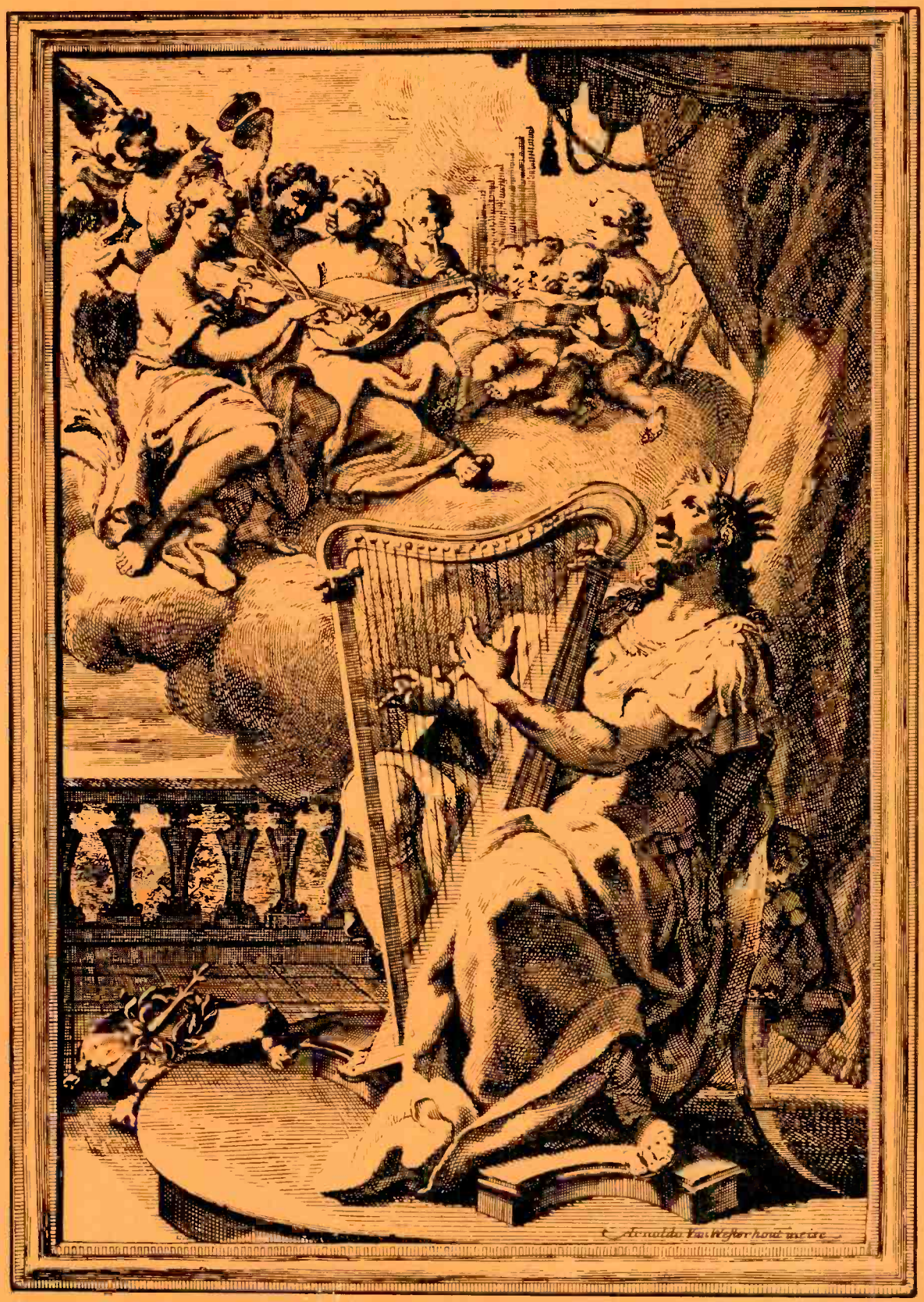
August 1972 25p

studio sound



SURVEY: AUDIO MIXERS

AES 42
A REPORT FROM LOS ANGELES

A SYNCHRONISED TAPE SPEED CONTROL SYSTEM

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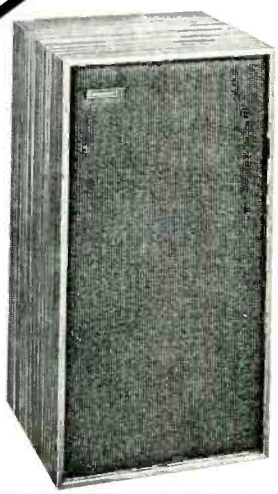

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Left to Right : Ditton 10 Mark II, Ditton 120, Ditton 15, Ditton 44, Ditton 25.

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studio sound
INCORPORATING TAPE RECORDER

AUGUST 1972 VOLUME 14 NUMBER 8

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LAST MONTH in this column we referred to the compact cassette as being a joke, a view we still hold. This comment provoked an unexpected reaction from a reader who telephoned his whole-hearted agreement. Not from him, however, the usual stories of wow, dropout, squeaking and jamming. He had purchased a disc album only to find the quality well below the Pop average. Reading the sleeve notes he learned that the recording had been mastered on a cassette 'because it was live'. Live that is, before the cassette took hold of it.

Perhaps we are out of touch but we simply didn't believe him. So we bought a copy and, sure enough, found it had been mastered on an Ampex stereo cassette recorder. While accepting that modern equipment can give passable 4.75 cm/s results by domestic not-so-hi fi standards, what possible excuse can be made for mastering at so low a speed, particularly in combination with the narrow track width of a cassette. Under tightly controlled conditions (carefully chosen and adjusted machine, selected cassette, meticulously cleaned heads, Dolby *A*), it is possible that a reasonable disc could result. But this is stretching equipment and operators to their limits. Why not take advantage of similar improvements in 38 cm/s performance? These have been less dramatic, admittedly, but only because the medium has been a good one from pre-*BTR2* days. The compact cassette was developed as a domestic system. Philip's initial attempts to compete Musicassettes against gramophone records were greeted with amusement from the trade. Today, after seven years, the disc is still a long way from dead. Our fear is that cassette mastering may become more than an isolated gimmick (in the disc in question, it was not presented as anything other than normal practice). If it acquires respectability, and if cassette recorders receive the casual treatment accorded to more conventional equipment, the result will be a long stride back towards the telephonic qualities of the seventy-eight.

FEATURES

COLUMNS

COVER

One of a series of illustrations from the *Gabinetto Armonico* by Filippo Bonanni, published in 1723. This engraving represents King David (no relation), to whom the work was dedicated. The *Gabinetto Armonico* has been reprinted by Dover Publications and provides a useful guide to contemporary instruments.

CORRESPONDENCE AND ARTICLES

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

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

SUBSCRIPTION RATES

Annual UK subscription rate for STUDIO SOUND *is £3 (overseas £3.80, $8 or equivalent).*
Our associate publication Hi-Fi News *costs £3.24 (overseas £3.66, $8.64 or equivalent). Six monthly home subscriptions are £1.50* (STUDIO SOUND) *and £1.62* (Hi-Fi News).
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.

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.*

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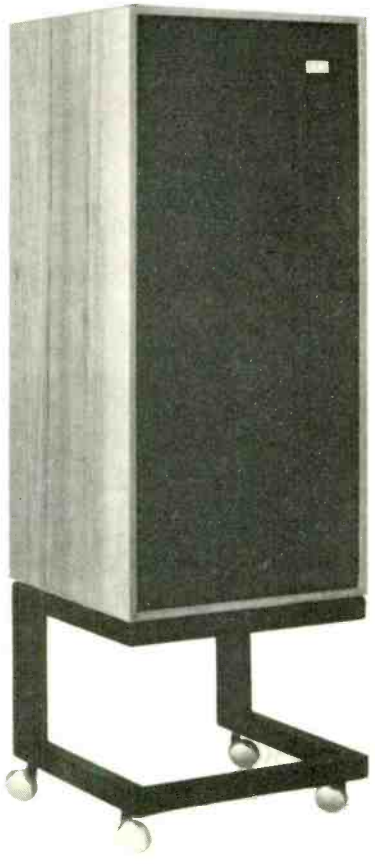
spendor

Studio Series



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*John Shuttleworth, 'Studio Sound' September 1970.

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Illustrated is the ME 102B, one of the three types of Wow and Flutter Meters distributed by us exclusively in the U.K. It is widely used by all the leading Broadcasting, TV and Recording Studios, manufacturers of tapedeck-tape recorders, turntables, record-changers —in fact by anyone concerned with the accurate measurement of drift and wow and flutter. Fuller details on application.

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- Printed circuit spooling motors.
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- All electronic functions remotely controlled.
- Separate aural and visual monitoring.
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Mono, Stereo, 4 Track = ¼" Tape
4 Track, 8 Track = ½" Tape
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16 Track, 24 Track, 32 Track = 2" Tape

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15 and 30 ips. fixed and variable
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8 Track	55½"	31"	30"
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2 Track	39½"	31"	30"
Mono	39½"	31"	30"

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Power at clip point: (per channel)	64 watts RMS into 4 ohms. 41 watts into 8 ohms. Over 100 watts into 8 ohms as mono amp
I.M. Distortion:	Less than 0.05% 0.01 watt to 30 watts level
THD:	Below 0.05% through band. Typically 0.0005% 30 watts at 1 kHz
Damping Factor:	Greater than 200 (zero to 1 kHz at 8 ohms)
Hum and Noise:	106 dB below 30 watts level
Load Impedance:	4 ohms or greater
Dimensions:	17" wide. 8¾" deep. 1¾" thin
Weight:	10 lb
Price:	**£97**

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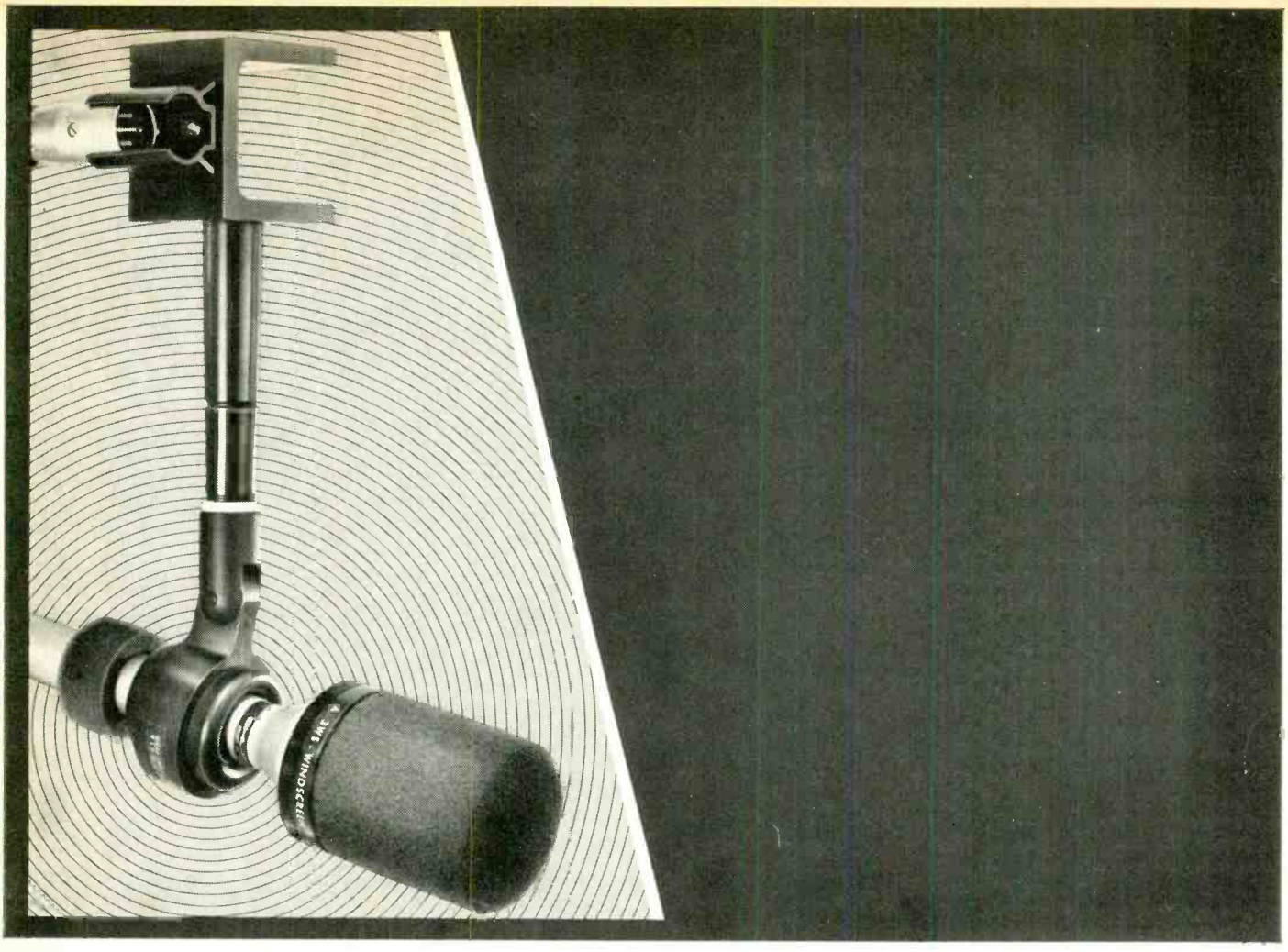

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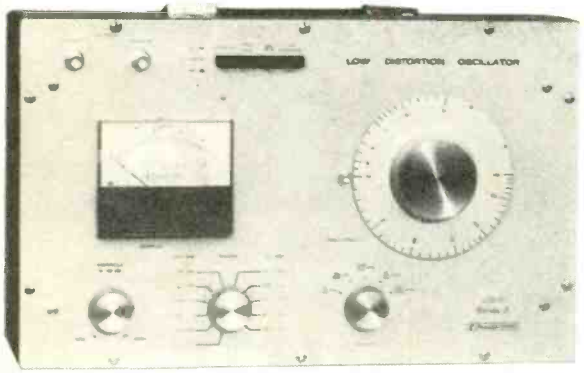

An instrument of high stability providing very pure sine waves and square waves, in the range of 5 Hz to 500 kHz. Hybrid design using valves and semiconductors.

Specification

Frequency Range:	5 Hz-500 kHz (5 ranges).
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Output Voltage:	10 Volts r.m.s. max.
Output Attenuation:	0-110 dB continuously variable.
Sine Wave Distortion:	0.005% from 200 Hz to 20 kHz increasing to 0.015% at 10 Hz and 100 kHz.
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Monitor Output Meter:	Scaled 0-3, 0-10 and dBm.
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Size:	17¼ x 11 x 8in.
Weight:	25lb.
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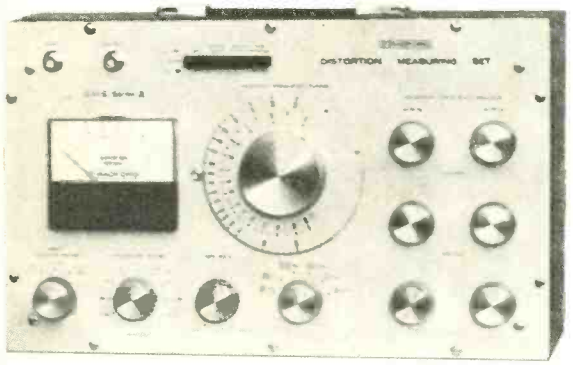

A sensitive instrument for the measurement of total harmonic distortion, designed for speedy and accurate use. Capable of measuring distortion products as low as 0.002% Direct reading from calibrated meter scale.

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Frequency Range:	20 Hz-20 kHz (6 ranges).
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Meter:	Square law r.m.s. reading.
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plug it into your monitor system and it bridges 600Ω lines to drive your speakers.

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

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Other advantages appropriate to users of all sizes include:

Excellent power and frequency response (—1dB).

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

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

Pre-set level control adjustable from front panel.

Unconditionally stable with any load.

Proof against misuse including open or short circuited output.

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

Low price (£47.0.0 each nett for 1 off to the professional user).

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Precis

Metric/Imperial Equivalents

Tape Speed

centimetres/second	inches/second
38	15
19	7.5
9.5	3.75
4.75	1.875

Tape length

metres	feet
270	900
360	1,200
540	1,800
720	2,400
1,080	3,600
1,440	4,800

Tape width

millimetres	inches
50	2
25	1
12.5	0.5
6.25	0.25

Distance

1 metre (m) = 39.370113 inches
1 centimetre (cm) = 0.393701 inches
1 millimetre (mm) = 0.039370 inches
1 kilometre = 0.6214 miles

Weight

1 kilogram (kg) = 2 pounds 3.37 ounces
1 gram (g) = 15.432 grains or 0.564383 drams
1 Tonne (metric ton, 1,000 kilogrammes) = 2204.6 pounds

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News

Exhibition news

THE INTERNATIONAL Broadcasting Convention will be held at the Grosvenor House Hotel, Park Lane, London, from September 4 to 8. There will be about 50 companies at the exhibition and on the five days of the convention the provisional topics under discussion will be management and engineering training, recording, distribution and satellites, transmitters, and educational broadcasting.

Sonex 73 will be held at the Excelsior Hotel, West Drayton, March 30 to April 1, 1973.

Link Electronics will be showing a mobile television unit at this year's Inter Navex exhibition. This exhibition and conference for audio-visual aids in education will be held at Olympia from July 25 to 28.

Splicing matt-back tapes

SCOTCH CLAIM that their new *621* splicing tape is 'designed for use with back-coated tape'. It is, however, also suitable for ordinary tape and comes in four sizes. Prices are £1.00 to £1.40 for cassette duplicating tape, £1.75 for 6.25 mm, £1.50 for 12.5 mm, and £2.75 for 25 mm wide tape. Further information from 3M House, Wigmore Street, W1A 1ET.

