May 1973 25p

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studio sound
AND BROADCAST ENGINEERING

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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 and musical engineering 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

BINDERS

Loose-leaf binders for annual volumes of STUDIO SOUND *are available from Modern Bookbinders, Chadwick Street, Blackburn, Lancashire. Price is 85p. Please quote the volume number or date when ordering.*

MAY 1973 VOLUME 15 NUMBER 5

ANNOUNCEMENTS AT THIS year's Public Address Engineers' Exhibition were audible. Thanks partly to the slow evolution of sound reinforcement equipment, partly to an exhibition attendance which most specialised industries would consider miserably low. If Sound '73 served no other purpose, it at least gave exhibitors the chance of a quiet rest and an opportunity to look more closely at the equipment they and their competitors were in business to sell.

The low attendance figures ('between 2,000 and 2,500') may be attributed to a go-slow by the APAE executive, not to mention that of ASLEF. Forgetting the latter, and we're still trying to, the APAE's delay and apathy in distributing exhibition tickets was nothing short of absurd.

This year, as last, the APAE declared their interest in absorbing a 'related' trade exhibition, a sideways reference to the Association of Professional Recording Studios' annual event. Since when did the small and declining absorb the large and flourishing? If the two exhibitions ever were to merge, we trust that the result would be controlled by the APRS secretariat. The APRS can have little taste for such a merger, however, and will no doubt leave the APAE to struggle on to Sound '74 and almost certain oblivion. The only suggestion we can offer, for what it is worth, is that the APAE guard themselves against their own inefficiency by scrapping the practice of pre-circulated ticket entry.

SUBSCRIPTIONS

STUDIO SOUND, *published monthly, enables engineers and studio management to keep abreast of new technical and commercial developments in electronic communication. The journal is available without charge to all persons actively engaged in the sound recording, broadcasting and cinematographic industries. It is also circulated by paid subscription to manufacturing companies and individuals interested in these industries. Annual subscription rates are £3 (UK) or £3.30 ($8 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.*

PAST ISSUES

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.*

Alice SM2 RANGE OF MIXERS

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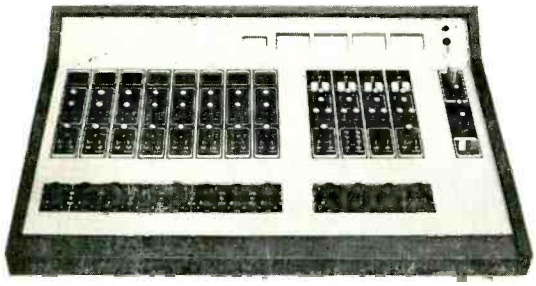

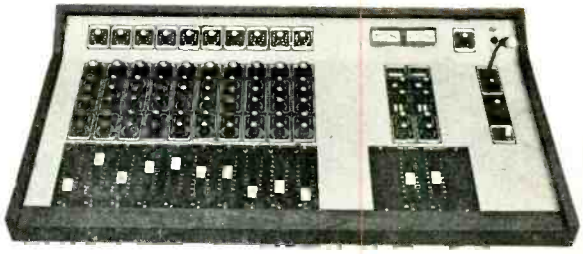

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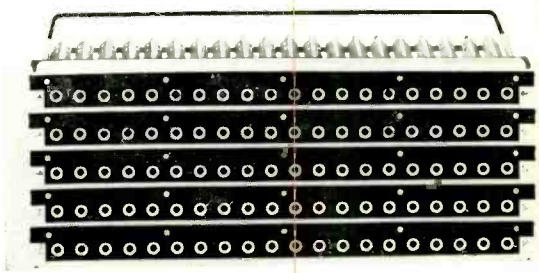

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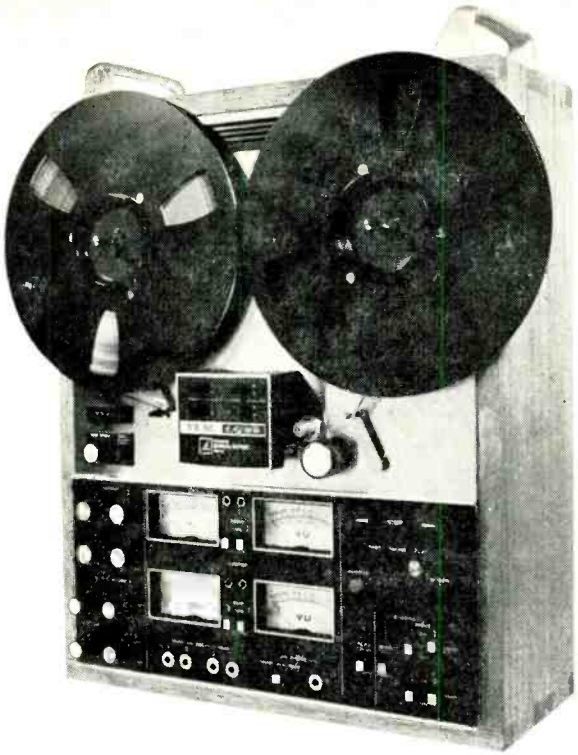

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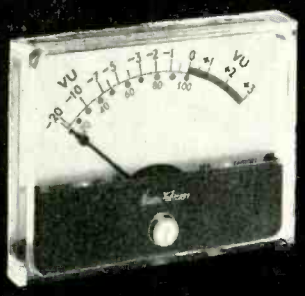

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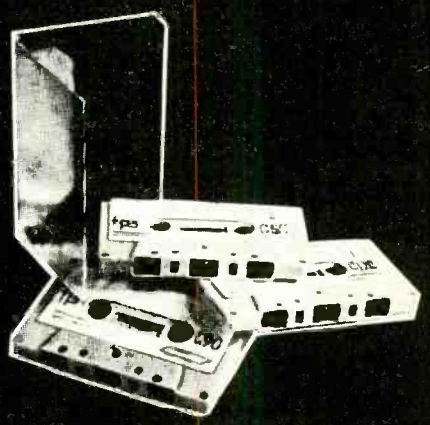

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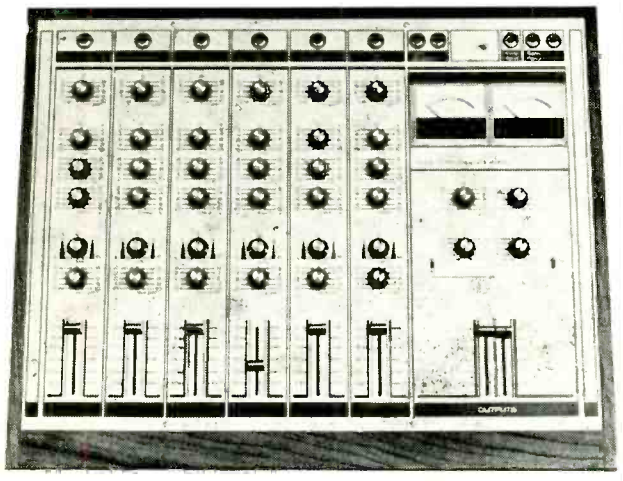

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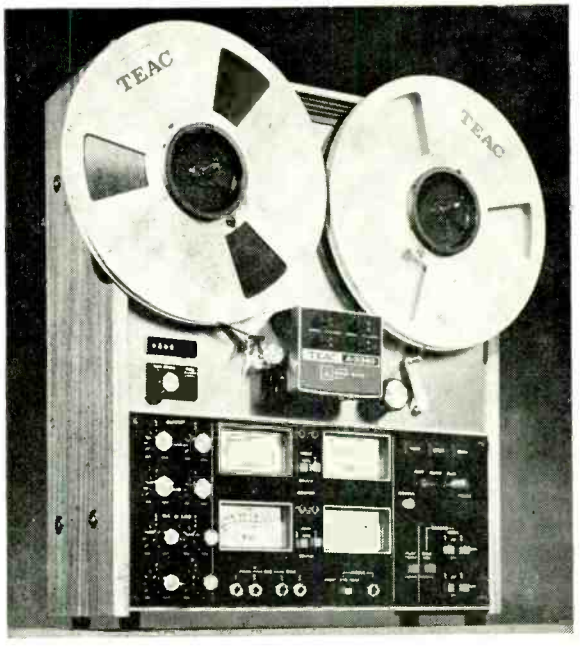

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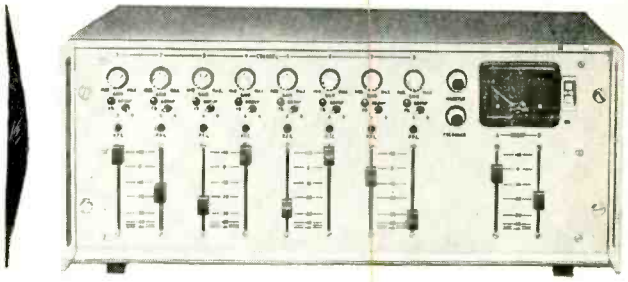

5 x 2 discotheque mixer

Stereo inputs: 2 gram, 2 tape, 1 mono microphone.
All inputs have pre-fade facility, and slide faders. There is overall bass and treble control, and stereo master fade. Other outputs are stereo slave, mono sound to light, and phones. Monitoring is by two Vu meters.

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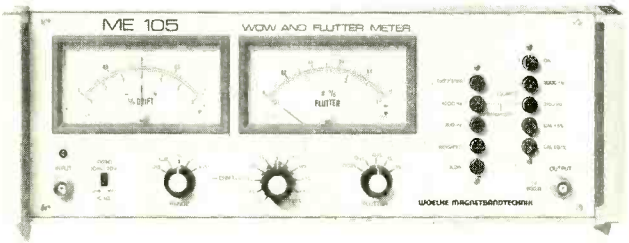

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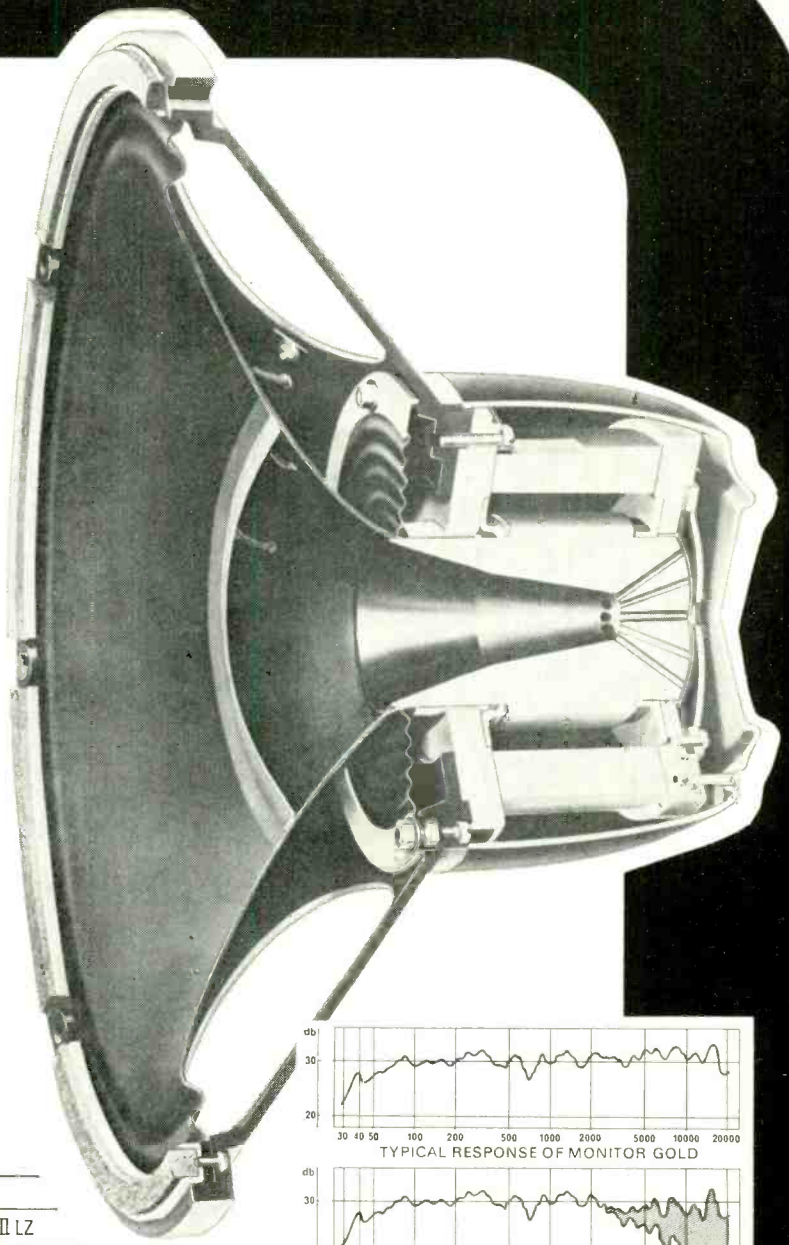

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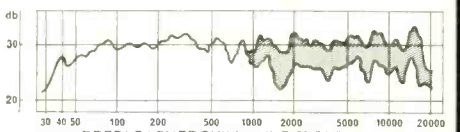

TREBLE "ENERGY" IN FIVE STEPS

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Frequency Response	23-20,000 Hz	25-20,000 Hz	27-20,000 Hz
Polar Distribution for 60° inc. Angle	—4dB at 10,000 Hz	—3dB at 10,000 Hz	—2dB at 10,000 Hz
Power Handling Capacity	50 watts*	35 watts*	25 watts*
Impedance Via Crossover Network	8 ohms (5 ohms min.)	8 ohms (5 ohms min.)	8 ohms (5 ohms min.)
Intermodulation Products	less than 2%	less than 2%	less than 2%
Bass Resonance	26 Hz	28 Hz	30 Hz
Crossover Frequency	1,000 Hz	1,000 Hz	1,200 Hz

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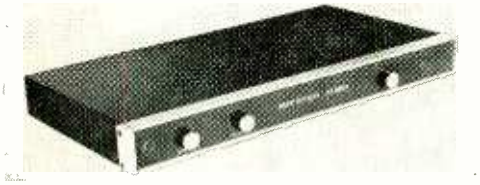
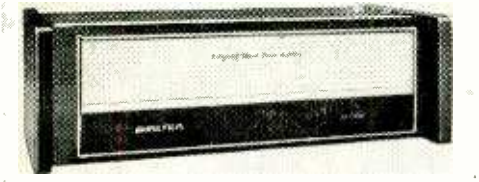
All quoted output powers are Root Mean Square values.



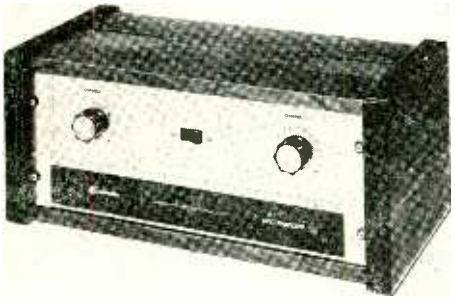
D.60 the 100 watt amplifier

Two channel extra-compact power amp. In stereo—40 watts per channel at clip point into 8 ohms; 62 into 4 ohms; in mono, 100 watts into 8 ohms. At 30 watts per channel into 8 ohms power response is ±1 dB from 5 to 30,000 Hz, THD is below 0.05% and hum and noise 106 dB below. Built-in protection against mis-use. Input sensitivity 0.75V into 25 Kohms. Size 17in x 8¾in x 1¾in high.



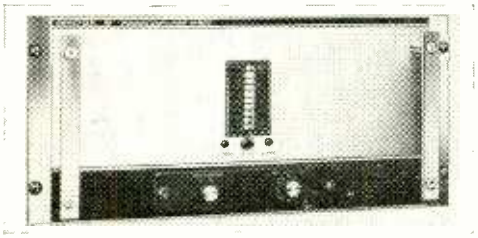
D.150 the 330 watt amplifier

Two channel model. 100 watts per channel at clip point into 8 ohms. 140 watts into 4 ohms loads. 330 watts into 8 ohms used mono. Power response ±1 dB from 5 to 20,000 Hz at 75 watts per channel into 8 ohms. THD less than 0.05%. Damping factor greater than 200 up to 1 kHz. Hum and noise 110 dB below at 75 watts per channel into 8 ohms. Input sensitivity 1.19V ±2% into 25 Kohms for 75 watts out. Built-in protection against mis-use. Size 16½in x 5in deep x 8in high, less front panel (Front panel optional extra, £15). 19in rack mounting fittings also available. Price, less front panel



DC.300A the 1,000 watt amplifier

Power at clip point (per channel) 200 watts into 8 ohms: 350 watts into 4 ohms: 500 watts into 2.5 ohms. Used mono—greater than 650 watts into 8 or 4 ohms. This new unit will operate into loads as low as 1 ohm and no longer requires protection fuses as did its predecessor the DC 300. Power response ±1 dB from zero to 20,000 Hz at 150 watts per channel into 8 ohms. Total harmonic distortion 0.02% at 300 watts per channel into 4 ohms. Hum and noise below 110 dB at 150 watts per channel into 8 ohms. IM distortion 0.05% from 0.01 watt to 150 watts per channel into 8 ohms. Input sensitivity 1.75V for 150 watts out per channel into 8 ohms. Size, with front panel, 19in x 7in x 9¾in (suitable for standard rack mounting).



M.600

Single channel power amplifier. 600 watts into 8 ohms or 1,000 into 4 ohms with THD less than 0.1%. Frequency response ±1 dB from zero to 20 kHz. Two M.600s can be linked to give a massive 2,000 watts into 8 ohms. With built-in automatic two-speed cooling and protection devices against mis-use. Weight 80lbs nett. Size 19in x 8¾in high x 16⅞in (standard rack mounting).

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We offer a widened range of 2 speed and 4 speed models from 15/16 to 60 IPS, ¼″ to 1″ tape width, with heavy duty solenoid operation and remote control facilities.

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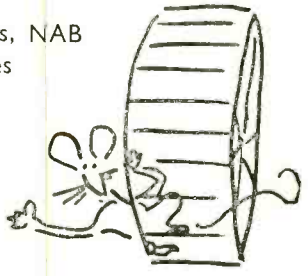
Prime mover for jingles, NAB and Q8 cartridges, machines instant start solenoid operated.



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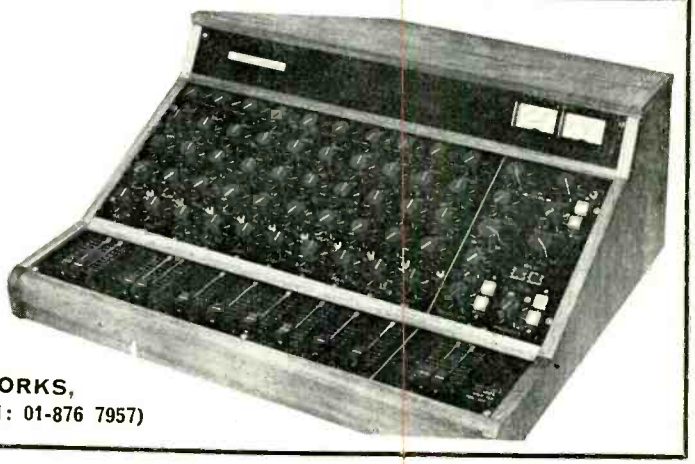
Weight: 9 kg.
PRICE: From £275.



MANUFACTURER: MAGNETIC TAPES LTD., CHILTON WORKS, GARDEN ROAD, RICHMOND, SURREY, ENGLAND. (Tel: 01-876 7957)

This little lot costs over £3,200!

...or you can have the Tuner for £720

Made by Scientific Audio Electronics Inc., these units are the ultimate standard of performance in medium and high-power, high fidelity reproduction. Each product in the SAE range features: the faithful reproduction of complex musical signals; uncompromised design parameters and components regardless of cost; military grade G-10 glass epoxy circuit boards; and selected deposited-carbon, close-tolerance resistors for lowest possible noise, consistent performance and utmost reliability. These units are guaranteed to meet the published specifications for five years plus a *five-year* parts and labour guarantee.

When we refer to SAE units as the ultimate standard in medium and high-power, hi-fi reproduction, we really mean it. Take their highest power amplifier, the Mark 23: 300* watts stereo RMS output per channel into 8 ohms (400* watts per channel before clipping), with only *0.02% harmonic distortion*, 20 Hz to 20 kHz with both channels driven to *300 watts RMS*. Signal to noise ratio guaranteed better than 100 dB below 300 watts RMS. And there are 4 power supply units to ensure full output.

In FM tuners, the SAE Mark Six at £720 (solid walnut case £20 extra) is probably the world's most expensive. But it is rather unique, incorporating three SAE exclusives: digital readout frequency display at 3 ins. rectangular oscilloscope for tuning and audio signals, and automatic selection of oscilloscope display when you touch the tuning knob. Sensitivity: 1.6 μV (IHF); S/N ratio: greater than 75 dB; IF rejection: greater than 100 dB. Channel separation 50 dB at 1 kHz.

SAE also manufacture four other lower powered stereo amplifiers, 2 stereo preamplifier equalizers and a stereo octave equalizer; plus the first loudspeaker of its type in the industry—the Mark XII solid state electrostatic transducer.

*British rating

distributed by:

HENRY'S RADIO LTD.

354/356 Edgware Road, London W.2

01-402 4336/5854.

For full details of these SAE units, contact:

Sole importer for U.K. and Southern Ireland,

TELE-RADIO PROTOTYPE ELECTRONICS

10c Sunningfield Crescent London NW4

Tel: 01-203 4020

Trade enquiries invited for areas outside London

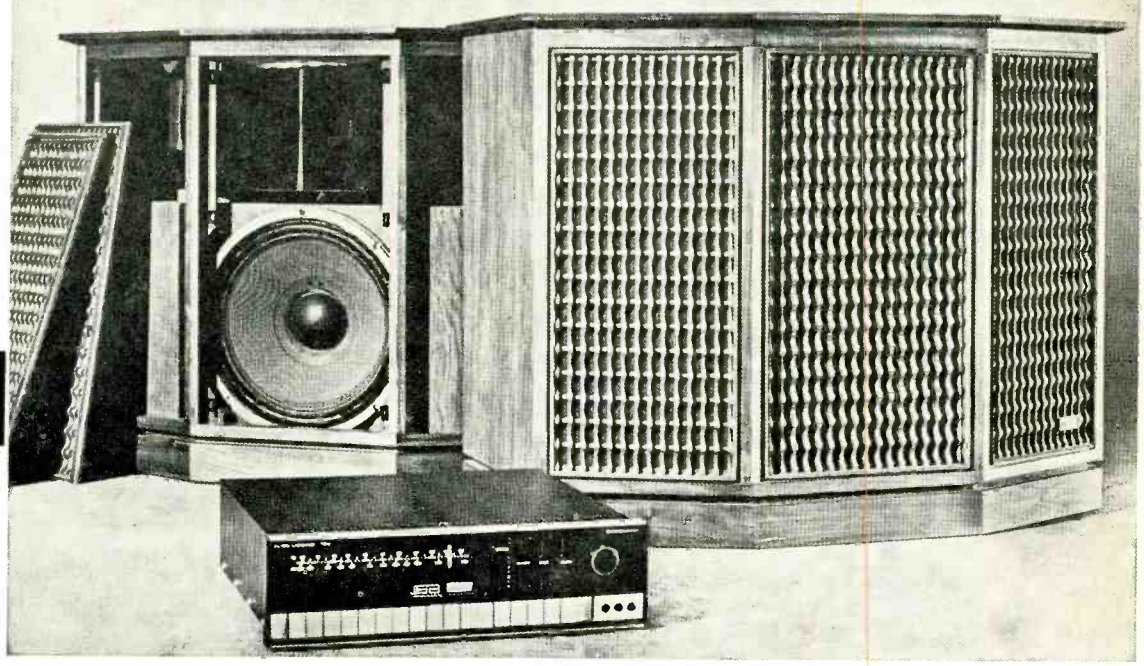
Now available in the U.K.– the world renowned ALTEC LANSING range.

Built a little better

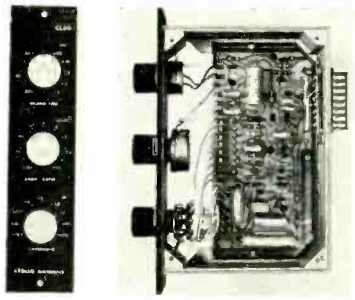
ALTEC LANSING

For further details write to sole U.K. Distributors: ACOUSTICO ENTERPRISES LTD., 6-8 Union Street, Kingston-upon-Thames, Surrey. Tel. 01-549 3471/3 (3 lines).

Altec speakers systems and stereo components are designed to offer you finer specifications for better listening and the latest features for better control of what you hear and the newest innovations for professional recording studios. And that's why we say they're built a little better.



APOLLO ELECTRONICS



COMPRESSOR-LIMITER
plug-in unit
model CL 36

- ★ 36 DB COMPRESSION CAPABILITY
  No meter can read that much compression
  Virtually impossible to overload the input
- ★ SMOOTH AND NOISELESS ADJUSTMENT OF THE COMPRESSION RATIO CONTROL
  It can be adjusted during recording session
- ★ WIDE RANGE OF THRESHOLD LEVELS
  To meet every possible application
- ★ VERY LOW OUTPUT NOISE AND DISTORTION
  They are measurable but not audible
- ★ UNITY GAIN FOR SIGNALS BELOW THRESHOLD
  It will not affect your noise reduction system because it does not expand below threshold
- ★ VERY SENSIBLE PRICE
  To meet everyone's pocket
- ★ AND THERE ARE TEN MORE PLUG-IN UNITS TO MATCH WITH IT IF YOU WANT TO BUILD A MIXER

96 MILL LANE, LONDON N.W.6
Telephone: 01-794 8326

P400-RS STEREO AUTOPHASE

Automatic programme controlled phasing effect unit for stereo and dual mono operation. Control source can be — own channel; cross channel; external or manual.

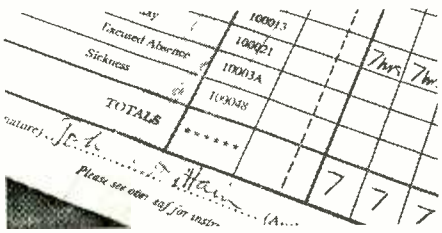
Simulates tape phasing or operates with its own fascinating, distinctive sound.

Audio & Design (Recording) Ltd.
St. Michaels, Shinfield Road, Shinfield Green, Reading, Berks. Tel: 0734 84487

The simple case for using Scotch Magic Transparent Tape

Ordinary transparent adhesive tape

Very visible. Ordinary tape makes a very visible join and spoils the appearance of the item.



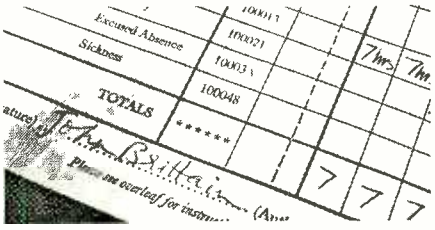
Difficult to write on. Because of its shiny surface ordinary tape is difficult to write on.

"Ghost" effect on copies. Ordinary tape gives a ghost effect on copies and photographs making the subject underneath difficult to read.

Non-permanent. Ordinary tape shrinks and yellows with age leaving an unsightly black line round the edges. It also tends to crinkle and peel off if exposed to moisture.

Scotch Magic Transparent Tape

Almost invisible. Magic Transparent Tape is much less obvious. It tones in with the background so the join becomes almost impossible to spot.



Easy to write on. Magic Transparent Tape is easy to write on—ballpoint and pencil reproduce perfectly. You can type on it too.

"Ghost-free" copies. You get perfect copies with Magic Transparent Tape. The taped section is just as legible as the rest.

It's permanent—so it won't shrink, discolour or peel off. Magic Transparent Tape isn't affected by sunlight, moisture or temperature change. It stays just the way you stick it down no matter how long you leave it.

You notice the improvements. Not the tape.

If you would like a free sample of Scotch Magic Transparent Tape, fill in this coupon and send it to: Commercial Trades Marketing, 3M United Kingdom Ltd., 3M House, Wigmore Street, London, W1A 1ET.

Name ...

Company ...

Position ...

Address ...

SS/5/73

3M

3M and Scotch are trademarks.
3M 2086

how do you clean your tapes?

LeeRaser
Bulk erasure is the only way to get rid of background noise and build-up of incompletely erased signals.

Ask for details of the new LeeRaser LR70 and LR71 tape demagnetisers

Contact ***Derek Owen*** *at our London office telephone* ***01-874 9054***
He will be glad to help.

LEEVERS-RICH
EQUIPMENT LIMITED

LEEVERS-RICH EQUIPMENT LIMITED
319 TRINITY ROAD · LONDON SW18 3SL
TELEPHONE 01-874 9054 · TELEX 923455
CABLES LEEMAG LONDON

A MEMBER OF THE MCP GROUP

Be Ready for Holidays & Europe!

On EMI cassettes & reels direct from manufacturer learn

FRENCH SPANISH GERMAN ITALIAN

...its so simple, just slip cassette into machine, or reel onto recorder. Each pre-recorded language course comes complete with manual. Ideal for beginners or as a brush up course!

Why pay £5 per course!

ONE COMPLETE COURSE OF 24-26 LESSONS **£1.49**

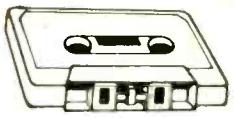
OR ALL FOUR LANGUAGES **£5.50** p&p 20p per order

GIGANTIC OFFER Most at less than **HALF PRICE**

MANUFACTURED UNDER CONTRACT BY EMI LOW NOISE 5 SCREW TYPE CASSETTES

with index cards at less than half list branded prices all in plastic presentation cases.

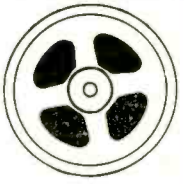
C60 32p, 10 for £3; C90 45p, 10 for £4.20
HEAD CLEANERS 30p; C120 58p, 10 for £5.50; EMPTY PLASTIC CASES 10p. P/P 20p



CHEAPER GRADES OF CASSETTES BY AUDIO CERTRON & OTHERS

5 SCREW TYPE INDEX CARDS AND CASES.
C60 25p, 10 for £2.35; C90 35p, 10 for £3.25; C120 45p, 10 for £4.25. P/P 20p
INDEX CARDS 3p PER DOZEN

RECORDING TAPES



SUPERB QUALITY WITH LEADERS & BOXED · POLY-ESTER · PVC · & MYLAR BASED. MANUFACTURED BY LEADING ELECTRONICS FIRMS

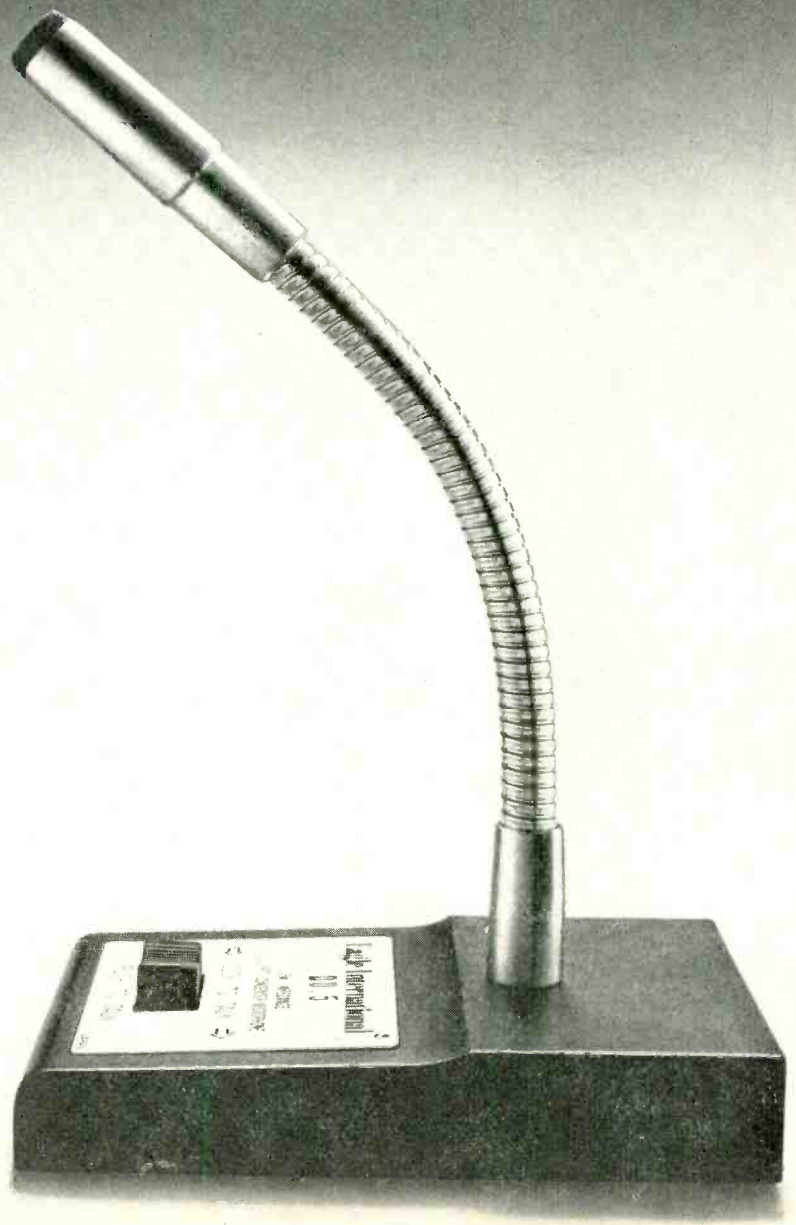
Why not try one and cut your recording costs?

	Standard Play		Long Play		Double Play	
5″	600′	35p	900′	42p	1200′	60p
5¾″	900′	40p	1200′	55p	1800′	80p
7″	1200′	48p	1800′	70p	2400′	98p

EMPTY SPOOLS 5″ 10p, 5¾″ 11p, 7″ 12p. P/P 20p

WALKERS (S) 16 Woodthorpe Road, Ashford, Mdx. 52136

As you can see, it takes up very little room.



