hz) (note 3): 63-10000
Empty section in accordance with DIN 45 513: *PER 535*

REFERENCE TAPE 19-25

Full track recording. Tape speed 19 cm/s 25 mm magneton tape *PER 525*. Wound on NARTB core, magnetic coating out.

Tape speed: 19 cm/s
Reference frequency:
Frequency: 1 kHz
Tape flux: 320 nWb/m
Recording for the adjustment of the gap (kHz): 1 and 10
Frequency response:
Equalisation (µS): 70
Single frequency (Hz) (note 3): 31. 5-18000
Empty section in accordance with DIN 45 513: *PER 525*

DIN REFERENCE TAPE 19 S (for studio equipment)

Full track recording. Tape speed 19 cm/s 6.25 mm magneton tape *PER 525*. Spool with core of 80 mm diameter. Magnetic coating in (=emulsion in=EI).

Tape speed: 19 cm/s
Reference frequency:
Frequency: 1 kHz
Tape flux: 320 nWb/m
Recording for the adjustment of the gap (kHz): 1 and 10
Frequency response:
Equalisation (µS): 70
Single frequency (Hz) (note 3): 31.5-18000
Empty section in accordance with DIN 45 513: Tape in accordance with German Board of standards

DIN REFERENCE TAPE 19 H (for amateur recorders)

Full track recording. Tape speed 19 cm/s 6.25 mm magneton tape *PE 31*. Spool with core of 80 mm diameter. Magnetic coating in (=emulsion in=EI).

Tape speed: 19.05 cm/s
Reference frequency:
Frequency: 1 kHz
Tape flux: 320 nWb/m
Recording for the adjustment of the gap (kHz): 1 and 10
Frequency response:
Equalisation (µS): 50+3180
Single frequency (Hz) (note 3): 31.5-18000
Empty section in accordance with DIN 45 513: Tape in accordance with German Board of Standards

DIN REFERENCE TAPE 9.5

Full track recording. Tape speed 9.5 cm/s magneton tape *PE 31*. Spool with core of 80 mm diameter. Magnetic coating in (=emulsion in=EI).

Tape speed: 9.5 cm/s
Reference frequency:
Frequency: 333 Hz
Tape flux: 250 nWb/m
Recording for the adjustment of the gap (kHz): 1 and 10
Frequency response:
Equalisation (µS): 90+3180 (note 4)

Single frequency (Hz) (note 3): 31.5-12500
Empty section in accordance with
DIN 45 513: Tape in accordance with German Board of Standards

Notes
1. Short test tape.
2. The stereo-reference tape consists of the level section for the right and left channels, recording on the separation track, recording for the testing of the cross talk (simultaneously approx frequency response section), noise recording for the adjustment of the gap, and empty section in accordance with DIN.
3. G = Gliding frequency section.
4. Until February 1967 Equalisation 120+3180 µS in accordance with DIN; since February 1967 90+3180 µS in accordance with CCIR recommendations.

Prices: all test tapes 6.25 mm wide — £10.30
12.5 mm wide — £19.00
25.0 mm wide — £36.00

The **Agfa Symmetry tape** consists of a normal magnetic coating on double-prestressed polyester base. The coating is however regularly interrupted perpendicular to the direction of recording. Thus any dc flux is reproduced only by a low amplitude noise voltage; the interrupted voltage of the symmetry tape coating is about 100 times (40 dB) higher as a result of the law of induction. This explains why the Agfa Symmetry Tape method is so sensitive.

Operating techniques are particularly easy since no special measuring equipment is necessary. The interrupted dc magnetic flux is perfectly audible via the loudspeaker, or it can be monitored by the level meters (VU or ppm). It is even possible to demonstrate how the earth's magnetic field causes interfering dc magnetic flux.

Agfa Symmetry tape is available as tape or film in various widths. It is 50m long. For ease of operation it is suggested that loops are made up. However, if the recorder has no erase head the whole length of tape must be used and it must be fully bulk erased before the work commences.

Agfa Symmetry tape is available as follows:

Width mm	*Spool/Core*	*Thickness m*	*Length m*
6.25	Normal spool 130 mm core 130 mm core	30	50
12	NAB core	30	50
25.4	NAB core	30	50
50.8	NAB core	75	50
16	Film core	75	50
35	Film core	75	50
17.5	Film core	75	50

Price: free to bona fide enquirers

BASF

CALIBRATION TAPES 38 cm/s, 12.5 and 25 mm WIDTH

Tape Width 26 mm

The tape is used for alignment of multi-channel magnetic recorders at 38 cm/s tape speed. The recordings are made across the full tape width. The magnetisation vector is parallel to the tape edges; deviations thereof are smaller than ±3 minutes with variations of less than ±1 minute across the tape width. Magnetisation variations across the tape width are less than ±0.25 dB.

When frequencies in the range of 31.5 Hz and 125 Hz are played back, the stray magnetisation (fringe effect) has to be considered.