Pc etching

ANY READERS keen to make their own pc boards in a big way may find these two items of interest. Perfection Parts are now selling a Swedish pc etching machine made by Transaco of Stockholm. It is modular equipment, meaning that it need be no bigger, or smaller, than you can afford. Perfection Parts live at 59 Union Street, London SE1 1SG, and they have a Northern office at Bradshaw works, Greengate, Middleton Junction, Manchester.

GM Technical Services, 127 Woodville Road, New Barnet, Herts, announce a new service for firms 'who want a quick, reliable and reasonably priced source for prototypes or medium production runs of small items'. These small items include nameplates and labels as well as printed circuit cards.

Further 21 radio sites announced

THE LOCATIONS of ten definite, and a further 11 probable, commercial radio stations were announced in June by the Minister of Posts and Telecommunications, Sir John Eden. The 'definite' group comprise Bradford, Edinburgh, Ipswich, Liverpool, Nottingham, Plymouth, Portsmouth, Sheffield, Swansea and Tyneside. 'Probables', likely to open later, are Belfast, Blackburn, Brighton, Bristol, Cardiff, Coventry, Huddersfield, Leeds, Teesside and Wolverhampton. This brings the total number of proposed stations to 26. Stations for Birmingham Glasgow, London (two) and Manchester were announced in 1971. Applications for broadcasting licences will be invited in September by the International Broadcasting Authority.

Radio Medway Festival

A SERIES OF network programmes and live concerts were held at the Central Hall, Chatham, by BBC Radio Medway during the week beginning May 29. The radio station left only a skeleton engineering staff at their High Street studios and concentrated on doing national broadcasts of the Tony Brandon programme, Woman's Hour, 20 Questions and Emperor Rosko. In the evenings, they gave a week of concerts including jazz and folk music. Equipment used for the recordings, which were supervised by station engineer David Penny, included a modified Chilton mixer, KEF *Concord* speakers, Revox *HS77*, Grampian spring reverb and HH power amplifiers. On the stage were six Beyer *M160* ribbons and three AKG *D202*. Two *D224* microphones were suspended above the audience as a coincident pair. Also on hand were four Studer *A62* tape machines.

Neon indicator lights

ITT ARE now making a range of neon lamps in three colours of thermoplastic moulding. The lamp heads are square and they are supplied with cable and a self-locking nylon grommet for panel mounting. The lamps take 0.3 mA at either 110 or 240V. Resistors are not supplied. The unit price is 30p and the price for a thousand is 19p each. Further details from ITT Components Group Europe, Electromechanical Component Division, West Road, Harlow 02796 26811, Essex.

BASF Figures

INCREASED PRODUCTION and lower capital expenditure are two of the reasons given by BASF for their improved figures for the first quarter of this year compared with that of last year. Net sales were up by 17 per cent and much of the gain, say BASF, is attributable to BASF AG and affiliates abroad. However, the figures still compare unfavourably with the trading position before the decline in profits. The statement says: 'Whether the current pace can be maintained is still an open question. Personnel costs, in spite of a reduction in the number of employees, advanced.'

Transatlantic Neve

NEVE TELL us that they delivered a 24 channel, eight track studio console to a Montreal studio less than 120 hours after the order was made. The desk, a standard Neve model, was delivered to 'Le Studio Andre Perry' seven and a half hours before it was to be used for a remote, live band performance and was ready three hours later. The desk is on loan until Neve have built the studio's own 32 in, 16 out console.

Fane quality control

FANE ACOUSTICS have installed a new frequency response tracing instrument in their quality control laboratory. The firm recently doubled its production space at the Batley (Yorkshire) factory.

Hi-Fi News record

OUR ASSOCIATED publication, *Hi-Fi News & Record Review* has collaborated with the educational record company Discourses in producing a record, called 'What Is Good Recorded Sound?', which demonstrates and compares some of the tricks and techniques used in recording. The same performers are used to demonstrate different ways of recording the same piece of music, enabling the listener to hear for himself just how different those ways are. With the record is a 16-page illustrated booklet written by the *Hi-Fi News* team and Bob Auger, who engineered the sessions at the Conway Hall. Until October 21 the record is available from Discourses Ltd, 34 High Street, Tunbridge Wells, Kent, at a reduced price of £1.20, thereafter £1.60. See advert on page 20 for further details.

New Products

QUAD EIGHT Electronics announce three of a new series of printed circuit boards which they first showed at the 42nd AES convention in Los Angeles. The *CA127* board has an op amp input, 30 dBm transformer output, and

continued 14

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Our claim to fame is being broadcast the world over.

Such is the power of Ferrograph tape recorders.

Used in major broadcasting stations as well as in the aircraft industry, Police and Fire Services and Government Departments.

A Ferrograph tape recorder is a status symbol—and an investment. The buyer knows he is getting a top standard machine which maintains that standard for many years. (We give a 3 year guarantee inclusive of record and replay heads.)

You may pay a little more at the outset, but the rewards are many in service and reliability.

Series Y Twin Channel Stereo machine *(illustrated)*: Housed in a light alloy casing, this machine is specially adapted for audio frequency instrumentation recording in scientific and industrial applications (purchase-tax-free for these uses). Input and output conditions suitable for matching professional equipment. Available in single or two-channel forms, recording full, $\frac{1}{4}$ or $\frac{1}{2}$ track. 3 tape speeds on each machine.

Other details are yours for the asking—just complete the coupon below.

If you have a recording problem contact Ferrograph. Special machines can be made up to customers requirements.

Series Y tape recorders are available direct from the Ferrograph U.K. company or principal overseas agents (list available on request).

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SL1 6BB

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continued

gain from unity to 40 dB. The *CA227* has transformer input and output and gain from 30 to 56 dB. It may be used, the makers claim, as a mic preamp, line amp or booster amp. *CA272* is a board which has dual amplifiers with op amp inputs and single ended outputs at 24 dBm and may be used as utility or mixer amplifiers.

The boards have similar specifications: over volts and short circuit protection is claimed to be 150 per cent, thd to be 0.2 per cent, and noise to be better than −110 dBm. Dimensions are about 7 cm by 18. The firm's address is 11810 Vose Street, N. Hollywood, Calif 91605, USA.

Orange Musical Industries showed their new graphic amplifier at the Chicago Trade Fair. The amplifier has, Orange claim, a 'unique ringing coil which produces clearer guitar tones'. The Trade Fair was held between June 17 and 21, and the firm's manager, Cliff Cooper, also revealed a new type of speaker enclosure designed and built by his firm.

A range of power supplies which has, its makers claim, constant current limiting, adjustable voltage outputs in the ranges 4-6, 6-12, 12-24 and 15-0-15 volts and current ranges from 0.1 to 1A, is now available from Farnell Instruments, Sandbeck Way, Wetherby LS22 4DH, Yorks. The 6V units have over-voltage crowbar protection and all the units are available for immediate despatch, after which they claim that no calibration is necessary.

Telefunken address change

AEG TELEFUNKEN have changed their address. From May 1 they have been at 2/4 Clerkenwell Green, London EC1. Telephone number is 01 251 0244.

Patents

Tape and its manufacture

Two patents concern themselves with magnetic tape this month. The first (BP 1275031) reveals a new method of tape manufacture. Ampex, who have taken out the patent, say that the usual way of manufacturing tape is to make a slurry of the iron oxide and carbon particles in a solvent and then to mix a solution of the binder resin into this. The result is then ground for many hours to distribute the solid particles evenly. Lecithin is often used to help dispersion.

The Ampex approach (and take a deep breath) 'rests on an appreciation that by using a triloweryl polypropyleneoxy quaternary ammonium compound in formulating the coating to be applied to the substrate of a tape or other magnetic recording media, a well dispersed mixture of magnetic pigment (such as gamma ferric oxide) and carbon particles in the coating composition can be obtained in a much shorter grinding time than has heretofore been possible using lecithin or other dispersing agents'. This means that if you want to reduce grinding time use the (tpqa) above mentioned. It would seem that the said substance also increases the conductance of the coating, a property which reduces the amount of carbon needed while keeping the coating as anti static as, to borrow a phrase, heretofore. The adhesion between coating and substrate is also improved.

The second invention, explained by the Audio Magnetics Corporation in BP 1275872, achieves good dispersion by subjecting the magnetic tape to ultrasonic vibration. The patent describes, with diagrams, every conceivable method of achieving this.

Video head block assembly

In a helical scan video recorder, the tape travels past the head at an angle to the axis of rotation of the recording drum. The angle is usually achieved by putting the feed and take-up spools at different heights. Mr Noboru Sato and Mr Tatsumi Nakano have patented a method of mounting the head so that the spools are on the same plane but the drum and motor are inclined. They claim that the old method 'will inevitably lead to considerable torsional stress being generated in the travelling tape and poor contact between the tape and the magnetic head drum. Thus the . . . magnetic recording tape will occasionally be injured.'

Their alternative, which is described in detail in patent 1273816, is to use an upper and lower base plate to mount the head so that it is inclined to the chassis of the recorder. The plates are shown in **fig. 1**. **Fig. 2** shows the complete assembly. The inventors claim that this method, unlike other similar means of mounting the block, makes it easy to remove the head for repair and maintenance.

FIG. 1

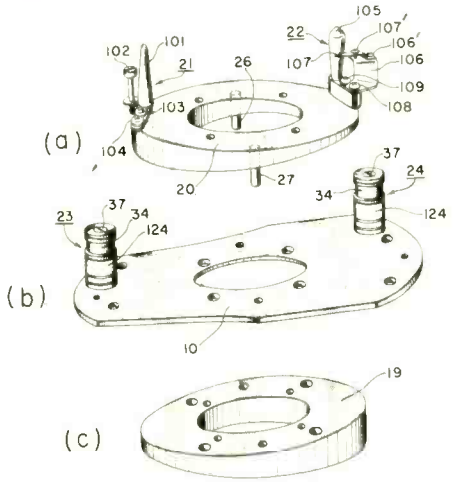
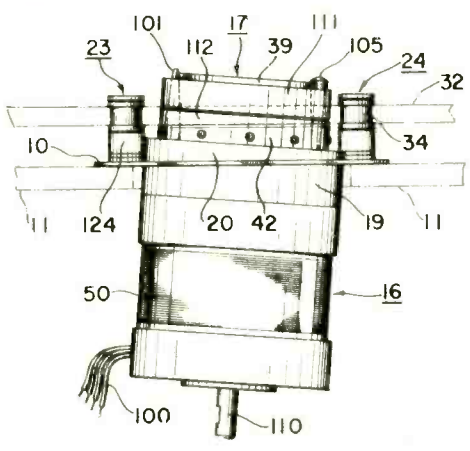


FIG. 2



Reducing wear

RCA claim to have a method of improving stability and reducing wear in tape recorders. BP 1275115, in which the invention is described, particularly concerns 'the minimisation of frictional effects' at the point where gap and tape meet.

As readers will know, the friction between head and tape causes oxide deposits to form on the head and this in turn causes the tape to screech because of the constant switching of the tape from static to dynamic friction. RCA suggest that this can be avoided by (are you ready?) enclosing the tape transport and heads in a container filled with a gas which will not absorb any moisture.

Normally the tape is heated by its friction with the head and this causes it to lose moisture. If this moisture is not replaced the tape will tend to lose oxide. By bathing the tape and

continued 16

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continued

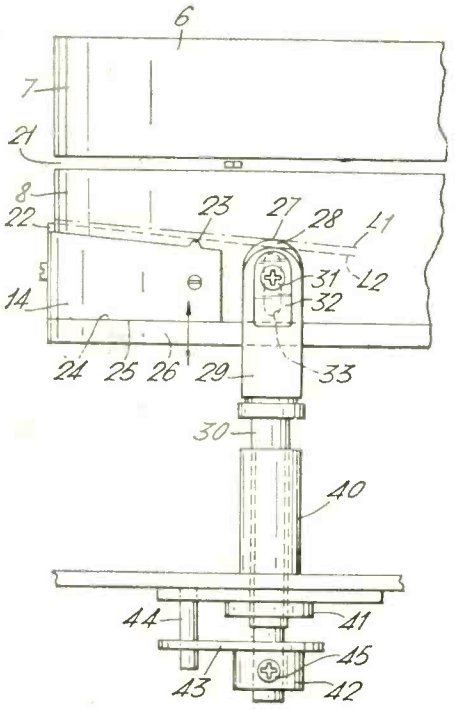
head in a gas which does not absorb moisture the effect is reduced. RCA suggest that those who adopt this system use carbon dioxide or sulphur hexafluoride.

Improved slow motion helical scan

In BP 1273749 Sony describe apparatus to improve slow motion and still frame pictures in helical scan video recorders. In previous machines, the patent states, poor slow motion and still frame pictures were caused by tracking error on recorded tracks and by a slight difference of angle between the recorded tracks and the path taken by the head during replay. Both these faults cause the machine to trace the guard band between adjacent tracks.

Sony claim that the tracking error is cancelled in slow motion and still frame pictures by the device shown in **fig. 3.** During normal reproduction the L-shaped tape guide piece 29 is below the normal guide pin 23 and so the tape rests on the latter. In slow or stop framing the L-shaped piece moves up because of the rotation of the shaft 30 caused by the movement of 44 and 42. The pitch of the bolt 40 and the nut 41 is so designed that when the shaft 30 is rotated about 60 to 90 degrees the L-shaped

FIG. 3



guide piece 29 rises about 100 microns, or 0.1 mm, and this cancels the tracking error.

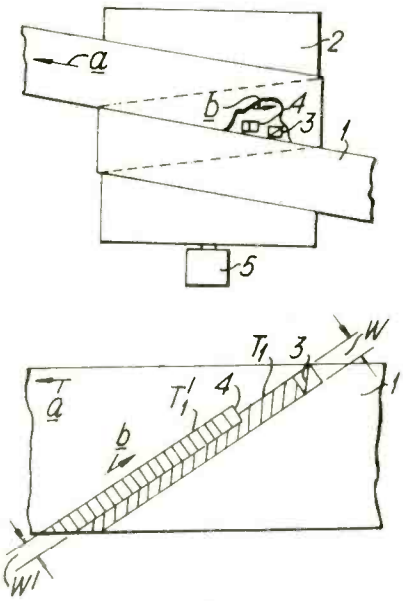
The patent goes on to describe head arrangements for full field and skip field types of recording and reproduction. Different heads are used for slow operation from those for full speed operation and there are different head arrangements for each field system.

The patent also describes the servo and switching systems used to move the members 44 and 42.

Helical scan colour video

Sony have also patented (BP 1275307) a method for reproducing luminance and chrominance signals on separate but overlapping tracks on a helical scan video recorder. Two heads are used, as shown in **fig. 4,** one of which has its head gap aligned at 90° to the direction of motion of the head and the other one being inclined obliquely to it, roughly at 90° to the

FIG. 4



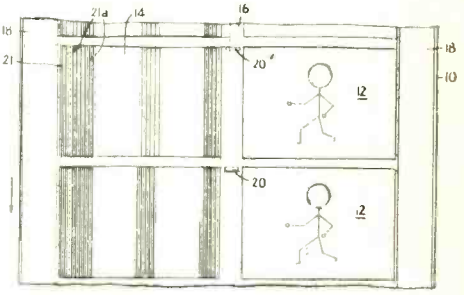
direction of motion of the tape. The first is the chrominance signal and the second is the luminance signal. They are recorded at different frequencies; the head 3 shown in the diagram is modulated at a low frequency and is given a wide gap whereas the head 4 is modulated at high frequency and has a narrow gap.

Improved monochrome video

The last of this month's video patents is that taken out by CBS (BP 1275790). It describes a monochrome method of recording colour information. The patent makes particular reference to the rerecording of films. A previous patent (BP 1040664) is also summarised and the more recent patent improves the older one, in which a certain amount of ringing occurred at the beginning of each scan line.

Fig. 5 shows two frames of the recording medium. The frames 12 show the luminance information and the frames next to them contain either encoded colour information or a second monochrome programme. The strip is about 8 mm wide. 18 is the sound track, some 1 mm wide on each side of the strip. There are a series of synchronising marks 20 which are precisely fixed so that the top edge of the marks is level with the top edge of the frame and so that the marks intersect the centre line of the strip of film. These marks replace the sprocket holes and are detected by a light pipe or other sensor.

FIG. 5



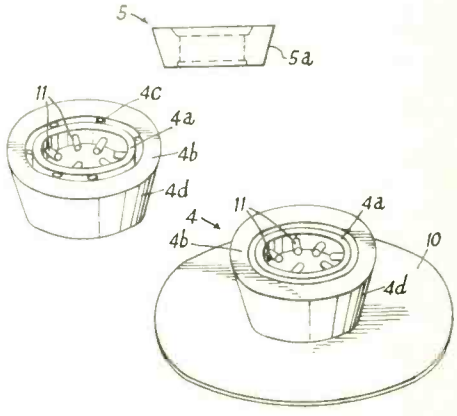
Endless tape cartridge

Yet another variation on the cartridge has come from Japan. The invention has been taken out by Tokyo Denki Kagaku Kogyo Kabushiki Kaisha and the number is 1274914. The inventors claim that in previous cartridges the portion of the tape coming out from the centre of the hub on which the tape is wound must pass over the tape already wound on to that hub. This causes a great deal of friction, which is the greater because of the tape near the hub being tightly wound.

Fig. 6 shows the hub and the turntable on which it is mounted. It is tapered to allow the tape to leave the hub more easily. There is a gap between the driving hub and the hub on which the tape is wound. Rollers 4c are placed in this gap to transmit torque from 4a to 4b.

The turntable 10 allows the tape to spool correctly. One can visualise the tape acquiring a marked bias if stored for long periods with one side of the tape stretched more than the other. The makers claim, however, that an obliquely inclined guide post elsewhere on the cartridge as sufficient to correct this fault. Such optimism is a rare thing in this gloomy age.