This is our new DD5 Paging Microphone, life-size.

It would hardly notice on even the smallest desk top or console, you'll agree.

We've managed to shrink things to this extent by using a sub-miniature Electret capsule.

There's a push-to-talk, slide-to-lock switch which incorporates spare contacts for priority page relays.

And at the same time, we've tailored the frequency response and output to make sure the message is always heard loud and clear.

Quite a lot considering the DD5 costs very little too.

Impedance: 600 ohms
Response: 600-9,000 Hz.
Sensitivity: –70dB (310uV)
List Price: £12.00 (excl. VAT)

Eagle International

Eagle International Precision Centre Heather Park Drive
Wembley HA0 1SU Telephone 01-903 0144

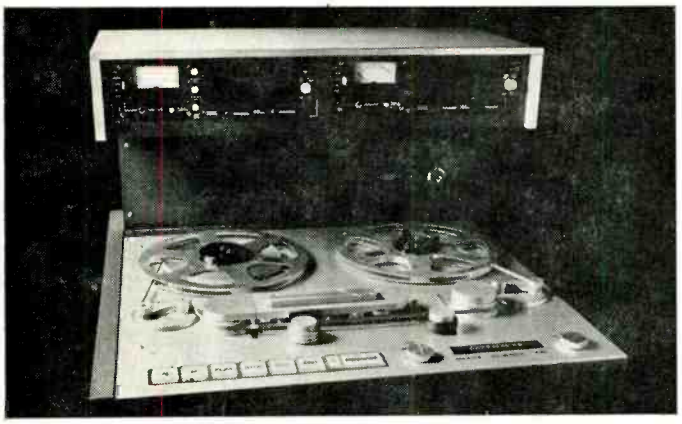
Please send me your catalogue containing full details of the DD5 and other PA equipment.

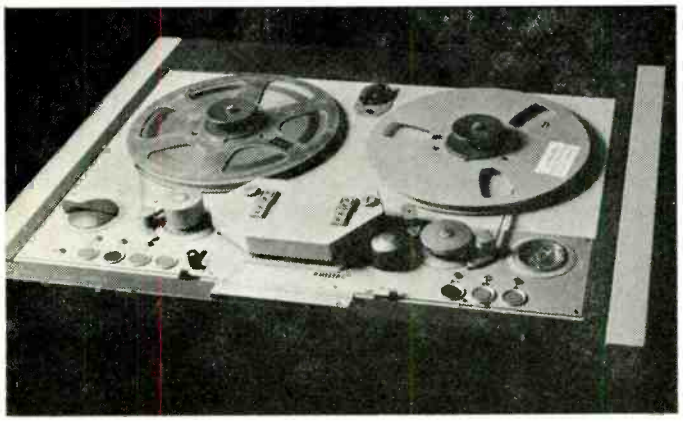
Name_____

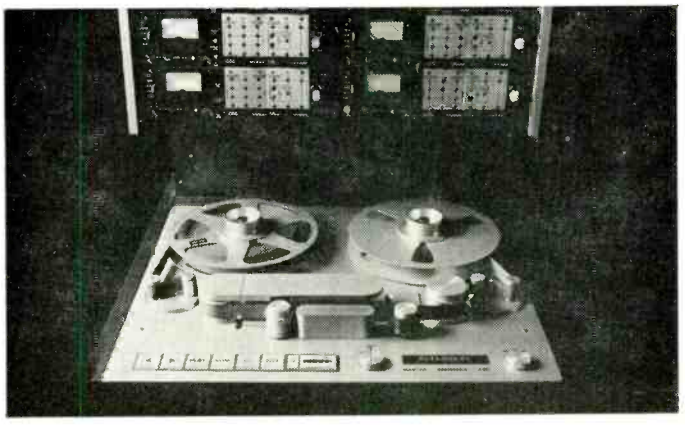
Address_____

SS2

They're not much use without us.







There's nothing quite so frustrating in this world as a tape recorder without tape.

So BASF make a tape for every tape recorder manufactured anywhere in the world.

Everything from $\frac{1}{8}$" LH cassettes right through to 2" tapes for all major studios. More than 128 different types in all.

Which is not really surprising when you think that BASF were the first company in the world to make tape.

So if you've got a tape problem — we've got a tape answer — call us and see for yourself.

BASF United Kingdom Limited,
Knightsbridge House,
197 Knightsbridge,
London SW7 1SA
Telephone: 01-584 5080

BASF

NEWS

EMI win commercial radio contract

EMI HAVE WON the £160,000 contract to build the IBA's commercial radio transmitters in London, Birmingham, Glasgow and Manchester. The two aerials for London and Birmingham will be the first of their type in the country, transmitting circular polarised vhf. Such systems have already been used in the United States to improve reception on hand and car radios.

The London aerial, 18m high, has now been mounted on the top of the IBA's 153m television mast at Beulah Heights near Croydon. The aerial will be used to transmit both the London news station and the general station to the London area. The Birmingham station's programs will be received from a similar arrangement on top of the 300m high Lichfield transmitter.

The contract also calls for four medium wave directional aerials to cover four cities. Each of these aerials comprises groups of three or four mast radiators with an average height of 67m and a spacing distance of 122m. These will not be built at existing IBA transmitter sites but at new locations near the cities they serve. A spokesman for EMI said they were not at liberty to disclose the name of one of the cities and the only additional information EMI were able to give was that Birmingham would be getting both a vhf and a medium wave transmitter.

Automix console demonstrated

FELDON AUDIO are completing negotiations for the agency to sell Quad-Eight equipment in the UK, and recently held a demonstration of Quad Eight's automatic mixing console at the Britannia Hotel, Grosvenor Square, London. The event was well attended, particularly considering the rail stoppage with which it coincided. Feldon used their Shirley Bassey multitrack tape to allow visitors to mix down on the equipment themselves.

The Compumix consists of a controller and a processor. The controller takes the form of a 1200 x 410 x 80 mm 24/24 line level mixing console. During mixdown the faders are operated on the console and the final mixdown is achieved by repeated runs through all or part of the tape using the update facility. Level matching problems during the update process have been eliminated by using an led above each fader which comes on when the level is correct for changing. Quad-eight claim that the levels are matched in this way to within 0.2 dB. The reference point is −15 dB.

The information is fed in an SMPTE code to two vacant tracks of the multitrack master recorder or to a separate data machine.

Signals from the faders of the controller appear as dc control voltages. The second part of the equipment, the processor, comprises a rack of voltage controlled amplifiers, power supplies, signal conditioning electronics and a/d, d/a convertors necessary for the system's operation. There is also provision for a bypass of the entire automatic mixing equipment.

When the tape is replayed, the processor translates the digital information on the tape through the ordinary mixing desk which is used either to monitor the mix or to rerecord it. Quad Eight are still investigating the market for their system in this country but they expect a large demand once 24 track desks become commonplace. Provisional price of the system is £9,750.

BBC and IBA charters extended

THE CHARTERS of both the IBA and the BBC have been extended to 1981. In a white paper published in mid March, the government announced their intention not to call for an enquiry into the future of broadcasting; such an enquiry had been recommended by the Commons Select Committee on Nationalised Industries in a report published last September.

According to the Minister for Post and Telecommunications, Sir John Eden, the reason for granting the extension to the charters, which were due to expire in 1976, is that new technical developments were unlikely to have a major impact on broadcasting before the early part of the 1980s. By this the minister is understood to mean the development of cable television.

The white paper, entitled 'Observations by the Minister of Posts and Telecommunications and the Independent Broadcasting Authority', also discusses the introduction of a fourth television channel. The report of the Select Committee on the Nationalised Industries had criticised the running of commercial broadcasting. The white paper is seen as an answer to these criticisms in anticipation of giving the IBA the fourth channel. The committee had suggested that the IBA should, if given the channel, be prepared to run unprofitable educational or social service programs subsidised by the existing commercial channel. It now seems that the government intends the fourth channel to be nothing more or less than a commercial proposition.

Stolen equipment

DURING THE early hours of Sunday February 11, a Revox *A77-1222* (serial *56353*) and an AKG *D190C* microphone belonging to the Enfield Arts Council were stolen from a car parked at Chase Farm Hospital, Enfield. Anyone approached to buy the equipment should contact the Enfield police or Council.

R. Goodman of Decca (left) with W. Whitlock, Quad Eight chief designer, and Dag Fellner of Feldon Audio (right)

Feldon take over Schoeps agency

THE UK AGENCY for Schoeps capacitor microphones, formerly handled by AV Distributors, has been awarded to Feldon Audio Ltd, 126 Great Portland Street, London W1.

Action Video move

ACTION VIDEO, distributors of closed-circuit television systems, are moving their sales and administrative offices to larger premises at 58/59 Great Marlborough Street, London W1. Their production, servicing and technical facilities will stay at 45 Marlborough Street, where there will now be room to expand. Action Video intend to build a showroom on the new site in which to demonstrate a wide range of equipment. They recently won a £50,000 contract to supply Abbey Life with a complete studio at their head office and links to videotape playback units in 45 branch offices.

Revox agency

INDUSTRIAL TAPE Applications would like to point out an ambiguity in their advertisement on page seven of April STUDIO SOUND. They are not the sole UK suppliers of all Revox machines but only for the 76 cm/s version.

Triad move

TRIDENT AUDIO Developments, makers of Triad mixing desks, recently moved to 4-10 North Road, London N7. The premises provide a larger production area and a number of offices, laboratories and work rooms. The new factory should allow them to make up to six large mixing consoles simultaneously.

one good name deserves another

Hampstead High Fidelity/STC

We are main distributors for all STC high quality professional microphones. The complete range is available from stock and can be seen in our Hampstead Showrooms. Professional terms available.

4038
BIDIRECTIONAL
Ribbon
30 Hz - 15 kHz
Impedance: 30Ω or 300Ω
Output: –80 dB ref IV at 30Ω

4104
BROADCAST QUALITY COMMENTATOR'S NOISE CANCELLING LIP MICROPHONE
Sensitivity –84 dB ref IV
Impedance 30 or 300Ω

4021
OMNIDIRECTIONAL
Moving coil
40 Hz - 12 kHz
Impedance: 30Ω
Output: –80 dB ref IV/dyne/cm²

4037 A & C
OMNIDIRECTIONAL
Moving coil
Frequency response:
30 Hz - 12 kHz
Sensitivity: –84 dB ref IV
Suitable for interviewing

4105
CARDIOID MICROPHONE
Small, lightweight and robust, suitable for high quality sound reinforcement
Impedance 30Ω

4115
LIGHTWEIGHT BROADCAST QUALITY NOICE CANCELLING RIBBON MICROPHONE
Impedance 30Ω
Sensitivity 85 dB ref IV

4001G
HIGH FREQUENCY PRESSURE UNIT
as used by leading loudspeaker manufacturers

HAMPSTEAD HIGH FIDELITY
91 Heath Street, Hampstead, London NW3 6SS
Telephones: 01-435 0999 and 01-435 6377

Also at **DESIGN AUDIO**
36 Marylebone High Street,
London, W.1
Telephone: 01-935 4058

PATENTS

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

February 7, 1973

1310336
Siemens AG
Telecommunications systems

1310337
Xerox Corporation
Scanner for distinguishing between background and intelligence areas on a document

1310346
Philips, J A
Electromagnetic surveying equipment

1310361
Plessey Co Ltd
Transformers and circuit arrangements incorporating same

1310377
Western Electric Co Inc
Telephone set speech networks

1310421
Pioneer Electric Corporation
Gramophone turntable unit

1310500
Plessey Co Ltd
Bidirectional amplifier arrangements

1310509
Plessey Telecommunications Research Ltd
Multiplex electrical signalling systems

1310538
International Business Machines Corporation
Data transmission systems

1310575
Matsushita Electric Industrial Co Ltd
Magnetic head assemblies

1310601
Telex Corporation
Tape apparatus

1310602
Telex Corporation
Rotary magazine for carrying a plurality of tape cartridges

1310659
Singer Co
Apparent altitude changes in camera visual system

1310679
Marconi Co Ltd
Monitoring arrangements

1310683
National Research Development Corporation
Graphical input apparatus for electrical apparatus

1310690
Marks, A M
Dipolar electroptic structures and method

1310716
Agfa-Gevaert AG
Cine projector

1310742
Bosch Elektronik GmbH, Robert
Selective call devices for radio receiver

1310791
RCA Corporation
Magnetic head structure and process

1310794
Thomson CSF
Rectilinear polarisation antennae

1310807
Saint-Gobain
Transparent panel of composite safety glass provided with an antenna conductor

1310816
Siemens AG
Oscillator circuit arrangements

1310853
Nittan Co Ltd
Sound generator

1310891
Post Office
Time division multiplex communication systems

1310944
RFT Messelektronik Dresden, VEB
Circuit arrangement for achieving variable transfer functions

1310950
Agfa-Gevaert AG
Apparatus and process for the production of electric charge distributions

1310987
Siemens AG
Signal channel fault indicating systems

1310991
Siemens AG
Apparatus for providing a visual display as a function of time of variations in value of a time-dependent quantity

1311012
Teletype Corporation
Character display cursor

1311027
Westinghouse Brake & Signal Co Ltd
Vehicle communication apparatus

1311129
Western Electric Co Inc
Colour television cameras

1311131
Hughes Aircraft Co
Electronic image motion stabilisation system

1311134
General Electric Co Ltd
Electrical automatic gain control circuits

1311137
Kombinat Robotron VEB
Method for the magneto-optical interrogation of the information stored in a magnetisable storage medium

1311138
Centre National D'Etudes Spatiales
Devices and circuits for switching high-frequency energy

1311184
Philips Electronic & Associated Industries Ltd
Convergence correction circuits

February 14, 1973

1311212
Burroughs Corporation
Modular disc file unit

1311251
Burroughs Corporation
Data handling systems

1311253
Compagnie Industrielle Des Telecommunications Cit-Alcatel
Apparatus for detecting a free channel in a telecommunications system

1311283
Marconi Co Ltd
Electronic character generating apparatus

1311344
Sanders Associates Inc
Electric display apparatus and circuit

1311345
Sanders Associates Inc
Position busy signalling apparatus

1311346
Sanders Asscciates Inc
Electric circuit and display system

1311347
Sanders Associates Inc
Ramp voltage generator

1311440
Sperry Rand Corporation
Light deflectors

1311503
Dick Co, AB
Display device including roll and crawl capabilities

1311532
Collet, M N
Electronic device for plane graphical representation with perspective effect

1311564
APT Electronic Industries Ltd
Magnetic recording and like apparatus

1311599
Fluckiger, M
Shoulder supports for violins or similar musical instruments

1311603
Minnesota Mining & MFG Co
Film cartridges

1311620
Ampex Corporation
Slot antenna

1311713
Sanders Associates Inc
Multiple choice display systems

1311737
Soc Industrielle Honeywell Bull
Multichannel unit of magnetic heads and a process for fabrication thereof

1311745
Philips Electronic & Associated Industries Ltd
Quadrature-modulated carrier decoder arrangement

1311763
Iwatsu Electric Co Ltd
Circuit for controlling the brightness of the scanning spot in a cathode ray tube

1311782
Teldec Telefunken-Decca Schallplatten GmbH
Method of producing gramophone-record stampers

1311783
Matsushita Electric Industrial Co Ltd
Multitrack magnetic head assemblies

1311787
Matsushita Electric Industrial Co Ltd
Pattern generating device

1311861
Metro Goldwyn-Mayer British Studios Ltd
Colour filter devices for contact printing machines or cinematograph projecting machines

1311891
Viatron Computer Systems Corporation
Video data display system

1311921
Ricoh, KK
Directional light transmitting screens

1311959
Matsushita Electric Industrial Co Ltd
Method for copying a recorded tape

1311967
Burroughs Corporation
Magnetic recording means

1311971
Romania, Ministerul Fortelor Armate
Microwave horn antennae

February 21, 1973

1312085
Sony Corporation
Counter for a tape record/playback mechanism

1312161/2
North American Rockwell Corporation
Electronic musical instruments

1312217
Sony Corporation
Frequency doubler circuits

1312282
Sony Corporation
Cassette having means thereon to vary its size

1312291
Goblin (BVC) Ltd
Audible alarm devices

1312323
Rosemount Eng Co Ltd
Signal processing circuits

1312334
Matsushita Electric Industrial Co Ltd
Magnetic recording and reproducing device

1312345
Olympus Optical Co Ltd
Tape recorders

1312356
Sperry Rand Corporation
Magnetic recording apparatus

1312361
Hughes Aircraft Co
Synchronised and continuously variable dc power supply

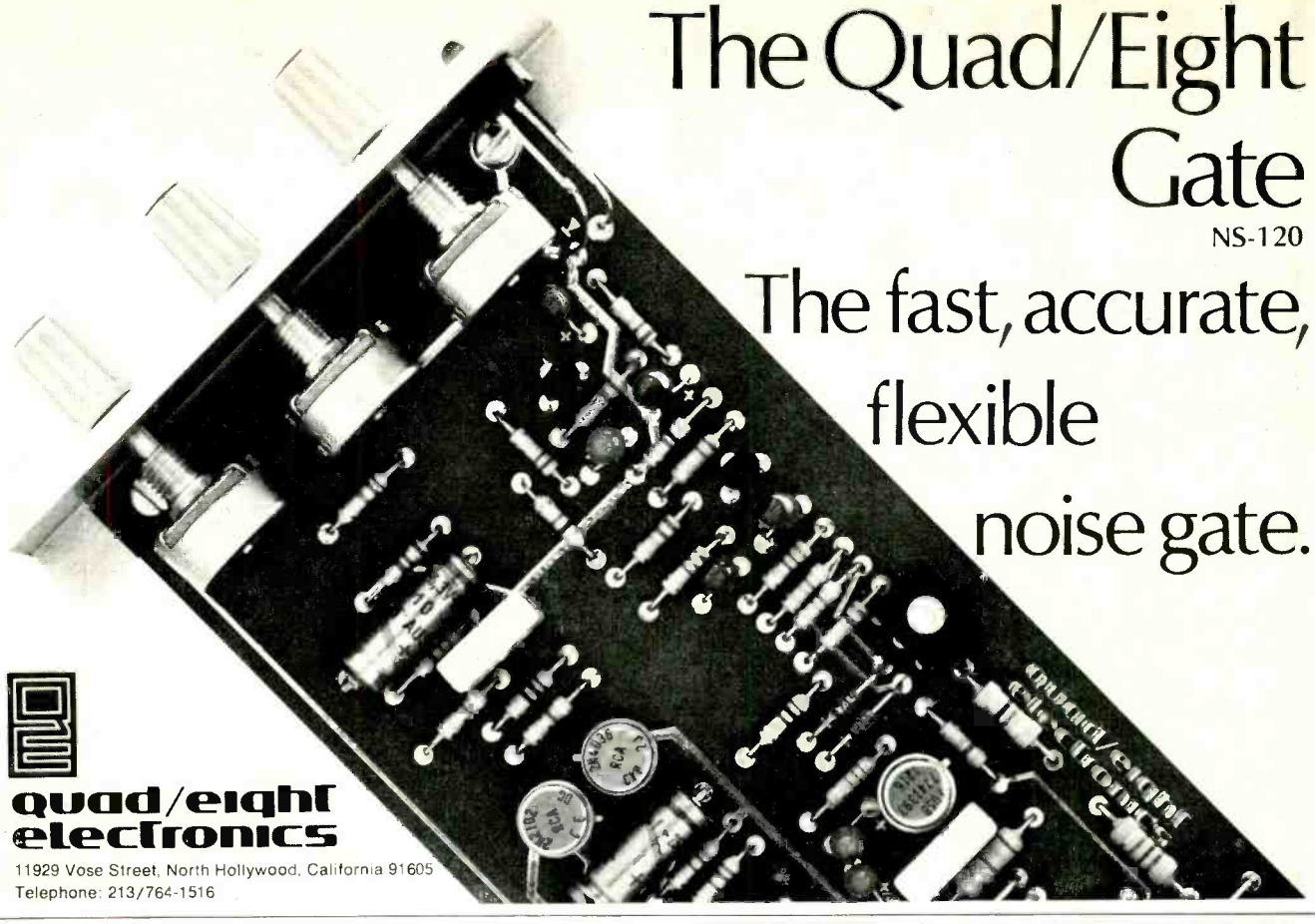
1312418
Philips Electronic & Associated Industries Ltd
Television tuner circuits

26 ▶

The Quad/Eight Gate

NS-120

The fast, accurate, flexible noise gate.

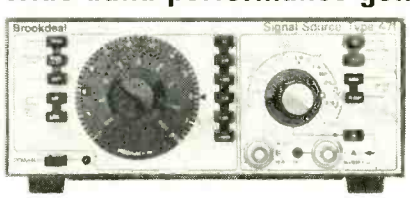


quad/eight electronics

11929 Vose Street, North Hollywood, California 91605
Telephone: 213/764-1516

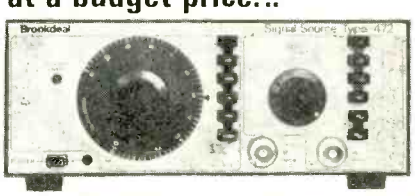
Choose your signal source!

I want the best low-distortion wide-band performance going...



It must be the Brookdeal 471 ! Radical new thinking in oscillator design gives extremely low harmonic distortion (typically 0·05% up to 10kHz) and total freedom from amplitude bounce. Six frequency ranges cover 0·001Hz to 1·1MHz, controlled manually or by an external voltage. Four decade continuous programming in log mode, two decade in linear. Output is sine or square wave from 3·16Vrms to 1 μVrms, calibrated to an accuracy of ±1%. A second output gives 3Vp–p for triggering etc. Square wave risetime is typically 30ns. Output may be switched on or off by a front panel push button. Get the full data – you'll be even more convinced !

Give me a really good oscillator at a budget price...



The new Brookdeal 472 is your best buy. A sensibly priced oscillator that still offers outstanding performance in a soundly engineered instrument. Frequency control is linear, having a two decade sweep on each range, covering 0·1Hz to 1·1MHz with manual or external programming. The output has complete freedom from amplitude bounce and low harmonic distortion (typically 0·1%). Waveform may be either sine or square. Amplitude is continuously variable from 5Vrms to <500μVrms, calibrated to an accuracy of ±1%. The second output gives a square wave of 3·5Vp–p for triggering etc.

Brookdeal

Brookdeal Electronics Ltd., Market Street, Bracknell, Berks.
Telephone Bracknell, (STD 0344) 23931 Telex 847164.

PATENTS

1312452
United Kingdom Atomic Energy Authority
Apparatus for measuring thickness
1312484
CTS Corporation
Electric circuit arrangements incorporating resistors
1312488
Digital Information Devices Inc
Capstan for driving tape
1312506
Standard Telephones & Cables Ltd
Waveguide antenna
1312508
Marconi Co Ltd
Capacitive transducers
1312516
Rank Organisation Ltd
Fibre-optical scanning apparatus
1312535
Compagnie Industrielle Des Telecommunications CIT-Alcatel
Capstan drive arrangement suitable for high speed intermittent tape drive
1312569
Hitachi Zosen KK
Apparatus for taking hemispherical motion pictures
1312597
Honeywell Information Systems Italia Spa
Frequency-to-voltage converter device
1312744
Bell & Howell Co
Dual speed machine handling magnetically striped cards and cards for same.
1312747
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Methods and devices for operating a piston siren by temperature responsive control of a drive source
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Antenna system for vhf and uhf radio direction finders

February 28, 1973
1312853
Sanyo Electric Co Ltd
Video tape recorders
1312868
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Arrangement for selecting and representing specified portions of an image
1312876
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1312895
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Combined high tension pulse voltage and oscillating voltage generator
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1312935
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Suppressing interference in receivers of electrical signals
1312943
Burroughs Corporation
Current-switching amplifiers
1312965
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Antenna system
1312985
Eastman Kodak Co
Film review mechanism for self-threading motion picture projectors
1313019/20
JFD Electronics Corporation
Antenna assemblies
1313044
Laboratory Data Control Inc
Integrating chart recording system
1313057
Brown Boveri & Co Ltd
Magneto-optical probes
1313098/9/1313100
Picker Corporation
Apparatus for recording patterns of electromagnetic radiation
1313151
Computer Image Corporation
Computer animation generating system
1313178
Beauviala, J P
Recording and reading device
1313194
International Business Machines Corporation
Scan speed error display apparatus
1313196
Sony Corporation
Comb filter circuits
1313206
Hill & Son, William and Norman & Beard Ltd
Organs
1313395
Western Electric Co Inc
Visual display apparatus
1313405
Energy Conversion Devices Inc
Electroluminescent arrangements
1313412/3
Matsushita Electric Industrial Co Ltd
Electrophoretic image reproduction
1313419
RCA Corporation
Television amplifier circuits
1313420
RCA Corporation
Noise cancelling circuits
1313423/4
Olympus Optical Co Ltd
Tape cassettes
1313535
Parke Davis & Co
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1313536
Eastman Kodak Co
Take-up mechanism for strip handling apparatus
1313551
Marconi Co Ltd
Capacitive transducers
1313567
Siemens AG
Carrier frequency systems
1313591
Chromatix Inc
Acousto-optic devices

Automatic bass playing

THOMAS ORGANS detail in BP 1,296,593 another invention in a field which, to my sorrow, appears to be of growing interest—namely electronic keyboard instruments which generate automatic bass lines.

A keyboard, either a pedal or hand, has the usual series of switches and output lines but these control a series of drivers which are arranged in the musical circle of fifths (F, C, G, D, A, E, B, F♯, C♯, G♯, D♯, A♯, F and so on). Each keyboard switch line goes to two adjacent drivers so that each driver receives inputs for two notes adjacent round the circle of fifths. In fig. 1 the keyboard *11* feeds drivers *13* via lines *12* and each driver *13* has its respective note indicated along with the respective pair of notes, the respective pair being the driver note plus its musical fifth. The crux is that the drivers are more sensitive to the input of their respective note than to the input for its fifth. Also, the keyboard is so arranged that the level of the outputs on its lines *12* can be controlled. At a first level the drivers will operate if they are receiving both inputs; at a second level if they receive an input for their respective note; and at the third level if they receive either input. What comes out of all this is that, by adjusting the output level and using a scanner, bass notes corresponding to all notes of a chord played on a manual can be automatically played in sequence to provide a walking bass line. Alternatively, bass notes corresponding to the root and fifth of a chord can be played alone automatically—depending either on a full chord or simply a root note. An automatic rhythm device is used to sound the bass notes in various sequences and rhythmic patterns.

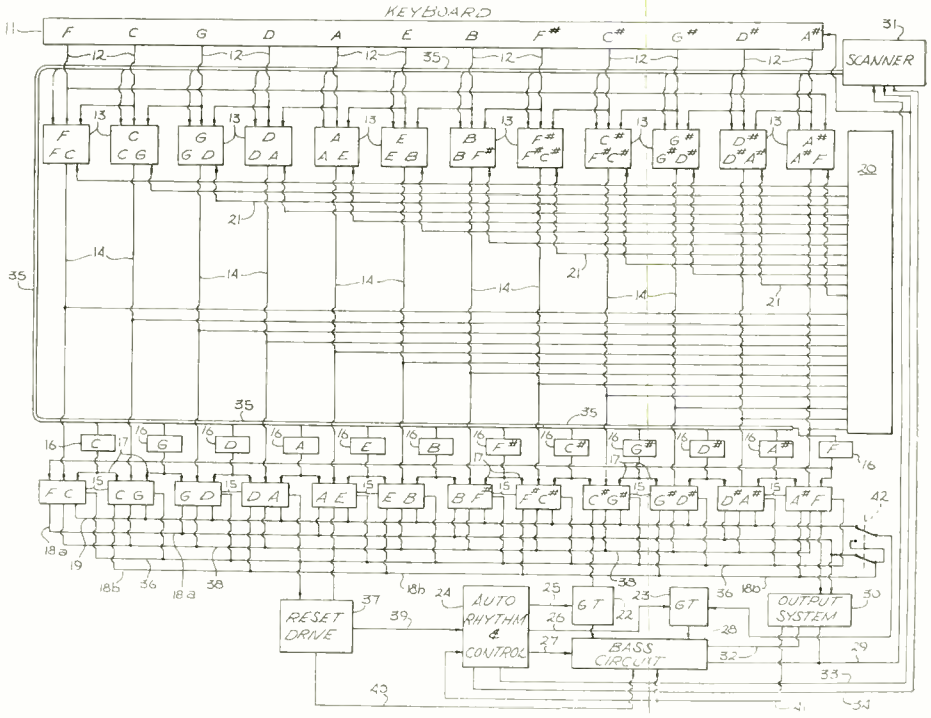


FIG. 1

Good bass lines are the foundation of pleasing music and this kind of automation (even though it may be theoretically and harmonically correct) is not what music is all about. A.H.

Mixing between colour and monochrome tv

WHEN A CROSS-FADE is made between a colour and a monochrome signal, and the colour burst is present only in the colour signal, the chrominance agc in the receiver will attempt to maintain the colour information and will degrade the picture. This will be true until the moment when the mix is completed, when the colour-killer operates. Using a combination of burst-sensors and logical OR gates (**fig. 5**), the patentees arrange for the colour-burst to be added to the monochrome signal *during* the cross-fade, turning itself off as soon as the signals are totally monochrome. What is done with most other colour mixers is simply to gate the colour burst into the *output* from the mixer: this has the advantage of simplicity and saves the receiver colour circuitry switching on and off during the program. There may be some subtle reason for EMI's elaborate solution to this non-problem, but they do not give it in BP 1,293,847. **R.S.**

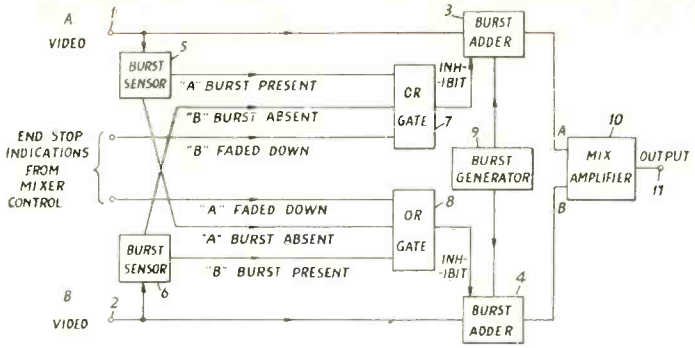


FIG. 5

Telerecording synchronisation

CENTURY 21 FILM Props Ltd describe in BP 1,295,663 an apparently straightforward method of synchronising a television playback system (e.g. a vtr and monitor) to a film camera, using pulses derived from the camera shutter to actuate a sync pulse generator. The normal tv frame rate being 25 f/s, and the camera rate 24 f/s, the speed of either or both systems must be modified. The system used would not look new to anyone familiar with vtr servo systems or film recording techniques. **R.S.**

A field sequential colour television camera

THE PROBLEMS of recording colour signals on to disc and tape being virtually solved, we are now awaiting practical low cost colour television cameras. Philips have a patent here for improvements to the old idea of the field-sequential camera, with a colour wheel spinning in front of a normal monochrome camera tube. This wheel traditionally has alternate segments of red, green and blue filter and is turned by a motor synchronised to the camera field scan circuits. The resulting field-sequential colour signals are then recombined using a minimum of two field delays so that the three colour signals are available simultaneously at all times.

As explained in BP 1,293,315 the problem with the above scheme is that earlier field delay systems have consisted either of a camera looking at a crt display or cubic metre of electronics, neither of which makes for a small low-cost colour camera. Philips' solution to this problem is the kernel of their patent. By separating the spectrum of each field into low frequency coloured information (0 to 500 kHz) and high frequency luminance (500 kHz to 5 MHz), they only need low bandwidth field stores.

Spectral division is carried out in block *15* of the **fig. 6** camera circuit and uses two short-term delays (100 to 140 ns) to generate an aperture correction signal which is subtracted from the main chain at amplifier *23*, so that the signal at *D* now consists of sequential chrominance plus low bandwidth luminance information. Two low bandwidth field stores supply the sequential colour signals at *J*, *K* and *L* but, instead of combining them, a three-pole three-way electronic commutator *27* driven by field syncs S_V produces simultaneous and separate colours at *N*, *P* and *Q*.

Instead of using red, green and blue filters on the colour disc, a clear filter replaces blue so the linear matrix *31* is used to recombine red, green and luminance signals at *Q*. The aperture correction signal (which is to say the monochrome signal of 500 kHz to 5 MHz) is now added to the red, green and blue signals at summing amplifiers *32*, *33* and *34*.

The patentees point out that their system is immune from the coloured smearing that results from differential lag in a multitube camera. Also the displacement between the first and third fields in a normal sequential camera is much reduced by the use of the aperture correction signal for the detail in the picture.