TONE LEVEL SECTION:
1 Hz +0.3 per cent/30s
Tape flux: 320 nWb/m
HEAD GAP ALIGNMENT SECTION:
1 kHz/8s; 10 kHz ±5 per cent/60s. Recording level 10 dB below reference level.
FREQUENCY RESPONSE SECTION (Hz):
1k - 31.5 - 40 - 63 - 125 - 250 - 500 - 1k - 2k - 4k - 6.3k - 8k - 10k - 12.5k - 14k - 16k - 18k - 1k
Recording time 8s each. Level deviations less than ±0.5 dB from 31.5 Hz up to 4 kHz; less than ±1 dB from 6.3 kHz up to 18 kHz

The level of the 1 kHz signal lies about 20 dB below the reference level. Tolerances mentioned above refer to a track width of 6.3 mm +0, −101.5 µm.
Equalisation: either DIN *45 513* with 35 µS or ARD (Figure 2).
UNRECORDED SECTION:
BASF magnetic tape, type *LGR* batch no *641 096*

Tape Width 12.5 mm

Equalisation: 35 µS
All the other properties are the same as specified for 25 mm tape width.

STEREO TEST TAPE 38 cm/s, 6.25 mm

The tape is used in addition to the DIN-Calibration tape *38* for aligning stereo recorders at 38 cm/s tape speed. The magnetisation vector is parallel to the tape edges, and deviations thereof are smaller than ±3 minutes.
TONE LEVEL SECTION:
1,000 Hz ±0.3 per cent, left channel/15s
Tape flux: 510 nWb/m ±5 per cent
1,000 Hz ±0.3 per cent 510 nWb/m, right channel/15s
Tape flux: 510 nWb/m ±5 per cent
Track width: 2.75 mm
TRACK POSITION ALIGNMENT SECTION:
1,000 Hz ±0.3 per cent 90s
Tape flux: 320 nWb/m
Recording track width: 0.76 mm in the middle of the tape
HEAD GAP ALIGNMENT SECTION:
Noise containing frequencies from 5,600 Hz up to 16,000 Hz/60s.
Tape flux: lower than reference level, recording across the full tape width
CROSS-TALK MEASUREMENT SECTION:
63 Hz left channel, right channel—8s each.
Tape flux: 110 nWb/m
1,000 Hz left channel, right channel—9s each.
Tape flux: 110 nWb/m
10,000 Hz left channel, right channel—8s each.
Tape flux: 110 nWb/m
Track width: 2.75 mm

DIN CALIBRATION TAPE 38-6.25 mm

The tape is used for alignment of magnetic recorders at 38 cm/s tape speed (DIN 45 513, sheet two).

The recordings are made across the full tape width. The magnetisation vector is parallel to the tape edges, and deviations thereof are smaller than ±3 minutes.
TONE LEVEL SECTION:
1 kHz ±0.3 per cent/30s
Tape flux: 320 nWb/m ±5 per cent
HEAD GAP ALIGNMENT SECTION:
1 kHz 8s, 10 kHz ±5 per cent/60s
Recording level: 10 dB below reference level
FREQUENCY RESPONSE SECTION (Hz):
1k - 31.5 - 40 - 63 - 125 - 250 - 500 - 1k - 2k - 4k - 6.3k - 8k - 10k - 12.5k - 14k - 16k - 18k - 1k

Frequencies in the range of 4 kHz and 18 kHz are repeated twice. Recording time 8s each.
Level deviations: ±0.5 dB from 31.5 Hz up to 4 kHz; ±1 dB from 6 kHz up to 18 kHz
The level of the 1 kHz signal lies about 20 dB below the reference level.
Equalisation: 35 µS
GLIDING TONE SECTION:
Frequency variation:
Linear from 30 Hz up to 100 Hz during 21.5s. Logarithmic from 100 Hz up to 16,000 Hz during 15s per octave. Start signal frequency: 1,300 Hz/1.5s
Identification signals at 100 Hz and 8,000 Hz.
UNRECORDED SECTION:
Edition 1965, type *PER 525*, batch no 0756.

When using this section the running direction of the tape must conform to the sign printed on the reverse side of this tape.

DIN CALIBRATION TAPE 19s-6.25 mm

The tape is used for alignment of magnetic studio recorders at 19 cm/s tape speed (DIN 45 513, sheet 3).

The recordings are made across the full tape width. The magnetisation vector is parallel to the tape edges, and deviations thereof are smaller than ±3 minutes.
TAPE LEVEL SECTION:
1,000 Hz ±0.3 per cent/30s
Tape flux: 320 nWb/m
HEAD GAP ALIGNMENT SECTION:
1 kHz 8s; 10 kHz ±5 per cent/60s. Recording level 10 dB below reference level.
FREQUENCY RESPONSE SECTION (Hz):
1k - 31.5 - 40 - 63 - 125 - 250 - 500 - 1k - 2k - 4k - 6.3k - 8k - 10k - 12.5k - 14k - 16k - 18k - 1k
Frequencies in the range of 4 kHz and 16 kHz are repeated twice. Recording time 8s each. Level deviations ±0.5 dB from 31.5 Hz up to 4,000 Hz; ±1 dB from 6.3 kHz up to 16 kHz.