FIG. 6



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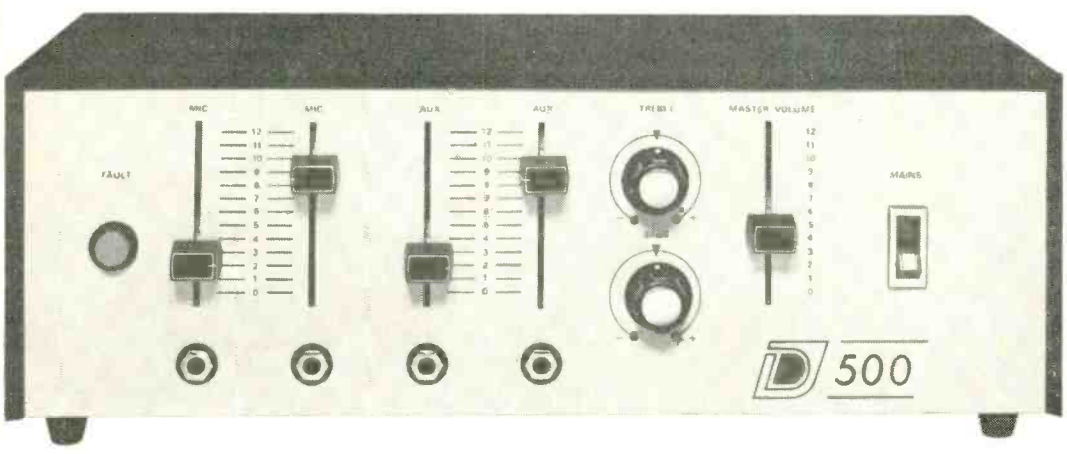

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THE FOLLOWING list of Complete Specifications Accepted is quoted from the May issues of the Official Journal (Patents). Copies of specifications may be purchased at 25p each from The Patent Office, Orpington, Kent BR5 3RD.

May 10, 1972

1278217
Etab Aesup and Mefina SA
Pushbutton switch

1278227
AKG Akustische U Kino-Gerate GmbH
Artificial echo device

1278276
Owens-Illinois Inc
Transistorised alternating voltage generator

1278279
Rental Maintenance Ltd
Method for the restoration of cathode ray tubes and thermionic valves

1278820
Bishop Graphics Inc
Printed circuit pattern mask

1278281
Texas Instruments Inc
Field effect transistors for integrated circuits and methods of manufacture

1278284/5
Wood, N
Manufacture of stringed musical instruments

1278309
Hypertech Corporation
Method and apparatus for making an imprint on a recording medium

1278320
Eastman Kodak Co
Motion picture camera

1278336
Xerox Corporation
Lens strip optical scannng system

1278346
Telefonaktiebolaget L M Ericsson
Arrangement for generating a series of digital signals

1278390
Gaf Corporation
Motion picture projectors

1278399
Mitsumi Electric Co Ltd
Current amplifying transistor

1278451
RCA Corporation
Discriminating signalling system

1278490
Philips Electronic & Associated Industries Ltd.
System for the transmission of binary information

1278536
Multiscreen Corporation Ltd
Film feed apparatus

1278573
Plessey Co Ltd
Gramophone record players

1278598
Pye Ltd
Storage tubes

1278610
Lee, F F and Burns, S K
Apparatus for continual television-like displaying time-sequential signals

1278636
Sierra Research Corporation
Clock synchronization techniques

1278648
Motorola Inc
Method of plastics encapsulating an assembly of electrical components

1278650
Centre Electronique Horloger SA
Frequency divider circuit

1278673
Konishiroku Photo Industry Co Ltd
Holographic camera

1278793
Thomson CSF
Semiconductor amplifier

1278878
AKG Akustische U Kino-Gerate GmbH
Shock-protected artificial reverberation apparatus

1278884
AKG Akustische U Kino-Gerate GmbH
Reverberation spring

1278898
RCA Corporation
Electrophotographic recording element including a photoconductor and method of making the photoconductor

1278907
Licentia Patent-Verwaltungs GmbH
Class-B push-pull output stage

1278927
Hitachi Ltd
Method of manufacturing a lead frame for a semiconductor device

1278944
Philips Electronic & Associated Industries Ltd
Arrangements for use with television camera tubes

1278957
Audits of Great Britain Ltd
Apparatus for sensing the frequency to which a wave signal receiver is tuned

1279063
Soc Lannionnaise D'Electronique
Polarisation selector apparatus for use with aerials

May 17, 1972

1279275
Sony Corporation
Magnetosensitive element

1279306
Ampex Corporation
Random access information retrieval system

1279312
Danfoss A/S
Feedback potentiometer for a servo-motor

1279314
Texas Instruments Inc
Reduction of parasitic bipolar effects in EGFET integrated circuits

1279315
Allen-Bradley Co
Pulse width modulation to amplitude modulation conversion circuit

1279354
Tesla Narodni Podnik
Apparatus and method for detecting phase deviation of a pilot sub-carrier in stereophonic multiplex broadcasting

1279457
Rederi AB Nordstjernan
Transducer in the form of an oscillating element

1279513
International Standard Electric Corporation
Method of and circuit arrangement for picture transmission in television telephony

1279534
Marconi Co Ltd
Television camera tube cooling arrangements

1279634
Dolby Laboratories Inc
Signal compressors and expanders

1279641
Eastman Kodak Co
Parallax panoramagrams and like pictures

1279700
Rosemount Eng Co Ltd
Analogue-to-digital converters

1279725
RCA Corporation
Avalanche diode oscillator

1279728/9/30
Eastman Kodak Co
Motion picture projectors

1279756
Philips Electronic & Associated Industries Ltd
Suppressing interference in fm radio receivers

1279795
Westinghouse Electric Corporation
Apparatus for transferring intelligence between two voltage levels

1279838
Cableform Ltd
Control circuits for DC electric motors

1279861
Telefunken Patentverwertungs GmbH
Method of direction-finding wherein a voltage is produced the phase position of which in relation to the phase position of a reference voltage represents a measure of the angle of incidence

1279907
Scanfax Systems Corporation
Switching system for tape rewind

1279952
Deutsche Grammophon GmbH
Methods of and apparatus for magnetic recording

May 24, 1972

1280032
Presearch Inc
Variable electrical delay device

1280049
Philips Electronic & Associated Industries Ltd
Television camera system

1280086
International Business Machines Corporation
Multistage transistor amplifier

1280088
Sprague Electric Co
Electric variable capacitors

1280104
Compagnie Des Montres Longines Francillon SA and Golay SA Bernard
Circuit for regulating the mean frequency of an oscillating system

1280117
Paquet, A
Electronic metronomes

1280127
Philips Electronic & Associated Industries Ltd
Method of manufacturing magnetic heads

1280154
Newport Instruments Ltd
Devices for the measurement of electric current

1280198
Eastman Kodak Co
Method of splicing films

1280261
Varian Associates
Display tube camera apparatus

1280308
International Standard Electric Corporation
Band pass filters

1280329
Matsushita Electric Industrial Co Ltd
Tape transport mechanisms

1280398
Mallory & Co Inc, P R
Integrated circuit audible alarm system

1280417
Bendix Corporation
Proximity-focused image-storage tube

1280457
RCA Corporation
Holographic identification system

1280461
Redifon Ltd
Method and apparatus for producing a projected visual scene

1280545
Standard Telephones & Cables Ltd
Solid state scanning system

1280590
Ampex Corporation
Systems for controlling the length of a loop of tape in a buffer chamber

1280603
Ampex Corporation
Servo-systems for synchronizing video tape recorders

1280630
Standard Telephones & Cables Ltd
Solid state scanning system

1280644
Fell (MFG) Ltd A & M
Cassettes for use with tape recording and/or replaying machines

1280645
Fell (MFG) Ltd A & M
Recording and/or replaying machines

1280651
RCA Corporation
Colour television camera overload compensating system

1280698
Victor Comptometer Corporation
Communications system having signal storage

1280706
Hitachi Ltd
Frequency measuring device for measuring repetition rate of pulse signal

1280719
Sony Corporation
Magnetic field detecting apparatus

1280772
RCA Corporation
Memory system

1280895
Matsushita Electric Industrial Co Ltd
Method of making a magnetic head

May 31, 1972
Delayed to June 1 due to public holiday.

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Letters

The ARP 2500

Dear Sir, Your reviews and discussions of synthesiser applications in studios and for the musician have been most interesting to me. At this point I am anxious to see you get hold of a Moog. However, I am writing hoping to be of help to musicians or studios thinking of buying a synthesiser.

Being in a successful group, I am in the fortunate position of having both ARP *2500* and *2600* synthesiser systems. David Kirk's review was astounding to me in that he seemed to unearth all the user problems of the *2500* in what I took to be a very short time. To reinforce what he said, I would not recommend the purchase of a *2500* before a much cheaper *2600*. In my own case, I bought a *2500* before the smaller synthesiser was available.

The only reasons that count when one is spending up to £7.000 on a synthesiser are what results do I get and how long does it take me to get them? For the first two years of getting to know synthetic sound, one can do everything one wants on a *2600*. The *2500* would confuse, does confuse and, although capable of astounding feats of versatility, needs much time and a *very* clear head to operate.

Stand up those studio owners that have customers with spare studio time; stand up those musicians who spend that spare time sober. The ARP *2500* matrix system is a good one but needs *two* operations to achieve a make between module functions. When one is setting up something really complex, it is easy to get so confused as to want to trace everything back. When one has 'ad a few, this proves to be utterly defeating. The matrix used on EMS equipment is better in this respect. The *2600* is ideal here; it is very cleverly prewired. Just when one thinks one has found an amazing noise with the whole face of the machine covered in patch cords, one notices that the set-up is already prewired, more or less. One can always over-ride a small section of the prewiring with only two cords. You can still see what you're doing and, more important, not be afraid of having a couple of beers to aid instrumental confidence and flexibility.

Even the *2600* is not as easy and clear to operate as the *VCS3*, but it is more appealing to the musician, more musical I feel. The tuning is rock solid, and the oscillator tracking uncanny. So why do Tonus make the *2500?*

Mine plays six notes at once, can have 20 sets of preset control voltages available, six audio signals mixed and instantly usable at various levels, the most incredibly subtle tone colours can be produced using the multimode resonator in conjunction with a normal filter, and the sequencer will provide exhilarating cascades of arpeggios. In fact it is the versatility of the *2500* that makes it eminently more suitable for stage work than the *2600*. Once the matrix has been dealt with stone cold sober, one can go away, get plastered and know that all will be well and that all the functions preset will come to life in tune.

But what of output amplifiers, voltage processors, inverters, time lags, mic preamps, reverb, envelope follower? All these are featured on the *2600* along with the really good oscillators. The *2600* can be plugged in, played and gives instantly appealing results. The *2500* can be plugged in, watched, and will provide an instantly appealing light show.

Yours faithfully, Pete Townshend (The Who), 2 The Embankment, Twickenham TW1 3DU.

Warm sound

Dear Sir, As UK representatives of Spectra-Sonics (California), we would like to clear a point mentioned in the June issue of STUDIO SOUND.

In Mr Dwyer's report on the AES Munich Convention, concerning the equation for power amplifier requirements when used in the bi-amp and tri-amp configuration, Mr Dwyer quite rightly queried the fact that in the equation the total power was *added* to arrive at the solution.

In this case, it would appear that the speaker was not inferring that power requirements were *acoustically* additive, but in fact were *financially* additive since fewer watts were required for a given spl.

This is a very pertinent point. In one case where a pa system used 1.8 kW of power, the crossover networks were passive and had 3 dB insertion loss. This meant in real terms that, at the average cost of £1 per watt for a professional power amplifier, the owner of that particular installation was very efficiently dissipating £900 worth of heat into the auditorium!

Yours faithfully, Stephen Court, Feldon Audio Ltd, 126 Great Portland Street, London W1N 5PH.

In favour of the dBV

Dear Sir, I was most interested to read the review of H. A. O. Wilms' paper on the 'Ambiguous dBm' in the June issue of STUDIO SOUND. As I understand the situation, and as I teach it to my students, the dBm is *not* ambiguous in the way indicated by Mr Wilms. If used as a unit of power (i.e. with a reference power of 1 mW) there is no difficulty at all and we need not go any further; but one hardly ever uses the dBm as a unit of power. The most common way to use the dBm is as a unit of voltage and here the trouble is that one *must* specify the impedance level of the circuit in question or the statement 'x dBm' is meaningless.

Mr Wilms's statement 'output level equals +12 dBm into 30 ohms' is thus precise and unambiguous; it means that the output voltage is such that 20 times the logarithm to base 10 of the ratio of that voltage to the rms voltage needed to dissipate a power of 1 mW in 30Ω is equivalent to a voltage of 0.173V rms. Thus, if Vo is the output voltage, the equation becomes:

$$+12 = 20 \log_{10} \frac{(Vo)}{0.173}$$

and so Vo is 0.689V. The output *power* is 15.8 mW as one should expect.

I do strongly support Mr Wilms's plea to drop the dBm altogether in favour of the dBV, though. For those lucky people who deal exclusively with matched circuits the dBm is useful, but for users of audio equipment which nowadays is designed to have low output impedance and high input impedance, the dBm has become a real nuisance. Perhaps a worked example will show up the sort of problem which students, among others, tend to find difficult. Consider a piece of apparatus with an output impedance of 10 kΩ (a reasonable figure) which is to feed a 600Ω line. We can match the apparatus to the line in many ways, but the two most common would be (1) a transformer, (2) some sort of emitter follower. Let us agree to use a perfect transformer and an emitter follower of voltage gain 'times one' to make life easier.

Case (A) If we start with a voltage level of 0 dBm in the apparatus, device (1) will produce a level of 0 dBm in the line whereas device (2) will produce a level of +12.2 dBm.

Case (B) If we start with a voltage level of 0 dBV in the apparatus, device (1) will produce a level of −12.2 dBV in the line and device (2) a level of 0 dBV.

These statements are equivalent to a reminder of the physical situation: the perfect transformer is a passive device and neither removes nor adds power from or to the signal, while the emitter follower takes power from the dc supply and adds it to the signal. Personally, I would rather work with case (B) and I am fairly sure that most people actively concerned with recording studios would agree with me.

Incidentally, I do not understand John Mosely's remark that Mr Wilms's proposal would make the vu meter obsolete—I cannot see how the vu meter comes into the argument at all. The ASA specification for a vu meter says, among other things, that it should read '0' when a level +4 dBm in 600Ω is applied to it. All we have to do is to agree that it should read '0' when a signal of level +1.8 dBV is applied to it (since 0 dBV = +2.2 in 600Ω).

I hope that my rather lengthy letter will shed light on what should not be a murky subject, and increase the number of adherents to the cause of the dBV.

Yours faithfully, J. M. Bowsher, The University of Surrey, Guildford, Surrey.

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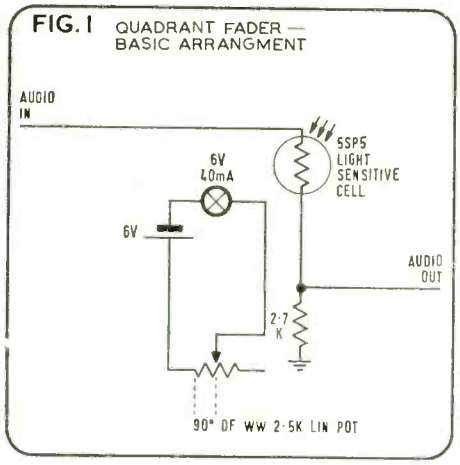
A Novel Quadrant Fader

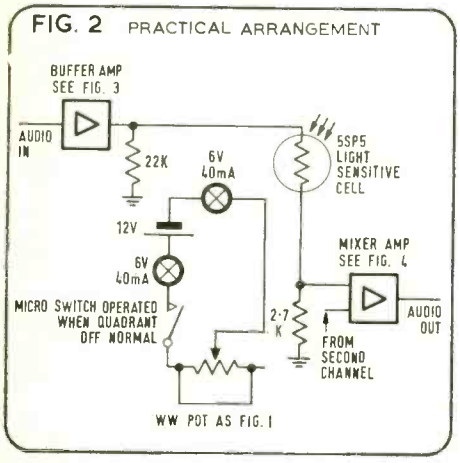
By M. J. Skeet

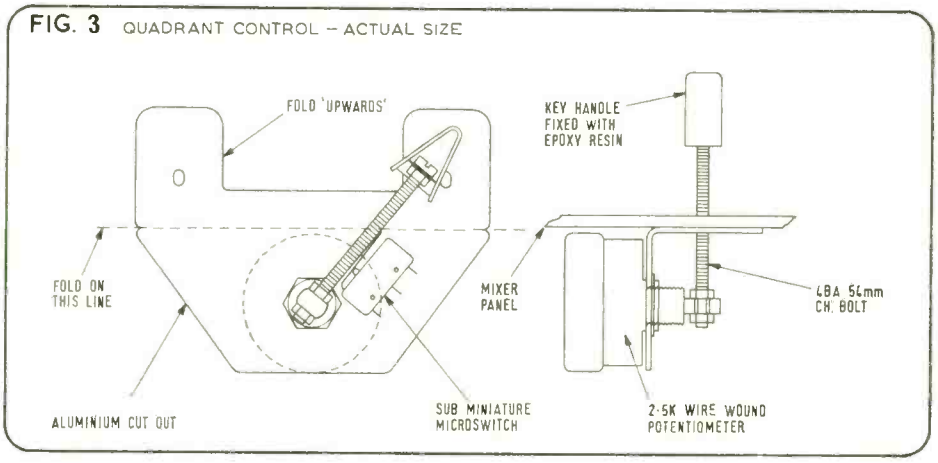
THE quadrant fader about to be described is successfully in use in a mixer employed for programme presentation purposes. Basically, mixers are put to one of two uses. One is the balancing of numerous microphone circuits to feed a tape recorder to produce a recording of an event or a performance. The other, as in my use for a mixer, is the selection, cross-fading and mixing of various programme sources. The output is fed over a pa system or to a tape recorder for future use. This quadrant fader is much used in the latter application but should be suitable for the former.