This patent would be the answer to a cctv prayer if a small low-cost field store could be perfected. **R.S.**

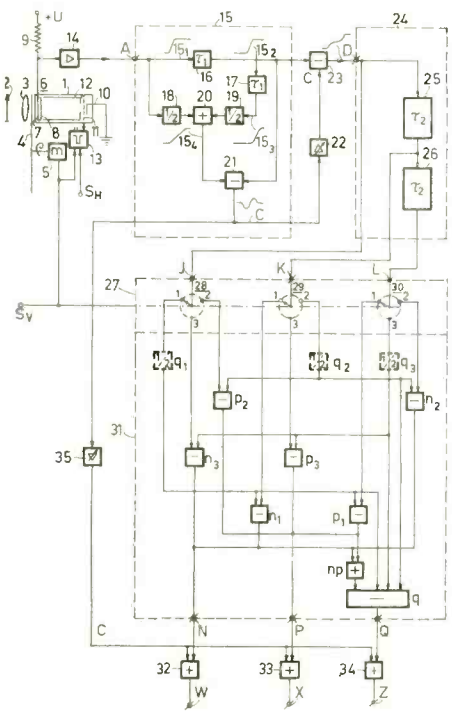


FIG. 6

Laser beam deflection

AMONG THE plethora of new display system patents, BP 1,292,989 from Texas Instruments is an interesting one which, although applicable to any light source, is clearly meant for use with a collimated laser. The basic problem with using laser light in television display systems is scanning. Mechanical scanning is difficult because of the high accelerations necessary to return the mirror system during line flyback time and TI's contribution to the art is their solution to this problem. The heart of their deflection system is a magnetostrictive equivalent of a mirror galvanometer (**fig. 7**) which is capable of sinusoidal oscillation with periods down to one-third of the line scan time (frequencies up to 45 kHz). Using two such devices, one operating at line frequency and the other at thrice line frequency, the first two terms of the Fourier series representing a sawtooth waveform can be generated. This is found to be an adequate approximation for television scanning. The modulated laser beam is switched between two such oscillating systems (**fig. 8**) so that, by only using the positive slopes of the triangular waveform, line scans with rapid flyback are achieved. **R.S.**

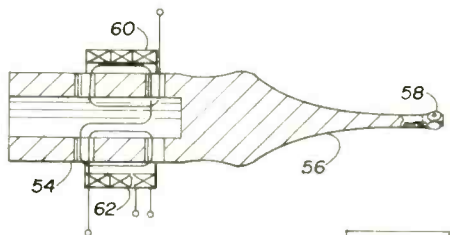


FIG. 7

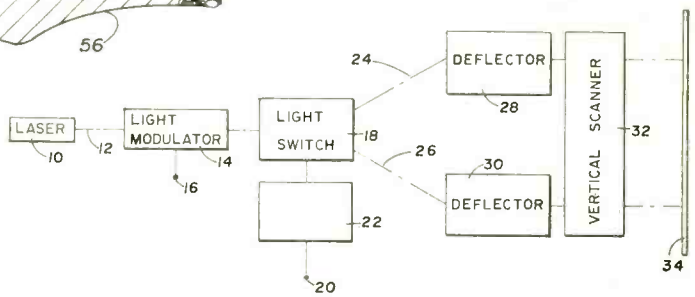


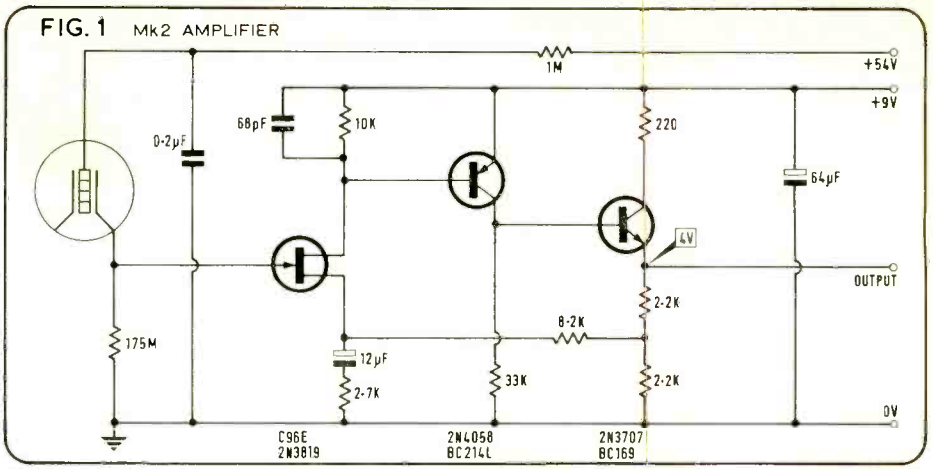
FIG. 8

Constructing a quadraphonic capacitor microphone

PART ONE

JOHN FISHER

The development and construction of a quadraphonic capacitor microphone is described in this short series. Though unsuitable for tetrahedral formats, John Fisher's design is intended for horizontal-surround quadraphony.



I DESCRIBED in 1971 the construction of a simple twin-diaphragm coincident stereo microphone. To judge from the number of letters I have received from as far away as South Africa, there was indeed some interest among readers in the subject of building stereo microphones along the lines described and there has been a worthwhile correspondence on the subject. This article begins with one or two points which have come up in letters and in building subsequent versions of the microphone. Later articles in this series will describe the construction of a small, battery operated variable polar diagram *quadraphonic* capacitor microphone on similar principles.

Incidentally I understand that this is probably one of the first four-channel microphones to be built in a single housing and, if anyone seriously involved in quadraphonic recording would like to investigate the potential of a properly coincident technique, I would be pleased to hear from them if they write in the first instance c/o STUDIO SOUND.

Amplifiers

I have found with the stereo microphones that, if you *can* get resistors of 150-300M ohms, it is better than using 1G ohm resistors (as the prototype did) and rolling off the rumble by reducing the feedback decoupling capacitor; the lower value of gate resistor removes the lowest troublesome frequencies before they get into the amplifier and also makes the circuit more tolerant of gate-leakage in the fet. Anyone stuck with 1G ohm resistors should definitely throw away extreme bass in order to avoid rumble from passing traffic and ventilation systems.

Secondly, the dynamic range of the microphone can be improved, if desired, by simple modifications to the original circuit. **Fig. 1** is the Mk 2 circuit, readily derived from the Mk 1 previously published, and has an improvement of at least 6 dB in the overload point into a high impedance load. The Mk 3 amplifier in **fig. 2** will feed lower impedance loads.

The output from the prototype microphones is intentionally higher than with many commercial capacitor microphones, in order to avoid the need for balanced line operation and high sensitivity microphone amplifiers. This high output level, very roughly of the order of 30 mV, could overload some microphone amplifiers. Indeed, if the microphone is used very close to sound sources which are very loud, it is conceivable that the head amplifier itself could overload. In such cases the highly linear and very simple unity-gain arrangement of **fig. 3** should prove suitable.

Components

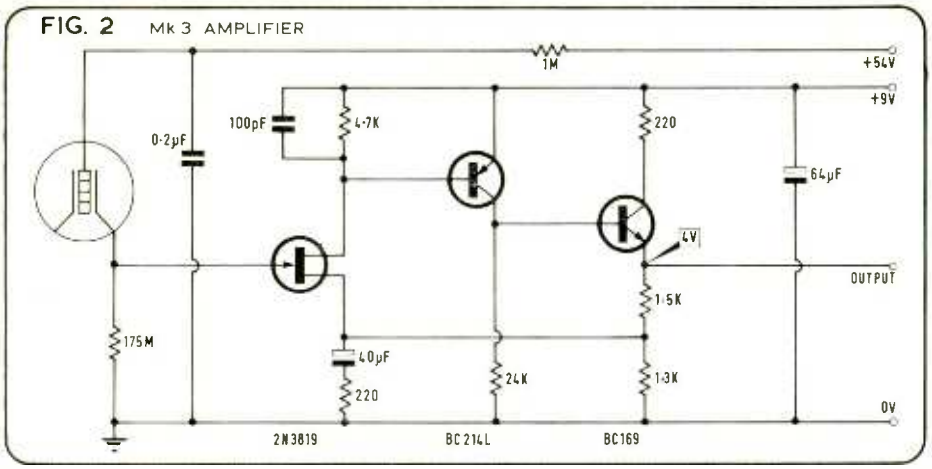
Some readers have reported difficulty in obtaining the Semitron *C96E* from the distributors (Semitron Ltd, Cricklade, Wilts.). I found them helpful when I bought my batch but, if you don't, substitute the readily available *2N3819*. If you happen to get a noisy or leaky specimen, first try interchanging source and drain lead. If that doesn't improve matters, they are now cheap enough to throw into the spares box. Any low-noise silicon transistors, plastic encapsulated, will do for the pnp and npn bipolars. Resistors: 125 mW are okay so long as you don't overheat them, and are a convenient size. I have located a number of high-value Welwyn and Morganite resistors in new and secondhand condition via surplus stores; if anyone is having difficulty I may be able to help. The price is about 50p each, plus postage, and does vary.

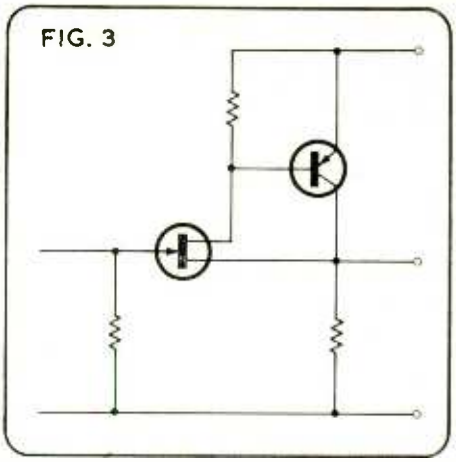
Capacitors: tantalum bead capacitors are now cheap enough to use extensively and are much smaller and probably more reliable than ordinary electrolytics. Electrovalue of 28 St Judes Road, Englefield Green, Egham, Surrey, can supply Siemens tantalum bead capacitors, resistors, hardware and the semiconductors. Celdis Ltd of 37 to 39 Loverock Road, Battle Farm Trading Estate, Reading, Berkshire, can supply Union Carbide tantalum capacitors. G.F. Milward of Drayton Basset, Tamworth, Staffs, can supply miniature tantalum capacitors. LST Electronic Components Ltd, 7 Coptfield Road, Brentwood, Essex, can supply Siemens capacitors and also semiconductors. Radiospares have suitable multicore cable.

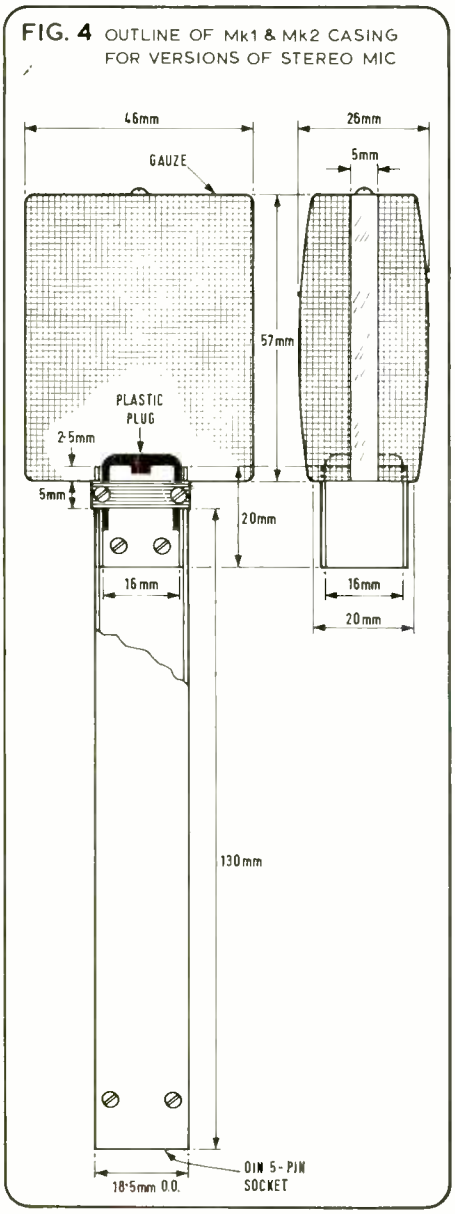
I am investigating new sources of the sputtered 25 gauge Melinex, which used to be obtained from George M. Whiley Ltd of Victoria Road, South Ruislip, Middlesex. I understand there have been some difficulties in obtaining supplies and, if any reader could let me know of other sources to pass on, I would be grateful.

Constructional Details

Fig. 4 shows the casework used on the Mks 2 and 3 microphones which has proved as







acoustically suitable and aesthetically more interesting than the Mk 1 design.

In the original unit, the head amplifiers were built on a strip of Veroboard. This made wiring very simple but, when building subsequent microphones, I found it was possible to get more symmetrical and compact amplifiers by dispensing with the Veroboard altogether and building between drilled plastic or paxolin end spacers. The components are self-supporting apart from positive, negative and ht bus-bars. The result has been a neater layout and a reduction in the length of case necessary to house the amplifiers. The fet gate leads and the 'hot' ends of the high-value resistors should be left in mid-air to minimise the chances of leakage. There isn't room for anything to flap around anyway! Capsule leads are taken straight to the fet gate.

It has been suggested that a resistor of about 1M ohms should be placed in series with the capsule centre plate and after the ht decoupling capacitor, to limit the fet gate current if the capsule arcs on test. Don't be tempted to leave it there. I did and spent a very unhappy evening chasing noise in the microphone until I realised what I had done. The resistor appears in series with the input and contributes noise. If it is not to degrade the s/n ratio, it must be shorted out when the microphone is otherwise working satisfactorily, or be replaced by a very much smaller resistor.

If you are using a mains soldering iron, do remember to unplug it just as you are soldering the fet leads in. It takes longer, plugging and unplugging, but not as long as replacing damaged fets!

Towards quadraphony

The original amplifiers were something of a sledgehammer approach to the problems of keeping down noise and providing a very linear amplifier with voltage gain. When it came to constructing the four amplifiers for the quadraphonic microphone to fit into the housing, which was to be a short tube of the same diameter as the casing of a standard Cannon eight-pin F & E plug, I chickened out of the knitting game and settled for two-stage amplifiers working off a higher voltage rail, which has proved successful. Since the circuit may appeal to anyone concerned only with going as far as two channels, it is also given here, in fig. 5.

Motives

There were several reasons why the quadraphonic microphone came to be built. First, I let myself in for doing a quadraphonic recording (flat, not tetrahedral) and this used my two back-to-back cardioid stereo microphones, set at right angles. Though musically the recording left a lot to be desired, technically the results were good enough to convince my colleague and I that quadraphony was our next step. 30 ▶

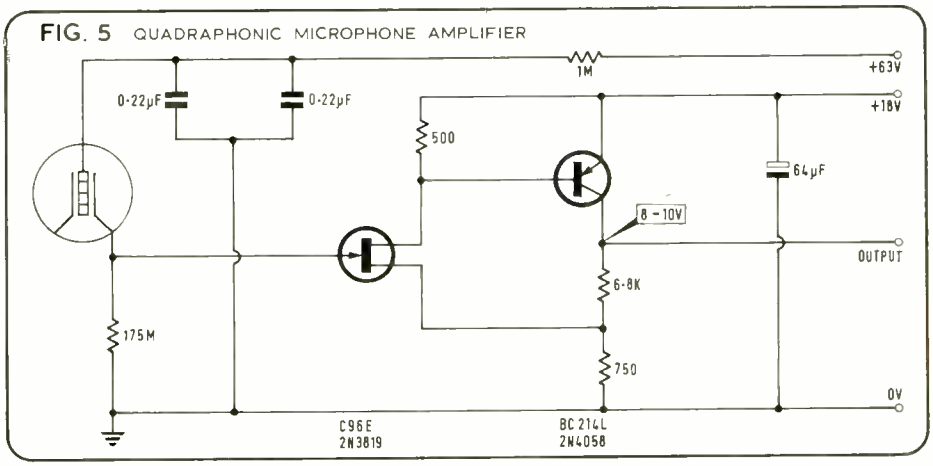
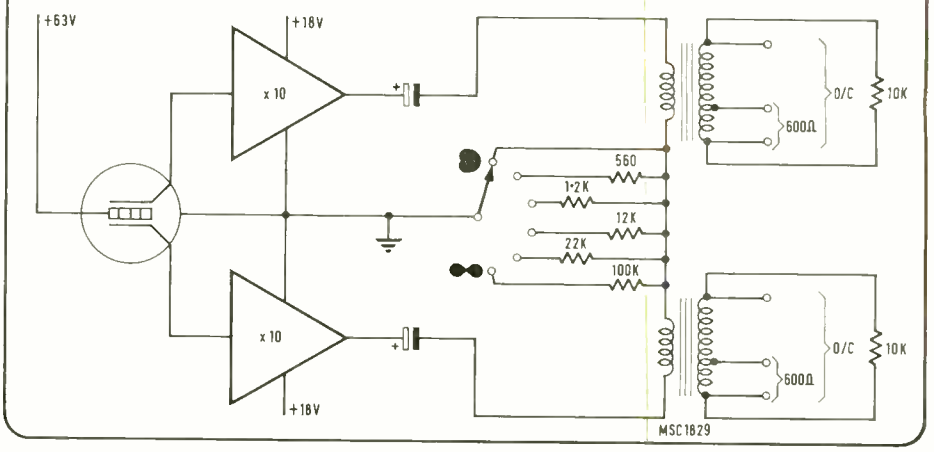


FIG. 6 BLOCK CIRCUITRY FOR VARIABLE POLAR DIAGRAM, SHOWN FOR DIAGONALLY OPPOSITE CHANNELS (e.g R_f, L_r); THE OTHER PAIR OF OUTPUTS DERIVED SIMILARLY FROM SECOND CAPSULE AT APPROX 90° TO THE FIRST.



Second, I already had a pair of capsules with the idea of making a variable polar diagram stereo microphone along the lines of the AKG *C24*. Although very satisfied with the results from the existing stereo microphones, which are unobtrusive in a building where an audience is present, I did feel the need on occasions to have the facility of variable polar response and variable angle between capsules.

Thirdly, I wanted to try out in practice the idea of obtaining variable polar responses by matrixing, rather than doing things conventionally by varying the polarising voltage on one diaphragm relative to the centre plate while keeping that on the other constant. There is little against and much for the conventional way but it does mean extra ht batteries for polarising (unimportant if you are using a mains supply). Also it does use both sides of a capsule to obtain a single output, whereas by matrixing very simply one can get a variable polar response (admittedly only easily over the cardioid to figure-of-eight via cottage loaf range) from both sides of a double diaphragm capsule.

At this point I should recall, for those who did not see the 1971 articles, that the microphones use a double-diaphragm capsule which owes much to the AKG *C12* capsule design, and which was described in *Hi-Fi News* in 1963. Photostats giving constructional details for the capsules are available from the editorial office, but do bear in mind that the plans must be followed precisely without attempting to 'improve' the design by intuitive alterations, and the work must be carried out to very close tolerances.

In view of my requirements, the two capsules were mounted in a housing (to be described later) nominally at 90° to one another, with a swivel arrangement which allows one capsule to be rotated ±30° relative to the nominal 90° setting. The outputs from the four capsule halves are fed to four separate head amplifiers. They are amplified by a voltage ratio of 10, approximately, and fed down a multicore cable, with ht, positive supply, negative return and earth, to the power pack.

Two sides

At the power pack, which also sets the polar diagrams, the signals from the two sides of one capsule are fed to corresponding sides of a pair of transformers (the familiar *MSC1829*, normally used the other way round in amplifiers based on the BBC design which has been described in many variants in these pages). The other ends of the transformer windings go to the top of a switched (or variable) resistor.

It can easily be seen that, when the value of the resistor is zero, one side of each transformer is earthed and the output from each secondary winding of the pair will be the normal (cardioid) output of one half capsule. So one has two back-to-back cardioids again. If the resistor now tends to infinity (tends to rather than being, in order to keep the dc conditions right on the coupling capacitors) it can be seen that the output from one transformer will be the difference signal between the two capsule outputs. Cardioid minus cardioid gives figure-of-eight, since cardioid can be regarded as the sum of an omni and figure-of-eight and on subtraction the omni components cancel; the output is therefore a figure-of-eight and the output in the other channel will be the same but in anti-phase. The same process is repeated for the other capsule. The result is four variable polar responses in pairs set diagonally to one another with the angle between the pairs variable by 30° about the nominal 90°. At intermediate settings, an output between figure-of-eight and cardioid will be obtained, the frequently termed 'cottage loaf' or hypercardioid output pattern. The value of resistor required to give the half-way pattern will depend, using this method, on the loading of the outputs, including—when only a pair are used for stereo—the loading on the unused outputs. The values shown were found to be satisfactory. It may be convenient to have dummy resistive loads available and the pattern required should be set up by ear to give the right *sounding* results.

Additional switching would be needed to provide an omni response and this is not often required. Otherwise the method appears to be as elegant as the variable voltage method and is more economical in providing four outputs instead of two from two capsules. I suspect that, for quadraphonic use alone, the microphone could be built without the swivel arrangement. Since two channel use is still likely to account for a good deal of the microphone's work, however, the time spent in providing the swivel arrangement was worthwhile.

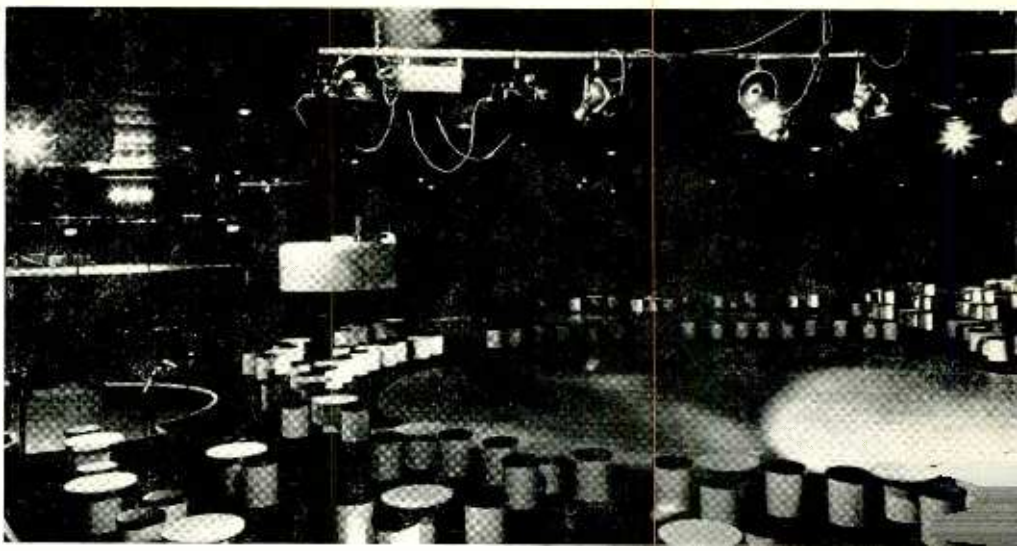
A minor disadvantage of this simple matrixing to obtain the variable polar diagram is the attenuation of the output signal as figure-of-eight is approached. Apart from the need to adjust channel faders or presets accordingly, this does not appear to be a serious disadvantage.

The '60 ohm input' tapping on the transformer is used to provide a floating output to feed 600 ohm mic amplifiers, although it should be possible to feed lower impedance inputs satisfactorily.

This appears to be an appropriate point to give details of the prototype power pack and variable polar diagram control. As before, they are built in a diecast box, which contains Cannon F & E eight-pin input socket, coupling capacitors, decoupling capacitors for the supply, four transformers (conveniently mounted on aluminium panels in the slots provided for printed circuits), a miniature AB Electronics two-pole six-way switch and resistors, four insulated three-contact jack sockets, a seven-pin DIN socket for floating outputs from one stereo pair at high and low level, and one five-pin DIN socket carrying the four unbalanced amplifier outputs, unaffected by polar response setting. In addition, the box contains two *PP3* batteries (life conserved if the mic cable is unplugged when not in use) and two Ever Ready *B155* (22.5V) flash/hearing aid batteries; these can be arranged to provide 54 or 63V polarising. The advantage of 54V is reduced risk of arcing but 63V gives a disproportionate improvement in output (and, apparently, s/n ratio), probably because of increased displacement of the diaphragm by the higher polarising voltage. A 0.47 µF capacitor is across the polarising supply in the power pack, in addition to the decoupling inside the mic itself. The eight-pin Cannon plug allows two earth pins as well as screen connection so one is used, with shorting links between the earth pins of the plugs, to put 750 µF across the 18V supply when the microphone cable is plugged in. There would be a lot to be said for providing an extra socket, or using a six-pin socket instead of the five-pin DIN, to allow an external 18V supply to be used when available. The 10k ohm dummy loads on the transformers prevent rf instability which may occur at the cardioid setting when feeding loads greatly in excess of this value.

Part Two will deal with the mechanical construction of the microphone and operational details.

FIG. 1: Auditorium showing protruding stage



Designing a music amplification system

BRIAN POOK*

The live presentation of electronically amplified music raises problems of balance which are often ignored by the performers and despaired of by the audience. In designing and equipping the Manchester Hard Rock Concert Hall, Electrosonic have assembled an audio system forming an integral part of the premises.

*Head of Audio Department, Electrosonic Ltd, 47 Old Woolwich Road, London SE10

UNTIL NOW, a permanent prestige pop concert hall and discotheque installation has not been achieved successfully in Great Britain. However, an adventurous project by Angelique Enterprises has changed this situation with the opening of the Hard Rock Concert Hall and Village Discotheque in Manchester. The auditorium and associated equipment both show a fresh approach to the enormous problems encountered; the design of the auditorium is by Richmond Designs Ltd and the sound, lighting and control equipment by Electrosonic Ltd.

Primarily, economic considerations must decide the audience size necessary for a project of this type, resulting in the need for a very large auditorium for the presentation of popular (and usually therefore expensive) top groups. However, a venue which is used permanently for Pop presentations must not only be capable of use by groups but also economically run on the other five days in the week when a big draw is not available. The obvious solution is to use the concert hall as a discotheque on these occasions. This, however, presents another problem; how to achieve an intimate and exciting atmosphere in a hall filled only to say one-third of its total capacity. This problem was overcome here by designing the auditorium to be capable of division into two sections using a massive revolving floor, 557 m^2 in area. This unit, the largest in Europe, is capable of carrying 2,000 people and the function of the building may be changed in a single mechanical operation.

The construction of the hall from an existing but unused bowling alley presented further problems as the building obviously possessed no stage, lighting equipment, sound equipment, dressing rooms or other fitments which are standard in even the smallest theatre. The low ceiling height added the final and most difficult problem to overcome.

The existing auditorium structure ruled out the possibility of conventional stage and prosenium arch construction and it was felt that the ideal solution was to build the stage into the auditorium as shown in **fig. 1.** The need to restrict the stage size was worrying in view of the incredible amount of equipment used by touring Pop groups and the low ceiling height caused concern over the problem of sound coverage using conventional techniques. The final solution was to install a permanent massive pa system with a studio control desk and microphone complement. This solution gave two main advantages in that it not only reduced the quantity of equipment on stage but also allowed design features to overcome the difficult acoustic and distribution problems. The deafening sound levels currently demanded, and the ever increasing public appreciation of good quality sound, dictated the need for a system sufficiently powerful to please the most critical group but also possessing quality and distribution impressive enough to satisfy listeners seated anywhere in the auditorium.

Loudspeakers and amplifiers

Obviously the key to a suitable system was the choice of loudspeaker installation. The distance from the stage to the furthest seat is over 30m and the ceiling height slopes from 4.6m at the stage to 2.6m at the auditorium rear. The conventional approach of a huge sound 'wall' emerging from multiple cabinets housing conventional drive units was rejected both from the distribution aspect and for the health of front row occupants! The line-source column approach was deemed unacceptable owing to the lack of penetration and poor bass performance, while the use of loudspeakers distributed throughout the auditorium would give lack of impact and directional information.

It was therefore decided that mid-range and high frequency range horns mounted above the stage would provide the ideal solution. Not only did these units provide the capability of producing the sound levels required, they also gave the projection necessary to achieve high sound levels at the auditorium extremities. The use of this technique gave superb control over the sound distribution owing to the closely defined directional pattern of each horn and resulted in the sound level being acceptable in the front seats. The low weight of these units allowed them to be mounted above the stage perimeter on a spot bar saving valuable space. Further, they were far more efficient than conventional drive units, thus reducing ampli-

fier power requirements. The use of such efficient high frequency units caused a problem in the design of a suitable matching bass speaker system. This was overcome by the use of massive horn loaded bass cabinets arranged to form the front of the stage.

The chosen combination was therefore six bass cabinets each housing two 380 mm drive units capable of handling 80W rms and 12 hf horns with special drive units. The hf horns utilised possessed no segmentation (thus eliminating the interference effects which are an unwanted effect of multicell units) and were constructed with one piece aluminium diaphragm and voice coil assemblies. The bass units housed the crossover networks and contained a variable attenuator, giving variable treble energy to allow for change in auditorium absorption characteristics with change in audience size.

Apart from the main pa, two other requirements existed in the concert hall design: foldback to stage and special effects in the auditorium. For these purposes eight portable loudspeakers were provided, capable of being plugged into numerous points around the auditorium perimeter and on stage. Each of these portable loudspeakers was constructed to house one hf horn coupled with a single 380 mm bass driver, this giving tonal balance similar to the main system although their portability eliminated the possibility of horn-loading the bass unit.

The total electrical power output of the system was obviously dictated by the loudspeaker complement, resulting in a total amplifier power of approximately 1 kW rms with space in the equipment racks to allow extension for further effects and foldback feeds. The amplifiers are standard Electrosonic solid-state rack mounting units modified to give visual indication of thermal overload in case of prolonged overdrive or output short circuit. An additional feature is the fitting of delay circuitry which brings the speaker loads into circuit after a short period, preventing any switch-on surges literally deafening any unsuspecting technician near the stage. The amplifier complement, together with a load patching panel to allow flexibility, was installed in a separate equipment room. The amplifiers were remotely controlled from the main sound control console, all interconnections being balanced giving complete freedom from interference and hum problems.

System central

Owing to the fact that the installation can be used as either a concert hall or discotheque but never both simultaneously, a single control point is possible. A cylindrical console was constructed in a position giving a focal point for the dj and a suitable viewing height across the auditorium for concert hall control. This console, the nerve centre of the system, houses controls for the lighting, special effects, sound, patching, tape and gram machines. This sound and lighting control location gives an ideal means of accurately assessing what is seen and heard by the audience. The lighting and sound desks are placed as shown in the photos, a large viewing window being constructed in the revolving floor wall and a talkback-to-stage facility installed between the control desks. The dj faces the small disco stage and has control of the discotheque sound, special effects and part of the main lighting. A four track machine is installed above the patch panel cupboard and the patch panel hinges outwards to reveal the main cable termination field for the whole system.

Mixing and sound control

The sound mixing desk had not only to be capable of mixing up to 24 microphones on the auditorium stage but also of mixing and panning special sound effects. The solution was to construct a single mixer which was electrically divided into two separate units, a 16 channel four group unit and an eight channel four group unit, the large one being for microphone mixing and the small one primarily for effects. Space consideration dictated the unusual mixer layout, as illustrated, but gave the advantage that a single seated operator could easily control the whole sound system. The four output groups of the effects mixer possess four extra fader controlled feeds which allowed cross feed into the four groups of the main mixer. The mixer desk is therefore capable of functioning as a single 24 channel four group unit with four sub groups from eight of the channels. The facility to generate revolving effects around the auditorium was felt to be essential and a quadraphonic pan pot was therefore fitted, possessing a single input on the patch panel which can be panned between four outputs. Four compressor/limiters are fitted, one on each group output, thus preventing overload and distortion on unexpected transients—or the occasional duff operator!

The mixer would obviously be used by many people unfamiliar with the system and possessing varying levels of technical competence. It was therefore decided that the facilities offered should be simple to use while giving a skilled operator the flexibility he demands. Each channel module is equipped with a sensitivity control, giving either line or mic inputs of varying level, bass and treble equalisation, echo send, panning to groups One and Two and pushbutton routing to the four output groups. The echo send feeds on the channels are automatically routed by the group-routing buttons to group echo outputs, giving the possibility of echo on groups of channels using the single echo unit installed. The panning between groups One and Two allows these to be utilised as a main stereo feed for the overall pa system, leaving the two other main groups for foldback to stage. On the effects mixer, the four output groups are intended to be routed to pairs of effects loudspeakers in the auditorium or discotheque corners, allowing four channel and disc reproduction.

The microphone complement was probably one of the easiest choices to make, the essentials being robustness as well as good performance and economy. After careful comparative testing in order to find the ideal pa microphone, the AKG *D1200E* was chosen as it possessed greatly superior anti-feedback characteristics to other makes, a better tonal balance for the intended purpose, and considerable mechanical strength. The selection of a microphone for bass drum and instrument amplifier use called for a smoother response with a more extended bass performance and therefore the AKG *D12* was chosen. The final choice was a couple of microphones suitable for cymbals, backing trios, acoustic guitars and other applications calling for a cardioid pickup pattern and studio-quality performance. For this application the AKG *D202ES* gives superb results, the variable bass attenuation being an invaluable facility.

The tape machines installed had to be capable of quadraphonic reproduction and almost studio performance; the Teac *A3340* was chosen. This machine proved to be capable of excellent results running at 38 and 19 cm/s and allows the possibility of producing stereo sound plus a digital pulse track for controlling Electrosonic multiplex equipment to sync lighting and projection effects. 34 ▶

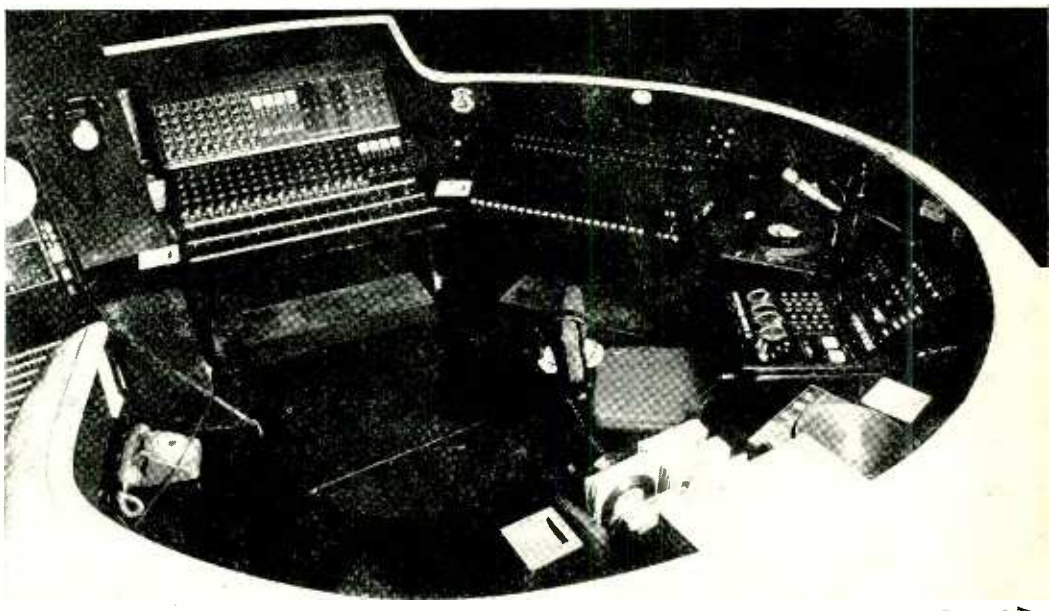


FIG. 2: Control cubicle showing the sound desk, four channel tape machine and patch panel.