The level of the 1 kHz signal lies 20 dB below the reference level.
Equalisation: 70 µS
UNRECORDED SECTION:
BASF magnetic tape, type *PES 40*, batch no A341D.
DIN Calibration tape 4.75 cm/s-6.25 mm.

The tape is used for alignment of magnetic recorders at 4.75 cm/s tape speed (DIN 45 513, sheet 5).

The recordings are made across the full tape width. The magnetisation vector is parallel to the tape edges and deviations thereof are smaller than ±3 minutes.
TONE LEVEL SECTION:
333 Hz ±0.3 per cent/30s
Tape flux: 25 nWb/m ±5 per cent
HEAD GAP ALIGNMENT SECTION:
333 Hz/8s 6.3 kHz ±5 per cent/60s. Recording level 20 dB below reference level.
FREQUENCY RESPONSE SECTION:
333k - 31.5 - 40 - 63 - 125 - 250 - 500 - 1k - 2k - 4k - 6.3k - 8k - 10k - 333 Hz

Recording time 8s each. Level deviations +1 dB from 31.5 Hz up to 2 kHz; +2 dB from 4 kHz up to 10 kHz.

The level of the 333 Hz signal lies about 30 dB below the reference level.
Equalisation: 120µS+1,590 µS
UNRECORDED SECTION:
BASF magnetic tape, type *LGS 26*, batch no 110 211.

DIN CALIBRATION TAPE 4.75/3.81 mm

(DIN 45 513, sheet 6)
The DIN Calibration tape 4.75 is used for adjusting magnetic sound equipment at 4.75 cm/s tape speed. The tape consists of four sections. The recordings are made across the full tape width. The magnetisation vector is parallel to the tape edges. Deviations thereof are smaller than ±2 minutes. Tolerance mentioned below refer to full track playback.
SECTION ONE: REFERENCE LEVEL
When playing back this section, the reference level is determined. The recorded wavelength corresponds to a frequency of 333 Hz ±0.3 per cent. The effective tape flux in magnetic short circuit (see DIN 45 520) is 250 nWb ±5 per cent for 1 mm of tape width. The harmonic distortion of the recorded signal is less than three per cent.

The duration of the signal is approximately 30s.
SECTION TWO: AZIMUTH ALIGNMENT
This section serves the purpose of aligning the gap of the playback head. Furthermore it is used for approximate determination of the frequency response.

Two signals are recorded on this section. The first one whose wavelength corresponds to a frequency of 333 Hz lies 20 dB below the reference level. Its duration is approximately 8s.

The second signal whose wavelength corresponds to a frequency of 10,000 Hz ±3 per cent also lies 20 dB below the reference level, taking into consideration the tape flux diagram. The duration of the signal is approximately 60s.

The gap of the playback head is aligned by adjusting the gap position during playback of the 10 kHz signal, until the output voltage reaches a maximum.

62 ▶

continued

Simultaneously the variations of the level are reduced to a minimum.

The equalisation of the playback amplifier is correct when the playback level of both the 333 Hz signal and the 10,000 Hz signal meet.

SECTION THREE: FREQUENCY RESPONSE
This section is used for determining and adjusting point by point the frequency of the playback amplifier (see DIN 45 511). The following frequencies are recorded on the frequency response section: 333 - 31.5 - 40 - 63 - 250 - 500 - 1k - 2k - 4k - 6.3k - 8k - 10k - 333 Hz.

The duration of each signal is about 8s and is identified by a preceding announcement. Deviations from the nominal frequencies are less than ±3 per cent. The deviations from the level according to the time constant curve are less than ±1 dB within the frequency range from 31.5 Hz up to 2 kHz less than ±2 dB, -3 dB at 8 kHz and 10 kHz.

The level of the 333 Hz signal lies approximately 20 dB below the reference level. The upper range of the frequency response of the tape flux corresponds to the impedance of a parallel combination of resistance and capacitor with a time constant of 120 µS. The lower range corresponds to the impedances of a serial combination of resistance and capacitor with a time constant of 1,500 µS.

SECTION FOUR: UNRECORDED SECTION (reference tape)
The tape used for the unrecorded section is a magnetic tape with electroacoustical properties corresponding to DIN 455 1376.

The unrecorded section serves the purpose of aligning the gap of the recording head, of equalising the recording channel, of testing magnetic sound carriers, and of determining the characteristics of recording and crossing heads.

ALIGNMENT TAPE 6.25 mm

The head alignment tape is used for adjusting the playback head of magnetic recorders. It is meant first of all for the technically trained amateur and for workshops.

A noise is recorded on the tape in standard gap position at a tape speed of 9.5 cm/s. Frequencies range from 5,600 Hz to 16,000 Hz. At 19 cm/s resp 4.75 cm/s tape speed the reproduced noise contains frequencies ranging from 11,200 Hz up to the upper limit of the recorder resp. 2,800 Hz up to 8,000 Hz track number three is erased according to four-track techniques.