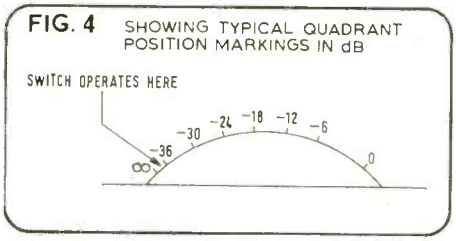
The basic concept is to use photoresistors in the audio paths; a lamp controls their resistance and 90° of a conventional 330° potentiometer controls the lamp brightness. Attractions of the system are numerous: it is noise free due to the relative sluggishness of the lamp/photoresistor response to any irregular tracking of the potentiometer; stereo channels are easily controlled—that is to say one lamp can control one, two, three, four or more stereo channels; the quadrant control can be some distance from the audio circuit being controlled with advantages to the layout within the mixer; and a channel monitor lamp can be incorporated on the mixer panel—the brightness of the lamp indicating the state of the channel concerned.

Fig 1 shows the basic arrangement. A potential divider is formed and a maximum attenuation of over 60 dB from the faded up level is easily possible. This occurs if the resistance ratio is greater than 1,000 to 1. With the *5SP5* cell used in the particular way being described—in a tin, matt black on the inside—its resistance is in excess of five MΩ. Lit at 3 mm from a 6V 40 mA lamp (PO No. 2) its resistance is around 2.5 kΩ. These are effective resistances as measured in circuit using a sine wave source and vvm. With a brighter lamp a lower resistance is possible but greater heat is created in the closed box. If use over long periods is likely then problems might be caused. If the cell is followed by 2.7 kΩ the resistance ratio is easily greater than 1,000 to 1. Hence the voltage ratio is greater than 1,000 to 1 and 20 log 1,000=20 x 3=60. Thus, when faded out the attenuation is greater than –60 dB.









An insertion loss around 6 dB occurs if used as described. This can be reduced if the cell is followed by a higher resistance—however, as a result of this, the attenuation already mentioned would reduce to below 60 dB and stray pickup could result if this following resistance is taken too high.

There are some other considerations as a consequence of using the fader described. The output impedance of the stage preceding the fader must be low. It has to be capable of feeding into some 5 kΩ—the load presented by the fader when faded up. This implies an output impedance under 1 kΩ if losses are not to become significant. Also the coupling capacitor from the preceding stage must be of such a value as to couple to the fader adequately at low frequencies. The best way around the first of these is to use a buffer amplifier on the input to the fader which will present a high impedance to any source connected to the mixer and give the required low impedance to the fader. This has been done in **fig 2**. The 22 kΩ resistor following the buffer amplifier is to reduce the surges from the electrolytic capacitor preceding it as the *5SP5*'s resistance is changed—especially when done quickly. The buffer and mixer amplifiers come from Mullard's book 'Transistor Audio and Radio Circuits'. Further details—frequency response, distortion, noise, are available in this fine publication. Using a mixer amplifier to follow the fader avoids the losses that resistive mixing would produce. Microphone channels connected via the Mullard microphone amplifier do not need any buffer stages as the output impedance of this amplifier is sufficiently low.

Fig 2 shows the practical set up. A panel monitor lamp is useful so the lamp circuit

continued 23

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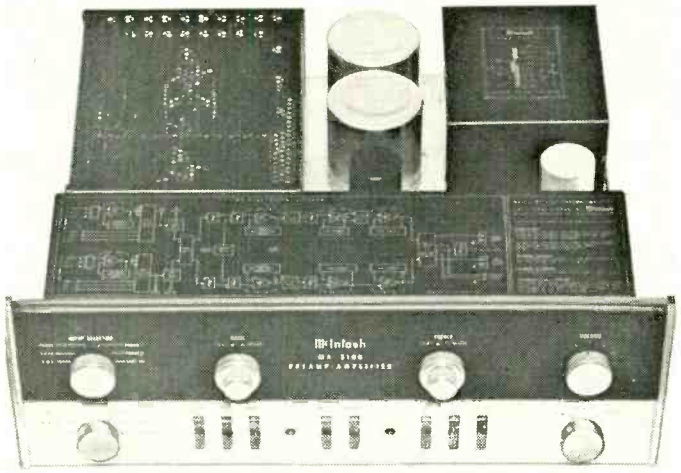

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Book Reviews

INTRODUCTION TO VIDEO RECORDING by W. Oliver. Published by W. Foulsham & Co Ltd, Yeovil Road, Slough, Buckinghamshire. Price £1.50.

GUIDE TO VTR compiled by Timothy Johnson, Sally Hall and Eve-Lynne Rubin. Published by Ovum Ltd, 22 Grays Inn Road, London WC1 8HT. Price £8.

THE increasing numbers of educational and industrial television equipment users differ from their audio counterparts in that they usually have no previous video experience. Audio consumers, even if non technical, have at least heard other equipment and professional sound men are informed by personal contact and by the technical press whereas, for a high percentage of closed circuit television users spending between £400 and £10,000, it is their first system. Both of these books are aimed at this information gap.

Introduction to Video Recording claims to treat the subject from two angles: 'For the non technical reader it tells in simple terms how video recorders work. And for the user who wants more technical information it gives details of typical equipment.' In my view it fails in both these aims. The 13 chapter headings including 'Choice of Systems', 'EVR,' 'Video Disc Systems,' 'Portable Video Recorder Systems' and 'Lasers and Holograms in Video Recording', whet an appetite that the book itself singularly fails to satisfy. Here are a few examples of the sort of technical error in which the book abounds. The chapter on cameras describes as a 'typical' cctv camera what is the most atypical camera I have ever come across, with no less than 11 controls (the majority of modern cameras of this class have virtually no controls other than those for the viewfinder if fitted). 'There are dozens of types and makes of vidicon in sizes ranging from very miniature to quite large.' In fact, nearly all vidicon tubes are one of two sizes, 16 mm or 25 mm in diameter, and a small numberof spare tubes will cover 95 per cent of cctv cameras in use. Again on cameras, the Philips *LDH 0050*, a low cost model, is described as 'offering many qualities usually found in more expensive professional cameras' and then goes on to list just those features found in *every* camera from the cheapest upwards: 'fully transistorised, printed circuit and auto level control'.

Video recorders are described (chapter nine) as having a writing speed of up to ten times the linear speed. If this were true, however, could one get a 5 MHz bandwidth from a 19 cm/s tape speed? In truth the ratio varies between about 50 and several hundred to one. Chapter nine again: 'The Philips ½ inch (12.5 mm) and the Ampex 1 inch (25 mm) models . . . typify a rotating head system and a helical scan system respectively'.

Factual errors aside, the explanatory sections are worse and my gloomy assessment was confirmed by an interested educationalist to whom I loaned the book for a non-technical appraisal; he found it 'generally confusing'. Why, for example, half way through the chapter on Choice of Systems, does the author launch into two and a half pages of colour television theory? The chapter on EVR does not explain clearl ythat it is essentially a playback system nor does it give any idea of the procedure and costs of getting programmes 'printed' for the machine. The chapters on videodisc and holographic systems fail to mention that neither is anywhere near production yet. All this could possibly be forgiven if at least some useful information on equipment and facilities were given. There is an interesting and lengthy description (the longest in the book) of an excellent slow and stop motion video disc system but it costs £40,000 and there is no mention of the low cost Japanese vtr that has been around for a year or two, costs just one per cent of the above figure, and gives just these facilities. There are no lists or tables of different models, and no mention of video cassettes. The chapter on costs only mentions two prices: a receiver/monitor (£80) and an unspecified studio (£300 a week to hire). All in all a disappointing effort which loses the novice through lack of order and logical sequence and which frustrates anyone familiar with the subject through downright error and lack of technical weight.

The *Guide to VTR* claims more modestly to be a 'news report on equipment suppliers and applications' and, although written by allegedly non-technical people, is such an excellent piece of technical journalism that it is useful to both engineer and non engineer.

The introduction to the three main sections discusses the present state and commercial prospects for helical scan vtrs and gives an interesting table estimating both the numbers in use and the current rate of sale of different models. The equipment section starts with a table of over 40 vtrs and has 14 columns listing cost, resolution, tape speed, weight and facilities. Then an explanation of technical requirements and problems such as bandwidth, noise and compatibility, which really does inform the newcomer and does not embarrass the engineer. The short section on tape is misleading in that it glosses over the problems of compatibility between certain machines and certain tapes: some tapes (not necessarily the most expensive) *are* better than others on certain machines. Individual makes of machine are then discussed with a candour that could only result from communicating with the actual *users* (how useful if equipment reviewers did this). Cameras and monitors are then listed and discussed in a similar way. Next, a large section is given to suppliers and services, including several independent consultants. This is very important if only because small distributors do not have the resources or knowledge to cover the whole field. A similar section on users of cctv equipment (a potted video version of this journal's 'Around the Studios') shows how similar users to oneself have handled similar problems. This is an extremely useful report and well worth the investment, particularly if the plan to supply up-dating sheets is carried out. (The Sussex University Bookshop were unable to trace the book so, if in difficulty, one should contact OVUM Ltd direct.) **Roderick Snell**

QUADRANT FADER

continued

voltage is 12V. 6V 40 mA lamps have been used. The strap across the full potentiometer winding is to improve the attenuation/tracking performance. To get full attenuation when the fader is fully faded down, a microswitch is provided. It might be possible to avoid using the microswitch by insulating the track of the WW pot at the appropriate point. This has not been tried but it is a way of reducing cost. The typical quadrant markings in dBs are shown in **fig 4.** The spread 0 to –6 dB gives a much appreciated delicate control at this point.

Mechanical construction could be tackled in several ways. **Fig 3** showing one example. The shoulders either side of the lever are nine mm thick 'segments' of an 80 mm diameter wooden cylinder. Alternatively that can be cut from plywood.

Components

Potentiometers	Colvern 2.5 KΩ WW	Electrovalue, 28 St. Judes Road, Englefield Green, Egham, Surrey
Cells	*5SP5* Light sensitive cells. Two in pack *B89.*	Bi-Pre-Pack Ltd, 222 West Road, Westcliff-on-Sea, Essex.
Switch	Sub-miniature microswitch and lever	'Radiospares'
Knob	Key handle from lever (key) switch	'Radiospares'

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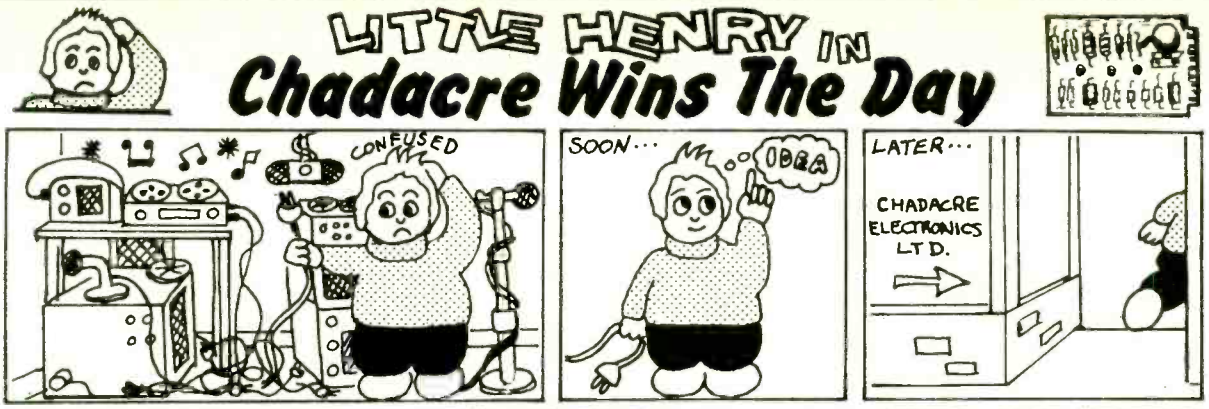

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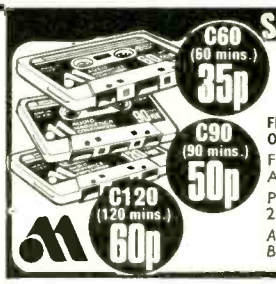

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Diary

BY KEITH WICKS

FINDING himself unsympathetic with the new director running Pye Recording Studios, maintenance engineer Ken Atwood resigned in June. The new management team are sorry to lose an engineer of his experience but wish him well in his new appointment at De Lane-Lee Studios.

At **Nova,** Greg Lake has been producing an Emerson, Lake and Palmer album. John Sherry produced Fumble for Sovereign Records, and Mike Copeland produced Renaissance for the same company. The Foggy Duo have been in for York Records, Phil Solomon produced several records for his company, Belgravia Productions, and Neil Reid continued reductions of his second album.

Gooseberry Studios are looking for a studio engineer with experience in at least four track work. Peter Houghton wants someone to take his place so he can devote most of his time to promoting business. People with qualifications but no studio experience should not apply. A basic salary plus a percentage of turnover will be paid and there is a good chance that the engineer will eventually become studio manager. Applicants should phone Peter Houghton on 01-437 6255.

At **IBC**, this month's artists have included the Bee Gees, Freddy Davis, John Baldry, Tony Cole, Rolf Harris, Lesley Duncan, Byzantium, Dana and Ireen Sheer.

Fans of the mid-50's skiffle craze will remember Chas McDevitt and Shirley Douglas. They have been to **Pan Studios** to record a budget album for the Joy label. Titles include *La Bamba, Rose Garden, She'll Be There, Snow Bird* and *Freight Train*. Lou Praeger has been making big band sounds for an album and the Caribbean continued work on their album of Grimsby-style steel band music. The studio is now starting 'a sort of Jesus Christ Superstar album on Indian instruments aimed at the Christian Asian population here in England'. Sounds like a violent demo!

In June's *Diary*, I mentioned that four people recently left **Wessex Sound Studios** and I said that one was a studio engineer. The studio's senior partner, Ron Thompson, has pointed out that the studio were at the same time engaging new staff. Also, none of those who left were desk engineers. Although Adrian Ibbetson had done some desk work, he was the studio manager, and not an engineer. I regret any confusion caused by the June article.

Brewers Droop continued working on an album at **Maximum Studios**. Mike Hugg has been in again, Feldmans Music made a budget album and Neil Innes put down several backing tracks. Kenny George produced Selisi Meya for CBS.

The work at **Intersound** has included sound recording for London Weekend Television's *A Train Now Standing* and *Doctor In Charge*. The studio has also recorded music for the Rolf Harris show. A cover version of Godspell was completed for Avenue Recordings and Pickwick did another *Top of the Pops*. Others at Intersound this month included Colin Hare and Terry Lightfoot.

From **Trident** Malcolm Toft reports that the desk they recently built and installed is working well. (The desk and its facilities were discussed in this column last month.) Ray Richardson, who joined Trident as studio manager about three months ago, has been telling us of other recently installed attractions. These include coloured lights which pulsate with the music and naked ladies on the walls which don't. For session men there are bright white lights, allowing them to study their music and admire the murals.

Adrian Kerridge at Lansdowne's Cadac desk. Photo by courtesy of 3M whose Scotch 206 tape is now used for all Lansdowne mastering.

Trident's recent customers have included Nilsson, Mama Cass and John Kongos.

Tony McCauley, Micky Most and Don McLean have been at **Orange** this month. Besides carrying out a lot of routine work for music publishers, the engineers have been continuing development work on their range of recorders.

Sarm have now issued their *Stop Smoking* record by hypnotist Edwin Heath on the Sarm 101 label. At the time of going to press, partners Barry Ainsworth and Gary Lyons were on the point of signing the contract to purchase a recording studio. Their current work consists of disc cutting, tape copying and freelance engineering. Recent cutting has included work by Fifth Dimension, Dawn, the Partridge Family and Jackie Charlton. Tape copying has been carried out for Bell, Rediffusion, Avenue, Gem, James, Carlin and Sympathy. Engineering work included a Buddy Greco album for Pye, a Johnny Hackett follow-up, and sessions by the Swinging Blue Jeans and Carol Bell. Sarm have also done several mobile recording sessions featuring university and college groups.

At Majestic Recording Studios, disc jockey Tommy Vance recorded a take-off of a typical American soul record. This will probably be issued as a single. Avenue have been recording rock and roll albums for the Canadian market and Palmer have made several reggae albums of current chart successes. Terry Warr, who wrote the original music for *Suburban Wives*, has been in to record music for the follow-up film. The title hasn't been decided yet but I am told that it may possibly be called *Commuter Husbands*.

Atlantic Recording artists Batdorf and Rodney performed at **Ultra-Sonic Recording Studios,** New York City, to a 50-member studio audience for broadcast over WLIR (FM), Garden City. Steve Goetz engineered this concert, which was one in a series of weekly concerts presented by Ultra-Sonic and WLIR (FM).

Other recent work has included various single and album sessions, radio commercials, sound tracks for TV commercials and music for an educational film.

Studio Sound freelance, Keith Wicks, has decided that, because of other commitments, he is no longer able to continue writing the *Diary* column. After 18 months of toil, he has handed over to assistant editor John Dwyer. An official bulletin stated that Keith was making a slow but steady recovery.

Studio complaints, threats, etc, should now be sent to John c/o STUDIO SOUND. Finally, many thanks to all those who have been so helpful in supplying information for this column.