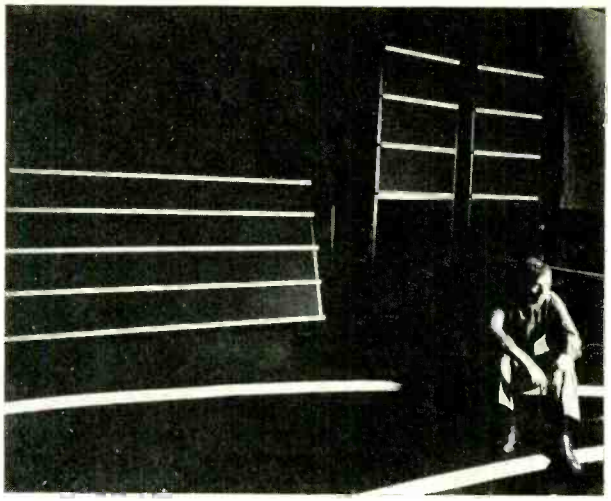


FIG. 3: Two types of Electrosonic loudspeaker.

The design of the discotheque control was approached from scratch with a view not only to incorporating several novel features but ensuring ideal ergonomics. The traditional main control between the two turntables was an obvious choice with control of the discotheque lighting and effects located behind it. Garrard *401* turntables and Goldring *L75* arms were chosen for performance combined with robustness. (Gates were too expensive and the Thorens *TD124* no longer available.) The turntables were modified for fast start by remote mains switching relay and Shure *M3D* pickup cartridges fitted, as these have been found by experience to be the only magnetic cartridge robust enough to be back-cued.

A jingle machine was essential and the latest *Rapid-Q* marketed by Hayden Laboratories was selected. This broadcast jingle unit possesses remote control of stop and start using logic switching, a servo-controlled motor giving excellent wow and flutter characteristics, and studio-standard electronics.

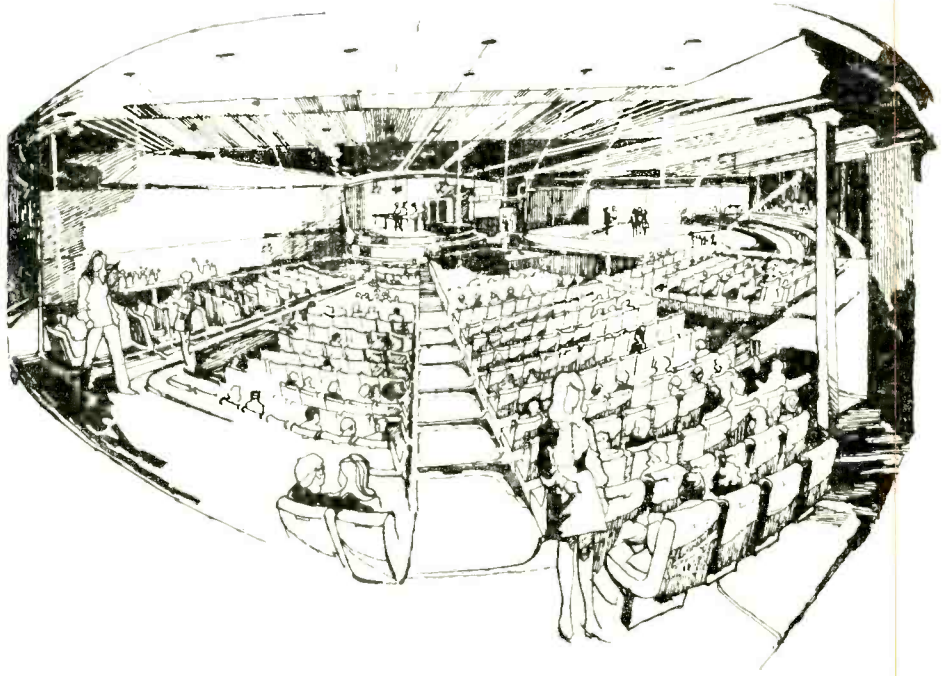
The four main sections of the discotheque control, namely disc One, disc Two, jingle and microphone inputs, were each equipped with their own equalisation and preset level control allowing all faders to be operated to maximum instead of a predetermined level. The faders are unusual in design, being Electrosonic quadrant units with internally illuminating scales, the disc fader scale illuminating on its turntable starting, the jingle fader scale on starting of the jingle machine and the mic fader on releasing the mic mute button or depressing a microphone on/off footswitch. In addition to remote start pushbuttons for the turntables, an unusual feature was provided by fitting an Autocue facility. This allows the automatic stopping of the jingle machine at the end of a jingle to start either turntables, selection of turntables being by a three-position level key with a central 'off' position.

The control unit was constructed with internal provision for quadraphonic reproduction when suitable records are available in quantity. The intended mode of use is four output feeds to four pairs of effects loudspeakers plus a mono feed for two additional bass speakers, these being movable from the stage base into the discotheque. A pan pot was therefore fitted with a changeover switch routing the outputs normally or via the pan pot, which receives a mono input feed. Monitoring was provided via headphones and two VU meters, both being switchable to any source of the final outgoing mix.

Special effects and lighting

The lighting installation consists of a standard theatre two-preset five group stage lighting control board with the two additional features of pushbutton flash and route-to-*Polychromatron* buttons on each channel. The *Polychromatron* is a standard Electrosonic sound-to-light converter unit with the important advantage of automatic gain control. This eliminates adjustment of the *Polychromatron* input level with change in sound system volume. The lighting effect system consists of stroboscopes, *Polychromatron*, colour cycling, colour wheels and slide projection.

The slide projection control is of particular interest, unique in this situation in being controlled via a line multiplex system. This digital control system allows the possibility of installing numerous multifunction control points around the auditorium and discotheque, while completely eliminating high wiring cost and system complexity. The system allows the possibility of simultaneously controlling 240 separate functions via a single twin inner screened cable linking three-pin control outlets. The control point of the console is equipped with encoding electronics which convert the action of slide selection into digital control signals, each projector group possessing its own decoding electronics. This enables any set of equipment to recognise only its own particular control functions, no matter where it is plugged in. The system is capable of controlling not only the slide projectors but also tape machines, special effects, cueing and intercommunication as required.



APRS 73

EXHIBITION OF PROFESSIONAL RECORDING EQUIPMENT LONDON

FRIDAY JUNE 22nd
10.00—21.00 HOURS

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10.00—18.00 HOURS

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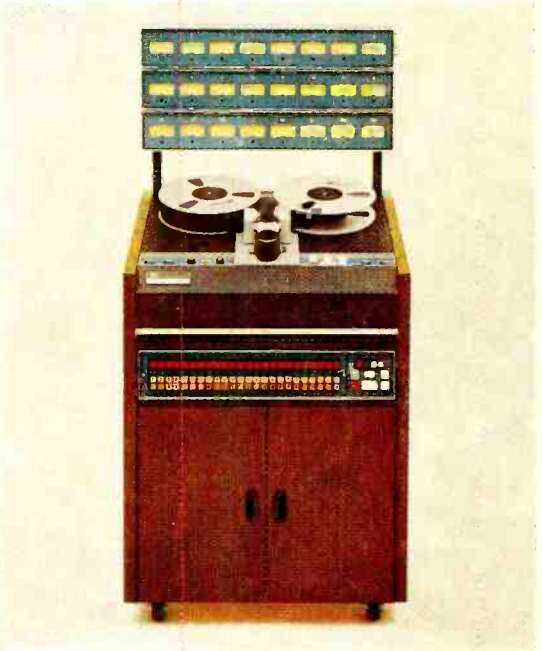
3M present a professional a lot less for



The 3M M79 professional recorder is 27″ wide, 24″ max. deep and around 4′ tall. It's the most compact professional recorder you can buy. But the M79 gives you a lot more – or less (depending on how you look at it) – than just mere space saving. Look at this.

Less hum – because of DC power throughout. Less noise – Normal SNR 64 db, Sync SNR 64 db. Less weight – the M79 weighs under 300 lbs. for 24 track. Less reeling time – it spools at 500 i.p.s. Fewer boards – because of unified channel electronics. No goofs – interlocked record logic and bias/erase integrity. No loops – mode-to-mode transport logic and dynamic breaking. No clutter – the Isoloop deck and modular design see to that.
No service problems – London-based service department.

and a professional tape

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.

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.

Scotch 206 tape also considerably reduces accumulated noise on multi-track recordings – a major problem up to now. It is also very tough, resists scratching and prevents drop-outs caused by tape debris.

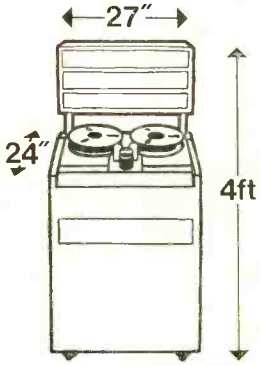
2. A new matt back coating
The new back coating improves the tape's handling characteristics, prevents slipping and ensures more uniform winding.

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 ¼″, ½″, 1″ and 2″ widths.
For further details of Scotch 206 tape and the M79 recorder range, contact: E. R. Haworth, Magnetic Products, 3M United Kingdom Limited, 3M House, Wigmore Street, London, W1A 1ET.

recorder that gives you your money-

The M79 also gives you the best servo around, 3 set speeds, built-in variable speed, CCIR/NAB/AES equalisation.



There are also several useful accessories. Like the 3M synchroniser/reader for synchronising audio recorded material to video recorded material. And the compact 'Selectake' unit which automatically locates a pre-selected tape position.

There are three M79 models (24, 16 and 8 track). All the basic units are the same size and have been designed so that the 8 and 16 track models can be expanded when required.

that gives you a lot more

3M

3M, Scotch, Isoloop and Selectake are trademarks.

3M 2082

By Roderick Snell

JVC NIVICO PORTABLE VTR

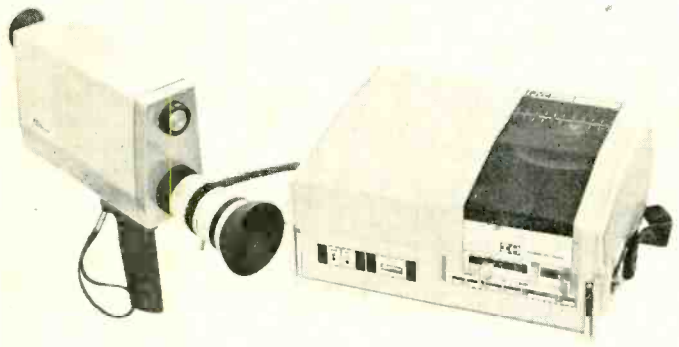


FIG. 1

THE NIPPON Victor Company with their brand nickname *Nivico* are probably best known in the UK for audio tape recorders, four channel discs, and other sound equipment. Until recently, their two 12.5 mm mains vtrs, conforming to Nivico's own format, were distributed here by the Rank Organisation. The winding up of that company's cctv interests coincided with the introduction of a new range of tv equipment which is now handled by Bell & Howell, whose association with the excellent American IVC 25 mm vtr range ensures their position in the UK tv scene.

The main technical feature that recommends this new Nivico 12.5 mm equipment is its conformity with the Electrical Industries Association of Japan Type One format. This is the second EIAJ/1 machine reviewed by STUDIO SOUND (the Sanyo *1100SL* slow-motion recorder was covered in February, 1973), and other interesting variations using this format include colour, electronic editing, time lapse and remote control models, which we intend to cover in future issues.

The Sony and Shibaden battery portable vtrs currently available in the UK are record-only machines conforming to their separate formats and so can only be replayed on their complementary mains recorders.

The Akai portable vtr system (October 1972 STUDIO SOUND) has built-in rewind and playback facilities but uses 6.25 mm tape and again has its own format. The one other EIAJ/1 portable system which was potentially a competitor to the Nivico was the *Instavideo* portable, made by Toshiba in Japan and marketed by Ampex. People possessing those glossy leaflets describing this attractive low-cost camera/recorder outfit are advised to discard them: after several delays and technical hitches, the project was abandoned at the end of last year.

SYSTEM COMPONENTS:

PV-4500 battery vtr/player to EIAJ/1.
GS-4500 camera with electronic viewfinder and internal electret microphone.
ACP-22K battery eliminator and charger.
Price: £780 with pvc carrying case.
Agents: Bell & Howell, Alperton House, Bridgewater Road, Wembley, Middlesex HA0 1EG.

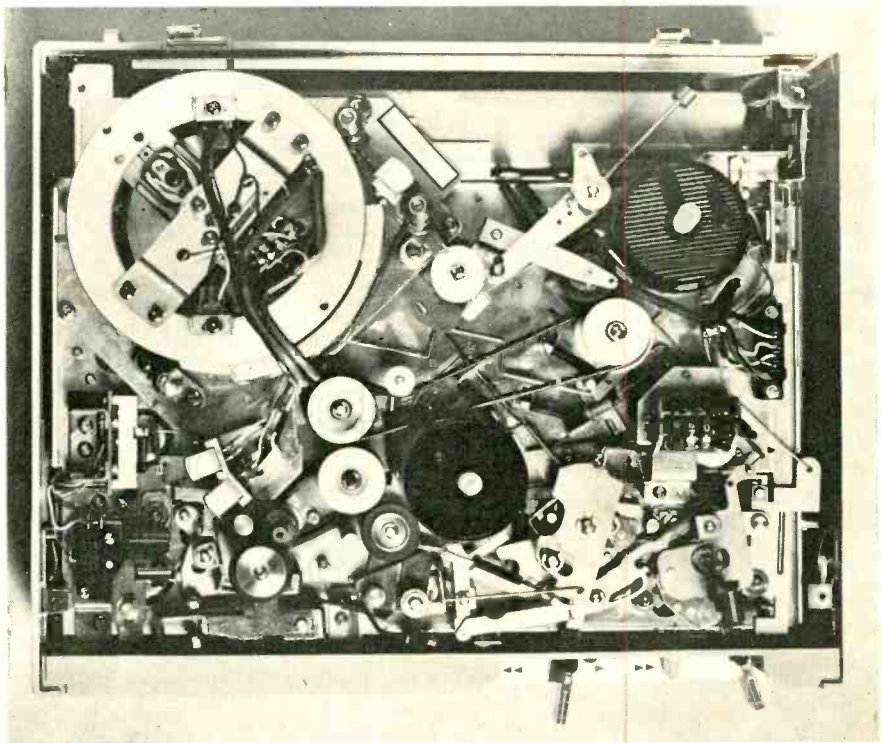
Technical features

The small size of the Nivico recorder belies its complexity; this is more accurately reflected in the cost, which is about £250 more than a simple combination of mains recorder and fixed-lens camera. The recorder has every feature of a larger mains machine except an 18 cm reel capacity and in addition has portability, solenoid-operated remote start, and a crystal-locked sync pulse generator built in. The camera has the performance expected from a 17 mm separate mesh vidicon type, and includes an electret microphone and preamp, a 4:1 zoom lens and a 36 mm electronic viewfinder which doubles as a playback monitor for on-location recording checks. The mains unit will (a) recharge the recorders built-in 12V lead/acid batteries in about five hours from flat, (b) run the system from the mains, and (c) recharge spare batteries through a separate outlet when the recorder is being used continuously.

The main recorder chassis is of 16 swg aluminium and carries the small motors for the head drum and tape transport, together with a surprising number of levers, pulleys and linkages (see **fig. 2**). The critical components in the tape path are the drum, fixed heads and guides, and these are all mounted on a thicker aluminium plate visible at the top left of the figure. Both head drum and tape transport are driven through flat belts from rubber pulleys on the small dc motors. The video heads are fitted to an aluminium diecast bar and factory

40 ▶

FIG. 2



BRITAIN'S LARGEST RANGE OF VTR'S from ACTION VIDEO

If you are looking for impartial advice on video tape recorders, ask Action Video. The range of makes and models they can supply is the largest in the country – and there is a selection of cameras, monitors, lenses and ancillary equipment to match.

½" VTRs conforming to EIAJ standard – all these machines are compatable with one another.

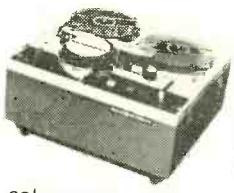
Shibaden SV–610 KD

monochrome with electronic edit

SV–612 E(K)

monochrome time lapse recorder for 1, 6, 12, 24 or 48 hours

SV–620 E(K)



colour with variable speed playback

SV–620 DE(K)

colour with electronic edit

SV–530 U

colour cartridge recorder

Ikegami TVR–321 E/U

monochrome with remote control

TVR–321–12L/24L

monochrome time lapse recorder for 12 or 24 hours

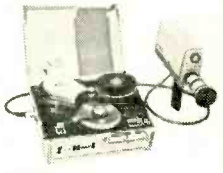
TVR–321 E/C

colour with remote control

JVC Nivico KV–350

monochrome

PV–4500



monochrome portable camera and recorder

National NV–3020 E

monochrome

NV–3082 E

monochrome portable recorder and camera

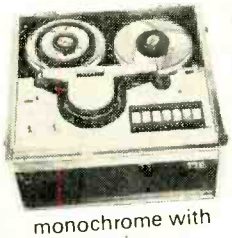
New from Sony AV–3620 CE

monochrome (625 line 50 cycles)

AVC/AV 3420 CE

monochrome portable camera and recorder

Sanyo 1100–SL



monochrome with slow motion

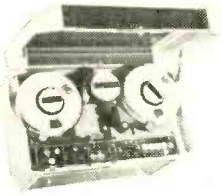
1" VTR's for professional and scientific use

Other ½" non-EIAJ VTR's by these manufacturers are also available from Action Video.

IVC–700 Series

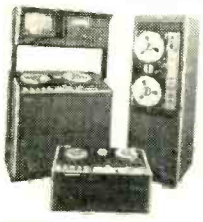
colour or monochrome, one or two audio channels, assembly edit

IVC–800 Series



colour or monochrome, simultaneous recording and reproduction, insert and assembly edit

IVC–900 Series

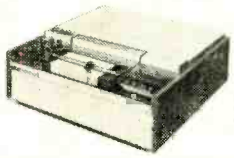


colour, matching broadcast standards

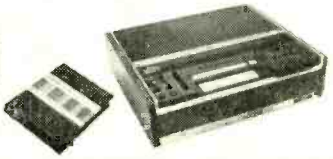
IVC–100 Series

colour cassette recorder

U-Matic Colour Video Cassette Recorders



Sony VO–1600



JVC Nivico CR–6100 U

Demonstrations of all these machines are available at Action Video.
No cassette-type VTR's can be delivered before June 1973.

ACTION VIDEO LTD
45 Great Marlborough St., London W.1.
Telephone: 01-734 7465/6/7

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aligned, with the advantage of easy replacement without jigs or microscopes.

All functions other than the capstan solenoid are mechanically selected by four levers. The main lever is unusual in its sequence of, from left to right: rewind, stop, play, fast-forward. The lever is sprung so that one cannot return from fast forward to play in one movement; the lever jumps back through play to the stop position. Despite, or because of, its complexity this system works quite smoothly; even when using the new ultra-thin tapes the handling was gentle enough not to cause damage. The other levers are a recording interlock, sound dub and still frame selector.

Rewinding a full 12.5 cm reel, 35-minute tape takes under three minutes, which is a good figure considering the small size of the motors used. The 12V battery pack (visible along the top of the recorder in **fig. 2**) runs the machine for 70 minutes per charge when used continuously with the camera, and for 90 minutes when used intermittently or without the camera.

The electronics are on two large printed circuit boards under the deck, and consist mainly of conventional discrete components. Integrated circuits are only used in the demodulator and sync pulse generator. Connection to the rotating heads is through a double rotating transformer; a worthwhile feature which ensures the absence of brush noise.

Possibly because of the small motor used, the drum servo was rather slow to synchronise; it took 2 to 3s between different recordings, up to 1s between different takes made at the same time, and up to 5s at the start of a tape. Another peculiarity of the drum servo was that, in the absence of off-tape syncs, the drum speed slowly dropped to one-third of normal on replay, and rose to about one-third above normal on record. This may have been deliberate, and intended to reduce the field disturbances between camera shots, but it also meant occasional delays while the servo 'caught up' and incidentally prevented the use of our normal method of signal-to-noise measurement.

With the tape supplied, the signal-to-noise ratio was under 40 dB but, using a modern tape (e.g. Sony or 3M *361*) it was about 1.5 dB better. The best performance from normal tapes was obtained with Memorex *Chroma 80*, which gave 41.5. As this was a new model, it was interesting to see whether it could benefit from 3M's new high-energy cobalt-loaded tapes: in fact a 1 dB improvement was gained over the best of the normal types. One maintenance criticism here was that the record bias potentiometer and relevant monitor points were highly inaccessible, making bias optimisation an awkward job.

It was very pleasing to find that the resolution was *better* than the specification; this is the weakest feature in all such equipment, and most manufacturers claim the very most that they can. Not only was the limiting resolution nearer to 260 lines than the claimed 240 but the response between 200 lines and the upper limit was better than most, giving subjectively crisper pictures; **fig. 3** shows the relevant section of the Marconi test card.

Compatibility with other EIJ/1 vtrs was also impressive; the alignment being so good that the tracking control never needed moving from its preset position, even when playing a 60 Hz NTSC recording of American origin. This, incidentally, gave a stable picture on my monitor, with the sound pitch reduced by the expected fraction of one-sixth. **Fig. 4** is a still frame which, apart from showing how good this can be, shows the resolution to be well over the 250 lines needed to resolve the second-from-top frequency grating on the right of the circle. The combination of rotating transformer and electronic head-switching just *prior* to field blanking period gives a worthwhile improvement in stability when compared with earlier vtrs. Apart from the aforementioned slow servo action, pictures were very stable and jitter-free.

The audio performance of the *PV-4500* was disappointing, being worse than the other portables in respect of both wow and frequency range. DIN weighted wow and flutter was 0.4 per cent rising to 0.5 per cent at the end of a 360m reel and, according to a Telex confirmation from Japan, the first of these figures was within specification. The high frequency turnover (–3 dB point) at 6.5 kHz was marginally outside the specified 7 kHz. Setting the recording reference level arbitrarily at 6 dB below clipping (there is no record level indication on sound or vision) gave a sound signal-to-noise ratio of 42 dB unweighted, this noise being a mixture of hiss and field-frequency spikes. In the tradition of most Japanese video equipment, the sound agc is really a limiter, acting on inputs of over 100 mV and having a recovery time constant of 2 dB/s.

The complete outfit was delivered in a large aluminium box of the type used for industrial film equipment; this is a good idea if one can afford the extra £50. The normal recorder carrying case is plywood-stiffened vinyl, and has the added advantage of doubling as a back pack. The camera itself was blemish-free, with good low light level performance.

The automatic assemble-editing of the Sony or Shibaden systems produces better joins between shots, but they are both bound to their own 'house' formats. The Akai, also bound to its own format, is lighter and smaller but has poorer resolution. Despite the criticisms, the Nivico *PV-4500* system is capable of very good monochrome recording which can also be played back on any other EIAJ/1 machine. This particular advantage together with its good overall performance probably makes the Nivico *PV-4500* the best all-round portable vtr system available in the UK at this time.

April 'Video' errata: See page 76.

FIG. 3

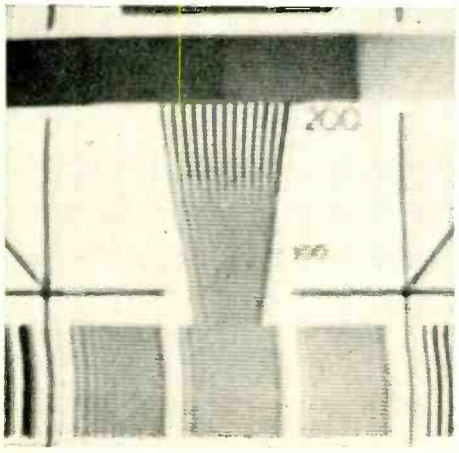
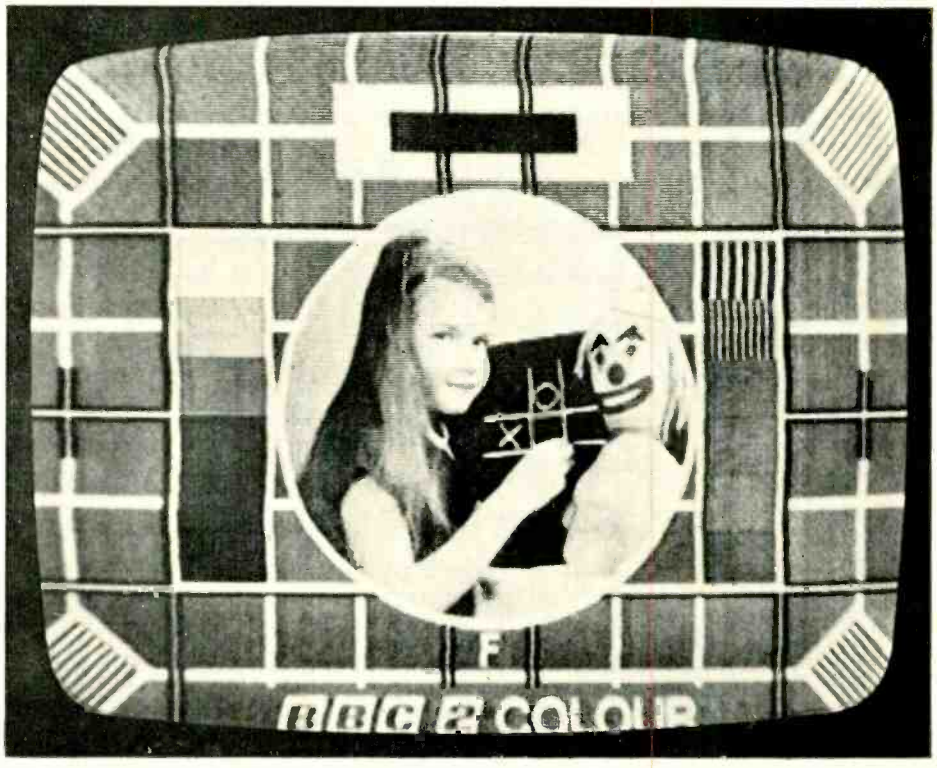


FIG. 4



DIARY

By John Dwyer

EMI HOLLAND'S studios recently changed their name from Bovema to Intertone. They have three studios as well as a number of mixing and cutting rooms. The studios opened in December 1959, before which EMI had used a church they owned in Heemstede as well as other buildings in the area. They designed studio One in 1958 thinking that it would meet all their future needs. Nevertheless they had to add another in 1968 and one more in 1972.

There is, as I saw for myself, a studio Five but EMI Holland seem to have an aversion to even numbers. If this is deliberate—how could you 'lose' two studios?—then I cannot imagine who is going to be impressed by the quantity of the studios rather than their quality.

Nevertheless, if you accept that EMI is not as big as you thought it's still pretty big. Studio One is 15 by 9m in area and between 4 and 6.5m high. The reverberation time is put at less than half a second at 1 kHz. The control room for the studio has an EMI 24/16 mixer; for type-number freaks it's called a *TG12345* mark three. I'm told that the desk has eight echo outputs but six returns. There are two cue outputs and a sync mixer. The control room One has a Studer *A80* 16 track and two Studer stereo recorders as well as a *BTR2* mono machine. Quad *303's* drive two Altec Lansing *604E* speakers and headphone drive is provided by a K & H stereo amp.

Studio Three is 4 by 2m in area and 3m high. It is used to record speech, ads and test recordings. The mixer in the control room is again an EMI, with 14 inputs, two outputs, two echo inputs and one echo output. The tape decks here are two Telefunken *T9* with stereo Sitral record replay electronics. There are also two Telefunken *M5* mono machines. Other facilities include an EMT *930* record player. Altec monitoring is used here as well, with EMI *V1069* amps as drivers.

Control room Four is used for editing, copying and master monitoring and has two Telefunken *M5* tape machines and two Studer B62 machines. Again, two *V1069* amps drive two Altec *604C* speakers.

Studio Five is 11m by 8m in area and 3m high with a reverberation time of 0.3s at 1 kHz. Its control room has a modified EMI *Redd 17* mixer with 14 inputs and four outputs, two echo sends and returns and two cue outputs. There is also a 16 track replay monitor mixer.

It appears that this desk originated in Abbey Road; Malcolm Davies and Geoff Emerick, who were with us, suddenly realised that that was one of the desks they had first learnt to mix on, and it wasn't long before they were madly swopping reminiscences. If the APRS ever start a museum that desk should be on show.

The five tape machines are a Studer *A80* eight or 16 track machine, a Studer *J37* four track, two Telefunken *M5C* stereo recorders, and a *BTR2*. For monitoring, a Quad *303* drives two Altec *604E* speakers and a Nivico *MC 105* is used for headphone monitoring and cueing.

Studio Five, EMI Holland

Studio One

Room Eight (cutting)

Control rooms six and seven are non-existent, and eight and nine are cutting rooms. Both are equipped with Neumann *SX68* heads and *601D* monitor speakers. Room Eight has a Studer *A80* stereo replay machine with an advanced head while the other cutting room has a similar arrangement on a Telefunken *M10* machine.

EMI use Neumann, Schoeps and AKG microphones, particularly the Neumanns. Although it is not generally EMI's policy to use Dolby's they do list at least one Dolby *A360* unit as part of their general equipment—the number is unspecified. Each control room has a patchboard connected to a main patchboard in the cellar. Up to 30 connections are possible. The echo units are linked to the studios via this patchboard, and there are two stereo and one mono EMT plates, an AKG *BX20* spring unit and an echo room with a reverberation time of up to 2.5s. Other equipment includes two Astronic *A1671* octave filters and 12 Siemens *297B* Sitral filters.

Last month the gremlins struck a few neat blows at our 'News' columns in STUDIO SOUND. The result was a picture of the new Ampex *MM1100* tape machine with a caption which almost said 'The Maple Leaf Four'. While it is true that the Maple Leaf Four were in the background we imagine that some readers might still have found the picture confusing. It was taken at **SB Independent Radio** studios in Dean Street, where the Four were recording with the Gordon Langford Quartet. I understand that SB were the first studio in Europe to have an Ampex *MM1100* delivered. The machine was introduced at the IBC exhibition in September.

The studio manager of SB is Peter Brown, who was at TV International for two years. At TVI he met SB's engineer, Ian Cook, who had previously worked for Neve for four years. Studio One and its attendant control room have been completed and work is expected to resume on studios Two and Three when it has been decided what the needs of commercial radio will be; studio Two, for example, may well become a drama studio.

Studio One is big—it will take up to 30 musicians. In the control room, besides the ill-captioned Ampex machine, there is an Audio Developments 16 mic input four group console. There are also two AEG Telefunken two track tape machines; microphones by Calrec, AKG and Beyer; an AKG *BX20* reverb unit; and some Dolby units. I also noticed a couple of Spotmaster turntables. The main monitors are Spendor *BC1s* and JBL *4310s*.

So far the studio has been used by Sarah Miles, Joss Ackland, The London Saxophone Quartet, Mark Brown and, during my visit,

a guy called Siva Choy, who was making a single playing drums, maraccas, tambourine, bells, bass, two acoustic guitars, an organ and a piano. Naturally he also did the vocals on the single.

SB's rates are £23 an hour for eight track and £18 for stereo or mono recordings, the same as for reduction. For demos SB have special rates of £15 an hour and £10 an hour for stereo; hurry while this offer lasts. SB's phone number is 01-439 1827.

Zoom Television describe their new studio in Fetter Lane as 'a hole in the ground worth a million'. It could be worth even more. Zoom started in closed circuit television in 1964 and have grown to four divisions and four addresses. The Studio has telecine, and vtr facilities and three colour cameras. There is also an outside broadcast closed circuit tv division which was responsible for relaying Muhammad Ali's Houston fight to some cinemas in England. They also do cctv work for conferences. Another division hires and sells video equipment; they have the sole UK agency for Ampex cctv equipment and are main distributors for Philips, Sony, Shibaden and for the 3M range of videotape. Their fourth division has a team of engineers who will maintain and repair video installations automatically if they have been bought from Zoom or if a company signs a service contract with them.

I would have thought the demand for a studio such as Zoom have just opened would be immense. Zoom obviously think so too, to judge by the amount of capital they have put into the project. To begin with, the studio occupies 66 m² of the basement of an office block at 15-19 New Fetter Lane. It's equipped with £100,000 of Videotape, Telecine and VCR transfer equipment. The standard facilities comprise two Philips *LDK3S* colour cameras; a caption camera; a vision mixer with effects, wipes and chroma key facilities, colour filling for foreground and background of caption camera; boom and fixed microphones, disc and audio tape facilities with an eight channel mixer, and lighting facilities. The above costs £50 an hour to hire or £300 a day inclusive of one vtr machine.

Videotape facilities

The videotape facilities include two Ampex 25 mm broadcast colour *VPR 7903* vtr machines with electronic editing facilities, and two 25 mm Ampex *VR7803* monochrome vtr machines, again with electronic editing. Rates for these are as follows: one colour unit £25 an hour; two colour units £40 an hour or £240 a day; one monochrome unit £15 an hour; two mono units £20 an hour or £120 a day.

For £30 an hour you can hire a 35 mm flying spot colour telecine machine with 35 mm separate sound. A 16 mm Marconi Mk 6 monochrome job, again with separate sound, costs £20 an hour. It is also possible to arrange to transfer 16 mm colour telecine.

Other rates can be obtained from Zoom at 353 3641. Zoom have offices in Pinewood Studios (though I am told they are not connected with Rank), Knutsford in Cheshire and Trowbridge, Wilts.