The head alignment tape serves the purpose of adjusting the head gap of the playback head or combined head in accordance with international standards by aural evaluation. Moreover, by switching to track number three a track position alignment is made possible. However, this alignment is only feasible with four-track recorders.

EMI

EMI Service Division, EMI Sound and Vision Equipment Ltd, 254 Blyth Road, Hayes, Middlesex UB3 1BW
Tel: 573 3888

FREQUENCY TEST TAPE *TBT 1A* (19 cm/s full track)

The EMI frequency test tape type *TBT 1* enables users to check their equipment quickly and easily and to judge accurately whether or not the reproducer conforms to the required characteristic for replaying 19 cm/s tapes made to the 100 µS recording curve.

The tape consists of a number of frequency bands which when played on a reproducer (the output being observed on a meter) provides a simple method of ascertaining whether the equipment is adjusted to the standard curve and able to reproduce tapes so that the full tonal values may be realised.

The frequency bands have been recorded at 19 cm/s and are made full track so as to be equally suitable for checking reproducers for either mono or stereo tape records.

Frequency	Duration	Purpose
8 Hz	60s	Azimuth alignment
1 Hz	30s	Level setting
40 Hz	15s	Frequency response test
110 Hz	15s	"
200 Hz	15s	"
500 Hz	15s	"
1 kHz	15s	"
2 kHz	15s	"
4 kHz	15s	"
6 kHz	15s	"
8 kHz	15s	"
10 kHz	15s	"
12 kHz	15s	"

Prices: *TBT 1A*—£4.00 each plus purchase tax of £0.70

FREQUENCY TEST TAPE *TBT 2A* (9.5 cm/s full track)

The EMI frequency test tape type *TBT 2A* enables users to check their equipment quickly and easily and to judge accurately whether or not the reproducer conforms to the required characteristics for replaying 9.5 cm/s tapes which have been made to the recording characteristic of 120 µS.

The tape consists of a number of frequency bands which when played on a reproducer (the output being observed on a meter) provides a simple method of ascertaining whether the equipment is adjusted to the standard curve and able to reproduce tapes so that the full tonal values may be realised.

The frequency bands have been recorded at 9.5 cm/s and are made full track so as to be equally suitable for checking either mono or stereo equipment.

Frequency	Duration	Purpose
6 kHz	60s	Azimuth alignment
1 kHz	30s	Level setting
40 Hz	15s	Frequency response test
60 Hz	15s	"
110 Hz	15s	"
200 Hz	15s	"
500 Hz	15s	"
1 kHz	15s	"
2 kHz	15s	"
4 kHz	15s	"
6 kHz	15s	"
8 kHz	15s	"

Prices: *TBT 2A*—£4.00 each plus purchase tax of £0.70

6. 25 mm TEST TAPES TYPE *SRT 17* and *SRT 18*

The reference for the frequency response sections of these EMI test tapes is the standard replay channel as specified by the recommendations of the IEC and the CCIR and detailed in the IEC Publication 94 (third edition, 1968) and Amendment no 1 of February 1971. All known corrections to allow for the differences between the replay head used during production, and the ideal head, have been made. All recordings extend across the full width of the tape.

The magnetic tape used has been selected for end-to-end uniformity and freedom from short-term sensitivity variations. It is wound on an 18 cm cine spool and both tape and spool conform to the dimensions given in the British Standard 1568—1960.

The container is made of mild steel to minimise the effect of any magnetic fields which may be at times close to the tape, for example, the field from the magnets used in test meters, loudspeakers, microphones, etc, or even a magnetised screwdriver.

Specification

SRT 17—38 cm/s 35 µS characteristic
SRT 18—19 cm/s 70 µS characteristic

SECTION ONE:
Over 1m of printed leader carrying type number and serial number, followed by 1m of leader identifying the first recorded section.

SECTION TWO: WOW AND FLUTTER
30s of 3 kHz with a total wow and flutter content of better than 0.08 per cent rms. The level of this recording is arbitrary and not related to the IEC frequency recordings.

SECTION THREE: SPEED CHECK
Ten seconds of printed tape with stroboscopic markings to enable tape speed to be checked. It is advisable to view by means of a neon or gas discharge lamp, although a filament lamp does give an indication. The supply frequency for the viewing lamp must be 50 Hz.

SECTION FOUR: REFERENCE LEVEL
Recording identifying announcement leading into 20s of 1 kHz recorded at a level where the effective flux in a short magnetic path is 320 nWb/m of tape width. The error on this level is no greater than ±5 per cent and the distortion is less than two per cent.

For program interchange purposes, replay channels are usually set to give an output of 2V or +8 dBm when replaying this frequency band.

SECTION FIVE: AZIMUTH ALIGNMENT
Recorded identifying announcement leading into 40s of 16 kHz (for *SRT 17*) or 10 kHz (for *SRT 18*) for purposes of relay head alignment. The level of this tone is arbitrary.