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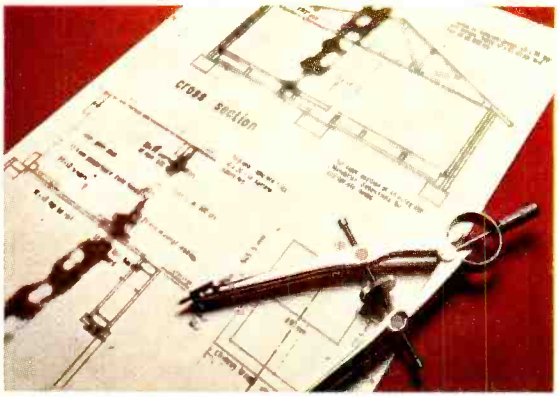

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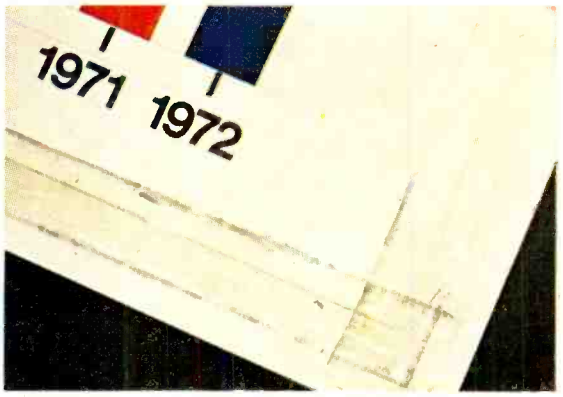

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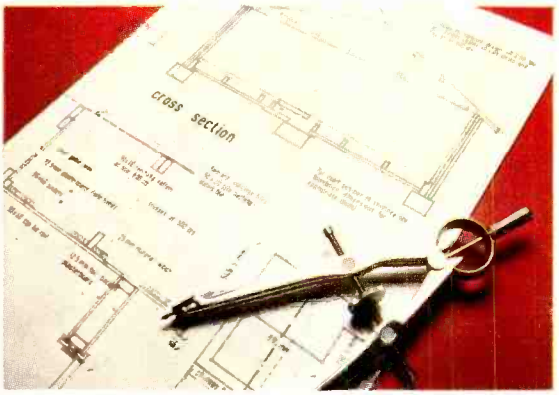

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Around the Studios

BY ADRIAN HOPE

Record Plant and Westlake Audio

RECORD Plant and their companion company, Tom Hidley's Westlake Audio, are not only in the record making business but in the studio making business as well. This is an essential concept to grasp before talking about what actually goes on at the Record Plant studios in New York and Los Angeles. For the policy is one of maximal independence from outside factors. This has enabled Record Plant to embark on a unique project. Namely, to have exactly matching studios on opposite coasts of the United States. It is thus possible for a tape to be started in New York, worked on in Los Angeles, returned to New York for finishing, and mixed down on either coast. The week before I visited the New York Record Plant, to be shown round by executive director Chris Stone, Quincy Jones had been recording there with Aretha Franklin and had flown off to Los Angeles (where he had other commitments) taking the tapes with him to work on them several thousand miles away before returning to New York to cut more sessions with Aretha.

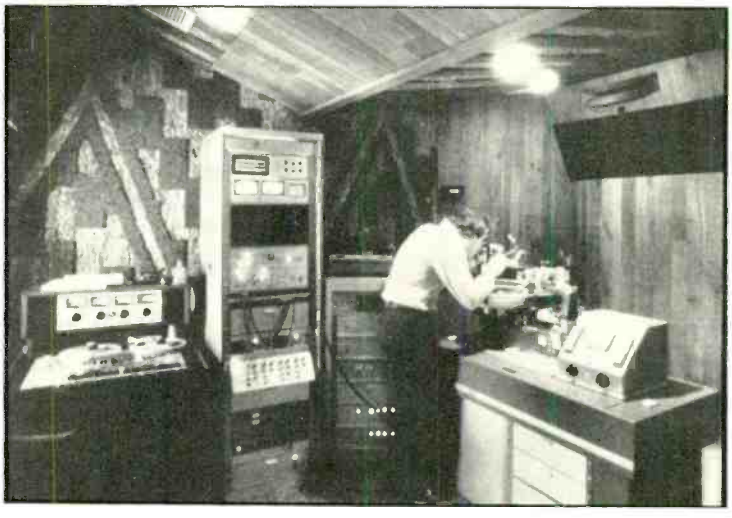
'By having exactly matching studios both here and in LA,' explained Chris Stone, 'an MD can record the basic tracks here, fly out to Los Angeles with the tapes to sweeten it up with strings and then fly back here to remix. We have even had the situation where an entirely New York based session was flown out on tape to Los Angeles for a guitar player who lives there to add a track.'

Clearly the only way this can work properly is for the two studios to be totally compatible. This is why Record Plant and Westlake build their own installations. 'We know a lot about building studios now,' said Stone. 'Westlake Audio have built studios for independents like producer Jim Guercio. Jim has a dude ranch out in Colorado. He will ask his groups (like Chicago) to come out for a few weeks and swim, hunt bear and, when they get tired of the other things, to record. Albert Grossman has a studio of this kind at Woodstock for people like The Band.'

I asked how much it would cost to have a studio built if I had a dude ranch.

'Around $250,000.'

I don't have a dude ranch.



Cutting room at Record Plant, New York.

One of Record Plants NY studios.

Record Plant not only made their opposite coast studios compatible; separate studios in the same building are equally compatible. Thus in New York their individual studios are matched in all respects other than size. The architecture, acoustics, design and equipment are all exactly compatible. Thus a tape can be moved from studio to studio in the same building as well as from coast to coast. Stone showed me frequency response curves of the left- and right-hand monitor speakers in the three New York studios. These are checked every 60 days by Tom Hidley, the mind behind virtually all the custom-built equipment used by Record Plant and sold by Westlake.

In New York, Record Plant have three studios and a cutting room. In Los Angeles they have two studios and the atmosphere is much more relaxed. Whereas the New York studios are spread out over the ill-distributed available space in four floors of an office block building (among Teamster Union, Draft Board and Meat Marketing Board Offices), in LA they own the whole building and have a sauna bath for 12 people and even a small hydro massage pool for use between sessions.

The New York studio is on West 44th Street and so is close enough to the heart of the film and record world to allow its use by session musicians who work on a tight schedule. In New York, no one has a car and people move only short distances. In Los Angeles, everyone has a car and distances are judged simply by the time taken to get there. The recognised New York session times are 10 to 13.00, 14 to

continued over

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17.00 and 19.00 to open end. Most of the sweetening with studio musicians is done during the day, with rock groups and re-mixing at night, explained Chris Stone. He originally brought Eddie Kramer over from England with a view to 'attracting the English musicians'. 'But he is now doing it at Electric Lady,' Stone went on. Having visited both studios, I was particularly struck by the way both Record Plant and Electric Lady talk about each other with a great deal of mutual respect. Likewise Record Plant work in a curiously schizophrenic way both in cooperation with Wally Heider and in competition with him. Between the two of them, Heider and Record Plant have divided the States up into two areas. In one area, location recording is done by Record Plant with a Wally Heider truck fitted out with Record Plant equipment. In other areas, the work is done by a Wally Heider truck with his own equipment.

'So when we cover the live Elvis Presley tour down in the South, we shall record some dates and Wally Heider will record the others,' said Stone. 'The same will happen if we go out on location to record an orchestra like the Philadelphia. That way, if someone comes along and says "How much for a dual 16 track in the desert?" we can always work it out one way or the other.'

The extent to which Record Plant and Wally Heider have now tied up the mobile business here can perhaps best be judged by the fact that the Rolling Stones no longer bother to bring their own mobile to the States.

Probably the biggest mobile job handled by Record Plant was the recording of the Bangladesh Concert organised by George Harrison in New York. For this, as usual, they used the Heider truck with Record Plant equipment, three or four of the recording tracks being simply for audience reaction. George Harrison and Phil Specter originally intended having the record out within about ten days and worked virtually night and day for a week at Record Plant in New York to produce a first mix. But, having done this, they weren't happy and felt they needed more time so finished the job out at A & M Studios in Los Angeles. Certainly the results justify the extra time spent because the mixed down quality on this lp must be among the best live recordings of their kind.

The Heider van with Record Plant equipment is also compatible with the Plant 'house' studios, as is their cutting room. Although I did not have a chance to see the truck, I am told that its acoustics match the studios and it even looks the same.

The studio and control room acoustics are all based on a system whereby the far end of the studio (from the control room) is acoustically dead with characteristics that liven and brighten as one moves up towards the control room window. This effect is so distinct that to walk down the studio from the live to the dead end and to talk at the same time feels rather like walking into treacle. Of course, rhythm section instruments that need a tight sound are put at the dead end of the studio with the strings at the live end, close to the control booth glass. This sound control is achieved by using a carpeted floor and a sawtoothed cork and bark roof with teeth pointed towards the studio dead end. The cutting room and control room acoustics are all designed to be dead behind the mixer but bright to his ear. This way there can be no spill from behind the engineer to confuse the mix. Because of the high intensity sound levels inevitably involved (around 110 dB), and the proximity of people like the Department of Agriculture, the soundproofing between studios and from the rest of the building is very extensive. Whereas the sawtooth ceiling works by carrying the sound forward, it does little or nothing to reduce transmission and this is achieved by some other designs by Tom Hidley. Chris Stone is not saying exactly how the soundproofing system works, because it took three years to sort out. But the walls are 960 mm thick with alternating layers of physically light material and air. All the studios have Hidley-designed double doors with airlocks and the floor insulation relies on 203 mm of floating concrete over a cavity and compressed foam. Since they opened four years ago they have rebuilt the main studio twice.

One of the first records ever made in this studio was the Hendrix *Electric Ladyland* recording that rather ironically helped make Hendrix enough money to open his own studio. It was on this session that Eddie Kramer met Hendrix, which started the train of events that ended with Kramer at Electric Lady.

The three control rooms all have 16 track machines, convertible to eight, 12 or 24 tracks by replacing a head stack. The console was built by Spectrasonics to Tom Hidley's specification. Record Plant are very proud of having been one of the first, if not *the* first, to use 16 track, around four or five years ago.

While I was there, engineer Roy Cicala was preparing ready to record David Peel for John and Yoko Lennon and next week had the group Alice Cooper coming in. Studio B was set up for a 13-piece jazz group and groups were rehearsing in the penthouse that Record Plant rent for that purpose at the top of the building. The monitors rely on a two-way system with Lansing components and a patented wooden horn that will produce up to 120 dB spl. The monitors (five per control room) are driven by five Crown *DC300*.

Although all the studios look the same, they are different in size. Studio A, the largest, has a double vocal booth that can hold up to 30 vocalists at one time.

The cutting room uses Neumann equipment and, like all the other rooms in the building, is kept to a closely controlled temperature. While I was there, they were mastering a record made by Syreeta Wright, artist engineered by Malcolm Cecil and Bob Margouleff. Cecil and Margouleff seem to spend all their nights and days in either Ladyland or Record Plant and presumably no longer have time to sleep. The Syreeta Wright backing again used Moog and drums. 'Malcolm went mad and actually used a real guitar as well,' said the cutting engineer with a grin, as he played me a track.

Before I left Chris Stone told me that, at one time, Record Plant had thought about opening up in England with a London studio matched acoustically and electrically to their Los Angeles and New York studios. Eventually they dropped the idea as they felt that the problems were too substantial. He also outlined his philosophy on how to run a successful studio. He maintains that the key is there are three factors to consider. Firstly the right engineers, secondly the right equipment, and thirdly the right atmosphere.

'If you have all three,' Stone insisted, 'you can't possibly lose'.

Record Plant NY control room.

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AES 42-A report from Los Angeles

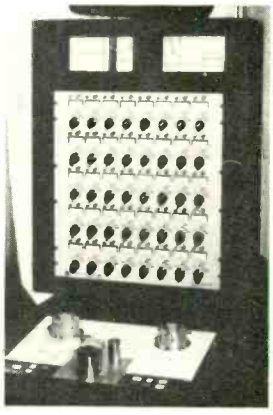
By Stephen Lamphen

LOS Angeles is known for Hollywood, smog and freeways. To audio professionals, however, it is also known for the West Coast Convention of the Audio Engineering Society. Every spring, manufacturers, distributors, engineers and others meet to discuss, discover and disect the newest in audio.

Thus, during the first week of May this year, this well-managed conglomeration of professional exhibits and technical sessions again invaded the Los Angeles Hilton Hotel. An estimated fifteen hundred AES members and non-members attended to see the wares of 67 manufacturers and representatives and to listen to some of the 75 technical lectures presented on almost every aspect of the audio field.

Through three large exhibit halls and almost a dozen demonstration rooms, millions of dollars worth of audio equipment was demonstrated. Not unexpectedly, there were more recorders and consoles exhibited than all other audio products. However, trends among the 21 recorder exhibits were very evident. In almost every line, price and size have been considerably reduced. 3M introduced the new *Series 79* which includes the smallest and lightest 16 channel recorder. The series has provisions for adding noise reduction circuitry directly with the recorder. It features a dc servo capstan system with fixed speeds of 19, 38 and 76 cm/s and variable speeds from 12 to 112 cm/s. The *Series 79* can also be 'synced' with a video recorder and a large part of the 3M exhibit was devoted to a working model of this feature, the video being produced by an RCA video recorder and the sound from a 3M machine. Ampex, financial troubles notwithstanding, were not far behind. In fact, their *MM-1000* recorder was synced with a video recorder at last year's West Coast Convention. But, though the *MM-1000* was still evident, Ampex offered a new recorder, the *MM-1100*, which was almost the same size as the 3M line and also reduced in price compared to its predecessors. There were a great number of 16 and 24 channel recorders offered by other companies including Auto-Tec, MCI, Studer and others but they paled compared to a Stephens 40 channel recorder. That's right: 40 channels! This custom-built recorder used custom-made electronics with a 3M-type transport and 50 mm tape.

At the other end of the scale, Nagra showed its stereo version of the standard Nagra portable and also exhibited the new Nagra *SN* recorder which is definitely the smallest professional recorder commercially available. This miniature marvel is less than 152 mm long, 100 mm wide and a little over 25 mm thick. Speeds are 9.5 and 4.75 cm/s and the frequency response at the top speed is 10-15 kHz within 2 dB. However, for film use, an 80 Hz filter is inserted and a 10 kHz filter can be switched in or out. This mini-recorder uses 3 mm tape

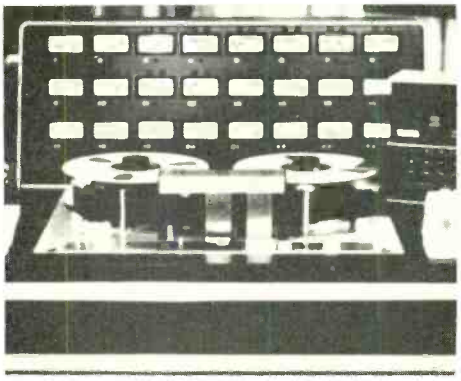


Stephens 40 track recorder.

(cassette size) wound on to special reels. It also phantom powers a tiny condenser mic which is also available. (The mic is less than 5 cm long itself.) Would you also believe that it also offered film sync, peak reading vu meter and automatic input compression? A newcomer to the convention was a large exhibit by the Tascam Corporation. Though this name may seem unfamiliar, the name Teac may not. This recorder manufacturer, normally associated with home high fidelity equipment, has entered the professional audio field with some very interesting products. Among their offerings was a four-channel 12.5 mm recorder for under $1700, which makes it the cheapest such recorder now available. They also showed a four channel recorder with built-in Dolby *A* for $6100.

But, most interesting in Tascam's display, was the Tascam *Model 10* console. In an eight in, four out configuration, with faders, remote transport control, remote overdub, quad panners for each output channel, built-in talk back mic and amp, 10 cm VU meters with

MCI 24 track *JH-24* recorder.



light effect diodes (leds) at the end of the scale marking to show instantaneous peaks and many options, this console will sell for under $2000. Many other consoles were shown and among the numerous manufacturers were Zero-Impedance, MCI, Olive, Multi-track, Quad-8, Automated Processes, Neumann, MCA, Langevin, Stevenson, Neve, Spectra Sonics, Vega, Altec, Quantum and Gately. A new company from Northern California, Zero-Impedance, showed a board made for the rock group Santana. MCI had a console and 16 channel recorder running so that interested conventioneers could mix master tapes supplied by various studios. In the Gotham exhibit, distributor for Neumann in the US, a Neumann console was shown which had the ability to gang faders together with a simple plastic insert which fitted where the finger push normally would go. With this system one could gang two, three, four or any number of channels together. This console also had a unique lighting fixture which hung over the faders and, in these days of accent lighting, many console manufacturers may have forgotten that the engineer must see exactly what he is doing and this solution is both simple and economical.

Quantum showed a few multi-channel boards including a package system of a quad console, four channel Ampex, two channel Revox, amps, headphones and JBL *4310* monitor speakers all for $7900. Harvey Radio of Los Angeles showed the new Stevenson portable console. This console is an eight in, four out affair with switching and equalisation and four 10 cm vu meters. The surprising thing is that it measures only 66 by 83 cm and costs about $1900. Cerwin-Vega, primarily a speaker manufacturer, showed a console designed for rock group sound systems. Though less complex (and cheaper) than its bigger brothers, this console, and others shown like it, seem to indicate that musical groups are heading for better quality equipment. Many console manufacturers will readily admit that a large part of their business is public address systems, which were largely ignored only a few years ago. But, in every console shown at the convention, the human engineering aspects were very evident. Knowing that the human arm can only reach so far and the eye cover so much distance at a glance, many consoles were more compact than ever before. Only a few of the boards were over 3m and even these would have been built twice their length a few years ago. However, this size reduction has led to fitting a tremendous number of controls in a small space and unusual switch positions and knob shapes were evident to give the engineer the ability to 'feel' the correct position without having to look. Lighted push-button switches and light emitting diodes were evident on almost every console. Due, no doubt, to costs,

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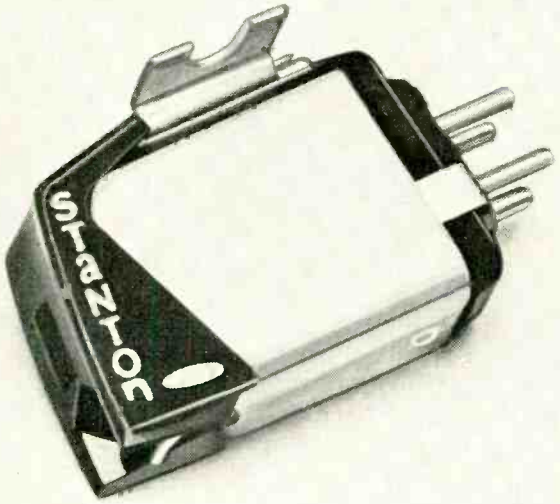

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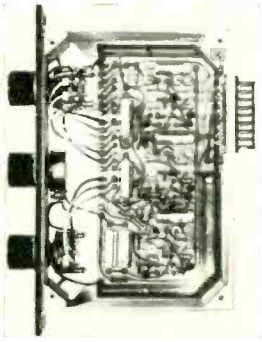

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most manufacturers were still using patch panels as opposed to switching networks. However, it was interesting to note that the 'mini-plug' patch panels far outnumbered the conventional 6.25 mm style. Again, space undoubtedly dictated this choice.