My last studio call before I went to Rotterdam for the AES Convention was to **Milner Sound**, a medium-sized studio off London's Fulham Road. John Milner was good enough to invite me down to see the studio, which is

Studio Three, EMI Holland

about 4 m² in area, and its facilities. The glass in the control room window is triple glazed. The desk, made by an associate of John's, has ten channels with four or eight outputs, full equalisation on each channel, three separate echo sends and returns, studio foldback, four compressor limiters, instantaneous mixdown of four tracks and Lockwood monitoring.

The control room at Milner is 5m by 3m and the studio is 8.5 by 5m. It all looks very well put together and the acoustic treatment very impressive. The ceiling is false, John Milner told me, and the upper ceiling is coated with fibreglass.

To be truthful I must report that I heard an aircraft passing over while standing in the studio as well as the noises of workmen next door. The aircraft noise came through a window at one end which I think John will have to do something about. What he does about the noise from next door I'm not so sure unless, which I think unlikely, it dies down sufficiently once the workmen have moved out. On the credit side the studio is well away from Fulham Road, so there's no problem with traffic noise.

It could be, as people have often told me in similar circumstances, that such things 'don't affect our recordings'. All the same, when a producer comes to see your studio he is not to know that, is he?

I must be fair to John Milner and point out that he has had considerable experience in the sound recording industry. Besides which he is reputed to toot a mean trad jazz clarinet as well as being a professional church organist. After he left the RAF he joined the BBC, where he worked for ten years as a tv sound engineer. He then joined Studio G, where he worked for 14 months before planning his own studio project. The most difficult part, he said, was finding the right premises.

His work includes 'every sort of recording work you can possibly imagine—as a professional, not for fun'. He has recorded the London Symphony Orchestra and chorus as well as the orchestra for the Murraymints ad, made at the Central Hall, Westminster. He said that after his first session, a big band, at the newly-opened studio, the only complaint was about the lack of ashtrays.

Milner also offer mono micro groove disc-cutting, multiple copying on to tape or cassettes and wild transfer on to 16 mm or 35 mm film tracks. Rates for four track and stereo recording are £12 an hour. John's number is 01-589 6477.

Trident. The bookings diary included names like David Bowie, Al Stewart, Neil Innes, Atomic Rooster, Davie Johnston, Bobby Harris and Mike D'Abo. Dave Kent-Watson came in to do some mixing for a Salena Jones album and mixing was also finished on Marsha Hunt tracks.

Majestic. Always Music used session men to put down tracks produced by Geoff Wilkins; Belsize produced a group called Fluff; Radio Luxembourg produced two singles at Majestic for use at the Midem festival and Mike Morton came in to do his usual cover versions. More recently Johnny Worth, who produced Jimmy Helms's Cube single now in the charts—*Gonna Make You an Offer You Can't Refuse*, engineered by Roger Wilkinson—has produced other tracks by Dave Cartwright and Harvey Andrews as well as music and sound effects for stories from Black Beauty. The stories were recorded for London Weekend, who will be releasing them world wide, John tells me. Mike Clayton has produced *If we only had love*, a single by Section which Derek Chandler engineered for the RCA label. Majestic will be installing a Triad 16 track desk some time in April.

At **AIR** John Punter and John Middleton have just finished engineering the new Roxy Music album. John Middleton is now roaming the globe with Cat Stevens to record an album in studios in Jamaica, New York and Los Angeles. Marsha Hunt's backing group, Thunderthighs, came in for sessions, as did Marsha herself. Carl Wayne is in the process of making an album and George Martin has been producing tracks for John Williams, the Huggett Family and a BBC film of the Kings Singers. Tony Ashton has been doing jingles and a group called Randy Stonehill came in to record three religious pop lp's. Rupert Hine used AIR this month to record an lp of *The Colditz Story* as well as an album by Yvonne Elliman. Other names that have used AIR in the past few weeks include The Casuals, Mott the Hoople, Pluto, Family, Thin Lizzie and Blue. On the film side AIR will be recording the next Bond film in May, and in April they will be doing a film called *Deadeye*.

I've had a letter from **RPM Studios** in Johannesburg which runs as follows:

'1972 was an extremely busy year for the studio facilities, studio One being booked for 88 per cent of its available time. More and more local groups are using the studio as well as the musical directors of various film companies. Groups using the studio were "Hawk" —a group that will be touring England from February onwards—"Stone Jug," "Carisma," "Impi," "Hocus," "The Miracles," "Waterloo" and vocalists Virginia Lee, Ge Korsten, Andre, Maria and Roy Memphis—all local chart toppers.

'Some major changes took place on the administrative side, the most important being the change-over to the RPM group format rather than individual companies under the RPM title. Geoff Tucker is now facilities manager in charge of studios, film facilities and television. The film side completed its SA

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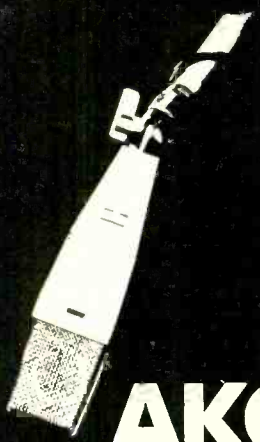
The two engineers and the big Five that made INDIGO'S success story

Bob M Auger/Dave Kent-Watson

Hayden Laboratories

- **Nagra 4S**
  Stereo Master Recorder
- **Sennheiser MKH 405**
  Condenser Microphones
- **Sennheiser MD 441**
  Dynamic Microphones
- **Rapid-Q**
  Broadcast Cartridge Tape Recorder

Audio & Design



- **F700RS**
  Compresser Limiters and Vocal Stressers

AKG

- **C412**
  Condenser Microphones
- **BX20**
  Stereo Reverberation Unit

Revox

- Stereo Tape Recorders

Sound Techniques

- **System 12 1C**
  Modular 18-channel Sound Mixer

RADIO AND TELEVISION IN WEST BERLIN

IN AN EFFORT to draw comparisons between audio consciousness in East and West Europe, I flew recently to Berlin. This, the first of two articles that came out of that trip, deals with the West, having particular relevance to radio and television. The second article deals with the East and appears on page 50.

The fact that West Berlin functions as an island without a sea is a two-edged sword. On the one hand it creates odd problems, like where to bury the dead or dispose of sewage. On the other hand, West Berlin is in the extraordinarily advantageous position of being able to broadcast radio and television propaganda to the Eastern countries. Eastern programs can equally well be picked up in the West. The nature of the material transmitted to and from West Berlin is not relevant to this article. Suffice it to say that, between the austerity of the East and the artificial gaiety of the West, there must be a mutually acceptable compromise.

West Berlin is well served by radio stations. The station I visited call themselves Free Radio of Berlin (Senders Freies Berlin) and are based in an extraordinary building near the 150m high steel-frame radio tower at the exhibition centre and fairground. The radio tower is no longer in operation but remains as a tourist attraction with a restaurant and observation platform to give a wonderful view over Potsdam. The original radio building was built in 1930, survived the 1939 - 45 war, and was then occupied by the Russians. It was subsequently taken over by the West Germans and enlarged a few years ago by the addition of a massive television studio complex connected to the original building by modern closed corridor catwalks. This new building is a maze of corridors which are still a jungle even to the station staff. Some of the architecture is extremely adventurous with the foyers floored in rough hewn stone. As the floors were originally laid they were even rougher than now; through the effect of wheeling equipment into the studios, some polishing down has occurred.

I had been put in touch with Dr Wilhelm Schlemm of the tv studios and he kindly arranged for me to be shown round by Gerhard Jensen, a German tv sound engineer who speaks better English than I do. Dr Schlemm is a Tonmeister and, as such, acts as a feedback channel between the musicians and the audio engineers. Although in some studios he may actually man the console and mix down, generally he moves between the studio and the control room pinpointing and correlating musical and audio problems.

In the centre segment of the 1930 Radio Building is a large concert studio which holds around 1,400 people. Over the past few years this has been insulated to keep out the noise of the jet aircraft. To the left and right of the concert studio there are smaller studios, some of which still suffer from jet noise. Dr Schlemm claims that the concert studio acoustics are 'the best in Berlin', a remarkable claim if one bears in mind the excellent characteristics of both the Philharmonic Hall and the Opera House.

The concert studio is used, as one would expect, only for large orchestral work. The acoustics remain the same regardless of audience size, each seat chair back being acoustically equivalent to a member of the audience. The control room incorporates a Telefunken console with eight channels for stereo microphones and 22 for mono. Virtually all radio programs are put out in stereo, although facilities for quad are being built up.

Incidentally, the Berlin stations were among the first (at least in Germany) to convert to stereo. By virtue of the small area they cover, they relied on just one transmitter so conversion was cheap and easy. There is no Dolby *B* in use but the emphasis was on 'as yet'. The concert studio console has Fairchild limiters which, as Gerhard Jensen put it, 'some engineers use and some don't'. Peak program meters are employed throughout the station, indeed throughout virtually all West German studios. Only once did I spot VU meters in the West and that was to 'provide a quick check on loudness' in a highly automated television control room (of which more later). VUs are almost universally condemned, if not despised.

EMT plates with a delay of 40 or 50 ms are used. Alternatively, reverberation rooms are available.

One of the smaller studios, used for Pop and chamber music, is offset to one side of the concert studio and looks rather like a gymnasium. The acoustics can be altered mechanically because most of the wall panels are reversible—hard on one side, soft on the other. This is in contrast to the concert studio, which has fixed acoustics and fixed reverberation time. The smaller 'gymnasium' studio, with windows over some of the wall area, has muffle stands for isolating instruments and a separate percussion room for use on the odd occasions it is really necessary.

What Gerhard Jensen described as a relatively 'antique' control room is still more than adequate. Another Telefunken console with two stereo channels, the rest mono, feeds Telefunken recorders including a four track. The console has a dial type phase indicator for mono-stereo compatibility.

Virtually all the tape recording machines at the station are Telefunken and, though most of the Senders Freies Berlin equipment is Telefunken, other Siemens equipment is popular in other West German studios. So far there has been little intrusion from the outside world but there are signs now that Neve desks are making headway. Some foreign consoles are selling at around 30 per cent less than the price of their German competitors.

While I was there, the main entrance hall to the radio station was being fitted out with television cameras operating from outside broadcast vans. This was for a series of Gala musical evenings to be held over the subsequent few days.

As the tv studios were built only recently, they have the advantage of a highly modern and rational design. Thus the three main studios (A, B and C) all lead off a single wide corridor along which vehicles can drive when moving heavy equipment. The tv studios themselves are virtually equivalent to those at the BBC, Wood Lane, but some points about the control rooms may be of interest. The same audio monitors are found throughout all the station studios. They are made by Telefunken for German radio and television to a design of the Rundfundtechnik Institute. The tv studio sound consoles are all made by Telefunken, as are the tape machines. Videotape recordings are all in mono although there are four track facilities and hopes for 16 track. These multitrack facilities are used where a prerecorded sound track (effect or music) is to be played back for a program being transmitted live or videotaped. This is equivalent to the BBC use of eight track Studer and Scully machines. The Berlin studios already have facilities for recording frame or line sync pulses on multitrack tape but they do not as yet have the facility to sync multitrack tape with videotape. Again this is comparable with the situation at the BBC. But the technical problems of syncing multitrack audio tape to video tape are not particularly substantial and the time must soon come when both the BBC and the Berlin station will be able to record video with synced multitrack sound for reduction to mono prior to transmission.

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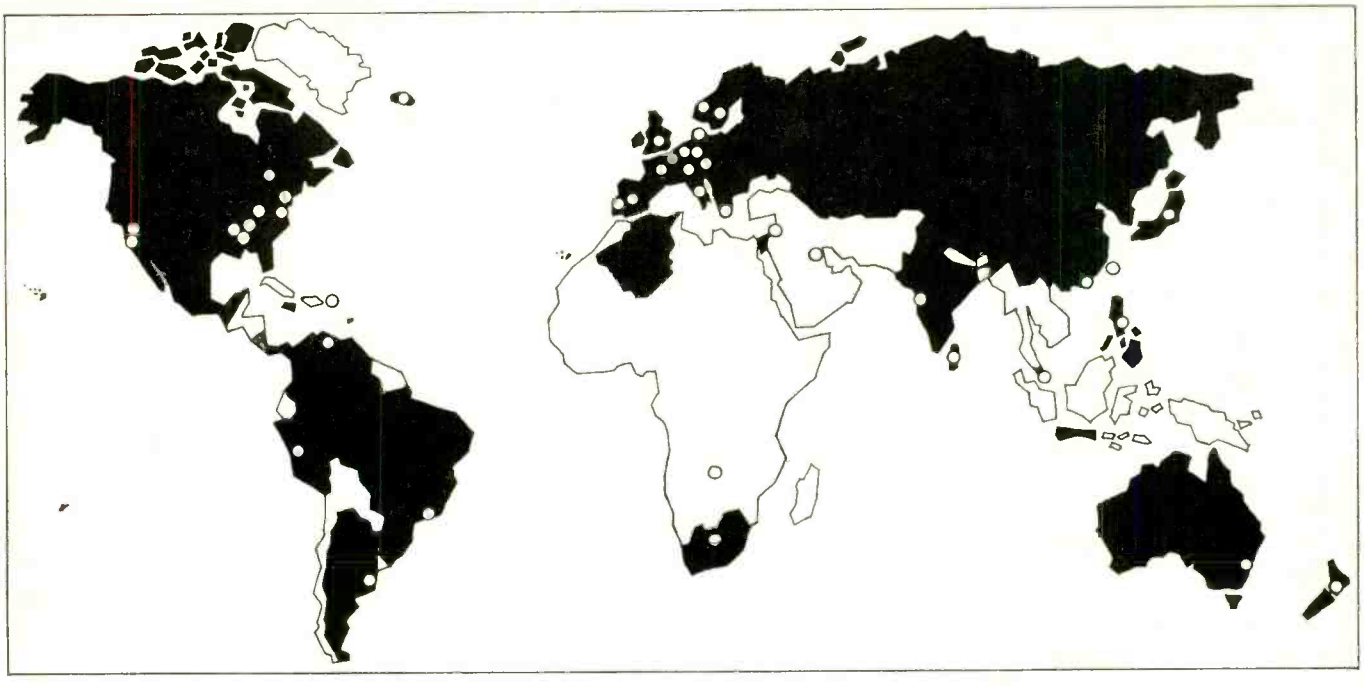
West Berlin television ob vans

Countries shown in black have Dolby equipped recording centres.
Dots show location of authorised distributors of professional Dolby Noise Reduction equipment.



The geography of silence.

One good reason to record in London is that every major studio here is fully Dolby-equipped. In addition to aiding engineers to achieve the highest possible quality on an original recording, the Dolby system reduces any low-level noise introduced when further work is done with a tape at another studio, often in another part of the world.

Because so many studios now have Dolby equipment installed, the system is widely used to protect the substantial investments of time, money, and creative effort made in London. Whether an original tape is sent to Nashville or Peking for reduction, or a copy master is sent to a licensee in Tahiti or Heidelberg, professional Dolby installations are there to guard against noise build-up.

Be sure that your studio sends and receives Dolby-encoded tapes. People everywhere will hear the difference.

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London SW9
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Telex 919109

BERLIN

This will give extra sound flexibility similar to that in studio disc production, whereas at present all reductions must be made prior to any video recording. Studio time costs will doubtless rise as engineers increasingly rely on having mixdown time available to them.

Over-dubbing and miming

On the subject of multitracking, I talked to various engineers about German attitudes to over-dubbing and miming. In Britain, the Musicians' Union will not allow straight miming. Not only is miming allowed in Germany but the tv studios can also mix or overdub say ten strings into 40.

There also seems to be, not only in tv but in all German recording work, a strong tendency to use multitrack to separate not only in space but in time. One musician will record his track one day, another the next, and so on for subsequent reduction into a hopefully coherent end product. As Gerhard Jensen put it: 'There is a risk that the whole thing becomes sterile'.

On the other hand it must be borne in mind that, whereas in London there are around 10,000,000 people, in West Berlin there are only around 2,000,000 and these in an unnatural isolation. So the difficulties of getting all the right musicians together at the same time are substantial. Multitrack techniques can bring the best sections together with only the cost of airfreighting the tape.

At the time I was in Berlin, the BBC were due simultaneously to televise and fm stereo broadcast from the Albert Hall. This had been done a year or so before in Berlin and we talked about the unforeseen difficulties and uninformed criticisms which would inevitably be incurred. The difference between a good stereo mix for radio only and a good stereo mix for television becomes evident when you place a small tv screen between two widely spaced speakers. One school of thought argues that the sound image should spill off the edges of the television screen to widen the visual image. Another school argues that the stereo image should match the tv picture in size. Whereas the tv sound balance could sometimes mate with the visual display, this kind of bumpy mix would be wholly unacceptable to a sound-only listener. A related problem also arose when the other Berlin tv station (ZTF) broadcast *Eugene Onegin* in fm stereo and colour tv. Because the orchestra were always off camera even greater problems arose over how wide its stereo base should be. Incidentally ZTF produced the *Onegin* broadcast using film rather than live transmission techniques since present videotape standards provide only mono facilities.

Berlin broadcasters are experimenting with the transmission of films carrying separate sound tracks in more than one language. Of all cities in the world, Berlin is perhaps the one that most needs this facility. Having so many languages to cope with, it has one of the biggest film track dubbing industries in the world. The subtitling of films is disliked by German viewers except in short film clip sequences. Films are already being televised with the original soundtrack on the tv sound carrier and the dubbed version of the film on a radio wavelength. Now the plan is to televise a film with two alternative soundtracks, each broadcast on quite separate carriers.

The system has the advantage of compatibility and, when stereo tv sound reception is worked through, it may be possible to transmit a mono mix on one such carrier and a stereo mix on the other. This should then keep everyone happy. Obviously sets will require modification, but already in Berlin plenty of sets are modified for another purpose. This is because, in addition to the three main German tv programs, there is a local low power American Forces station. The American transmissions are put out in monochrome on the same line standard as German television but, for licence reasons, with sound on an entirely different standard. Private enterprise being what it is, converters are readily available to enable German sets to receive American sound so the average West Berlin viewer has at least four stations to view; more if he chooses to watch East Berlin television. DDR music programs have a very high reputation and are widely watched in the West. By the same token, West Berlin television transmissions are watched by the East for entertainment content and news value.

As another off-shoot of Berlin's complicated political position, although both East and West transmit in colour they can only receive each other's stations in monochrome. This is because the East European colour standard is Secam and the West German standard is Pal.

No mobile vtr

Because West Berlin covers such a small area, there are no mobile vtr units. Signals are sent back from outside broadcasts via landline or short wave links to five vtr rooms, each with two machines. A centralised telecine unit covers three rooms, each with two 16 mm and two 35 mm machines. All the telecine equipment is flying spot and the 16 mm machines are pneumatically operated with virtually instant start.

The music outside broadcast produced during my visit was being recorded on two separate vtrs, each with a different sound mix, one for radio and one for television. A similar double vtr technique is used for all outside broadcasts. One vtr records the natural sound plus the announcer and the other records the natural sound only. The latter tape is kept for the archives but the commentary may be used for reference or for cuing. All the trucks transmit a continuous tape loop call sign so that the source of any signal can be immediately and remotely identified. This is necessary to avoid chaos when video contributions are coming in from all over Germany.

All German television uses star point switching with the centre of the star at Frankfurt. Thus all television programs for transmission are carried by lines into Frankfurt and switched out from there to the relevant transmitters. Even a Berlin-originated broadcast to be transmitted by the Berlin transmitter will go first to Frankfurt and then be switched back again to Berlin.

A promising new venture in the Berlin tv station is the current test run of a totally automated studio. Something like this has already been running for a year or more in Hamburg. The Berlin studio requires only one or two operators standing by for emergencies.

'The problem with this type of studio is more one of boredom over the shifts,' I was told. All the video and sound sources arrive at the studio and are process switched by an end signal. This can be towards the end of a videotape or a magnetic signal near the end of a film. Fade rate is preset and a preplanned program can be punched on paper tape by an engineer with the times of videotape, slide, film or any other inserts. If any item over-runs, the system will readjust the other items to recover the predetermined end time.

The automated studio uses a single unmanned colour camera trained on a chair suitable for a real live announcer. Most German television announcers are women. In fact a large number of women are employed for tape editing, machine operation and other technical work. The announcer may control the camera herself or even this may be automated. The only manual control that I could see (other than override buttons) was a manual fader for the lights in the studio. Readers with a sympathetic regard for Hal in Clarke/Kubrick's *2001* will doubtless have their own fantasies on what could happen if the Berlin studio computer gets its own ideas on creative television!

Television and radio in Berlin have a long history. The first radio programs went out in 1923, a year or so after those in Britain. The original transmitter has been silent for years.

The West Berlin radio station has an interesting museum of old radio and television relics and one rather surprising fact to be gleaned is that the opening of the 1936 Berlin Olympic Games was televised by outside broadcast

52 ▶

Telefunken audio desk

VEB DEUTSCHE SCHALLPLATTEN, EAST BERLIN

FOG, A BANKRUPT airline, and a delayed flight into Berlin's Tegel Airport conspired to make me 24 hours late into the city and unable to cross from the West to the East via Checkpoint Charlie until a Saturday afternoon.

I had arranged by letter and telegram to meet Joachim Garten, technical director of the East German record company VEB Deutsche Schallplatten, at their studios in the Reichstagufer. The frontier guards directed me away from Checkpoint Charlie down Friederichstrasse to the wide Unter den Linden which leads down to the Brandenburg Gate at another point on the border to the West. Virtually all the shops in East Berlin are closed on a Saturday afternoon and the streets are full mainly of families out walking together. At the Brandenburg Gate, more border guards directed me along a deserted street towards the canal which runs between East and West and I found the Reichstagufer to be a short road running along the side of the canal to a large old building just on the Eastern side of the wall. In fact the VEB Deutsche Schallplatten studios are housed in the Presidential part of the Reichstag which lies on the Eastern side of the border. The Reichstag itself lies in the West, of course, but only a matter of metres away.

My first impression of the VEB Schallplatten building was of the superb architecture. Both in East and West Berlin, so many of the old buildings have been rebuilt in modern utility fashion that it was a memorable experience to see inside a building dating back to pre-1939 Berlin. This one has vast wide stone stairs, massive high arched ceilings, echoing corridors, and enormous brass-handled wooden doors leading off to the various rooms.

There is one main studio in the Reichstagufer building which is used predominantly for recording small orchestral and chamber music. About 2 km away is a second studio in a newer building which is used mainly for Pop music. And in Dresden there is a massive 14,000 m^3 studio that was once a church. This is used for large orchestral recordings and secular works. The aim is to make all three studios and their control rooms compatible.

No discs are pressed or tapes duplicated in Berlin. This is done at Babelsberg, about 80 km away. The discs are cut in Berlin, however, and Herr Garten showed me the Reichstagufer cutting room. Two Neumann cutters (incorporating Leitz microscopes) are used with a cutting amplifier made by VEB Schallplatten themselves. The cutting heads are *SX68* and various other Neumann equipment is used together with Dolby *361*. Altogether the studio I visited had 15 such Dolbys.

Medium size

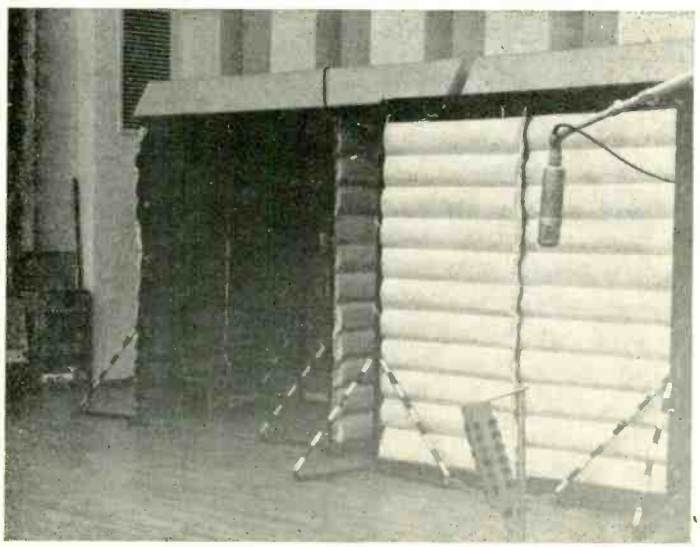
The Reichstagufer studio is of medium size and will hold ten to 15 musicians. Its acoustics are fairly live with a fairly high ceiling. The microphones used are Sennheiser, AKG and both East and West German Neumanns. The studio is fairly long and thin. One main wall has all along its length large bulbous semi-spherical and semicylindrical protrusions made of hard plaster-like material and acting as sound diffusers. The other side of the studio is walled with flat wood panels. One end wall is taken up almost wholly by a glass window into the control room and the other end has a pair of large booths made from padded canvas or plastics material. These booths are of course used for instrument separation but seem rather larger than most of those I have seen elsewhere. Also they are closed in at top, rear and sides, only the box front being open. All the padded material is mounted on tubular metal frames.

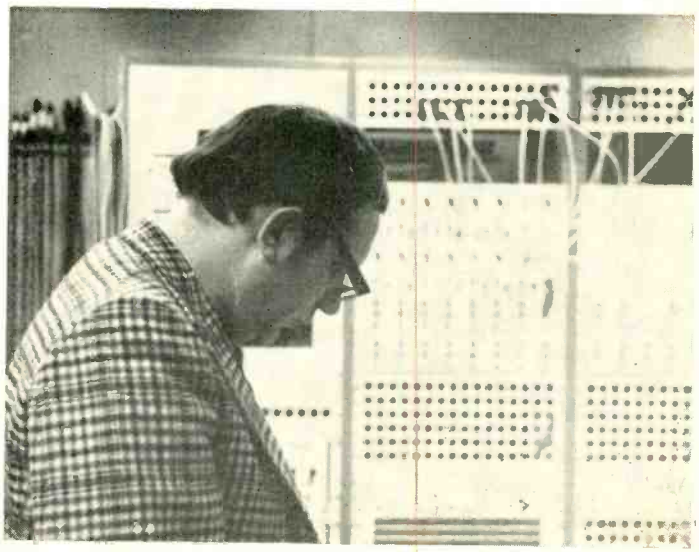
The control room has a Telefunken 30 channel mixing desk. Another such desk is used in Dresden (remember the point about compatibility). The tape machines are eight-track Telefunken. Virtually all discs presently issued in East Germany are stereo but there are facilities for mixing down to quadraphonic. Four channel master tapes are being produced for the future. The Telefunken console (which was made to VEB Schallplatten's design and plans) uses peak program meters throughout. Thus, as in West Germany, there is total rejection of VU meters.

Because it was Saturday there was no recording in progress, weekend recording only taking place in East Berlin in the event of real necessity. Usually the studio can handle three or four sessions per day, with a maximum of two four-hour sessions per day for any orchestra. The sessions are normally morning and afternoon or afternoon and evening, with the usual problems of musicians working in orchestras or dance bands at night.

On duty in the studio were several engineers including Paul Arnold, the technical manager, who demonstrated their DDR-built oscilloscope goniometer. This is mounted on the console and gives a visual indication of any

Below left: Pop studio
Adjacent: Paul Arnold





phase deviation between channels Two or Four. Under total in-phase circumstances, the oscilloscope displays a true circle and any phase shift shows up as a distortion of the circle into an oval pointing in a radial direction. The console is pan potted with all the usual filtering and is transistored throughout.

The console has pushbutton phase reverse, 30 dB drop, stereo, mono, left-only and right-only channel controls. A closed loop tape delay made by Schallplatten themselves provides a delay of between 20 and 120 ms. While I was there they were demonstrating its capabilities with some Schallplatten tapes of wind in the trees and distant bells. The loudspeaker monitors are also built in the DDR and seem to produce a very creditable sound. I calculated the cost to be around £400 each. I understand they are used throughout most East German recording and broadcasting studios. (*A pity we lack such standardisation here.*—Ed.)

We looked briefly at a quality control room where DDR disc equipment is used to check the cut masters. These are then sent to Babelsberg for pressing and issued on the various VEB Deutsche Schallplatten labels. The *Eterna* label is for Classical music only, *Amiga* carries Pop and Show music, *Nova* covers a wide range of tastes, and *Litera* is mainly spoken word. Some children's recordings are available on *Litera* and VEB Deutsche Schallplatten have a mutual exchange tie-up with the Russian *Melodia* label.

The Classical discs sell at around £1.60 and £2.10 for Popular. VEB Deutsche Schallplatten also have a fairly extensive list of cassettes (Philips 4.75 cm/s type). There are at present some 150 in the list and, although many of these are original DDR recordings of fairly characteristic East German music, I noticed a fair number of Western titles. For instance the original soundtrack from the film *Funny Girl* is listed, so is a collection of recordings by Ella Fitzgerald and Billie Holiday. Ray Conniff, the *My Fair Lady* soundtrack, Mirielle Mathieu and Bert Kaempfert recordings are also available.

Agfa mastering

Cassettes I am told are very popular now in East Berlin. Most of the mastering tape used in the studio seems to be made by Agfa and the cassettes may be of similar origin.

The cassette title list is fairly representative of the range of commercial recordings sold in the DDR and, for that matter, the kind of light music on the radio or on television. Apart from Classical music which is always plentiful on disc, radio and TV (and highly respected in the West), concentration in the East is on Teashop music, March music, Opera and the like.

On our way out of the Reichstagufer we passed through the entrance corridor and I noticed that, in common with most recording studios, some of the year's favourite and most successful recordings were represented in gallery of sleeves. I was particularly impressed by the beautiful monochrome line-drawing sleeves of some of the latest releases. The sleeve card seems rather flimsy by Western standards but the sleeve content is both informative and exceedingly tasteful.

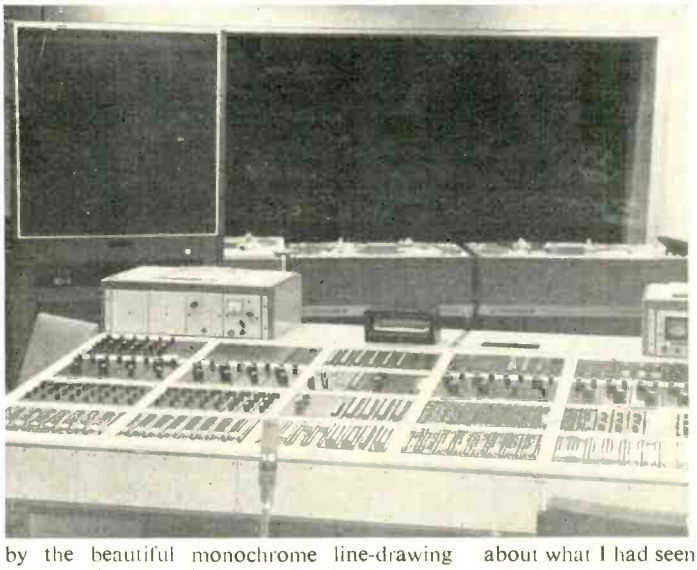
As I sat at the border checkpoint waiting for my passport to be checked, I had time to think about what I had seen. It suddenly dawned on me that really (apart from the use of ppms instead of VUs) there had been very few differences between Eastern and Western studios. That, I think, is really the most important point of all to emerge.

Adrian Hope

Oscilloscope goniometer

Joachim Garten

Reichstagufer control room



DIARY

Airways contract in November. Their 30-minute film on the New Blue Train for SA Railways is completed and is awaiting final approval. Two feature films were mixed at RPM and the music tracks for four local films were recorded in studio One. Some 15 commercial films were mixed during the year and the editing rooms were hired out for a total of 1,250 hours by outside clients.

'On the record side, RPM had eight numbers in the charts. Eight numbers were released overseas during 1972, the most notable of which was the original recording of "Delta Queen" by Proudfoot. This number has been released world-wide—24 cover versions have been recorded and it has appeared on ten hit parades.

'Other RPM groups to make the charts last year were Four Jacks and a Jill, Gentle People, Late Harvest, Aerophone and Proudfoot.

'Other overseas releases were Dan Hill's "Sounds Electronic" series, Mike Hankinson's "Classical synthesiser" through Ad-Rhythm, vocalist Maria with her single "I'm on Fire" in Brazil, and the Gentle People lp in Brazil. The local release of A & M's Gallery and their "Nice to be With You" received a gold disc in September.

'1973 is going to be another big year for this young company. It celebrates its first five years in operation in April. Its publishing company, Clan Music, under the guidance of Chris Kritzinger, is going from strength to strength and should make its mark overseas in the next few months.

'Educasting SA (Pty) Ltd, a newly-formed company, in association with the overseas company, are going full steam ahead with their Educassette teaching system through a Johannesburg college, which will keep studio Two fully booked for months ahead, producing programmes. A Neumann lathe has been installed and a Westrex stereo cutting system will be installed in the near future.

'Studio One now has full 16 track recording facilities with 20 mix inputs to a Studer *A80* machine—the only 16 track machine in South Africa.'

Unfortunately, because of the usual boring space reasons, last month's piece about **Indigo** was shorter than I had intended, as was that about **Marquee**. Among the consequent casualties was Salena Jones, who had come into Indigo to record a single for the Indigo label called 'Some Other World'—quite a coup for them, I should think. It was Indigo's first eight track session, for which they used a hired tape machine. Now, as I reported last month, the studio have acquired an Ampex *MM1100* eight track, convertible to 16 or 24 if the need arises, as it well may.

Indigo are also involved in the classical scene; they recently recorded the British Youth Choir and Chamber Orchestra in Sheffield Cathedral and Michael Davis, co-leader of the Halle Orchestra, has been into the studio with pianist Rayson Whalley to record an lp of Walton and Debussy pieces for the Indigo label.

According to Bob Auger, local groups have made good use of the studio, and Indigo are now building a dj studio next to the existing studio. To do this they have formed a company with ex-Beeb dj Peter Hearne. The studio will be equipped, I am told, with Rapid-Q Cartridge machines, Thorens turntables, AKG mics, and stereo Revox machines, and will be available for hire as well as being used by Indigo's own company.