SECTION SIX: FREQUENCY RESPONSE
This consists of a series of tones of ten seconds duration each preceded by an announcement. The level at 1 kHz is 20 dB below the reference level. The frequencies recorded are as follows:
SRT 17: 1 kHz, 30 Hz, 40 Hz, 60 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 6 kHz, 8 kHz, 10 kHz, 12 kHz, 14 kHz, 16 kHz, 18 kHz, 20 kHz.
SRT 18: 1 kHz, 30 Hz, 40 Hz, 60 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 6 kHz, 8 kHz, 10 kHz, 12 kHz, 14 kHz, 16 kHz.

Test tapes *SRT 17* and *18* supersede type *SRT 12* and *SRT 13* respectively. *SRT 17* is similar to *SRT 12* but has an extended frequency range. *SRT 18* has an extended frequency range but is recorded to a 70 μS characteristic as against the 100 μS of the *SRT 13*. Where *SRT 18* is used instead of *SRT 13* to check a 100 μS replay chain, the following levels will be obtained: 1 kHz 0; 30 Hz −0.7 dB; 40 Hz −0.7; 60 Hz −0.7; 125 Hz −0.6; 250 Hz −0.6; 500 Hz −0.6; 2 kHz +1.0; 4 +1.9; 6 +2.1; 8 +2.2; 10 +2.3; 12 +2.3; 14 +2.4; 16 kHz +2.4.

Prices: *SRT 17*—£12.75 each plus purchase tax of £2.23
SRT 18—£12.75 each plus purchase tax of £2.23

6.25 mm TEST TAPES TYPE *SRT 19*

The reference for the frequency response section of this EMI test tape is the standard replay channel as specified by the recommendations of the IEC and the CCIR and detailed in the IEC Publication 94 (third edition, 1968) and amendment no 1 of February 1971. All known corrections to allow for the differences between the replay head used during production and the ideal head, have been made. All recordings extend across the full width of the tape.

The magnetic tape used has been selected for end-to-end uniformity and freedom from short-term sensitivity variations. It is wound on an 18 cm cine spool and both tape and spool conform to the dimensions given in the British Standard 1568—1960.

The container is made of mild steel as above.

Specification
SRT 19 9.5 cm/s 90+3180 μS characteristic

SECTION ONE:
One metre of printed leader carrying type number and serial number, followed by 1m of leader identifying the first recorded section.

SECTION TWO: WOW AND FLUTTER
Thirty seconds of 3 kHz with a total wow and flutter content of better than 0.08 per cent rms. The level of this recording is arbitrary and not related to the IEC frequency recordings.

SECTION THREE: SPEED CHECK
Thirty seconds of printed tape with stroboscopic markings to enable tape speed to be checked. It is advisable to view by means of a neon or gas discharge lamp, although a filament lamp does give an indication. The supply frequency for the viewing lamp must be 50 Hz.

SECTION FOUR: REFERENCE LEVEL
Recording identifying announcement leading into 20s of 400 Hz recorded at a level where the effective flux in a short magnetic path is 250 nWb/m of tape width. The error on this level is no greater than ±5 per cent and the distortion is less than two per cent.

For program interchange purposes, replay channels are usually set to give an output of 2V or +8 dBm when replaying this frequency band.

SECTION FIVE: AZIMUTH ALIGNMENT
Recorded identifying announcement leading into 40s of 6 kHz for purposes of replay head alignment. The level of this tone is abitrary.

SECTION SIX: FREQUENCY RESPONSE
This consists of a series of tones of ten seconds duration each preceded by an announcement. The level at 1 kHz is 20 dB below the reference level. The frequencies recorded are as follows: 400 Hz, 30 Hz, 40 Hz, 60 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 6 kHz, 8 kHz, 10 kHz. 12 kHz, 14 kHz.

Test tape *SRT 19* supersedes type *SRT 14* which was recorded to a 120 μS characteristic.

Where *SRT 19* is being used to check a 120 μS replay chain, the following levels will be obtained: 400 Hz 0; 30 Hz +5.2; 40 Hz +3.8; 60 Hz +1.9; 125 Hz 0.4; 250 Hz 0; 500 Hz +0.1; 1 kHz +1.2; 2 kHz +1.3; 4 kHz +1.9; 6 kHz +2.1; 8 kHz +2.2; 10 kHz +2.2.

Price: *SRT 19*—£15.00 each plus purchase tax of £2.63

TUTCHINGS

Tutchings Electronics Ltd, 14 Rook Hill Road, Friars Cliff, Christchurch, Hants
Tel: Highcliffe 2019

TEST TAPE No 1
This tape is used to measure the playback frequency response of quarter and half track recorder.

Pure tones 40 Hz-10 kHz. Each band has voice identification. Recorded to *IEC 70* plus 3180 μS characteristic at 19 cm/s.

Track two carries continuous 7.5 Hz tone for azimuth alignment. 8 cm spool.
Price: £1.55 (including packing and postage)

TEST TAPE No 2
This tape is used to measure the playback frequency response of quarter and half track recorders.