As consoles and recorders shrank, ancillary equipment grew. The number of noise reduction systems, filters, phasers, limiters, compressors, expanders, equalisers, vcos, electronic delays and other more exotic offerings was tremendous. Of the four companies offering noise reduction systems, Dolby, by sheer market coverage, is far in front of any competition. However, some competition is coming from DBX, Burwen and Audiotek, whose prices, in some cases, are far below those of a Dolby. Allison Research showed their Kepex (fast becoming a necessity in large studios), their Gain Brain, an rms and peak limiter in one module, and their new *VCA-1* voltage controlled amplifier. Using the *VCA-1*, a single fader could control the level in an infinite number of channels since the control voltage is completely isolated from the signal and, for instance, using one pot and a hundred *VCA*s one could make a one hundred channel ganged fader. Two companies were showing phasing devices which produce phase shift in recordings and its distinctive 'swishing' sound. Perhaps the newest and most interesting of all these devices were what one might call 'rate changers'. This relatively new field encompasses electronic delay devices, frequency shifters and similar equipment. After the introduction of the Delta *T-101* digital audio delay line (which can delay an audio signal from 5 to 320 ms through digital processing) no less than three other manufacturers have introduced similar devices. Eventide Clock Works of New York demonstrated both a phase shifter and a digital delay line. However, the digital delays are still somewhat expensive (Eventide's is $3,500). Another delay circuit, the Cooper Time Cube, shown by UREI, is one-third the cost of other digital delay systems due to a different approach. It employs sampling of the analogue audio waveform and an analogue technique called the 'bucket brigade' to provide two channels of delay (14 ms and 16 ms). Moog showed a frequency shifter which, like other devices, could shift the pitch of a note without affecting rhythm. Demonstrating the system, Robert A. Moog turned a drum track into a rather convincing castanette sound.

The tape manufacturers were also showing their new products. Scotch, celebrating their twenty-fifth anniversary of tape production, showed their new *208-209* tape. This has the same characteristics as *202-203* but with heavier backing for heavy-duty uses. Agfa showed their line including their new *SHD* high output, high frequency response cassette. Maxell, a fast-rising Japanese tape manufacturer, showed their line of *UD50-10* high-output, high energy mastering tapes in 6.25, 12.5, 25 and 50 mm formats. The author was also shown their new backing process. Unlike Scotch *206-207* and others which have a rough surface applied to the back of the tape for better tracking, the Maxell processed tape, not yet available, employed what was called 'subtractive backing'. In this process, the polyester base is made slightly thicker than necessary and, through chemical processes with special acids, the back is chemically altered leaving a consistently rough surface. This, of course, guarantees a uniform backing without any flaking or peeling. Though their initial production costs have been high, prices will soon be competitive enough to introduce this tape commercially.

Microphone manufacturers were also out in force with Neumann, AKG, Beyer, Shure, Sennheiser, Electro-Voice, Sony and others represented. Electro-Voice showed their new cardioid dynamic mic, the *DS-35*, designed with the use of (are you ready?) laser holography! According to E-V, this design allows 6 dB more gain before feedback in public address systems. E-V also showed a new 'cocoon' for stage miking. A mic is placed in one of the cocoons and kept only about 3 mm off the floor to pick up primary reflections of the performers. This idea was introduced by Shure some time ago and employed their spider-like mic suspension. But the E-V cocoon, Model *411*, also protects the mic from noise if bumped and keeps out dust and dirt. Thus, if you see large grey mice on the stage floor, do not put out traps!

The speaker manufacturers were not hard to find; just head for the music resounding throughout the hotel. JBL showed their line of monitor speakers including the *4310*, *4320* and new *4350* systems. The *4350* are very large five-speaker four-way systems and produce a very brilliant sound characteristic of other JBL speakers but with a fuller bass from the two 38 cm woofers. Altec introduced its new line of 'Voice - of - the - Theatre' systems, *1202B*, *1204B* and *1208A*. Unfortunately these systems are boxed and grille-clothed like most others and lack the natural appeal of the old 'Voice-of-the-Theatre' systems where one could see all the components and the baffle design. But the exhibit hardest to ignore was the Cerwin-Vega demonstration room. When they turned on their system the whole hotel knew it! Their speaker systems contained four 60 cm woofers with sectoral horns. The level in the room must have been something over 120 dB and many members complained of this excessive level though the rock musicians must have been in seventh heaven. One would think, with the overload lights of their power amplifiers almost continually lit and with speakers at such ear-shattering levels, that Cerwin-Vega must recycle their barefoot salesmen every six months or so. Electro-Voice showed their updated version of the *Sentry II* system, called, logically enough, the *Sentry III*.

One sad note at the convention was the Crown exhibit where a recorder, burned almost beyond recognition in their devastating fire last November, was displayed. One salesman explained that it was a matter after that of deciding whether they should quit or come back even more competitively. It is good news then that they chose the latter and, even after such a short time, showed many new and interesting products. Among them was a new amplifier, the *D-60*, which is almost the same as the *D-40* except that the distortion is lower and the output transistors are automatically

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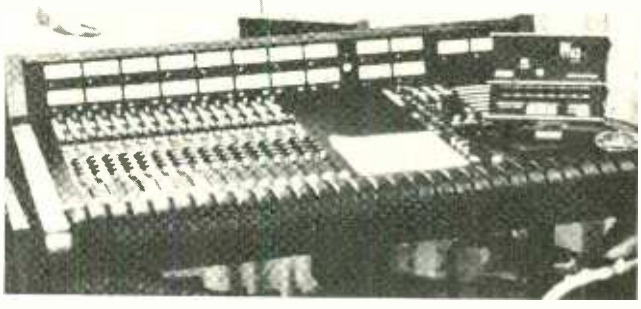
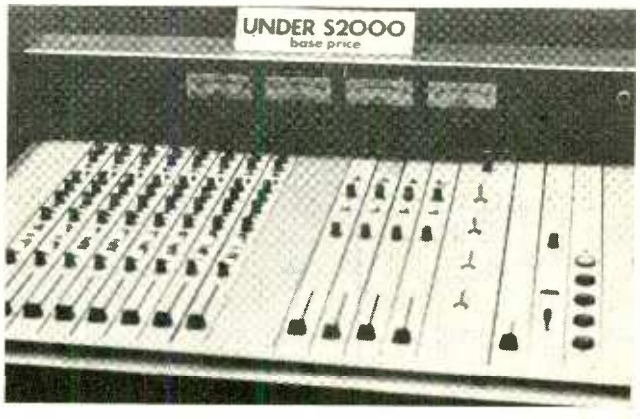


MCI console with digital readout tape counter.



Teac *Model 10* console.

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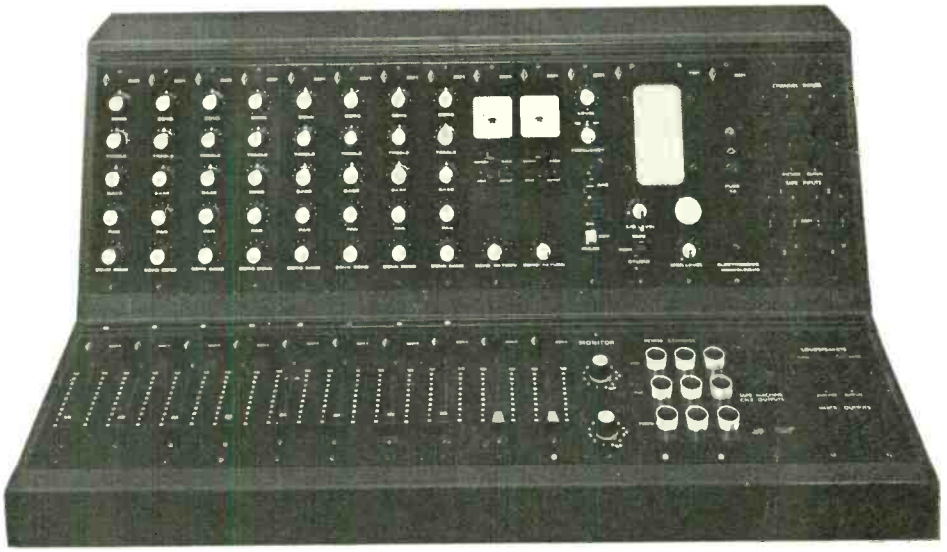

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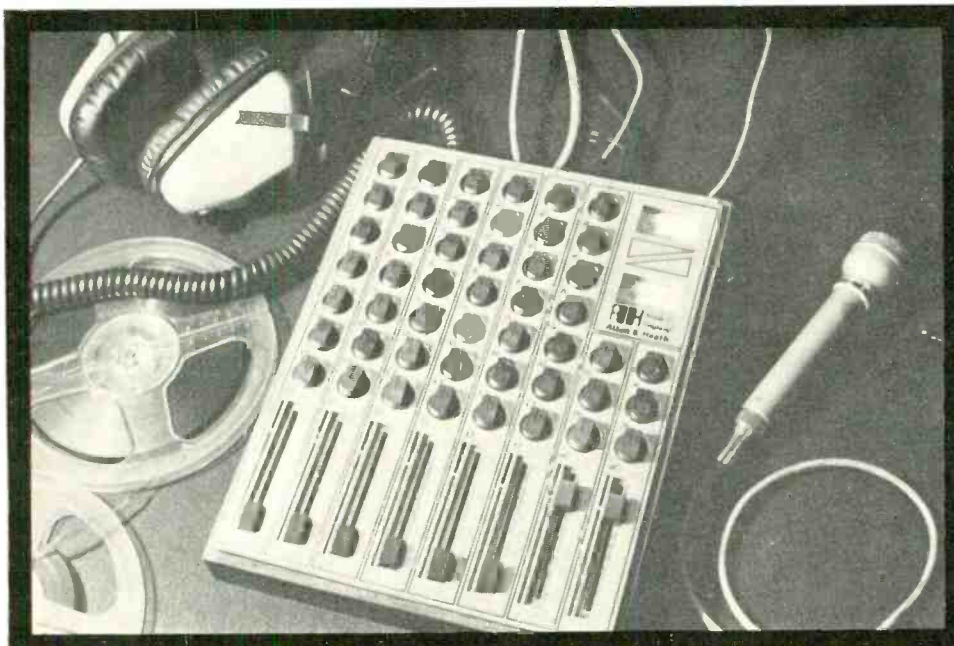

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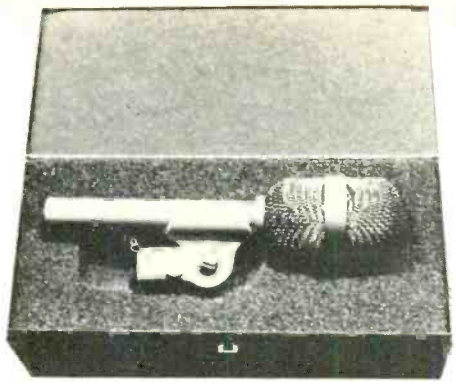
protected and use no fuses. Another device shown was called the *Variable Speech Control* which, using a tape recorder, can speed up the rate of speech (or other programme material) without affecting its frequency or tone. This is accomplished by a sampling technique where the sampling rate is inversely proportional to the tape speed. Control can be produced from half to three times normal speed. Those poor engineers with commercials which are too long or too short are sure to grab this piece! Crown also showed an IM Distortion analyser along with most of their line of recorders. They expect their new factory to be completely operational in a few months.

However, the real heart of a convention is not the exhibits but the technical sessions where new ideas and new approaches are presented. These sessions occur at the same time as the exhibits and you must be very time-conscious not to miss the lectures you want to hear. The technical sessions were split under 12 headings: tape recording, instrumentation, disc recording, electronic music, sound reinforcement, quadraphonics, radio and tv audio, acoustics, digital audio, signal processing, transducers and a recording workshop. The disc recording session had two papers presented on quadraphonic disc recording. One was on matrix approaches to quad and the other was on the JVC discrete quad disc. These were followed by Jack Rabinow of Rabco with a very humorous, rambling discussion on the merits of straight-line arms for turntables. In the electronic music section, Robert Moog showed the theory behind his new high-accuracy frequency shifter capable of reducing or augmenting existing programme material by as much as 5 kHz with a 70 dB dynamic range.

One of the most interesting lectures in the sound reinforcement session was on a system for reproducing train sounds in a model railroad system. Herb Chaudiere of Robin M. Towne Associates used a working model to demonstrate the system. A small amplifier and speaker are carried inside the tender, behind the engine. Audio signals are fed through the tracks, which also power the locomotive. White noise is used for steam noises and the rhythm of the engine is kept in time with the speed of the train by putting a multi-contact switch on one of the wheels of the locomotive to turn the audio on and off. The steam whistle included in the system is also designed with the characteristic change in pitch as the volume increases.

In the same session, Allen Eberts of DuKane presented a paper on audio delay lines using the 'bucket brigade' system of delaying analog signals. In the following two sessions, the normally staid and conservative presentation of papers was rocked by controversy. The first session was devoted exclusively to quadraphonics. The first lecture, by Benjamin B. Bauer of CBS Labs, was on the theory and uses of the CBS *SQ* matrix system. The purpose of the lecture was to show compatibility with mono and stereo reproduction. Next, Howard Durbin of Electro-Voice, showing the algebraic matrices for many of the matrix quad systems,



Top: The new Electrovoice *DS-35*.

Centre: Louis Dorren, inventor of the Dorren quad broadcast system.

Adjacent: Four track Teac *80-4* with Dolby *A*.

showed that, although many of the systems are similar, one cannot adequately decode a signal produced for another. In some cases, the effects were abnormal and even resulted in lost channels. After this, J. Robert Ashley of the University of Colorado, a prolific writer and speaker at AES gatherings, presented a paper 'Is Four Channel a Fraud?'. He concluded that, from subjective analysis, many concert halls could be approximated by merely delaying the sound to the back two channels. And in some cases, such as a back seat in a concert hall, one could dispense with the back channels altogether. Donald L. Patten of Shure Bros. then presented a most revealing paper with a method of representing quad signals on a scope. The system he described and demonstrated would show level, acoustic position and even out-of-phase signals. Discrete quad produced a pattern of equal intensities in each channel (when the music was so) but all four channels showing the same general format. However, when a matrix system was placed on the scope, a large blank area appeared between the back two channels indicating an out-of-phase condition between the back two speakers.

Next day, during the Broadcasting session, James Gabbert and Louis Dorren gave a lecture on the Dorren Quadraphonic Broadcast System. This is the only broadcast system which has passed the experimental stage in which four discrete signals can be transmitted. It follows the logical algebraic example of normal stereo broadcasting but takes into account the four signal in quad. Mr Gabbert, during his introduction of Mr Dorren, stated that all these matrix systems were 'a big ripoff' for the consumers who were taken in by the false and misleading advertising of the matrix proponents. Lou Dorren, also speaking of matrix systems, quoted B. B. Bauer as saying that out-of-phase signals produced confused localizations of a sound source and unusual pressures on the ear. Thus, concluded Dorren, all matrix systems are not only bad approximations of true quad but can be uncomfortable since they all use out-of-phase signals in the back two channels. This point, you may recall, had been shown in the quad oscilloscope display the day before. The Dorren system, however, does not use any out-of-phase signals since it is not a matrix system at all. Mr Dorren went on to explain the channel bandwidth used for this system which is greater than that now used for stereo. Mr Gabbert said that FCC (Federal Communications Commission) approval of such a system was necessary and that they had applied for permission some time ago. Having received no reply, they considered that this silence from the FCC was tacit approval by the Federal Communications Commission and would begin broadcasting with the Dorren System on May 10. One lecture later, B. B. Bauer, who had been quoted in the Gabbert-Dorren lecture, arose to give a paper on the CBS *SQ* disc for broadcasting. He began, however, castigating Gabbert and Dorren for their lecture. He said that such a paper should be presented at a trade fair—not the AES Convention—since they were obviously trying to 'sell' their system and deriding other matrix systems in the process. Perhaps Mr Bauer forgot that he was here to sell the CBS *SQ* system. Nevertheless, he presented his paper on the *SQ* system and mentioned, in passing,

continued over

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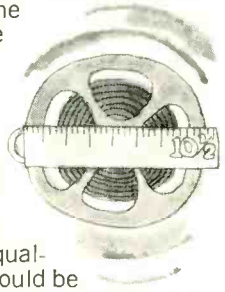
THE PROFESSIONAL CAPABILITY FACTOR

In an area where versatility and performance often tend to be nothing more than a set of written specifications, one tape recorder stands apart from all the rest, Revox.

Revox is built to such exacting standards that Julian Hirsch writing in Stereo Review was moved to comment, "We have never seen a recorder that could match the performance of the Revox A77 in all respects, and very few that even come close."