Granada TV, the old firm of both Bob Auger and Dave Kent-Watson, used the studio to record theme music for a new drama series. The music was composed by John McCabe and performed by members of the Halle Orchestra. Peter Adamson, an associate of the studio, recorded a thing called 'Tutenkamen —In the Valley of the Kings', which I am told is a hit of 1922, for a Granada documentary.

Next month I'll do justice to Marquee.

Finally, my crystal ball did me proud last month when I hinted that Birmingham Broadcasting would get the commercial radio contract in my home town: Brum. Of course, some meanies will say that it was a foregone conclusion and other cliches like that. Birmingham Broadcasting's chairman is Mr John Parkinson, national chairman of . . . yes, you guessed: The Cooperative Party. He is also principal of Solihull Technical College. His managing director is Mr David Pinnell and his financial director is Mr Geoffrey Battman. The other two contracts announced were for Glasgow and Manchester. They were won by Radio Clyde, chairman Ian Chapman; and the Greater Manchester Independent Radio Group, chairman Mr Biel Pearson. More about this next month as well as news of some exciting doings at De Lane Lea.

Adrian Ibbetson, engineer, and Norman Davey, technical consultant, discuss technical matters in the control room of Radio Fleet. Fleet are a demo and commercial radio studio in the United Newspapers building near Fleet Street.

BROADCASTING

equipment. This seems to predate British outside broadcasts by a year or so.

As with television, there is a fairly wide choice of local radio. Apart from Senders Freies Berlin radio, there is the completely separate RIAS radio station which is American-funded but German-speaking. But what must not pass unnoted is the German licensing system. For just as the BBC are non-commercial so Berlin radio and television is predominantly non-commercial. A combined tv and radio licence (monochrome or colour, it makes no difference) costs 8.50 DM per month, similar to the price of a UK colour tv licence. The cost for radio only is 3 DM per month (about 40p). But because, like the BBC, Berlin radio and television are always short of money, there is a tightly reined short period of commercial radio and tv each day. The commercial radio is mostly in the morning and the commercial tv mostly in the afternoon. Because it is tightly knit and clearly commercial in content, it is presumably easy to avoid. But it brings in money and keeps the licence fees down. The concensus of opinion among those I spoke to seemed to be that, provided the amount of commercial time did not increase, the system was a good one. I wonder if the same system could work in Britain.

The old radio tower now stands defunct and the new 240m high tower puts out most of the West Berlin radio and television transmissions. Over in the East, the East Berlin tower rises to around the same height with a revolving restaurant near the top. Both towers pump out their own version of the truth about the world today as their controllers see it.

Adrian Hope

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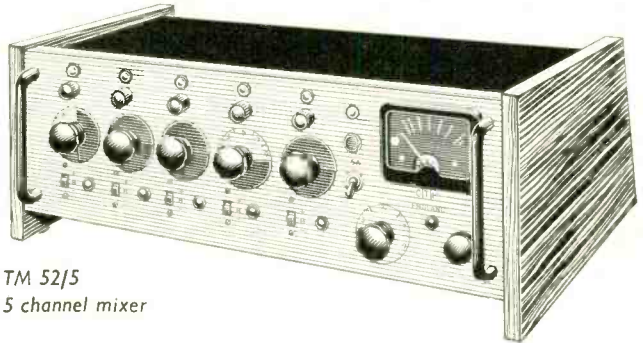

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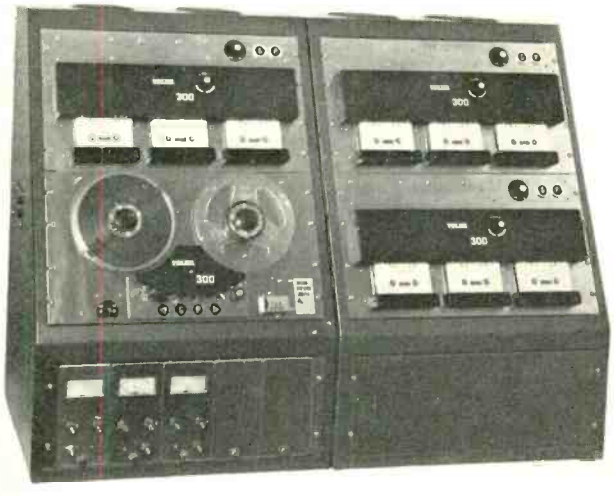

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Headphones: a comparative review

HUGH FORD AND
JOHN SHUTTLEWORTH

Sixteen headsets representing a cross section of currently available models are given objective tests by Hugh Ford with subjective comments from John Shuttleworth.

TO ATTEMPT to make meaningful measurements of headphones is probably equally fraught with doubtful practices as the same operation on loudspeakers. Normally loudspeakers are measured under free field conditions (that is either in an anechoic chamber or in an open space). They are then used in a 'live' room which will have little resemblance to the conditions under which they were measured. In the case of headphones, measurements are undertaken with the help of an artificial ear which is intended to simulate the impedances of the human ear. Unfortunately there are several types of artificial ear in use and the measurements associated with this review were done on the latest design in the form of the Bruel & Kjaer *4153* which was built as a result of the deliberations of the IEC Technical Committee TC29.

It is probable that measurements on headphones have a better chance of being meaningful, from an environmental point of view, than those on loudspeakers. However, in both cases, the conventional measurement techniques are open to question.

The columns of STUDIO SOUND have already been used to air a number of criticisms of loudspeaker measurements and I do not intend to add to the discussion in this review. The inclusion of any measurement technique does not mean that we believe it to be without shortcomings, but that we feel it a valid measurement for the purposes of comparison.

All the review samples were measured under as near as possible identical conditions, the artificial ear being equipped with the adaptor for circumaural earpieces and the earphone being pressed on to the artificial ear by a force of 5N. The drive to the headphones was from a Quad *303* power amplifier with only one channel connected and the headphones set to stereo and maximum sensitivity in every case.

The following notes will be of assistance when comparing and interpreting the results and referring to the frequency response data and tone burst waveforms:

Input for 100 dB spl

These results were determined by applying a frequency modulated 1 kHz sine wave to the headphones, the purpose of the frequency modulation being to reduce the effect of any sharp resonances. The Stax electrostatic headphones were measured through their recommended drive units.

While sensitive headphones are desirable for some applications, high sensitivity can be an embarrassment when headphones are connected to the output of many power amplifiers in series with a low resistance, because power amplifier noise levels may prove excessive. The average input for left and right earphones is quoted.

Unbalance between channels

This is quoted as the difference in sensitivity of the left and right earphones at 100 dB spl with a 1 kHz frequency modulated input.

Impedance at 1 kHz

Impedance was measured for individual earpieces by applying a 1 kHz sinewave at a constant current of 10 mA. It should be noted that all the headphones equipped with internal volume controls changed their impedance according to the volume control setting.

Efficiency

The input power at 1 kHz for 100 dB spl sound output showed an enormous variation, the electrostatic headphones being the least efficient, as is to be expected. With battery-operated equipment, highly efficient headphones may considerably reduce overall power consumption, resulting in longer battery life.

Second harmonic distortion

The second harmonic is normally the prevailing harmonic in headphones, and the intermodulation performance will tend to show other non-linearities. The quoted figures are the worst of the two earpieces, which were similar in distortion in all except the Stax *SR-X*, where the better earpiece performance has been added.

Quoted distortion figures of less than 0.1 per cent are unreliable because of inherent distortion in the measuring equipment. In cases where distortion of less than 0.05 per cent is quoted, harmonic cancellation has occurred.

Intermodulation distortion

This was measured by the normal SMPTE method with a mixture of 50 Hz and 7 kHz signals in the voltage ratio 4:1. The measuring system distortion was negligible when compared with the quoted performance.

Maximum output

The 1 per cent total harmonic distortion point was considered as a reasonable maximum usable output, total harmonic being chosen because it includes all spurious signals embracing non-harmonically related resonances. No attempt was made to measure in excess of 120 dB spl as, not only is this above the largest realistic output, damage to the headphones would be likely above this level. All headphones gave an adequate output for domestic use, but the Audio *CIS-1000* and Dynatron *SP-3* may be inadequate for some monitoring applications.

External sound reduction

The sound reduction offered by headphones is important when listening in noisy surroundings, and also when trying to leave other people in peace—often the whole point of using headphones.

The sound reduction was measured with both wide band pink noise, and with a 1 kHz sinewave, by noting the reduction in output from the artificial ear when the headphones were mounted on it. The results clearly divide the samples into two groups which one might think was obvious from inspecting the samples—but the apparently heavily shielded Trio with its great bulk offered insignificant sound reduction.

Tone burst performance

The tone burst oscillograms shown are the result of bursts of 1 kHz sine wave beginning and ending at the zero crossover point. Oscillograms such as that taken from the TTC *G3500* show a poor attack time and also excessive ringing which is apparent at least 10 ms after the removal of the tone. Only serious defects will be apparent from the oscillograms in view of the limited Y scale shown, and further Y axis expansion would be essential to investigate defects more than around 15 dB down which can clearly be of great audible effect.

For ease of reference, the results of the tone burst oscillograms have been tabulated from grade 'A' down to grade 'C' in order of performance.

Frequency response

The frequency response plots were made by feeding the headphones with pink noise of such amplitude that the output sound pressure level was 100 dB over the 20 Hz to 20 kHz frequency spectrum. The resulting output was then analysed in one-third octaves. The difference between the samples of headphone is quite amazing and, while one may argue about the overall shape of the frequency response plots, it is quite clear that some samples of headphones exhibited the most undesirable characteristics.

As with the tone burst data, the frequency response results have been divided into grades 'A', 'B' and 'C' in descending order of performance.

The overall picture

All the samples will be subjected to listening tests so it will be very interesting to see how the results of these tests compare with the results of measurements, and with this in mind I have not at the time of writing listened to program material on any of the samples.

Based purely on the results of measurements, I would consider the Stax *SR-X* the best of the samples, subject to its poor rejection of external noise and possibly the higher distortion in one earpiece. If the rejection of extraneous noise is at a premium, the likely second choice I would put at either the Dynatron or the PWB. Now for the bottom of the list: my calculated guess—the Audio *CIS-2000*. **Hugh Ford**

THE DESIGN of headphones presents similar problems to those encountered in designing loudspeakers. Since the headphones are more directly coupled to the ear, however, some of these are considerably lessened.

To obtain a reasonable bass response, the loudspeaker designer has to ensure that air at the rear of the cone is suitably isolated from that at the front, and this normally means enclosing the speaker in a box which itself raises additional problems. In normal headphones, the ear cushion isolates the rear of the cone from the ear, allowing bass to be reproduced without the use of an enclosure.

Where it is felt desirable to provide a degree of isolation from external sound, some type of enclosure must be used and the designer is then faced with problems of boxiness and coloration.

The desired amount of sound exclusion from external sources depends upon the level at which the headphones are used. In many cases, phones with a high sensitivity but poor sound isolation can produce better results than phones with a lower sensitivity and higher sound isolation.

There are occasions when complete isolation from outside sound might be desirable, such as monitoring a piano recording in the same small room as the piano, but this is an unusual requirement.

The headphones were tried in turn on the usual speaker test tape and given the ratings shown for the various section.

The phones quickly divided themselves into three distinct groups: the AKG *K60*, Sennheiser *HD414*, Stax *SR3* and *SR8* forming the group with highest quality sound.

The next group, with good sound reproducing qualities, were the Koss *HV1* and *K6/LCQ*. All in the third group would be adequate for communications or non-critical speech applications but each had degrees of coloration or faults in response that would make them less suitable for monitoring or uses where high quality is important.

After the plans had been tried on the usual section of the test tape, they were each subjected to the organ and percussion recording used as a test for loudspeakers. This recording consists of deep pedal notes on the organ together with fierce transients from the percussion department and quickly shows up faults otherwise unnoticed on normal program material. The only headphones to cope with this tape at even moderate levels were the AKG *K60* and the Sennheiser *HD414*. While these both gave clean natural sound, all the others distorted at some stage in the tape and most distorted very badly indeed. This was the only test where the two Stax electrostatics came off badly; they sounded as though the plates were rattling together a lot of the time.

Most of the phones supplied for review were of 8 ohms impedance and therefore designed to be used via the loudspeaker terminals of an amplifier. It is more sensible to design headphones of about 600 ohms impedance as they can then be used either from a 600 ohm line or from a speaker terminal without loss of quality or sensitivity. The AKG *K60*, Sennheiser *HD414* and Koss *K6/LCQ* were consequently considered more versatile than the others tried and results of the tests show that this impedance does in fact make sense.

It was not possible to complete the tests on the TTC headphones as an intermittent contact made sensible judgement impossible.

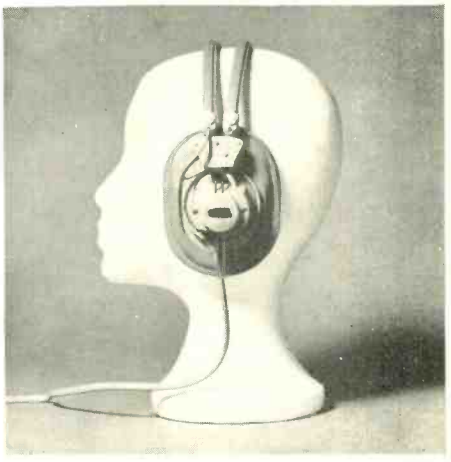
The Howland West *CIS 1000* were so insensitive and lacking in treble response that they were suspected as being faulty. Apart from this the *CIS 1000* were uncolored and gave a pleasant sound. The TTC phones, when working, were judged to have better than average isolation from outside sounds but to be rather boxy and coloured. A full report on the Trio phones is given as these were the best of the third group. Other phones in this group are given a rating for each section of the tape, the top rating measuring that they equal the Trio on that section.

The best units for sound quality were the Stax *SR8* and, had it been able to cope with the organ and percussion tape, it would have been hard to beat.

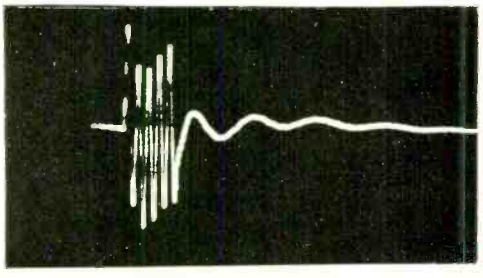
On the results of these tests, however, the AKG *K60* and Sennheiser *HD414* are easily the best headphones for studio use. The AKG are more critical of program material and therefore would be more use when checking tapes, but there is very little between them and the Sennheiser. Both these phones have the added advantages over the Stax that they do not require a polarising voltage and are of a more useful impedance.

The Koss four channel headphones were tried on discrete four channel master tapes. In spite of their weight, they were comfortable to wear for quite long periods. Sound quality was good and there was a marginal but perceptible improvement in sound over the stereo versions of the same tapes played through the Koss phones switched to stereo. But there was not sufficient separation between the front and rear channels to make the phones useful for monitoring four channel tapes.

AKG K60



MEASURED PERFORMANCE
Input volts, 100 dB spl 1 kHz: 1V
Input power, 100 dB spl 1 kHz: 1.43 mW
Channel imbalance: 0 dB
1 kHz impedance: 700 ohms
2nd harmonic distortion (per cent)
at 40 Hz: 1.6
at 1 kHz: 0.1
at 6.3 kHz: 0.03
Intermodulation distortion, 100 dB spl SMPTE: 1.45%
Maximum output for 1% thd at 1 kHz: 117 dB
Wide band external sound reduction: 15 dB
1 kHz external sound reduction: 16 dB
Tone burst performance: C
Frequency response performance (see curve): C



AKG K60

Choir: Clean natural full sound.
Musical box: Good transients, smooth top response.
Organ: Plenty of firm bass, excellent balance.
Folk singer: Very natural reproduction of voice, guitar sounded real.
Dance band: Well balanced. Good separation of instruments.

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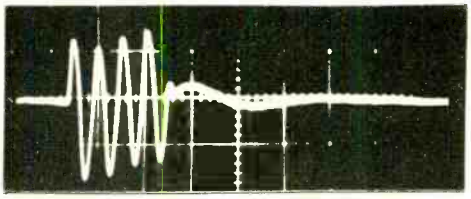
HEADPHONE COMPARISON

Piano concerto: Silky string sound, natural piano sound, singing tone.
Wind sextet: All instruments reproduced naturally.
Voice: Very natural, faults in recording clearly heard.
Full orchestra: Climaxes handle well.
Organ and percussion: Excellent reproduction, instruments well separated.

AUDIO CIS 1000

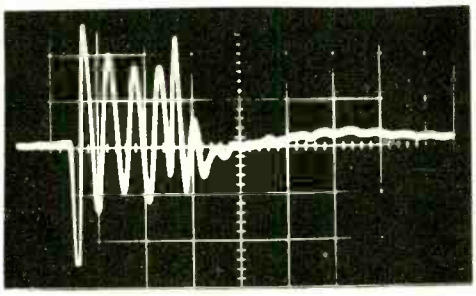
MEASURED PERFORMANCE
Input volts, 100 dB spl 1 kHz: 75 mV
Input power, 100 dB spl 1 kHz: 1.2 mW
Channel imbalance: 0 dB
1 kHz impedance: 4.8 ohms
2nd harmonic distortion (per cent)
at 40 Hz: 1.6
at 1 kHz: 0.07
at 6.3 kHz: 0.03
Intermodulation distortion, 100 dB spl SMPTE: 1.7%
Maximum output for 1% thd at 1 kHz: 104 dB
Wide band external sound reduction: 0dB
1 kHz external sound reduction: 0 dB
Tone burst performance: A
Frequency response performance (see curve): B



AUDIO CIS 2000

MEASURED PERFORMANCE
Input volts, 100 dB spl 1 kHz: 3.55V
Input power, 100 dB spl 1 kHz: 1.26W
Channel imbalance: 0.2 dB
1 kHz impedance: 10 ohms
2nd harmonic distortion (per cent)
at 40 Hz: 5.0
at 1 kHz: 2.2
at 6.3 kHz: 0.31
Intermodulation distortion, 100 dB spl SMPTE: 1.9%

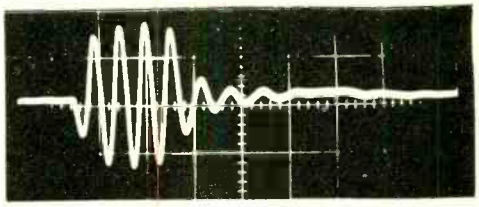
Maximum output for 1% thd at 1 kHz: 113 dB
Wide band external sound reduction: 12 dB
1 kHz external sound reduction: 10 dB
Tone burst performance: C
Frequency response performance (see curve): B



DULCI SH1300VS

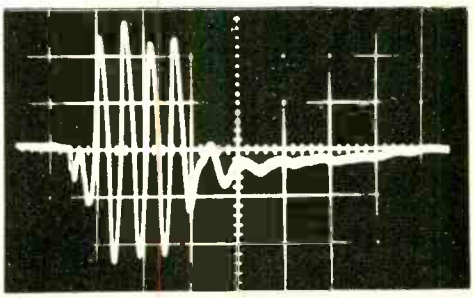
MEASURED PERFORMANCE
Input volts, 100 dB spl 1 kHz: 49 mV
Input power, 100 dB spl 1 kHz: 0.19 mW
Channel imbalance: 1.8 dB
1 kHz impedance: 12.5 to 58 ohms, depending on volume control setting
2nd harmonic distortion (per cent)
at 40 Hz: 0.06
at 1 kHz: 0.01
at 6.3 kHz; 0.06
Intermodulation distortion, 100 dB spl SMPTE: 0.3%

Maximum output for 1% thd at 1 kHz: 120 dB
Wide band external sound reduction: 17 dB
1 kHz external sound reduction: 16 dB
Tone burst performance: B
Frequency response performance (see curve): B



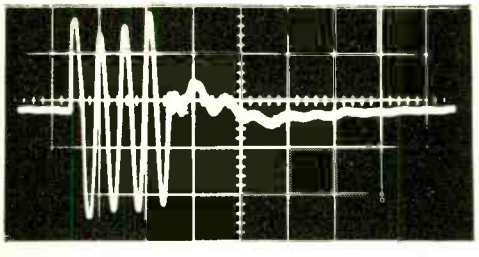
DYNATRON SP3

MEASURED PERFORMANCE
Input volts, 100 dB spl 1 kHz: 110 mV
Input power, 100 dB spl 1 kHz: 1.05 mW
Channel imbalance: 0.4 dB
1 kHz impedance: 11.5 ohms
2nd harmonic distortion (per cent)
at 40 Hz: 0.06
at 1 kHz: 0.08
at 6.3 kHz: 0.11
Intermodulation distortion, 100 dB spl SMPTE: 0.7%
Maximum output for 1% thd at 1 kHz: 99 dB
Wide band external sound reduction: 15 dB
1 kHz external sound reduction: 10 dB
Tone burst performance: B
Frequency response performance (see curve): C



KOSS HV1

MEASURED PERFORMANCE
Input volts, 100 dB spl 1 kHz: 106 mV
Input power, 100 dB spl 1 kHz: 72.4 mW
Channel imbalance: 4 dB
1 kHz impedance: 15.5 ohms
2nd harmonic distortion (per cent)
at 40 Hz: 4.5
at 1 kHz: 0.14
at 6.3 kHz: 0.1
Intermodulation distortion, 100 dB spl SMPTE: 1.7%
Maximum output for 1% thd at 1 kHz: over 120 dB
Wide band external sound reduction: 0 dB
1 kHz external sound reduction: 0 dB
Tone burst performance: B
Frequency response performance (see curve): A



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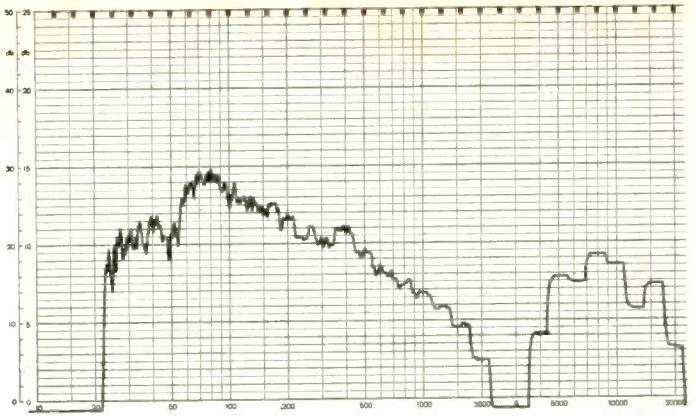
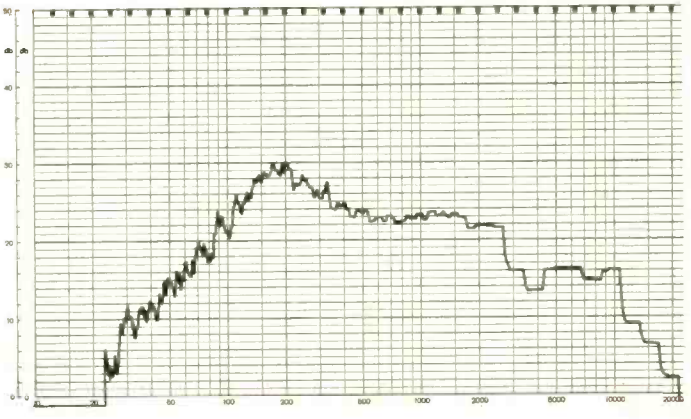
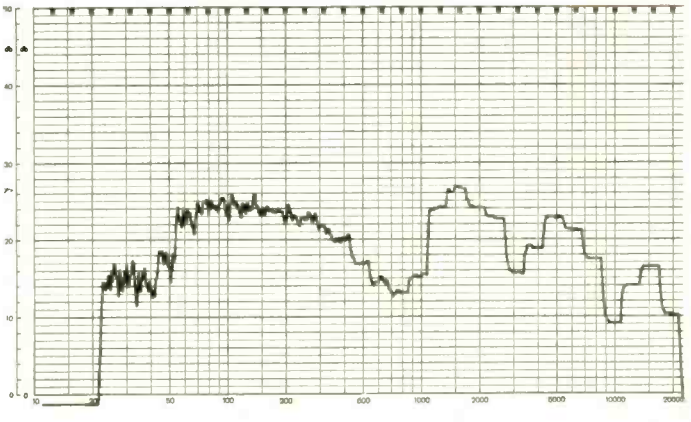
AKG K60



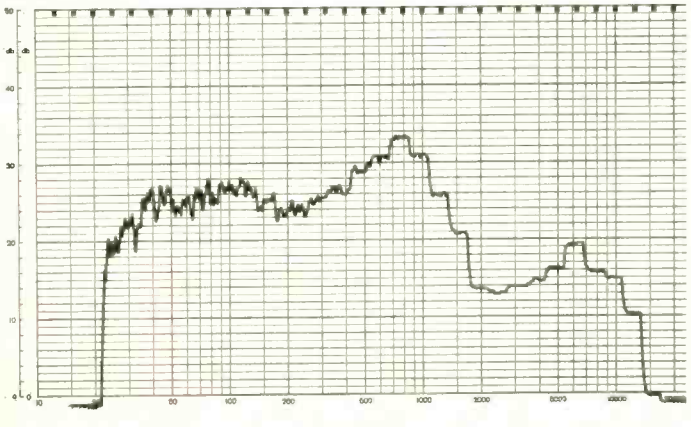
AUDIO CIS 1000



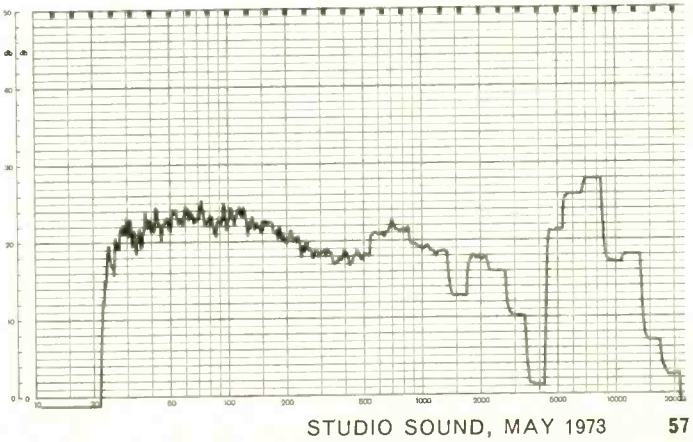
AUDIO CIS 2000



DULCI SH 1300 VS



DYNATRON SP 3



HEADPHONE COMPARISON

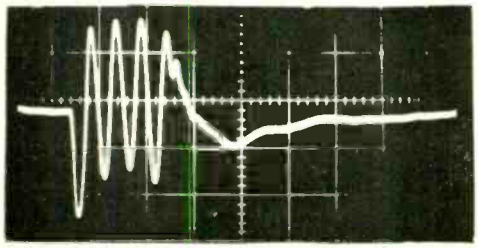
KOSS HV1

Choir: Natural sound but a little thin. Bass and treble good.
Musical box: Excellent transient response.
Organ: Clean sound with good treble but balance not quite right.
Folk singer: Excellent reproduction of guitar, voice a little bright.
Dance band: Very pleasant sound. Drum well and clearly reproduced.
Piano concerto: Natural string sound, excellent piano sound.
Wind sextet: Good separation of instruments, very natural sound.
Voice: Pleasant and natural. Some recording faults not easily noticed.
Full orchestra: Sound a little thin, some light distortion on climaxes.
Organ and percussion: Too much distortion to be acceptable.

KOSS K6/LCQ 'QUADRAPHONIC'

MEASURED PERFORMANCE
Input volts, 100 dB spl 1 kHz: 275 mV
Input power, 100 dB spl 1 kHz: 1.54 mW

Channel imbalance: 1.6 dB
1 kHz impedance: 49 to 89 ohms, depending on volume setting
2nd harmonic distortion (per cent)
at 40 Hz: 0.06
at 1 kHz: 0.08
at 6.3 kHz: 0.5
Intermodulation distortion, 100 dB spl SMPTE: 0.3%
Maximum output for 1% thd at 1 kHz: over 120 dB
Wide band external sound reduction: 13 dB
1 kHz external sound reduction: 12 dB
Tone burst performance: C
Frequency response performance (see curve): B

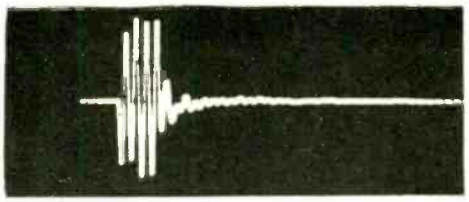


KOSS 'Quadraphonic' (Switched to stereo)
Choir: Full natural sound but very slightly muddy.
Musical box: Very natural only slightly lacking in transients.
Organ: Excellent bass; full natural sound.
Folk singer: Natural voice but guitar a little dull.
Dance band: Pleasant sound but separation of instruments could be better.
Piano concerto: No sheen on the strings, piano sound full but slightly dull.
Wind sextet: Natural pleasant sound.
Voice: Very natural and well reproduced.
Full orchestra: Climaxes handled well.
Organ and percussion: Slight distortion in 'difficult' passages.