Pure tones 40 Hz-7.5 kHz. Each band has voice identification. Recorded to *NAB 90* plus 3180 μS characteristic at 9.5 cm/s.

The second track carries continuous 5 kHz tone for azimuth adjustment. On 8 cm spool.
Price: £1.55 (including packing and postage)

TEST TAPE No 3
This tape is used to measure acoustic responses of recorders, microphones and loudspeakers.

One third octave bands of filtered white noise 40 Hz-10 kHz. Each band has voice identification. Recorded to *IEC 70* plus 3180 μS characteristic at 19 cm/s. On 8 cm spool
Price: £1.55 (including packing and postage)

TEST TAPE No 4
This tape is used for reverberation and transmission tests of rooms, studios, etc. It can also be used for subjective testing of room acoustics and listening tests on loudspeakers and enclosures.

One octave bands of filtered white noise with centre frequencies 100 Hz-5.4 Hz with voice identification of each band. Recorded to *IEC 70* plus 3180 μS characteristic at 19 cm/s. Track two carries full range of unfiltered white noise. On 8 cm spool.
Price: £1.55 (including packing and postage)

TEST TAPE No 5
Azimuth and vertical head alignment tape for setting the height and azimuth of quarter track heads by ear.

Full track white noise; track three has been left blank. On 8 cm spool.
Price: £1.55 (including packing and postage)

TEST TAPE No 6
This test tape is for use in factories or service depots. It should be used with an oscilloscope or output meter and filters.

Azimuth and vertical head alignment tape. Full track 1.25 kHz with track three erased and recorded at 7.5 kHz. On 8 cm spool.
Price: £1.55 (including packing and postage)

Test tapes for any speed and recording characteristics produced to special order.

Test discs

AUDIX

Audix Sound Systems, Bentfield End, Stanstead, Essex
Tel: Stanstead 3132

ADX 301
Frequency response tests, channel identification, phase tests, bands of various musical items.
Price: £1.50

DECCA

Decca Record Co Ltd, Decca House, Albert Embankment, London SE1
Tel: 01-735 8111
Of a number of Decca discs the only ones now available are as follows:

LXT 5346
Frequency test record: 30 Hz to 20 kHz in bands. Mono only.
Price: £2.15

SKL 4861
(Give Yourself a Stereo Checkout)
Price: £2.15

DGG/POLYDOR

Deutsche Grammophon/Polydor, 17-19 Stratford Place, London W1
Tel: 499 8686

101497
220497
Stereo 18 cm 45 rpm records for testing phase, balance, music, voice and effects.
Price: on application

EMI

EMI Records, The Gramophone Co Ltd, EMI House, 20 Manchester Square, London W1
Tel: 01-486 4488

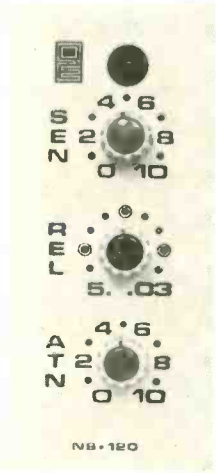
TCS 101
A 30 cm stereo record of 30 Hz to 20 kHz bands.
Speed: 33⅓ rpm

TCS 102
A 30 cm stereo record of 30 Hz to 20 kHz gliding tone.
Speed; 33⅓ rpm

TCS 104
A 30 cm mono record of 30 Hz to 20 kHz bands and gliding tones cut as a sum signal (lateral grooves).

TCS 105
A 30 cm mono record or 30 Hz to 20 kHz bands and gliding tones cut as a difference signal (vertical grooves).
Prices: on application

NEW EQUIPMENT



Noise gate

DESIGNED FOR multitrack mixdown noise gating, film and realtime noise attenuation, the Quad-Eight *NS-120* has been released in the US at $98. The three controls comprise: threshold (with led gating status display), release time (30 ms to 5s), and attenuation range (–50 to 0 dB). A ±28V dc power supply is specified for +24 dBm maximum output. Sixteen channels may be accommodated in one model *1600* 483 x 89 mm standard card rack.

Manufacturers: Quad/Eight Electronics, 11929 Vose Street, North Hollywood, California 91605, USA.

Monitor loudspeaker

DESCRIBED BY LECSON as suitable for studio monitoring applications, the *HL1* horn enclosure is capable of handling 100W program. Four drive units are employed including two 330 x 203 mm paper cone units feeding an exponential split path. Midrange is handled by a 127 mm hyperbolic cone driver radiating across 100° horizontal, 30° vertical. A low distortion tweeter is loaded by a die-cast exponential horn, crossover frequencies being 380 Hz (12 dB per octave) and 5 kHz (18 dB per octave). Nominal impedance is 8 ohms. The *HL1* retails at £89.

Manufacturers: Lecson Audio Ltd, Nuffield Road, Industrial Estate, St. Ives, Huntingdon PE17 4LD.