But performance is only part of the story. When you've produced a truly professional quality machine you should be prepared to go all the way and provide complete professional capability. That's why Revox is the only machine in its price class (or anywhere near it) that's built to handle NARTB professional 10½" tape reels.

A 10½" reel offers twice the recording time of the standard 7" reel found on most tape recorders. And while much has been made of slower playing speeds and double-play tapes, the fact remains that frequency response, signal-to-noise ratio, dynamic range and a number of other important recording characteristics are adversely affected by slower speeds and thinner tapes.

Certainly smaller reels, slower speeds and thinner tapes have their place in home tape recording and Revox provides for them, but they have nothing to do with professional performance standards.

If you want fully professional performance and capability and you're not prepared to settle for anything less, the answer is Revox.

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continued

that the *SQ* system did not have any out of phase signals and that he agreed with what he had stated in the quote given by Dorren.

During the course of his paper, a graph was shown which represented the levels of the four channels for an *SQ* encoded record. The section of the graph between the back channels started to dip in towards the centre and then was omitted. However, from what was drawn one could conclude that the back pattern continued in, looking like a cardioid microphone pattern, and indicating that, indeed, the back two channels were 90° out of phase. At the conclusion of Mr Bauer's paper, John Moseley of Sansui rose to ask a question and Mr Bauer asked him if it was true that not only was he employed at Command Studios but that he also was associated with the Sansui matrix system. After Mr Moseley affirmed this, Mr Bauer stated that, therefore, Mr Moseley was unfit to make any statements about the *SQ* system since Mr Moseley was a competitor!

Mr Moseley protested and asked why CBS had stated that soloists could not be placed in the back centre of an *SQ* disc? Was this not because the two channels were out of phase? Did not any signal appearing thus cancel out when played in stereo? Mr Bauer admitted that it was so but that all matrix systems were the same and that the back channels were in 'quadrature'. At this point, it became somewhat difficult to know just who had the floor and a virtual shouting match ensued. Mr Bauer, after a series of speakers affirmed the back channel phase shift, stated that he did not wish to discuss it any longer and, to everyone's surprise, left the podium. Peter Scheiber, co-inventor of the E-V matrix system, then took the podium to defend Mr Bauer, but met with a similar fate. The meeting was abandoned almost an hour after it was supposed to have ended with what seemed to be a loss to the matrix systems and a gain for the Dorren system.*

After all this excitement, the convention settled down to its normal peaceful sessions, starting next day with digital audio technology. Stockham and Miller presented a paper on attempts to remove surface noise and even background musical accompaniment from old wax and lacquer Caruso recordings. They also outlined attempts to compensate for the 'horn sound' of these acoustic recordings. Thus one could take such a recording, remove and replace the musical accompaniment with a stereo (or quad!) background and still keep the original voice! One of the most interesting and most humorous lectures was given in the next session on electronic circuitry and signal processing.

Derek Tilsey, of Neve, presented a myriad of slides on the evolution and adaptability of console design and manufacture. Virtually every imaginable console was shown from a two in, one out job up to 54 channels in and 24 out! (Not long, one would guess, until they have one built for the Stephenson 40-track recorder.) He ended with a humorous discussion on ash trays. The most popular, he assured his audience, was the long thin one with the knob that went up and down. However, he concluded, one with a centre knob was becoming much more popular, at which time he showed a slide of a quad panner labelled 'ash tray' with the standard lettering L, R, B, F, which, he stated, stood for Lucky Strikes, Raleighs, Benson & Hedges etc etc. Mr Tilsey's lecture was preceded by a lecture on the new miniature EMT reverberation plate which measures only 1m by 2m.

The session ended with a lecture on the new Dolby *354* unit for movie theatres. Thus Dolbyised sound tracks could now be produced. The unit had the ability to switch from a Dolby film to the Academy Curve, which is the standard pre-emphasis for films, and to cut out the unit altogether for flat response. The *364* can be recognized by its distinctive cover plate band.

In the next session, on transducers, Paul Klipsch, a pillar of the AES and audio in general, presented two papers, on time delay distortion and modulation distortion in loudspeakers, in the space of 20 minutes! To be sure we could all see his slides well, he began with a doctor's eyechart—except his contained a single word, written successively, which described, in his words, the content of the previous papers in no uncertain terms.

The final session was the recording workshop which was a continuation of last year's workshop. This year they took a master tape, added a track and produced a mix. However, due to the fact that this was open to the public at no charge, the presentation was not aimed at the professional but at the public. Some interesting capabilities were shown, however, with some of the equipment available. For instance, they assumed that a bass track had been accidentally erased from the drum tracks. They simply took a Kepex and fed it with the bass guitar as the control signal. By also feeding a 30 Hz note in, one could 'key' the 30 Hz note with the bass guitar rhythm—that is to say, every time the bass guitarist played a note, a 30 Hz note would be produced in unison. This did indeed sound like a bass drum.

Preprints of many (but not all) lectures were available by mail for those who could not attend the convention. However, the cost is prohibitive unless one is a member. And, speaking of membership, the AES is an international organisation with sections in almost every country of the world, including a large section in Great Britain. The international headquarters are 60 East 42nd Street, New York, New York 10017, in the United States. For those seriously interested in audio, whether one be manufacturer, musician, teacher, technician or student, membership of the only professional organisation devoted exclusively to audio should be seriously considered.

Mr Moseley was scheduled to present a paper to the convention entitled 'A Scientifically Comparative Study of Different Quadraphonic Matrices'. Under pressure, reported to have come at least partly from Mr Bauer, it was withdrawn and the preprints destroyed. However, one or two copies survived and the paper shows Bauer's SQ system to be the most wanting of the systems tested.* **Ed.

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Designing a Transportable Mixer

By Julian Vereker (*Magnetic Tapes Ltd*)

WHEN this project was first started, over two years ago, there were very few mixers suitable for use in small studios and mobile recording units. We felt there was an important gap in the market and the *M10/2* was conceived to complement the Chilton *100/S* and other tape recorders of similar quality.

A mixer handles lower signals and provides greater amplification than other parts of the system in which it is used. Unless it performs better than the rest of the chain, it will add appreciably to noise and distortion. This seems an obvious point but it can easily be overlooked. Our object has been to achieve a very high standard of performance without compromising versatility.

The equivalent input noise needed to be better than −120 dBm with the 600 ohm balanced microphone input and the overall distortion should not exceed 0.1 per cent, mainly second harmonic, at +10 dBm output. The mixer needed to cope with a wide dynamic range and about 40 dB overload margin seemed to be a good design aim.

We wanted to concentrate on basic signal mixing facilities, which is after all what a mixer is for. But different people have different ideas of what their mixer should be. They may want anything from a simple four inputs single group (4/1) to a device with 32 or more channels in and out (32/32). The mixer had to be designed to allow extra units to be added in accordance with individual requirements.

We started by considering the simplest form of ten channel mixer, ten input channels with equalisation, a mixing amplifier and one or two output groups, then looked to see how it could be made more versatile. The following arrangement seemed best; four of the ten input channels are grouped as two stereo pairs to accept any stereo signal and the other six are mono channels with pan pots to place their output on to the two output groups. Each of the ten channels has bass and treble equalisation, channel gain and a linear fader to control its output on to the mixer bus. Breakjacks are fitted into the two output groups as well as each input channel to allow further signal processing outside the mixer.

I think most would agree that good monitoring facilities make it so much easier to check the signal being recorded that the cost of their inclusion is justified. The mixer has two ppms, two monitor outputs to drive power amplifiers, and two headphone amplifiers, with inputs which may be switched pre or post fade on the output groups.

A line-up oscillator is invaluable for setting up recorders, mixer and other associated equipment; we considered five spot frequencies and amplitude control to within 0.5 dB a minimum requirement. The design chosen is a Wien Bridge with an fet first stage. This enables the frequency switching to be accomplished by changing only the resistors in the feedback path. This is because the fet has a high input impedance and, even with low value frequency determining resistors, the loading is not sufficient to prevent the circuit from oscillating. There is one other advantage: the frequency selector switch could be replaced by a 500 kΩ potentiometer and then the audio band 30 Hz to 18 kHz could be used for checking frequency response.

The mixer has to be capable of driving a wide variety of recorders without elaborate alignment procedure, so the outputs to the recorder are varied by controls on the front panel, eliminating the need to realign the ppms for different output levels. A group selector switch incorporating a mono/stereo facility is also provided to cater for recorders which do not have input mixing or channel selection.

Often in recording sessions the recorder is away from the mixer and the mixer is isolated from the sound source, so a remote tape pause facility for the recorder and two cue light contacts were also considered necessary additions. These are provided on a set of illuminated pushbutton switches.

The packaging of the electronics and the styling of the unit was given much detailed thought. The Chilton *M10/2* employs a plug-in circuit board system within a non-modular package to reduce costs without sacrificing versatility. This system enables the user to substitute a wide range of input amplifiers without the expense of changing a complete channel—as he has to do in a modular system—or of providing for everything in the module with a consequent increase in complexity and cost. For example, one could insert balanced or unbalanced microphone or line amplifiers with a choice of gains, RIAA equalised low level for magnetic cartridges or at high level for ceramic pickups. The need to cater for specialised requirements seemed to be best served by a 'general purpose' circuit board on to which a variety of amplifiers could be assembled, and for which the user could specify the input parameters. All the resulting boards are pin compatible.

We found that some of the circuits had to be designed from scratch if we were to meet our own standards of performance and interchangeability and it was inevitable that there would be detail refinements of the *100s* recorder. The most important amplifier in a mixer is the microphone input. It has to handle very small signals from the microphone without adding much noise and, at the other end of the scale, a singer bellowing into a capacitor

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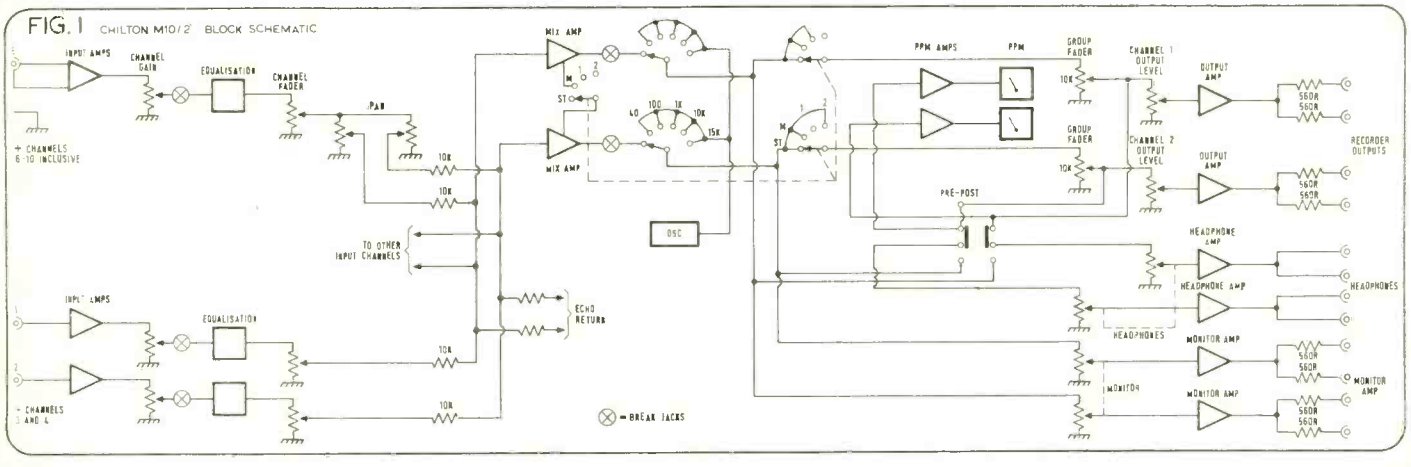
FIG. 1 CHILTON M10/2 BLOCK SCHEMATIC



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The Philips GA202 Record Deck not only betters the internationally respected DIN Standard for high-quality audio, but sets completely new high standards for record reproduction.

Its three speeds (33⅓, 45, 78 rpm) can be adjusted precisely, using the stroboscopic disc and fine-speed controls provided, and are accurately maintained by a tacho generator that keeps wow and flutter to less than 0·13%. Switching on and off is done silently through a bi-stable multi-vibrator. And photo-electronic switch-off at the end of a record is silent and vibration-free, exerting no side-thrust on the stylus.

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microphone must not overload the circuit and cause distortion. Our design shows great similarity to the basic circuit published in the BBC Engineering *Monograph No 46*, in that both series and shunt negative feedback loops are derived from a chain of four resistors in the emitter of the second transistor but it differs in several ways. First, there is a bootstrap capacitor connected to the first transistor's split collector resistor. From the ac point of view this has the effect of raising the resistor's value and thus increasing the open loop gain. This overcomes the disadvantage of actually having a high value of resistor which would need a large voltage across it in order to obtain the optimum collector current for low noise operation. Other changes are mainly concerned with the use of extremely low noise silicon transistors, which are not of the *BC 109* family. The optimum source impedance for silicon transistors is considerably higher than that of their germanium counterparts; for example, the *CET 107* in the BBC design showed its minimum noise figure with a source of approximately 800Ω. Compare this with the transistors used, which show a minimum noise figure with a source of about 10 kΩ. This must in essence be a generalisation as the optimum source impedance changes considerably with different collector currents.

Since microphones have not changed their impedance to suit, the turns ratio of the input transformer has been increased to keep the collector current low and reduce the RF noise contributed by the first transistor. This of course requires the resistor values in the feedback loops to be altered to redefine the input impedance as otherwise this would be too low, a point which has been overlooked by one of this magazine's contributors. This amplifier has low distortion in the open loop condition due in part to the choice of collector currents, and since there is a high degree of feedback the thd is reduced to about one tenth of the distortion in the original BBC design at the same operating point, i.e. 2 dB below clipping. It is interesting to note that many of the published designs for balanced input microphone amplifiers used in studio mixing desks bear a similar relationship and thus owe a similar debt to the BBC original.

After very little thought it seemed that there was no reason why the balanced line input amplifier should not have the same basic circuit arrangement with a lower active gain and a 10 kΩ input impedance. To achieve this the same transformer as is used in the microphone amplifier is turned 'back to front' with suitable changes in the resistor values. This measure means there is no need to stock different printed circuit boards or transformers, with obvious financial advantages. Unfortunately, the same does not apply to the balanced line output amplifier.

After making many sketches we made a full size model of the mixer and mounted control knobs on to it. At this early stage it became apparent that it would be a problem to find a series of aesthetically and ergonomically acceptable knobs at a reasonable price. Neither were we satisfied with the knobs supplied with the linear faders, as we felt that they should be dished, not domed, and that they should be marked with a reference line. Our solution was to have a complete set of knobs made.

The next stage was to evolve a simple aluminium chassis on to which the main sub-assemblies could be mounted. The assembly of the mixer is greatly simplified by manufacturing each sub-assembly as a completely wired unit; the interconnections would only need to be pushed into the appropriate edge connector. The rear panel of the mixer carries the input, breakjack and output fields. Because of the wide variety of sockets in use this panel can be detached to allow for a choice of connectors.

At this stage it should be mentioned that it is very important to have a complete set of drawings and accurate jigs of both metal and wood components; even the wood panels need to be made to close tolerances of the order of 25 mm so that there is no 'fiddling' during assembly to waste time and add to the cost.

An integral power supply has many disadvantages. The problem of hum can be overcome but only if a costly toroidal transformer is used and the size of the mixer increased. In any case many users have their own power supply. Bearing in mind considerations of cost, size and performance we believe the best solution to be either an external power supply or a regulator to enable the use of any suitable power supply. But we cannot stress too strongly the necessity of ensuring that the total supply noise and ripple is kept low; a total of about 100 μV at full load is in our opinion the most that can be allowed.

The mixer signal path is straightforward; the input signals are received via sockets on the back panel and go straight to the input amplifiers; these are mounted in the upper compartment of the rear panel assembly. The top of this panel forms a removable 'lid' allowing access in order to change the amplifier type.

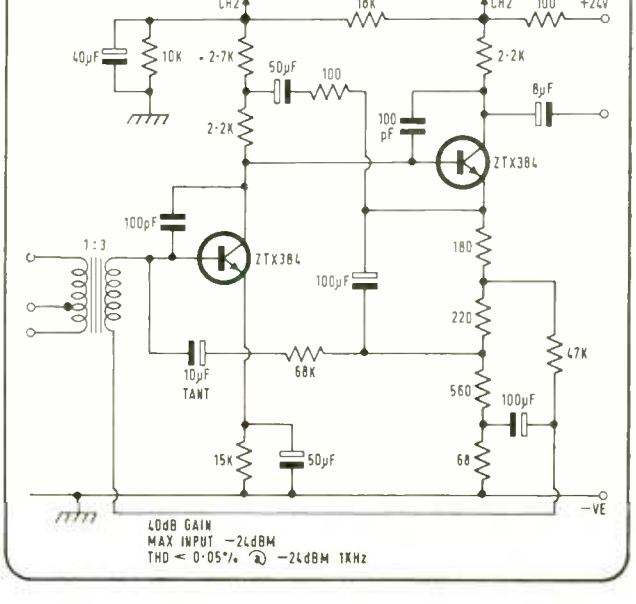
The amplified signal is then routed to the channel gain control, which is situated on the front panel, and then back to the breakjack field at the back of the mixer. The signal can thus go out and be processed further to add reverberation, compression and so on. The signal is then returned to the mixer along the second signal core in the screened cable. On its return the signal passes through the mixer's own equalisation before it goes to the linear faders. In the case of the two stereo channels, the output of the faders is fed through mixing resistors directly on to the appropriate mixing bus. On the mono channels the fader output is taken to a pan pot which then feeds the mixing buses. The output of the buses is taken to the virtual earth mixing amplifiers. The outputs of these go to group breakjacks mounted on the rear panel where the circuit can be broken again and the signal processed further.