PRINZ SOUND

MEASURED PERFORMANCE
Input volts, 100 dB spl 1 kHz: 70 mV
Input power, 100 dB spl 1 kHz: 0.47 mW
Channel imbalance: 0 dB
1 kHz impedance: 10.4 to 295 (maximum and minimum internal volume settings).
2nd harmonic distortion (per cent) at 40 Hz: 1.0
at 1 kHz: 0.08
at 6.3 kHz: 0.85

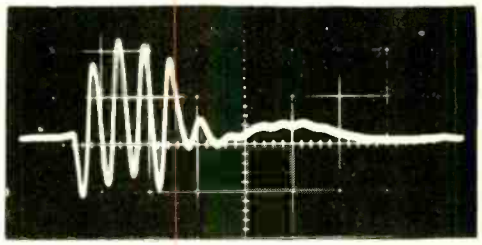
Intermodulation distortion, 100 dB spl SMPTE: 0.27%
Maximum output for 1% thd at 1 kHz: over 120 dB
Wide band external sound reduction: 5 dB
1 kHz external sound reduction: 5 dB
Tone burst performance: C
Frequency response performance (see curve): C



PWB MC

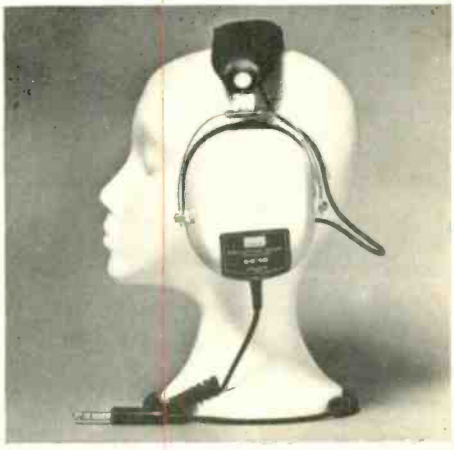
MEASURED PERFORMANCE
Input volts, 100 dB spl 1 kHz: 46 mV
Input power, 100 dB spl 1 kHz: 0.24 mW
Channel imbalance: 0 dB
1 kHz impedance: 8.8 ohms
2nd harmonic distortion (per cent)
at 40 Hz: 0.22
at 1 kHz: 0.07
at 6.3 kHz: 0.07

Intermodulation distortion, 100 dB spl SMPTE: 0.4%
Maximum output for 1% thd at 1 kHz: over 120 dB
Wide band external sound reduction: 10 dB
Tone burst performance: A
Frequency response performance (see curve): B



SANSUI SS-10

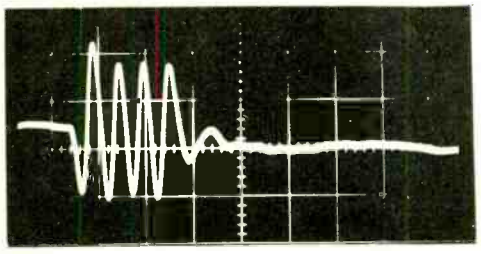
MEASURED PERFORMANCE
Input volts, 100 dB spl 1 kHz: 60 mV
Input power, 100 dB spl 1 kHz: 0.42 mW
Channel imbalance: 0.3 dB
1 kHz impedance: 8.6 to 21.5 ohms, depending on volume setting
2nd harmonic distortion (per cent)
at 40 Hz: 0.06
at 1 kHz: 0.04
at 6.3 kHz: 0.06
Intermodulation distortion, 100 dB spl SMPTE: 0.3%
Maximum output for 1% thd at 1 kHz: 120 dB



Wide band external sound reduction: 16 dB
1 kHz external sound reduction: 24 dB
Tone burst performance: A

HEADPHONE COMPARISON

Frequency response performance (see curve): C

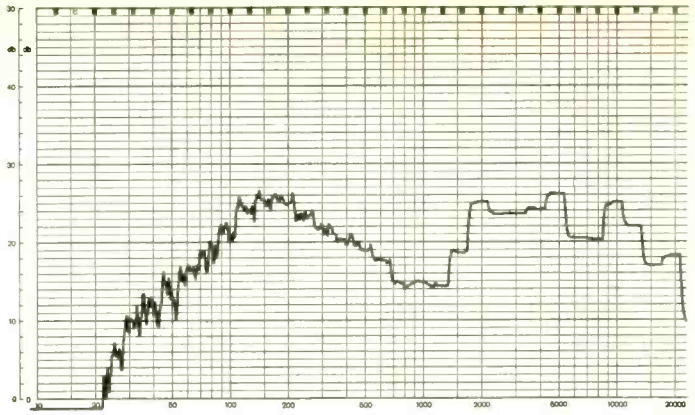


SENNHEISER HD414

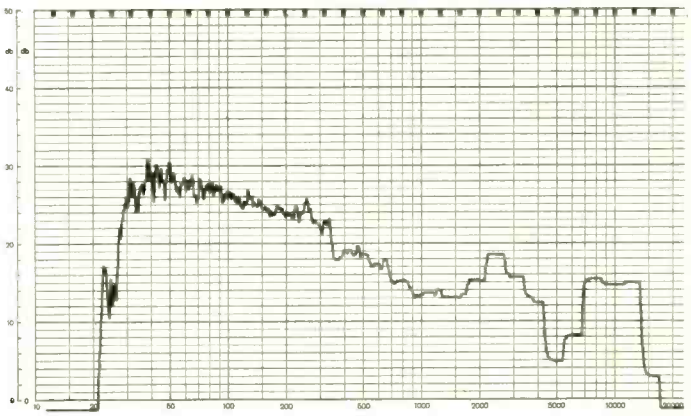
MEASURED PERFORMANCE

Input volts, 100 dB spl 1 kHz: 480 mV
Input power, 100 dB spl 1 kHz: 0.105 mW
Channel imbalance: 0 dB
1 kHz impedance: 2·2k ohms
2nd harmonic distortion (per cent):
at 40 Hz: 1.1
at 1 kHz: 0.06
at 6.3 kHz: 0.20
Intermodulation distortion, 100 dB spl SMPTE: 0.25%
Maximum output for 1% thd at 1 kHz: over 120 dB
Wide band external sound reduction: 0 dB
1 kHz external sound reduction: 0 dB
Tone burst performance: A
Frequency response performance (see curve): B

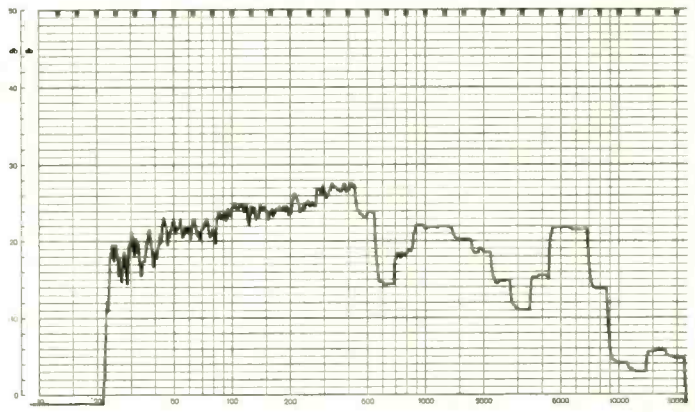
KOSS HV1



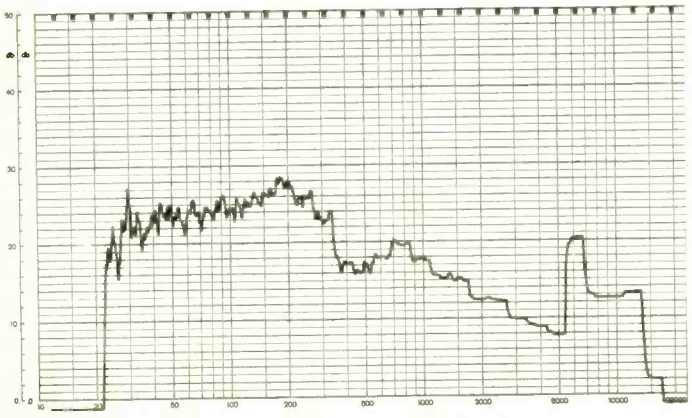
KOSS K6/LCQ



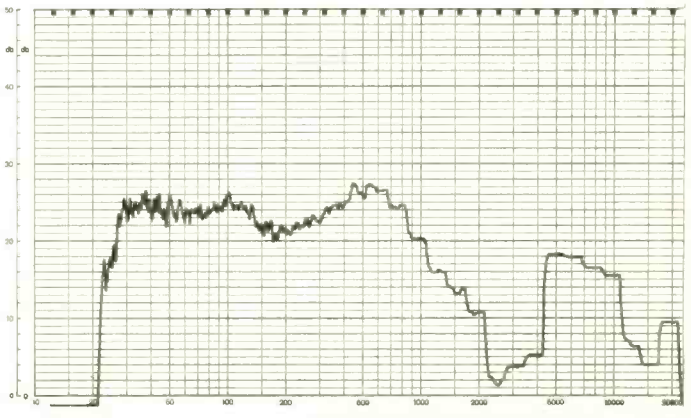
PRINZ



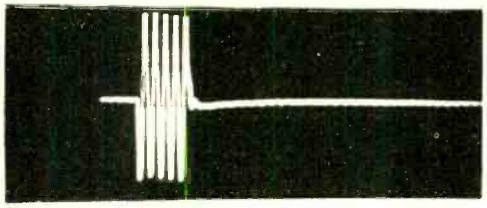
PWB MC



SANSUI SS-10



HEADPHONE COMPARISON

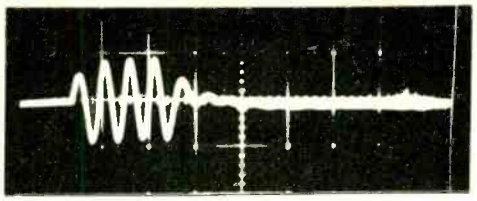


SENNHEISER HD 414

Choir: Full natural sound; very clear with plenty of bass.
Organ: Bright two-foot stops and firm bass.
Musical box: Excellent transients very good sound.
Folk singer: Very good sound but not quite true to the original voice. Only marginally out, however.
Dance band: Very pleasant sound and quite accurate though slightly 'warmer' than the original.
Piano concerto: Good string sound, excellent piano tone.
Wind sextet: Pleasing sound with accurate separation of instruments.
Speech: Natural and pleasant, some recording faults very slightly masked.
Full orchestra: Pleasant accurate warm sound. Climaxes handled well.
Organ and percussion: Full pleasant and accurate sound with no sign or distortion in the difficult passages.

STAX SR-3
MEASURED PERFORMANCE
Input volts, 100 dB spl 1 kHz: 1.5V
Input power, 100 dB spl 1 kHz: 70.3 mW
Channel imbalance: 0 dB
1 kHz impedance: 32 ohms
2nd harmonic distortion (per cent)
at 40 Hz: 1.4
at 1 kHz: 0.06
at 6.3 kHz: 0.16

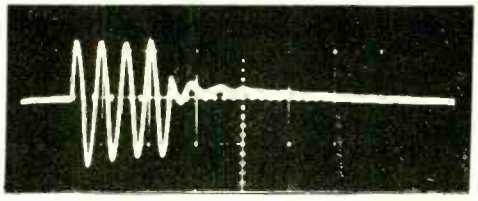
Intermodulation distortion, 100 dB spl SMPTE: 0.7%
Maximum output for 1% thd at 1 kHz: 118 dB
Wide band external sound reduction: 3 dB
1 kHz external sound reduction: 1 dB
Tone burst performance: A
Frequency response performance (see curve): B



STAX SR3
Choir: Natural sound with good bass and treble.
Musical box: Excellent transients, accurate reproduction.
Folk singer: Good guitar, very slight coloration on voice.
Dance band: Good clear natural sound, drum well reproduced.
Piano concerto: Excellent string tone with just the right sheen. Very realistic piano sound.
Wind sextet: Natural sound, good separation between instruments.
Speech: Very natural but sibilants slightly over emphasised.
Full orchestra: Clean natural sound, well balanced and climaxes handled well.
Organ and percussion: Serious distortion on 'difficult' passages.

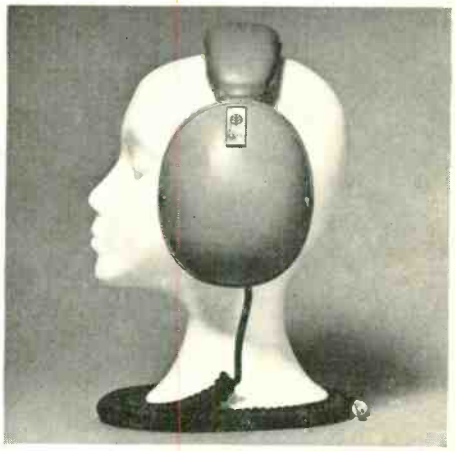
STAX SR-X

MEASURED PERFORMANCE
Input volts, 100 dB spl 1 kHz: 3.8V
Input power, 100 dB spl 1 kHz: 525 mW
Channel imbalance: 1.8 dB
1 kHz impedance: 27.5 ohms
2nd harmonic distortion (per cent)
at 40 Hz: 0.22
at 1 kHz: 0.32
at 6.3 kHz: 0.1
Wide variation between channels. Best 0.16% at 1 kHz, 0.14 at 40 Hz.
Intermodulation distortion, 100 dB spl SMPTE: 0.18%
Maximum output for 1% thd at 1 kHz: over 120 dB
Wide band external sound reduction: 4 dB
1 kHz external sound reduction: 4 dB
Tone burst performance: A
Frequency response performance (see curve): A

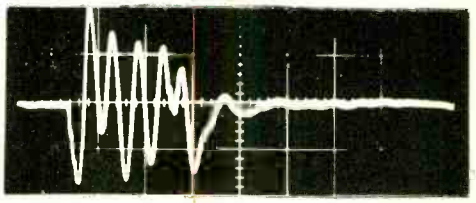


STAX SRX
Choir: Natural well balanced sound; good firm bass.
Musical box: Excellent transient response; full natural sound.
Organ: Excellent reproduction throughout the range; bright two-foot stops and full firm bass.
Folk singer: good guitar, voice exactly right.
Dance band: All instruments reproduced clearly and with a natural sound.
Piano concerto: Excellent string sound, very natural with just the right balance. Piano very natural.
Wind sextet: Pleasant natural sound, all instruments well reproduced.
Voice: The most natural sound heard in this section during these tests.
Full orchestra: Full natural sound with good separation of instruments. Climaxes handled well.
Organ and percussion: Some distorton on difficult passages.

TRIO KH-71
MEASURED PERFORMANCE
Input volts, 100 dB spl 1 kHz: 194 mV
Input power, 100 dB spl 1 kHz: 3.42 mW
Channel imbalance: 0.9 dB
1 kHz impedance: 11 ohms
2nd harmonic distortion (per cent)
at 40 Hz: 1.0
at 1 kHz: 0.16
at 6.3 kHz: 0.06
Intermodulation distortion, 100 dB spl SMPTE: 3%.



Maximum output for 1% thd at 1 kHz: 120 dB
Wide band external sound reduction: 2 dB
1 kHz external sound reduction: 0 dB
Tone burst performance: C
Frequency response performance (see curve): C



TRIO KH71
Choir: Slightly boxy and rather dull sound.
Musical box: Slightly lacking in transient response.
Organ: Firm bass but two-foot stops not as bright as the original.

THE HV1 IS NOT A STEREOPHONE YOU'LL TAKE LIGHTLY.

Up to now, lightweight headphones have meant lightweight sound. But Koss have changed all that. In developing the HV-1, Koss engineers have come up with a High Velocity Stereophone that offers not only unusual lightness and hear-through characteristics but also the exciting full range sound of Koss as well.

Koss were content to make a light headphone only when they were sure that their designers had overcome the disadvantages inherent in other manufacturers' lightweight models. This was achieved by greatly reducing the mass of the moving diaphragm assemblies, giving the new Koss HV-1 High Velocity Stereophone a wide-range frequency response of unusual fidelity. Highs are brilliant and crisp while the bass is deep and rich without muddiness or boominess.

Designed to fit close to the head, the new Koss HV-1 Stereophone has a stylish, low-silhouette design without the cone-type projections found in other headphones. This slim design permits unusually fine acoustical tuning of the element chamber at the factory as well as presenting a smart, professional appearance. The micro weight HV-1 lets you listen comfortably hour after hour. Lighter than 10 ounces, the Koss HV-1 has the perfect balance characteristic of all Koss Stereophones plus a glove-soft vinyl-covered headband and acoustical sponge ear cushions.

The new HV-1 proves that because a headphone is light it need no longer be cheap in construction and lacking in performance.

Suggested Retail Price £20

KOSS STEREOPHONES

TAPE-MUSIC DISTRIBUTORS LTD. 114 Ashley Road · St. Albans · Herts. AL15JR
Telephone: St. Albans 64337-9

Please send free colour brochure containing details of complete Koss range from £10 to £69 PLUS VAT

Name .....

Address .....

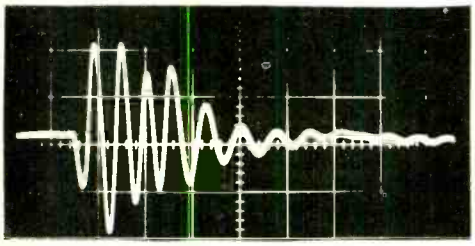
SS

HEADPHONE COMPARISON

Folk singer: Guitar dull, voice slightly coloured.
Dance band: Muddy sound, rhythm section dull.
Piano concerto: Strings lost their sheen, poor piano sound.
Wind sextet: Very slightly dull but otherwise quite natural.
Voice: Reasonably free of coloration but lacking in transients.
Full orchestra: Slightly boxy and a little muddy.
Organ and percussion: Too much distortion to be acceptable.

TTC G3500

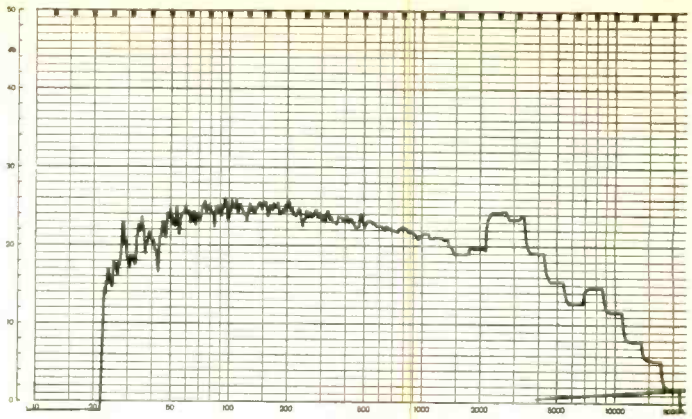
MEASURED PERFORMANCE
Input volts, 100 dB spl 1 kHz: 62 mV
Input power, 100 dB spl 1 kHz: 0.48 mW
Channel imbalance: 1.9 dB
1 kHz impedance: 8 to 37 ohms, depending on volume setting
2nd harmonic distortion (per cent)
at 40 Hz: 0.13
at 1 kHz: 0.03
at 6.3 kHz: 0.13
Intermodulation distortion, 100 dB spl SMPTE: 0.15%
Maximum output for 1% thd at 1 kHz: over 120 dB
Wide band external sound reduction: 14 dB
1 kHz external sound reduction: 25 dB
Tone burst performance: C
Frequency response (see curve): B



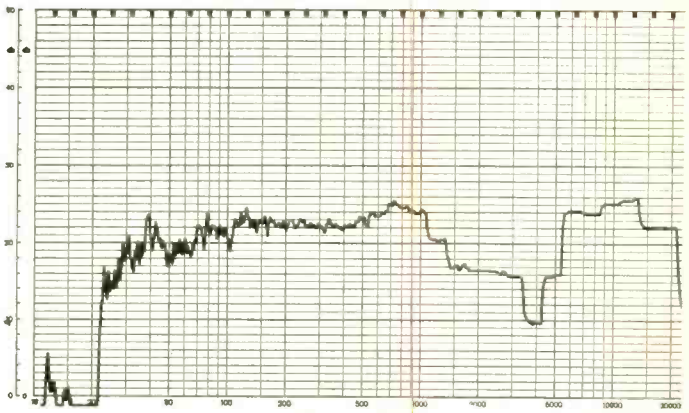
WHARFEDALE ISODYNAMIC

MEASURED PERFORMANCE
Input volts, 100 dB spl 1 kHz: 9.9V
Input power, 100 dB spl 1 kHz: 891 mW
Channel imbalance: 1 dB
1 kHz impedance: 110 ohms
2nd harmonic distortion (per cent)
at 40 Hz: 9.0 (the overall distortion of the Wharfedale dropped rapidly with sound level, however I consider the ability to reproduce

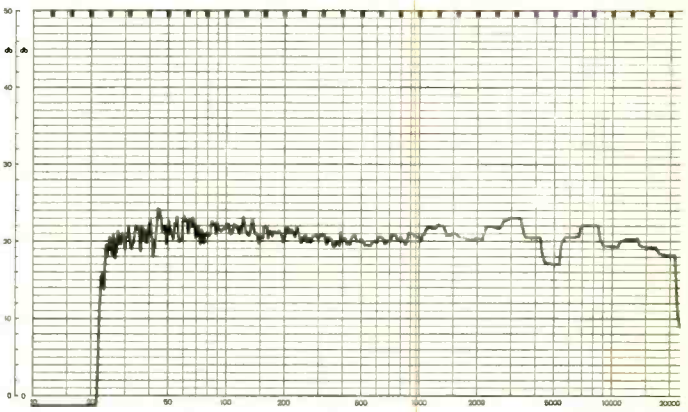
SENNHEISER HD414



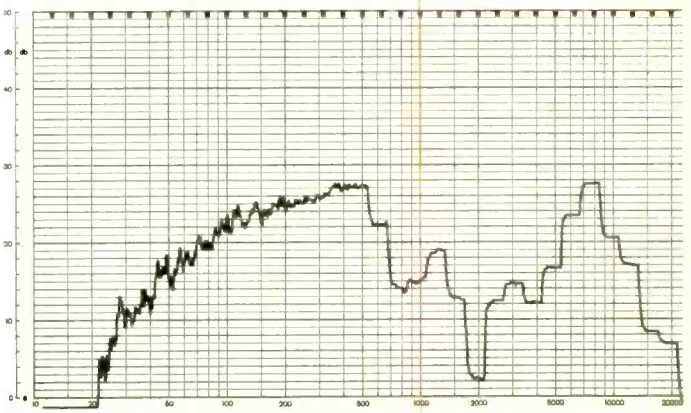
STAX SR-3



STAX SR-X



TRIO KH-71



P.W.B.

Natural Sound

Monitoring Stereo Headphones

ELECTROSTATIC TYPE N.S.E.

These headphones have a full frequency range and outstanding transient response, eminently suitable for monitoring purposes.

MOVING COIL TYPE M.C.

These headphones are suitable for high fidelity listening and monitoring. The lightweight mylar diaphragm gives a comparable performance to the electrostatics.

Both headsets weigh only 13oz each and can be worn for long periods without fatigue.

Hear these headphones in the London area at:

Audio T, 190 West End Lane, NW6 1SQ
Speaker Selection, 611 Forest Road, E. 17
Grahams Electrical, 88 Pentonville Road, N1 9HS
Guildford Hi Fi, 270 High Street, Guildford

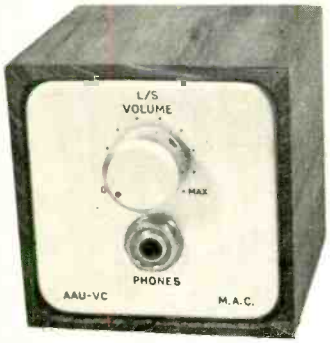
Leaflets available from:

P.W.B. Electronics Ltd.
1 Norfolk Gardens, Leeds LS7 4PP, England
Tel. Leeds 682550

AAU HP

- ★ 4 Stereo Headphone Outputs.
- ★ 4 Independent Volume Controls.
- ★ Auto-Impedance Matching.
- ★ Ideal for Multi Headphone Foldback Monitoring during Recording Sessions.

Housed in a Solid Teak Case.



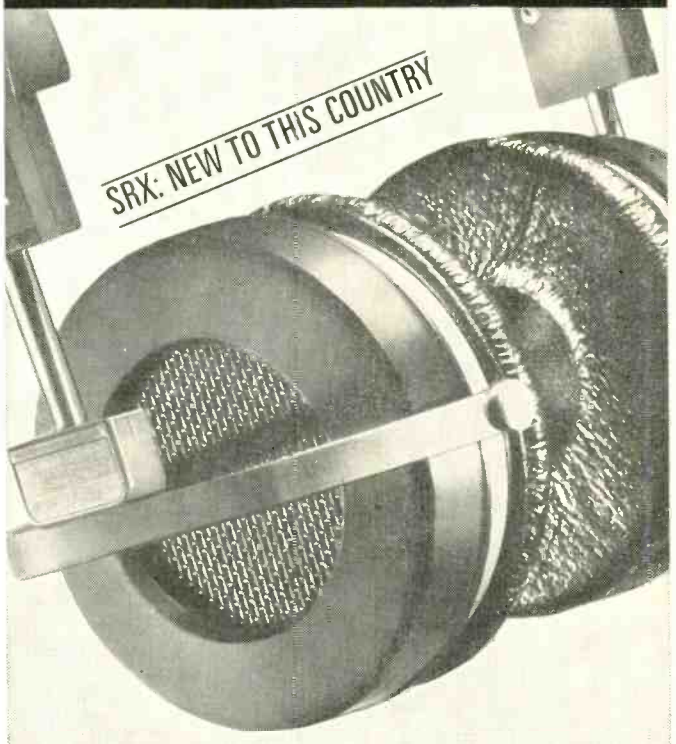
AAU VC

★ A Unit designed to provide Control of Volume for High Quality Monitoring or Extension Speakers at the Speaker Location **Without Loss of Damping** to the Bass Speaker. Incorporates High Quality Attenuator Transformers.

For further information of AAU VC, AAU HP and our Full Range of Units write to:

M.A.C. LTD.
17A Bathley St, Nottingham

STAX HEADSETS



the finest money can buy

STAX SR-3. The brand leader in electrostatic headsets. Ultra-light, ultra-comfortable thanks to the separate SRD5 energising unit (mains operated for optimum performance). Traditional Stax quality for only £49.00.

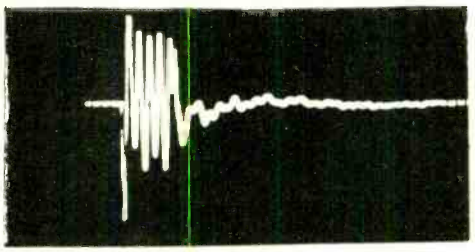
STAX SR-X. The most talked-about Stax development for years – SRX "superphone" and separate energising unit SRD-7. At last available in U.K. Smooth, deep, pure sound for £96.00. Experience Stax sound at your nearest franchised dealer. Technical specifications and stockist list on request.

WILMEX LTD

Import Division, Compton House, New Malden, KT3 4DE.
Telephone: 01-949 2545

HEADPHONE COMPARISON

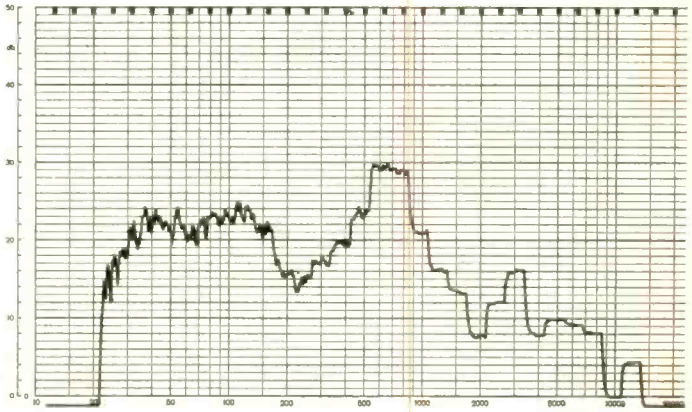
100 dB spl with reasonable distortion to be essential for good quality monitoring.
at 1 kHz: 0.9
at 6.3 kHz: 0.05
Intermodulation distortion 100, dB spl SMPTE: 7.4%
Maximum output for 1% thd at 1 kHz: 103 dB
Wide band external sound reduction: 4 dB
1 kHz external sound reduction: 0 dB
Tone burst performance: C
Frequency response performance (see curve): B



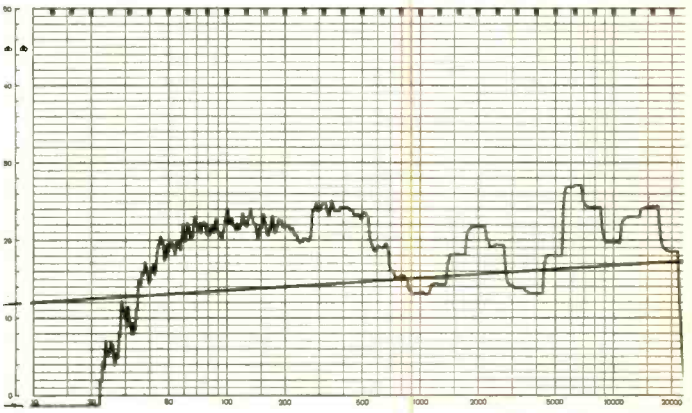
WHARFEDALE ISODYNAMIC

Choir: Fairly natural but sound a little dull.
Musical box: Excellent transients, pleasing sound.
Organ: Firm bass and bright treble, a good sound.
Folk singer: Very slight coloration on singer's voice. guitar quite natural but sound a little more 'dry' than the original.
Dance band: Pleasant full sound but some slight mid-range coloration.
Piano concerto: Quite good string sound but lacking the 'sheen' of the original, piano well reproduced.
Wind sextet: Good separation of instruments, bassoon a little dull but otherwise excellent sound from the other instruments.
Voice: Fairly accurate but slightly lacking in presence.
Full orchestra: Pleasing sound, some distortion on climaxes.
Organ and percussion: Bad distortion on difficult passages.

TTC 3500



WHARFEDALE ISODYNAMIC



Philips sound is out of this world and doesn't cost the earth.

N6302 Frequency range 16-20,000 Hz. Sensitivity 112 dB at 1mW. Weight only 450 gm. 'Sound Dimension Control' lets you adjust stereo effect exactly to match your own ears.

LBB9902/N6301 Frequency range 20-20,000 Hz. Sensitivity 112 dB at 1mW. Weight only 370 gm.

High quality headphones are usually expensive.

Making them *in*expensive comes a bit harder.

Philips have done just that with these Hi-Fi stereo headphones. They give you beautifully crisp, clear sound. At a very reasonable price.

Each has a 6½ ft coiled lead with a 5-pin DIN 360° plug you can insert two ways – to mute the loudspeakers or let them play.

Hear these headphones at your Philips dealer's. And for a brochure on all Philips audio and recording accessories, write to Philips Electrical Ltd., Dept SP, Century House, Shaftesbury Avenue, London WC2H 8AS.

PHILIPS

We want you to have the best.

PHILIPS

Survey: monaural, binaural and 'quadraphonic' headphones

The following lists comprise all headphones known to be available in spring 1973. Prices include VAT unless otherwise specified. Similarly, all models are wired for stereo unless otherwise stated.

AKG

Agents: AKG Equipment Ltd, 182/184 Campden Hill Road, London W8.
Phone: 229 3695

K60

PRICE: £15 (pre VAT)

K180

PRICE: £28 (pre VAT)

AMPLIVOX

Amplivox Communications Ltd, Beresford Avenue, Wembley, Middlesex, HA0 1RU.
Phone: 01-902 8991

Minilite (single steth with boom mic).
Standard sensitivity version: 115 dB SPL/25 mW.
Maximum input: 50 mW.
Impedance: 300 ohms.
Frequency response: 100 Hz to 3.5 kHz ±3 dB
PRICE: £17.97.

ASTROLITE

Impedance: 300 or 6k ohms, available parallel or series wired, single or dual sided.
Sensitivity: (100 dB spl): 1 mW.
Weight: 185 gm.
BASIC PRICE: £11.82.

AMPLIGARD

Impedance: 150 ohms (parallel wired) or 600 ohms (series).
Power handling: 50 mW.
Noise exclusion: high (based on Amplivox Ear Defenders).
Boom microphones: noise-cancelling magnetic, carbon or throat.
Weight: 450 to 570 gm (depending on microphone).
BASIC PRICE: £29.92.

PWB

Manufacturers: PWB Electronics Ltd, 1 Norfolk Gardens, Leeds LS7 4PP.
Phone: 0532 682550

MC

Drive unit: Polyester film diaphragm with mechanical crossover to high frequency radiating dome.
Impedance: 4 to 16 ohms.
Adjustable headband: soft headband cover, easily removed for cleaning.
Ear pads: Replaceable soft foam filled simulated leather cover, easily removed for cleaning.
Weight: 364 gm.
PRICE: £17.50+VAT.

Electrostatic

Frequency response: 20 Hz to 20 kHz ±3 dB.
Impedance: 130k ohms at 10 kHz.
Sound level: 95 dB at 100W rms input.
Adjustable headband: Soft headband cover.
Ear pads: Replaceable soft foam filled simulated leather cover.
Weight: 364 gm including 2.5m connecting cable.
Energiser: Suitable for connection to any amplifier of 5W or more. Self polarised and requiring no connection to an ac supply.
Source impedance of energiser: 4 to 16 ohms speaker outlet terminals.
Weight of energiser: 924 gm.
Dimensions: 50 x 16 x 90 mm (hwd).
TOTAL PRICE: £37.50+VAT.

BEYER

Agents: Beyer Dynamic (GB) Ltd, 1 Clair Road, Haywards Heath, Sussex.
Phone: 0444 51003

DT 48

PRICE: £40.36+VAT.

DT 48S

PRICE: £40.36+VAT.

DT 49

PRICE: £10.50+VAT.

DT 96A

PRICE: £11.40+VAT.

DT 480

PRICE: £27.25+VAT.

DT 507

PRICE: £4.90+9VAT.

DT 509 (mono)

PRICE: £7.70+VAT.

DT 509 (stereo)

PRICE: £8.45+VAT.

DT 900

PRICE: £8.70+VAT.

DT 98 A/B, 99 A/B

PRICE: £21.72+VAT.

DT 100

PRICE: £14.27+VAT.

DT 100V

PRICE: £34.05+VAT.

DT 109

PRICE: £23.60+VAT.

DT 109V

PRICE: £42.97+VAT.

DUETTE

Agents: J. J. Silber Ltd, 11 Northburg Street, London ECIV 0AU
Phone: 01-253 8031.

ES 300D

Impedance: 8 to 16 ohms.
Headband: padded.
PRICE: £5.06+VAT.

ES 350

Impedance: 8 to 10k ohms, switchable.
Headband: rubber sleeved.
PRICE: £5.69+VAT.

ES 1000

Controls: Mono/stereo switch.
Headband: padded.
PRICE: £8.02+VAT.

DULCI

Agents: Lee Products (GB) Ltd, Dallas House, 10-18 Clifton Street, London EC2P 2JR.
Phone: 01-247 6711

DH 650D

Impedance: 8 ohms.
Cord: 1.8m.
PRICE: £1.74.

SH 850 GX

Impedance: 8 ohms.
Cord: 3m.
Controls: volume sliders.
PRICE: £2.97.

SH 1300 VS

Impedance: 8 ohms.
Controls: volume on each phone.
PRICE: £3.93.

SH7 OGR

Impedance: 8 ohms.
Cord: 1.8m.
PRICE: £1.58.

DYNATRON

Agents: Dynatron Radio Ltd, Maidenhead, Berkshire.
Phone: 0628 23331.

SP2

Drivers: separate lf and hf.
Impedance: 8 to 16 ohms.
Sensitivity: 100 dB spl ref 1 mW at 600 Hz.
Maximum input: 500 mW.
PRICE: £9.35.

GRUNDIG

Agents: Grundig (GB) Ltd, London SE26 5NQ.
Phone: 778 2211

220

PRICE: £26.01 (pre VAT).

211/ADR

PRICE: £8.62 (pre VAT).

KOSS

114 Ashley Rd, St Albans, Herts.
Agents: Koss-TMD Ltd, 11 Redvers Road, London N22 6EP.
Phone: St Albans (56) 64337.

ESP-9

Frequency response: 15 Hz to 15 kHz ±2 dB.
Sensitivity: 80 dB spl at 1 kHz ±1 dB ref .0002 dynes/cm² for 1V input.
THD: 0.2% at 110 dB spl.
Sound isolation: 40 dB average.
Power handling: 10V (12W) maximum continuous.
Source impedance: 4 to 16 ohms.
Power supply: Mains or self-energising.
Cushions: Fluid filled.
Boom microphone: Mount incorporated.
Cable: 1.8m.
Headset weight: 390 gm.
PRICE: £69+VAT.

K2+2 'Quadraphonic'

Power handling: 5V maximum continuous.
Source impedance: 3.2 to 600 ohms.
Cushions: Fluid-filled.
Cable: 3m coiled.
Weight: 600 gm.
PRICE: £45+VAT.

AKG K180

WHY USE 600 OHM HEADPHONES?

Almost all professional recording engineers choose 600 OHM headphones since they can be driven, not only from studio programme lines, but also directly from the outputs of professional recording equipment.

AKG EQUIPMENT LTD.
182/4 Campden Hill Road
Kensington London W8 7AS

Telephone 01·229 3695.

FOR A LIST OF DEALERS—CONTACT US OR STUDY THE ADVERTISEMENTS IN THIS MAGAZINE

HEADPHONE SURVEY

PRO-4AA
Sound isolation: 40 dB average.
Power handling: 5V maximum continuous.
Source impedance: 4 to 16 ohms.
Cushions: Fluid-filled.
Boom microphone: Mount incorporated.
Cable: 3m coiled.
Weight: 650 gm.
PRICE: £28+VAT.

PRO-600 AA
Details as *PRO-4AA* but matching 600 ohm line.

KO-727B
THD: Unmeasurable at 95 dB spl.
Source impedance: 4 to 16 ohms.
Cushions: Foam filled.
Cable: 3m extended.
Headset weight: 450 gm.
PRICE: £16.50+VAT.

KRD-711
THD: 0.51 at 110 dB spl.
Signal handling: 5V maximum continuous.
Source impedance: 3.2 to 600 ohms.
Headband: Flexible polypropylene.
Cable: 3m coiled
Headset weight: 320 gm.
PRICE: £10+VAT.

K-6
THD: Unmeasurable at 95 dB spl.
Source impedance: 4 to 16 ohms.
Cushions: Foam filled.
Cable: 3m coiled.
Controls: slide level at each ear.
PRICE: £12.50+VAT.