Speech rate translator

DETAILED SPECIFICATIONS of the Crown *SRT-1* speech rate translator have been released by the UK agents, Macinnes Laboratories. The *SRT-1* operates in conjunction with an *SP844* four channel tape player and a five speed variable tape drive system, allowing $\frac{1}{2}n$ to $4n$ variation in spoken word rate with no change from the original pitch. Claimed frequency response is 50 Hz to 10 kHz +1 –3 dB, splicing period being 20 ms. A binaural output functions in time quadrature to provide signal outputs which would otherwise be lost during time compression. Crown claim to have eliminated quantizing errors produced in digital processors. Four inputs are provided, switch selectable, with optional automatic level control. The *SRT-1* costs £2,000.

Agents: Macinnes Laboratories Ltd, Stonham, Stowmarket IP14 5LB.

Optical synthesiser

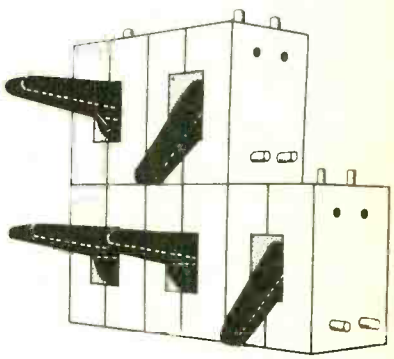
A VERSATILE OPTICAL synthesiser has been developed by Audio Applications. The *Lightmaster 601* incorporates six channels, fader controlled, each working up to 1 kW maximum. Effects modules may be plugged into any channel. Five basic modules are available at present: sound to light, flow light (ten variations), sequence flashing, random flashing, and keyboard activated. Features include over-ride (black out) switches on each channel, interference suppression, separate master faders for manual and automatic control (permitting manual/auto cross-mixing), front panel fuses, and 13A power outlet sockets. Dimensions are 489 x 267 x 179 (ldh), 5.5 kg, and the price of the 3 kW model is £148. Options include 6 kW output (£10) and brightness indicator lights (£12).

Manufacturers: Audio Applications Ltd, Kensington Barracks, Kensington Church Street, London W8.

Modular routing matrix

AN AUDIO MATRIX system assembled to individual requirements is offered by Design Engineering. Each junction comprises a lever-action switch set on at 90° from vertical and off at 45° dip. This action permits rapid wipe-off of a switch program, dimensions being such that 10 x 10 switches make a 220 x 95 mm assembly. A choice of lever colours is offered for priority coding. Long life low resistance nickel silver switch action is utilised, allowing direct linking of x and y axes.

Manufacturers: Design Engineering Ltd, 254 Ringwood Road, Ferndown, Dorset BH22 9AR.



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NOTE: Advertisement copy must be clearly printed in block capitals or typewritten.

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

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01-723 6635

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Hawk Street, CARNFORTH, Lancs. Tel. 2273

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J. J. Francis (Wood Green) Ltd.,123 Alexandra Road, Hornsey, London, N.8. Tel. 01-888 1662.

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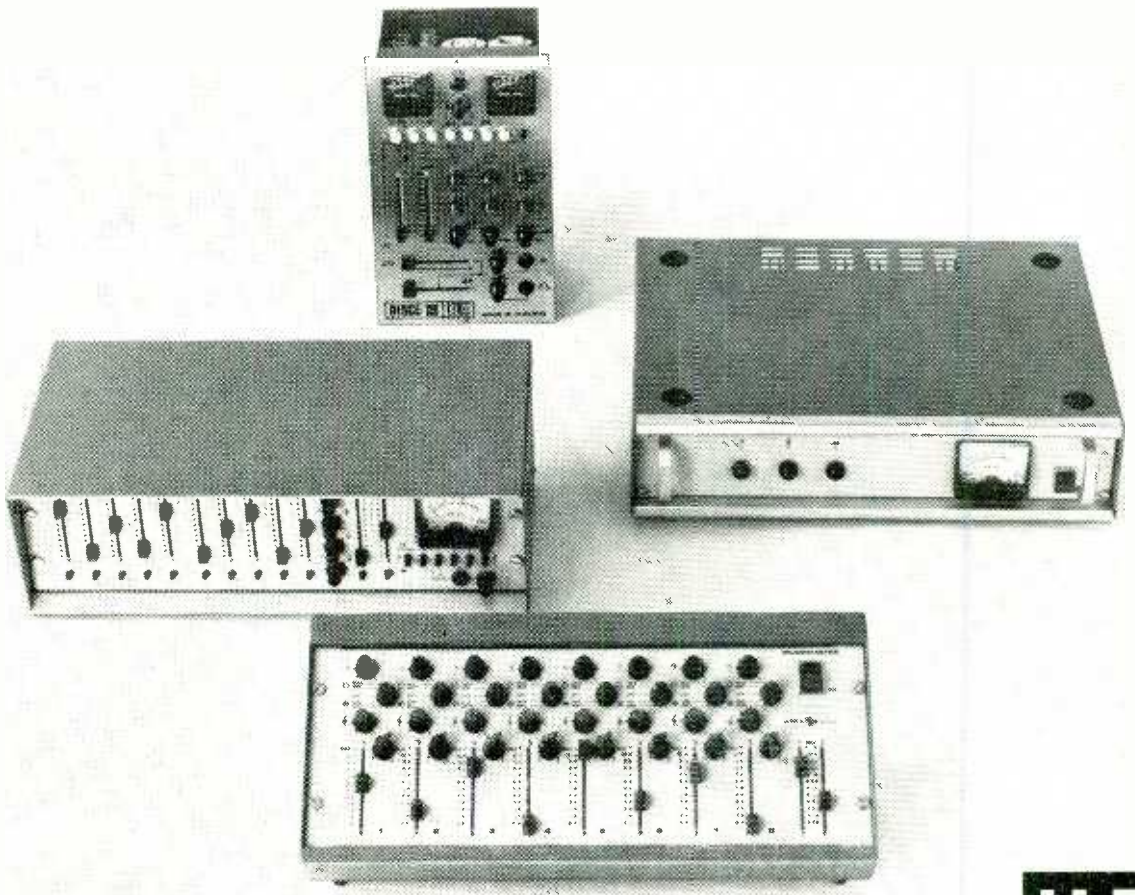

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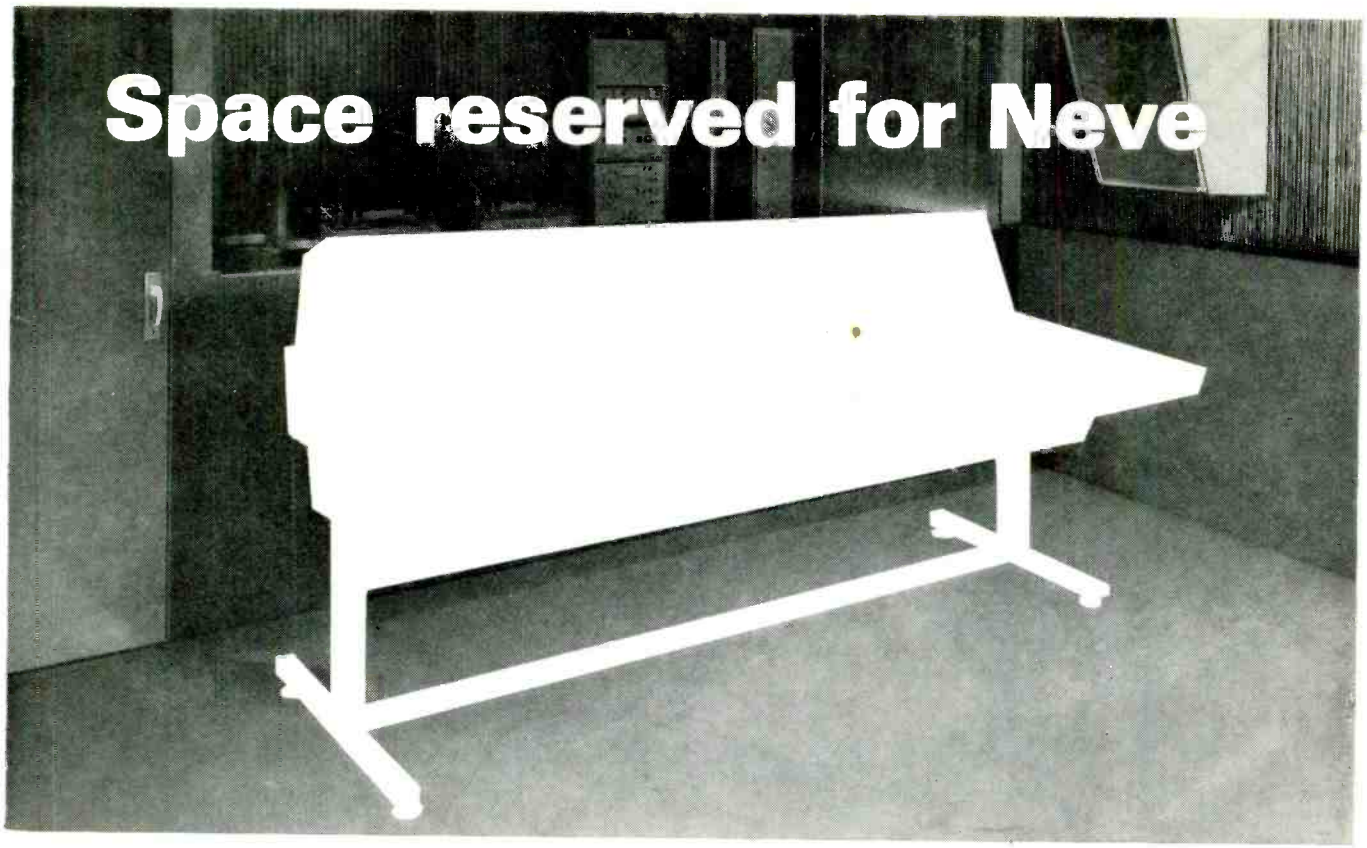

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