HV-1
Sensitivity: 95 dB spl for 5V rms input. 14 dB transient headroom.
Distortion: 0.5% at 109 dB spl.
Source impedance: 3.2 to 600 ohms.
Cushions: Soft foam.
Cable: 3m coiled
Headset weight: 276 gm.
PRICE: £20+VAT.

KO-747
THD: 1% at 110 dB spl.
Sound isolation: 40 dB average.
Source impedance: 300 ohms nominal.
Cushions: Fluid-filled.
Controls: Stereo/mono switch and volume controls.
Cable: 3m extended.
Headset weight: 609 gm.
PRICE: £20+VAT.

PRO-5LC
THD: 1% at 95 dB.
Power handling: 40 dB average.
Source impedance: 4 to 1k ohms.
Cushions: Fluid-filled.
Boom microphone: Mount incorporated.
Headset weight: 550 gm.
PRICE: £30+VAT.

MARANTZ (USA)
Agents: Pyser Britex (Swift) Ltd, 2nd Floor, Roussel House, North End Road, Wembley, Middlesex.
Phone: 01-583 8378

SD1
Impedance: 8 ohms.
Power capacity: 1W per channel.
Cord: 3m coiled.
PRICE: £11.50+VAT.

NIKKO
Agents: Howland West Ltd, 3-5 Eden Grove, London N7 8EQ.
Phone: 01-609 0293

77S
Impedance: 8 ohms.
Sensitivity: 105 dB spl from 1 mV.
Maximum input: 30W (diode protection).
PRICE: £16+VAT.

HW3F
Impedance: 8 ohms.
Maximum input: 300 mW.
PRICE: £5+VAT.

CIS 200
Impedance: 8 ohms.
Maximum input: 200 mW.
Weight: 348 gm.
PRICE: £3.90+VAT.

CIS 250
Impedance: 8 ohms.
Maximum input power: 500 mW.
Weight: 435 gm
PRICE: £7.50+VAT.

CIS 300
Impedance: 8 ohms.
Maximum input power: 500 mW.
Weight: 406 gm.
PRICE: £9.60+VAT.

CIS 500
Impedance: 8 ohms.
Maximum input power: 500 mW.
Weight: 667 gm.
PRICE: £15+VAT.

CIS 800
Impedance: 8 ohms.
Maximum input power: 400 mW.
Weight: 406 gm.
PRICE: £6.60+VAT.

CIS 1000
Impedance: 8 ohms.
Maximum input power: 500 mW.
Weight: 232 gm.
PRICE: £10.50+VAT.

CIS 2000
Impedance: 8 ohms.
Maximum input power: 500 mW.
Weight: 725 gm.
PRICE: £21+VAT.

NIVICO
Agents: Denham & Morley (Overseas) Ltd, Denmore House, 453 Caledonian Road, London N7.
Phone: 01-607 6568

5944 'Quadraphonic'
Impedance: 8 ohms.
Nominal input: 1 mW.
Maximum output: 100 mW.
Distortion factor: less than 0.5% (at 1 mW).
Cord: 2m.
Weight: 603 gm with cord.
Diaphragm diameter: 38 mm.
PRICE: £23+VAT.

STH-10E
Diaphragm: 70 mm parabolic curved.
Controls: volume on each channel.
Padding: cushioned pads headband and ear pads.
Weight: 362 gm.
PRICE: £13+VAT.

PHILIPS
Agents: Philips Electrical Ltd, Century House, Shaftesbury Avenue, London WC2
Phone: 437 7777.

N6302
Impedance: 600 ohms.
Sensitivity: 112 dB at 1 mW.
Nominal power unit: 1 mW.
Maximal power input: 20 mW.
Weight: 450 gm.
Cord: 2m coiled.
PRICE: £26+VAT.

LBB 9902
Impedance: 600 ohms.
Sensitivity: 112 dB at 1 mW.
Nominal power input: 1 mW.
Maximum permissible power input: 20 mW.
Suitable for use under tropical conditions.
Weight: 370 gm.
PRICE: £9.50+VAT.

PICKERING
Agents: Highgate Acoustics, 38 Jamestown Road, London NW1.
Phone: 267 4936.

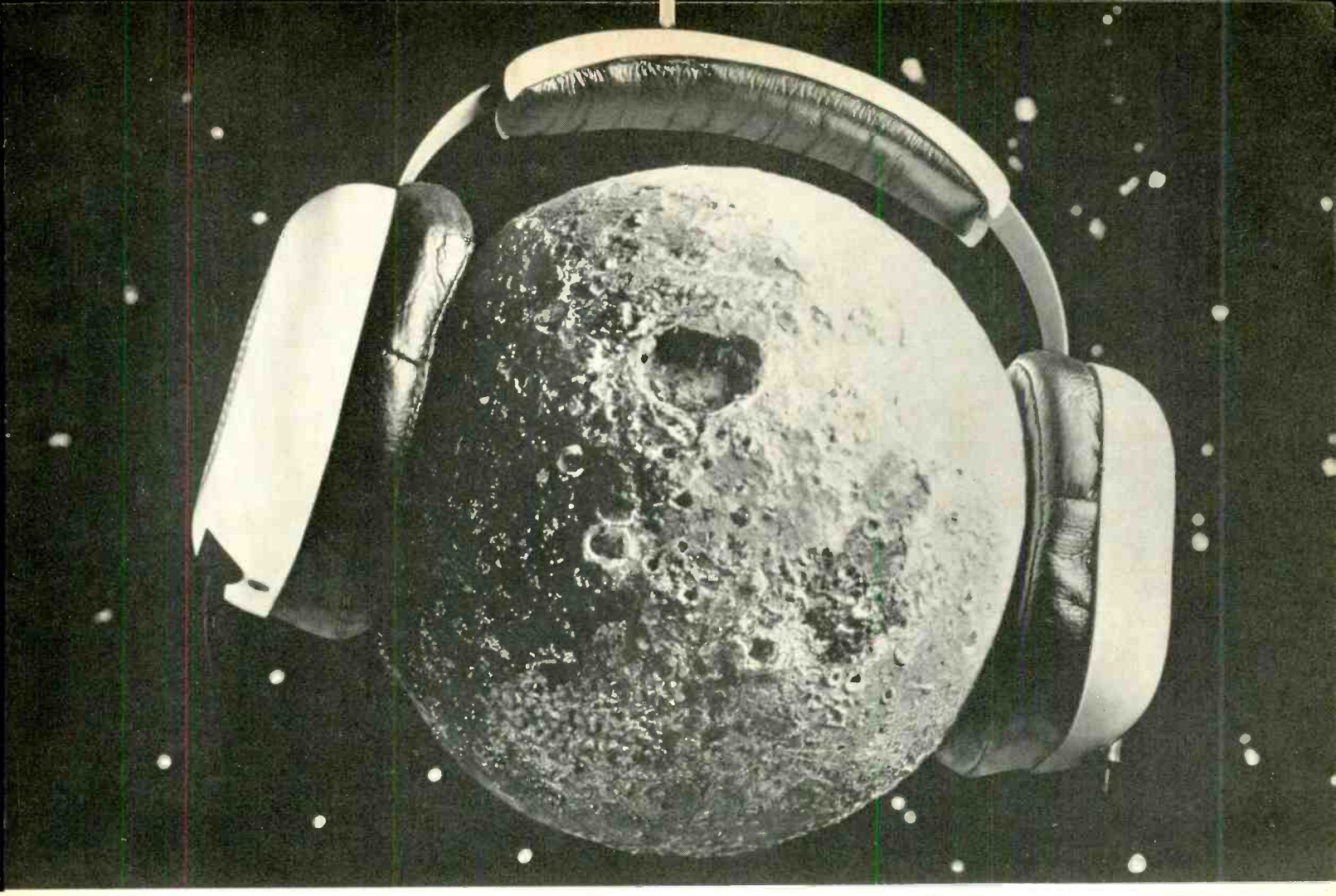
PH-4955
Frequency response: 10 Hz to 22 kHz.
Sensitivity: 100 dB spl, 110 mV at 1 kHz.
Maximum power input: 0.5 W rms.
Distortion: 1% at 115 dB spl.
Input impedance: 8 ohms.
Weight: 785 gm.
Cord: 3m coiled.
Transducers; Separate dynamic woofer and tweeter with LC crossover network.
PRICE: £29.50+VAT.

PH-4933
Frequency response: 60 Hz to 10 kHz ±3 dB.
Power capacity: 500 mW rms.
Distortion: 1% at 115 dB spl.
Impedance: 8 ohms nominal.
Weight: 609 mm.
Cord: 3m.
PRICE: £21.50+VAT.

PIONEER
Agents: Shriro (UK) Ltd, 42 Russell Square, London WC1B 5DF.
Phone: 580 6996.

SE-20A
Earpiece element impedance: 8 ohms.
Maximum input: 0.5W per earpiece.
Cord: 2.4m.
Weight: 380 gm.
Price: £7.88+VAT.

70 ▶



Wharfedale Hi Fi Isodynamic Headphones

Isodynamic, *adj.* Of or pertaining to equal (magnetic) force.

Mission Accomplished: electrostatic quality for less than half the price.

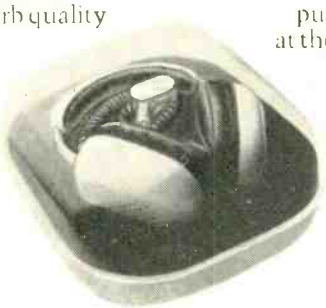
That was our mission.

The same superb quality of performance as electrostatic headphones. But for less than half the price.

And by going to the moon we've accomplished it.

Because one of the things that took man to the moon was a unique polyimide film.

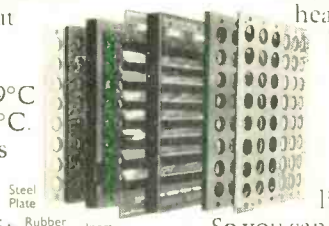
And we've turned it into a unique diaphragm.



Giving you pure stereo sound at the revolutionary price of £19.95* Plus. Lightweight comfort. And good looks. Complete with this elegant foam-lined container with transparent lid. It'd look good beside your deck. And let you store the phones neatly and dust free.

Unique Diaphragm

In the NASA space capsules polyimide film has to withstand great temperature fluctuations. As low as –269°C or high as 400°C. And it also has to withstand tremendous vibrations. So it has to be flexible. But without destroying the printed circuitry. Which is bonded into the polyimide film.



Rubber Magnets

Another Wharfedale Hi Fi exclusive.

Which give you an equal magnetic force from lightweight magnets. And so avoid the heavy iron magnets used in more conventional headphones.

Weightless Capsule

Or almost. For the whole lot weighs a mere 13ozs of sheer lightweight strength. So you can wear the phones for as long as you like.

And if you'd like the full inside story then fill in the coupon.

*Manufacturer's recommended retail price at the time of printing.

UK and Foreign Patents exist. Further Patents applied for.
UK Registered Design No. 956537. Other Design Registrations pending.
Made in England

Wharfedale Hi Fi. Pure and simple.

Send me details of Isodynamic Headphones and your nearest recommended dealer.

(BLOCK CAPITALS PLEASE)

NAME

ADDRESS

SSS

Wharfedale Hi Fi
Idle, Bradford, Yorkshire.
A division of the Rank Organisation.

Wharfedale Hi Fi, Idle, Bradford, Yorkshire

HEADPHONE SURVEY

SE-30A

Matching impedance: 4 to 16 ohms.
Sensitivity: 115 dB/0.3V (400 Hz, artificial ear).
Maximum input: 2V (each channel).
Cable: 4.8m.
Weight: 380gm.
PRICE: £12.60+VAT.

SE-50

Matching impedance: 4 to 16 ohms.
Maximum input: 0.5W (each channel).
Earpiece elements: 76 and 43 mm.
Cord: 4.8m coiled.
Weight: 626 gm.
Volume controls: Provided on each earpiece.
Tone controls: Hi cut on each earpiece.
PRICE: £21.90+VAT.

SE-L20

Matching impedance: 4 to 16 ohms.
Maximum input: 0.5V.
Sensitivity: 97 dB/0.1V.
Driver: 38 mm.
Weight: 205 gm.
Connecting cable: 2.5m.
PRICE: £10.53+VAT.

SE-L20A

Matching impedance: 4 to 16 ohms.
Maximum input 0.5V.
Frequency range: 20 Hz to 20 kHz.
Sensitivity: 97 dB/0.1V.
Driver: 38 mm.
Weight: 205 gm.
Cable: 25m.
PRICE: £7.88+VAT.

SE-L25 (neckband)

Matching impedance: 4 to 16 ohms.
Maximum input: 0.5V.
Sensitivity: 97 dB/0.1V.
Driver: 38 mm.
Weight: 160 gm.
Cable: 3m.
PRICE: £14.90+VAT.

SE-L40

Matching impedance: 4 to 16 ohms.
Maximum input: 0.5V.
Sensitivity: 96 dB/0.1V.
Driver: 38 mm.
Weight: 230 gm.
Cable: 3m.
PRICE: £17.43.

PRINZ
Agents: Dixons Technical Ltd, 3 Soho Square, London W1.
Phone: 952 7011

8V

Basic stereo headset.
PRICE: £5.50+VAT.

205V

Basic stereo headset.
PRICE: £7.50+VAT.

808V

Sliding volume controls on each channel.
PRICE: £8.50+VAT.

SH6

Adjustable headband and removable earpads.
PRICE: £3.50+VAT.

RANK BUSH MURPHY
Manufacturers: Rank Bush Murphy Ltd, PO Box 596, Power Road, London W4 5PW.
Phone: 01-994 6491

K600

Sensitivity: 1V at 400 Hz applied direct to the driver will develop 127 dB of sound pressure, relative to 2 $\times 10^{-5}$ N/m^2
Distortion: less than 1% at maximum output of 143 dB spl.
Impedance: 4 ohms.
Cord: 2.4 mm coiled.
Weight: 550 gm.
PRICE: £11.90+VAT.

RANK-WHARFEDALE
Manufacturers: Wharfedale Hi-Fi, Idle, Bradford, Yorkshire BD10 8SQ.
Phone: 0274 612552

Isodynamic

Frequency response. 30 Hz to 20 kHz +2 —4 dB ref 1 kHz.
Impedance: 120 ohms ±15%.
Sensitivity: 30 mW gives 95 dB spl.
Power handling: 25V rms maximum input (music or speech).
Weight: 450 gm including 3m coiled cable and plug.
PRICE: £19.95+VAT.

DD1

Impedance: 8 to 16 ohms.
Drivers: Separate lf and hf units.
Weight: 600 gm.
Cord: 4.5m.
PRICE: £12.50+VAT.

SANSUI
Agents: Vernitron Ltd, Thornhill, Southampton.
Phone: 0703 44811

SS2

Impedance: 8 ohms.
Distortion: Less than 1% at 1 mW Input.
Maximum input power: 500 mW.
Cone diameter: 70 mm.
Weight of cone paper: 450 mg.
Diameter of voice coil: 132 mm.
Cord: 1.8m.
Weight: 360g.
PRICE: £9.06+VAT.

SS10

Driver: 80 mm.
Maximum input: 500 mW.
Impedance: 8 ohms.
Sound pressure level: 110 dB.
Main cord: 3m coiled.
Extension cord: 2m (straight).
Weight: 625 gm.
PRICE: £15.67+VAT.

SS20

Driver: 80 mm and 50 mm.
Impedance: 8 ohms.
Maximum input: 500 mW.
Network: 6 dB/oct.
Crossover frequency: 1 kHz.
Sensitivity: 105 dB (at 200 Hz).
Tone control: —12 dB at 10 kHz.
Main cord: 2.5m coiled.
Extension cord: 2m straight.
Weight: 780 gm.
PRICE: £20.79+VAT.

SENNHEISER
Agents: Hayden Laboratories, Hayden House, 17 Chesham Road, Amersham, Buckinghamshire.
Phone: 024 03 5511

HD 414

Frequency response: 30 Hz to 20 kHz +4 dB (free field).
Impedance: 2k ohms.
Efficiency: 1mW produces 102 dB spl at 1 kHz.
Maximum loading: 100 mW (DIN 45 573).
Headband: plastic.
Ear pads: foam.
Weight: 135 gm.
Cord: 3m.
PRICE £13.50+VAT.

HD 412 Monaural

Single-capsule version of *HD414*, hand held.
Cord: 30 cm coiled (unstretched).
PRICE: £14.25 + VAT.

SHARP
Agents: Sharp Electronics (UK) Ltd, 48 Derby Street, Manchester M8 8HN.
Phone: 061-832 6115

HP400H

Drivers: Separate lf and hf units.
Controls: Volume.
Sensitivity: 56 dB spl at 600 Hz, 1 nW.
Impedance: 8 to 24 ohms.
Cord: 3.6m coiled.
Weight: 650 gm.
PRICE: £19.49.

HP100

Sensitivity: 60 dB spl at 600 Hz, 1 mW.
Impedance: 8 ohms.
Cord: 2.5m.
Weight: 307 gm.
PRICE: £8.24.

HP200

Sensitivity: 60 dB spl at 600 Hz, 1 mW.
Impedance: 8 ohms.
Cord: 2m.
Weight: 395 gm.
PRICE: £5.99.

SHARPE
Agents: Macinnes Laboratories Ltd, Stonham, Stowmarket, Suffolk IP14 5LB.
Phone: 044 971486

HA10 Mk 2

Frequency response: 30 Hz to 15 kHz ±3 dB.
Power capacity: 2W.
Impedance: 8 ohms (others to order).
Noise attenuation: 40 dB.
Harmonic distortion: (driven at 1V) 50 Hz 1.7%; 200 Hz 0.35%; 500 Hz 0.76%.
Sensitivity: 115 dB ref 2 $\times 10^{-5}$ N/m^2 at 500 mV input.
Weight: 696 gm.
PRICE: £23.25+VAT.

HA660/Pro

Frequency response: 20 Hz to 20 kHz ±3 dB.
Power capacity: 2W.
Impedance: 8 ohms (others to order.)
Noise attenuation: 40 dB.
Harmonic distortion: 1 kHz.
Sensitivity: 95 dB spl for 540 mV input.
Weight: 754 gm.
PRICE: £31+VAT.

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HEADPHONE SURVEY

SONY
Sony (UK) Ltd, Pyrene House, Sunbury Cross, Sunbury on Thames, Middlesex.
Phone: 76 87644

DR4A
Impedance: 8 ohms.
PRICE: £8.50+VAT.

DR4C
Impedance: 10k ohms.
PRICE: £9.50+VAT.

DR5A
Impedance: 8 ohms.
PRICE: £6.75+VAT.

STAX
Agents: Wilmex Ltd, Import Division, 24/26 Ensign Street, London E18JD.
Phone: 01-949 2545.

SR-3 Electrostatic
Electrostatic capacity: 120pF (including cord).
Sound pressure level: 95 dB at 100V rms.
Maximum sound pressure level: 115 dB.
Polarising voltage: 200V dc.
Ear cushion: Replaceable soft vinyl leather.
Weight: 420 gm (including cord).

Power unit for above (SRD5)
Maximum input: 5W.
Frequency response: 20 Hz to 20 kHz ±1 dB.
Distortion: less than 0.1% at 1W/1 kHz input.
Controls: Phones/Is switch.
Polarising source: 200 to 240V ac, 0.25 mA.
Dimensions: 67 x 67 x 170 mm.
Weight: 940 gm.
TOTAL PRICE: £49 + VAT.

SRX Electrostatic
Electrostatic capacity: 120 pF (including cord).
Impedance: 130k ohms at 10 kHz.
Sound pressure level: 95 dB 100V rms input.
Maximum sound pressure level: 115 dB.
Polarising voltage: 200V dc.
Ear cushion: Replaceable soft vinyl leather.
Weight: 370 gm (including cord).

Power unit for above (SRD7)
Maximum input: 5W.
Frequency response: 10 Hz to 30 kHz ±2 dB.
Distortion: 0.02% at 1W/1 kHz input.
Controls: *ES*: ear speaker, *SP*: loudspeakers,
Polarising source: 200 to 240V ac 0.25 mA.
Dimensions: 73 x 120 x 215 mm.
Weight: 1.7 kg.
TOTAL PRICE: £96+VAT.

SUPEREX
Agents: Acoustic Research International, High Street, Houghton Regis, Bedfordshire.
Phone: 0582 603151

PEP-77D Electrostatic
Frequency response: 15 Hz to 18 kHz ±2 dB.
Sound exclusion: 30 dB at mid frequencies.
Impedance: 4 to 16 ohms.
Power supply: Mains or self energising via separate control unit.
Weight: 350 gm.
PRICE: £61.60.

PRO-B6
Weight: 520 gm.
Cord: 4.5m coiled.
PRICE: £30.80.

QT-4B 'Quadraphonic'
Weight: 460 gm.
Controls: 2/4 channel switch.
PRICE: £34. (£25.85 without 2/4 channel switch.)

SST
Weight: 551 gm.
PRICE: £20.80.

ST-V
Maximum power: 2W.
Weight: 522 gm.
PRICE: £16.40.

SW-2
Maximum power: 2W.
Weight: 435 gm.
PRICE: £13.10.

ST-F
Maximum power: 500 mW.
Weight: 232 gm.
PRICE: £13.10.

ST-C
Maximum power: 2W.
Weight: 406 gm.
PRICE: £10.90.

TRIO
Agents: B. H. Morris & Co. (Radio) Ltd, 84/88 Nelson Street, Tower Hamlets, London E1.
Phone: 01-790 5011

KH 51
Impedance: 8 ohms.
Maximum input: 500 mW.
Driver: 76 mm diameter.
Cord: 3m.
Weight: 460 gm.
PRICE: £10.50+VAT.

KS 71
Impedance: 8 ohms.
Maximum input: 500 mW.
Driver: 76 mm diameter.
Cord: 2m.
Weight: 440 gm.
PRICE: £17+VAT.

TTC
Agents: Adastra Electronics Ltd, Unit N22, Cricklewood Trading Estate, Claremont Road, London NW2 1TU.
Phone: 452 6288/9

H1
Impedance: 2k ohms.
Cord: 1m.
PRICE: £1.26+VAT.

H2
Impedance: 4k ohms.
Cord: 1m.
PRICE: £1.34+VAT.

H3
Transducers: crystal.
Cord: 1m.
PRICE: £1.95+VAT.

H4
Impedance: 8 to 16 ohms.
Cord: 1m.
PRICE: 66p+VAT.

H5
Impedance: 8 to 16 ohms.
Cord: 1.5m.
PRICE: £3.15+VAT.

H6
Impedance: 8 to 16 ohms.
Cord: 1.5m.
PRICE: £5.85+VAT.

H7
Boom: 200 ohms microphone incorporated
Impedance: 8 to 16 ohms.
PRICE: £7.35+VAT.

H10
Impedance: 8 to 16 ohms.
Cord: 2m.
PRICE: £2.50+VAT.

H11
Impedance: 4 to 16 ohms.
PRICE: £3.45+VAT.

H13
Impedance: 4 to 16 ohms.
Cord: 3m.
PRICE: £6.75+VAT.

H14
Impedance: 4 to 32 ohms.
Cord: 2m.
PRICE: £8.85+VAT.

H15
Impedance: 4 to 16 ohms.
Cord: 3m.
PRICE: £9.84+VAT.

H17
Impedance: 4 to 16 ohms.
Cord: 5m.
PRICE: £9.68+VAT.

H18
Impedance: 4 to 16 ohms.
PRICE: £12.75+VAT.

H19
Impedance: 4 to 16 ohms
Cord: 3m
PRICE: £17.85+VAT.

H20
Impedance: 4 to 16 ohms.
Cord: 3m.
PRICE: £30.75+ VAT.

H21
Impedance: 4 to 32 ohms.
Cord: 2.5m.
PRICE: £13.50+VAT.

H22
Impedance: 4 to 32 ohms.
PRICE: £13.50+ VAT.

H23
Impedance: 4 to 16 ohms.
Cord: 3m.
PRICE: £9+VAT.

H40
Impedance: 4 to 16 ohms.
Cord: 3m.
PRICE: £2.40+VAT.

audix

SOUND SYSTEMS AND ELECTRONICS

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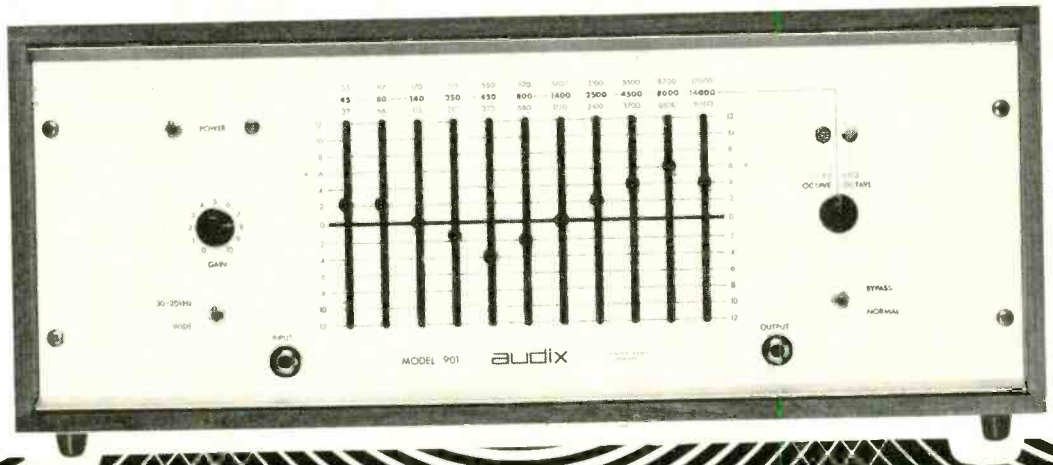

MODEL 901

The eleven frequency audio equaliser illustrated is representative of the expanding range of limiters, distribution amplifiers, monitor amplifiers, disc reproducers, etc. available from Audix for recording and broadcast studio applications.

The equaliser provides ±12db of control over an audio bandwidth of either 37–11,500Hz, 45–14,000Hz, or 55–17,000Hz on eleven logarithmically spaced frequency centres. Selection of the required bandwidth is via a control which allows the basic curve centre frequencies to be shifted up or down the audio bandwidth by 0.3 of an octave.

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well and would indicate leakage resistances in excess of 10 mΩ; however, for some reason the leakage test would not work if the sensitivity control was set to its fully clockwise position. This is a definite malfunction of the unit and is possibly connected with the loading of its internal oscillator.

Here examination of a second sample bridge did not reveal this fault; it is therefore concluded that this is a 'one off' fault and not a design error as such. The second sample showed very much improved sensitivity to capacitor leakage and useful indications of leakage could be clearly seen with leak resistances in excess of 30 mΩ.

The leakage test voltage is in the order of 18V so some care is required when testing low voltage capacitors.

On the resistance ranges the peak test voltage never exceeds about 20V, the test waveform being in the form of more or less rectangular pulses. In practice the power dissipation into a resistor has a maximum of a small fraction of a watt and is far too small to cause any damage to even the most miniature components.

A similar test voltage is used on the capacitance ranges and some care must be used when testing capacitors which have a voltage rating of 20V or less. Naturally the polarity of electrolytic capacitors must be observed, but the bridge terminals are colour coded red and black with this in mind.

The current drawn from the battery, or external power supply, was found to vary between 15 mA and 30 mA depending upon the value of the component under test. Normal use of the instrument should therefore give a battery life of several months.

Summary

At a cost of £15.75, this resistance/capacitance is certainly cheap but the measurement accuracy of the review sample could hardly justify its purchase for serious use. I would not have thought that measurement errors as large as 31 per cent could be tolerated in any applications.

Examination of a second sample of the type 43 R/C bridge gave somewhat better accuracy overall but was no better at indicating a null when high impedances were being measured; hence the lack of any percentage error in the following results at 10 mΩ.

BRIDGE RANGE	PERCENTAGE ERROR		
	high end of scale	mid-scale	low end
10 ohms to 1 kΩ	−5.75	−4.9	+2.0
1 kΩ to 100 kΩ	−4.21	+0.95	+4.16
100 kΩ to 10 mΩ	see text	+3.89	+8.89
10 μF to 0.1 μF	−1.70	−1.39	+9.94
0.1 μF to 1 kpF	−4.40	−5.53	+9.02
1 kpF to 10 pF	+4.06	−3.36	+7.90

Nombrex 44

Like the resistance/capacity bridge, this instrument is fully transistorised and comprises a single transistor oscillator followed by a driver stage to feed the bridge circuit. The detector amplifier comprises three transistors, one of which acts as an active selective filter in order to improve the detector sensitivity.

The front panel accommodates five controls two of which are rotary switches, a miniature meter for indicating bridge balance, and two terminals which also accept banana plugs for connecting the unknown inductance.

In operation the bridge is first switched on by rotating the range control to the likely range; each of the four ranges cover two decades. The rotary switch selecting 'Q' or 'tan delta' is then set to the appropriate position and bridge balance obtained by manipulating the detector sensitivity control in combination with the inductance potentiometer and the 'Q/tan delta' potentiometer.

In practice it is easy to obtain a good balance on the three lower inductance ranges covering 1 μH to 1H but balance becomes increasingly difficult as the measured inductance increases to 10H.

As already stated, each range covers two decades of inductance but the readability of the calibrations of the inductance control is such that the accuracy at the lower end of the scale certainly could not exceed ±5 per cent when great care is taken to avoid parallax etc. A similar situation also exists with the 'tan delta/Q' control but in this case there is an effective overlap of functions which does not exist with the inductance control.

On the high inductance range, considerable difficulty was sometimes experienced in obtaining a well defined null as a result of lack of detector sensitivity. In spite of this, the inductance accuracy was within about ±15 per cent. However, the accuracy within which 'Q' could be determined was a very variable beast.

The worst mid-scale error on the three lower ranges was about 8 per cent and the instrument was found to be within 15 per cent with all other values of inductance tested down to 5 μH, below which the measurements became rather unreliable from the point of view of the standards used for the review.

The accuracy of the 'tan delta/Q' control showed a similar pattern in that, on the higher inductance range, the detector sensitivity was in some cases insufficient to obtain an accurate null with the 'tan delta/Q' control. The calibration accuracy was generally within ±10 per cent on the lower inductance ranges.

The overall instrument accuracy depended upon the combination of inductance value and inductance 'quality'. No defined pattern of error could be determined, hence no table of errors is included in this review.

In my opinion the claimed accuracy of inductance measurement is far too optimistic; measurement accuracy is the effective addition of all measurement tolerances including the internal standard (±1 per cent) internal oscillator frequency stability (measured as ±0.8 per cent) dial readability (±5 per cent in some positions) balance potentiometer linearity (probably about ±5 per cent), etc. The addition of the above errors is hardly likely to lead to an instrument accuracy of ±5 per cent.

In spite of these criticisms, the Nombrex *44* inductance bridge is a useful little instrument. Provided one accepts its limitations, it can be an asset to the normal complement of workshop testgear if the purse will not stretch to a more expensive instrument. **Hugh Ford**

April 'Video' errata: Our apologies to Roderick Snell for reversing **figs. 3** and **4**, The Mullard tube discussed was the Mullard *XQ1402*, correctly named on page 41 but referred to as *XQ1400* on page 42 Detailed correction next month.

Classified Advertisements

Advertisements for this section must be pre-paid. The rate is **7p** per word, minimum **70p.** Box Nos. **20p** extra. Semi-display rates on application. Copy and remittance for advertisements in **JUNE 1973** issue must reach these offices by **16th APRIL 1973** addressed to: The Advertisement Manager, **Studio Sound,** Link House, Dingwall Avenue, Croydon CR9 2TA.

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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Sound Technicians

Thames Television have vacancies for Sound Technicians at their Teddington Studios.

Candidates should have experience in all aspects of sound operations in television productions and formal qualifications in electronics would be an asset, although this is not essential.

Applications would also be welcome from suitably qualified personnel wishing to be considered as Sound Trainees.

Please write giving brief details of age, qualifications and experience to the Personnel Officer, Thames Television Limited, Teddington Lock, Teddington, Middlesex.

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Further particulars of the post from the **Deputy Personnel Officer, University of Durham, Old Shire Hall, Old Elvet, Durham DH1 3HP.**

Applications in writing, giving details of age, qualifications and experience, together with names and addresses of two referees or copies of testimonials, to the **Deputy Personnel Officer, University of Durham, Old Shire Hall, Old Elvet, Durham DH1 3HP,** by 22nd May, 1973

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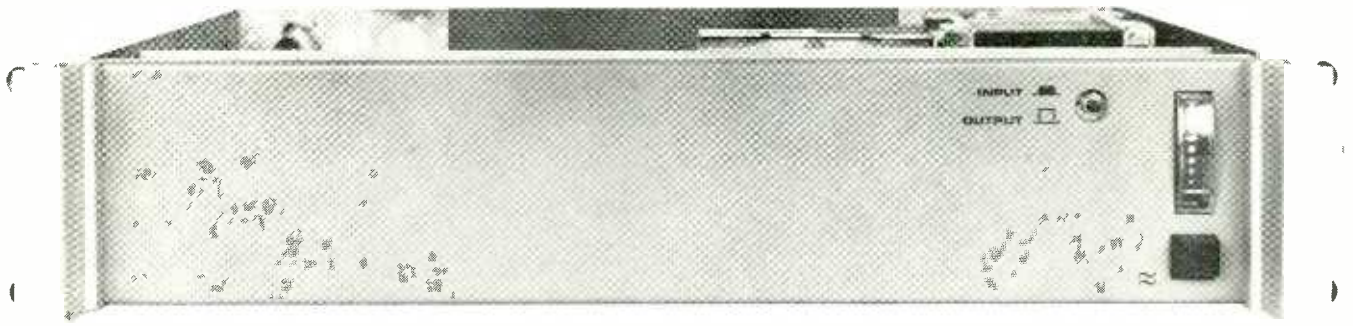

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Output stage - maximum	−99.0 dBm
Neve specification claim	*−80.0 dBm*
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Neve specification claim	*−125.0 dBm*

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