The advantages of a virtual earth mixing amplifier, as has been mentioned in this magazine on many occasions (Hayward, Robinson, Levesley), is that it ensures the proper mixing of all the signals without any appreciable interaction.

The output facilities on the mixer are quite comprehensive. The group select switch is preceded by the oscillator select switch and followed by the linear faders for each output group and the monitor output control. The faders are followed by the group gain controls, which feed into the output amplifiers, by the headphone pre/post fade switch and by the ppm amplifiers.

When the prototype mixer emerged, we put it to work in a small studio to record demonstration tapes, and gained much practical experience in this way. We made some alterations to reduce the possibility of rf pickup. The limitations of a simple mixer are the lack of elaborate signal processing and control facilities. However, this need not be a disadvantage in that external 'add on' units such as compressors, equalisers and so on can be plugged in to increase the number of functions that the mixer will perform without having to allow for all the possibilities at the outset.

FIG. 2 30/600Ω MICROPHONE INPUT



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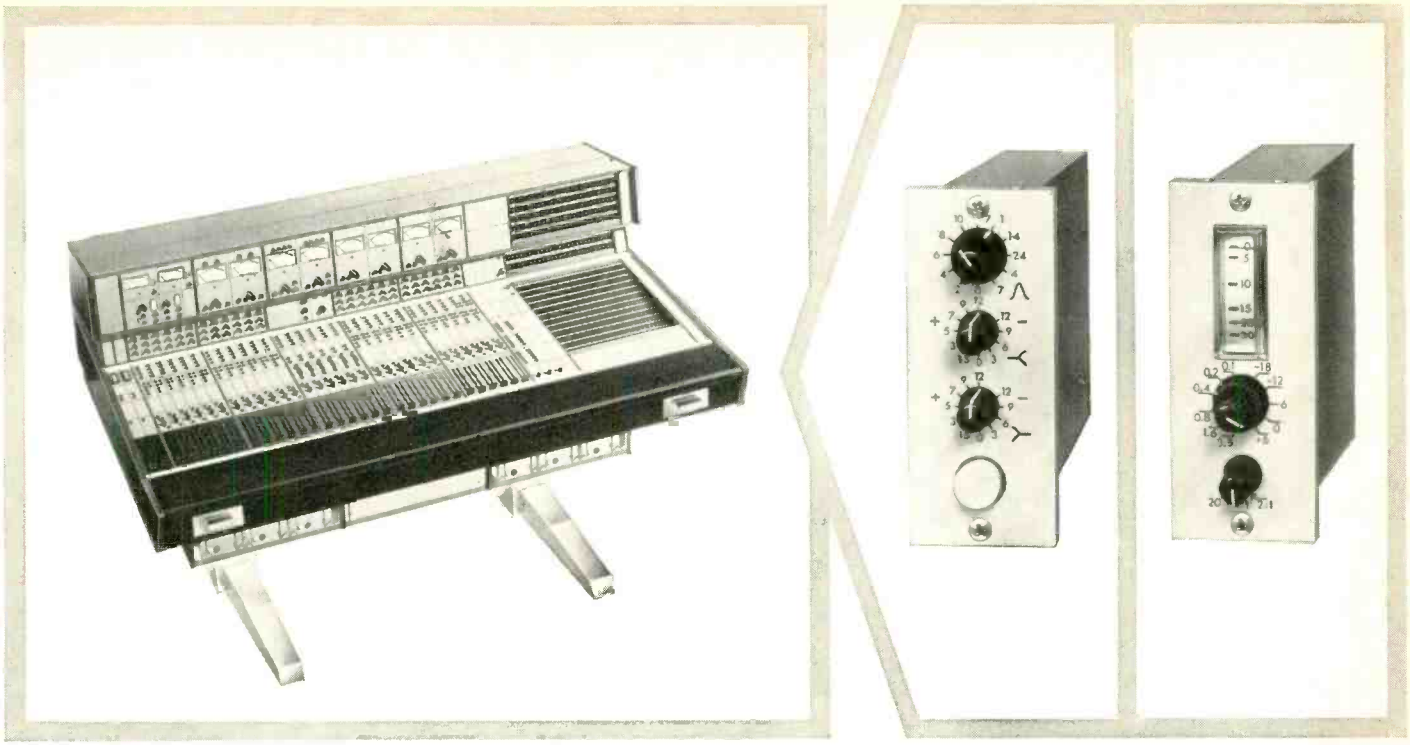

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SM range
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Fully modular mixing system designed for eight or 16 track recording in small studio environments. Full facilities include matrix switching and built in power amplifiers. Available with integral eight track tape machine. Prices on application to Freehurst Ltd, 87 Wardour Street, London W1.
Modules:
BD 6 peak limiter in standard Alice module. Price: £78.
BD 7 variable ratio compressor and noise gate. Price £125.
CNS Crosstalk and noise suppression module. Price: £93.
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BD 24 power supply module, physically similar to *CNS*. Mains powered. Price £29.
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ALLEN & HEATH
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A range of consoles and system blocks for all audio mixing applications.

Stereo Sub-Miniature 6-Channel Mixer
Each channel: gain, treble, mid, bass, echo, foldback and pan. Two outputs with individual line or echo inputs with gain, bass and treble. Overall size 220 x 290 x 2.50 mm. Price: £120.

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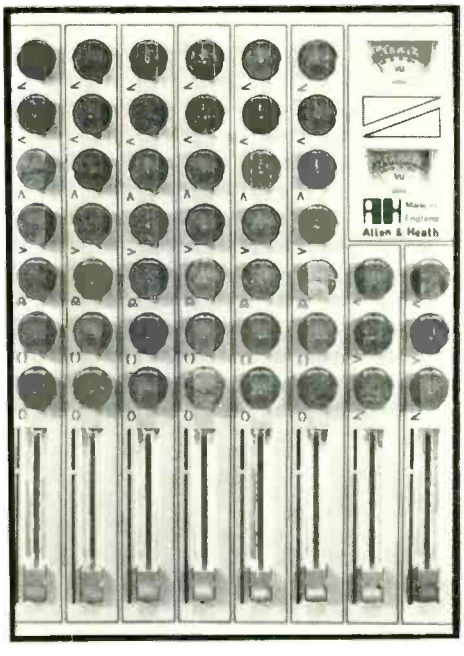
Input *AS/1:* presence, pre and post-fade listen, —20 dB pad, bass cut, linear fader, 200 ohm input. Output *AS/2:* monitor, main fader, peak level meter. Complete mixers from £74.

Adjacent: Compact 6/2 mixer by Allen & Heath

Below: Allotrope desk built for J. P. Jones.



Standard Studio Range
Input *A/1:* gain, treble, mid, bass, echo, foldback and pan.
Output *A/2:* main gain, line/echo level with bass and treble.
Equaliser *A/3:* gain, variable hi-pass and lo-pass, variable frequency mid-lift with bandwidth.
Limiter *A/4/A:* in and out gain, attack, release, gain reduction meter. Amplifier *A/5:* stereophonic 1W headphone, monitor amplifier.

A full range of complementary modules for multi-track switching, monitoring, talkback, echo, foldback, metering and quadraphonic circuitry. Complete mixers from £268.00.

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Tel: 01-437 1892 (sales)

Custom built sound mixing desks. Typical installation, supplied to J. P. Jones (Led Zeppelin), comprises wide range input sensitivity (an electric musical instrument may be plugged directly into a channel), comprehensive frequency correction, and four-speaker monitoring, selected and mixed on the channels. The desk has been made as compact as possible for one-man operation and quickly dismantles into three sections for transportation. There are 16 inputs (although wired for 24) and 16 outputs (eight groups), four echo and two foldback send circuits. The four echo returns may be selected to the monitor mix. Other facilities include pre and post fade listen, phase reversal, and switchable insertion of limiters, compressors and other devices. There are two jackfields, the one visible in the photograph providing access for synthesisers and electronic musical instruments.

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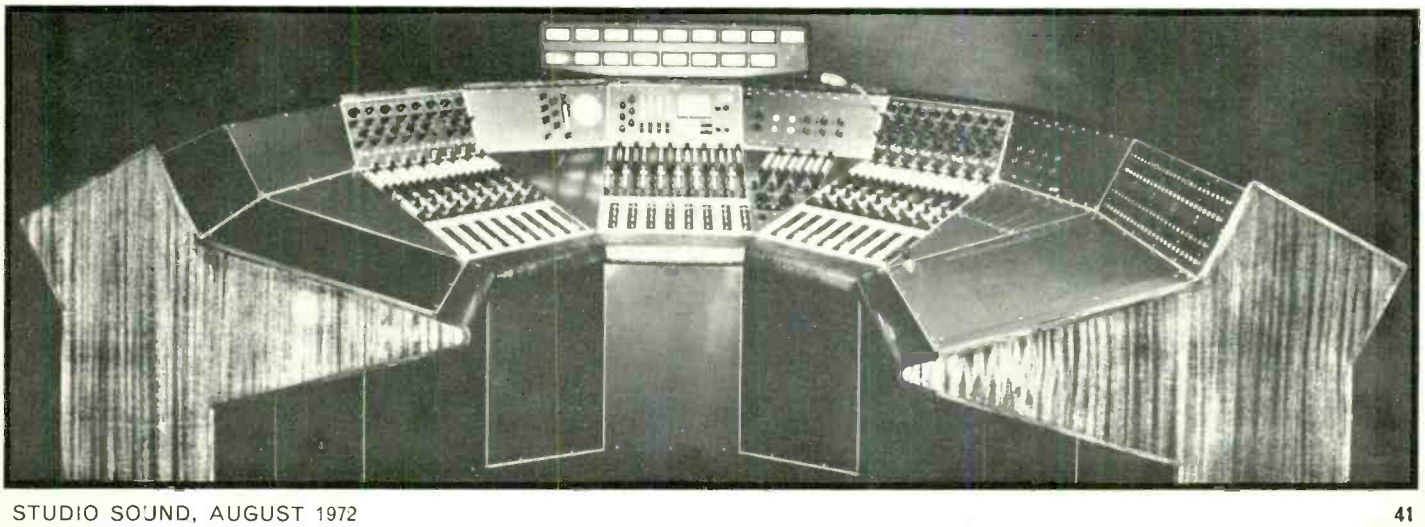

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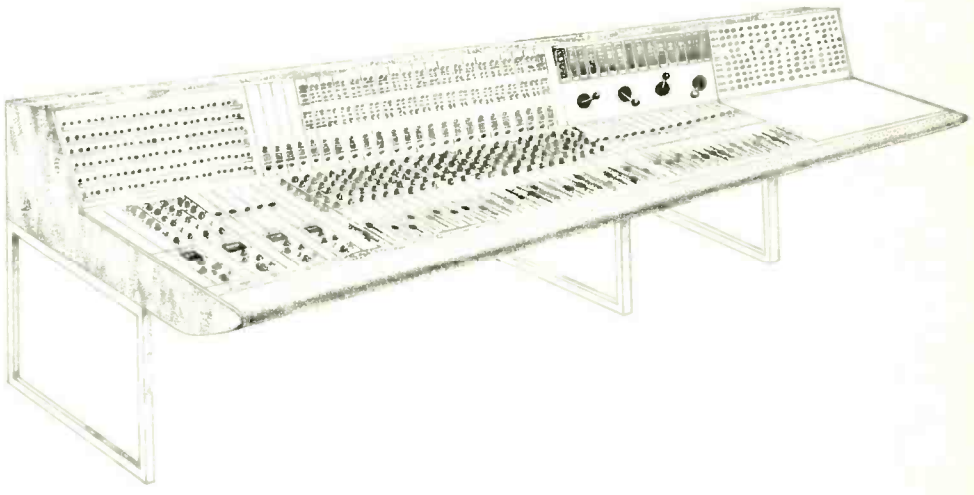
MAYFAIR SOUND STUDIOS' recently commissioned control desk is a perfect example of imaginative, well conceived self-assembly. Engineers Hudson and Maynerd, provided with our chassis frame, were able to select from the Rosser range of modules a permutation tailored to their precise and highly individual requirements.
The result of their labours is the extremely attractive and completely functional console shown left. Though the mixer includes many advanced and unique features such as light meters and fully comprehensive monitoring and sub-mixing facilities, it was possible, by self assembly, to cut the cost to a fraction of that normally expended on an off-the-shelf model.

We've kept pretty quiet about it up to now but for the last five years we've also kept pretty busy—making mixers and other electronic equipment. Disc, T.V., Radio and Electronic Music studios, Theatres, Factories and Universities, we've experienced the most varied specifications and met them.
For instance when **N.A.T.O.** moved its H.Q. from Paris, it could not take its broadcast studios with it. So a new complex was designed for Brussels, nine studios in all. Understandably the competition for supply of sound mixing and line distribution equipment was fierce. So we feel that our pride in having our equipment selected for use throughout the complex in the teeth of opposition from companies, large and small, from the whole of the Western world is justified. To have met these stringent standards of quality and reliability is itself a form of guarantee that seems to satisfy our clients.
Also we try to keep them satisfied which is why you may have come across complete T.V. stations which have adopted Rosser equipment as standard. To us a customer who repeats orders is a satisfied customer.
Should you have a requirement in view, why not contact us? We could visit you promptly with a portable demonstration mixer for exploratory discussions or you might prefer a day or two on the coast, away from it all, visiting us. Just drop a line or ring us at **0792-53461**

FUTURESOUNDS at **ROCKFIELD** required a 24 Channel, 16 Track quadrophonic control desk but were too busy recording to spare time for self-assembly. Shown right is an artist's impression of the answer they came up with. Maintaining close liaison with Douglas Rosser himself throughout the design of the console they arrived at this mixer, currently under construction, which is completely custom designed and built to meet their very sophisticated needs with limiters, equalisers, instant digital "Track-selected" read out and what may be the most complex though simple to operate monitoring system yet devised.
Since Kingsley Ward is already recording on Rosser equipment in his present 8 Track studio, he was able to order with complete confidence in its performance and total reliability. What's more the price came as a very pleasant surprise.



ROSSER ELECTRONICS LTD.

ELECTRO-ACOUSTIC LABORATORIES, B.B.C. BUILDING, ALEXANDRA ROAD, SWANSEA

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MIXERS

continued

APOLLO
Apollo Electronics, 96 Mill Lane, West Hampstead, London NW6.
Tel: 794 8326

Range of plug-in units housed in rigid moulded castings. Panel dimensions of the units are 190 x 45 mm matching the width of Penny & Giles 1520 faders. Supply voltage (except for the PA10) is 24V dc, preferably stabilised; the ripple may not exceed 1mV rms. Prices on application.
Modules:
MA 80 microphone amplifier, *PE16* presence equaliser, *CL36* compressor-limiter, *EX60* programme expander, *LA26* mixer-line output amplifier, *PA10* plug-in monitor amplifier, *EPF4* foldback echo send pan pot, *TB90* talk-back amplifier, *SG56* signal generator, *MP62* magnetic pu amplifier, *M112* 12 input mixer, *PS24* power supply.

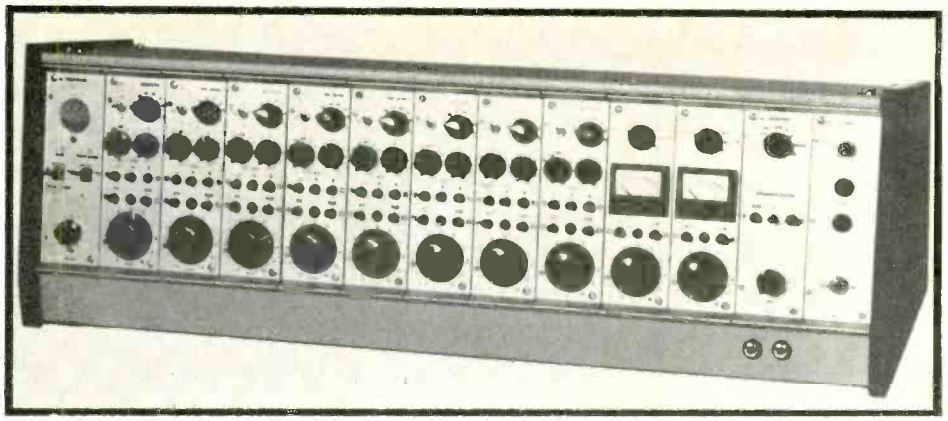
AUDIO DEVELOPMENTS
Audio Developments, Hall Lane, Walsall Wood, Staffs.
Tel: 054 33 5351

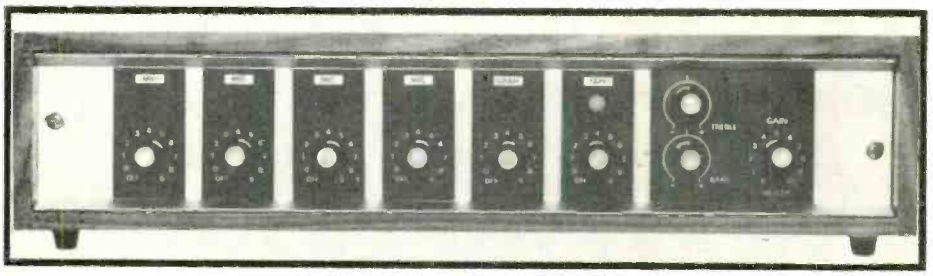
AD-71 series of modular mixers with pc interconnectors, standard vu, ppm or coaxial ppm. Typical price: £3,000 for complete 12/4 desk.

AUDIX
Audix BB Ltd, Stansted, Essex.
Tel: 027-971 3132/3437

MXT-800
Compact modular mixer intended for use in radio stations, theatres and small television and recording studios. Up to 16 input channels can be provided with two or four output groups and a wide selection of ancillary modules such as talkback, monitoring, limiting and echo channels. Rotary or linear faders are available. Modules include microphone channels having facilities for two inputs at two or four group working, group module incorporating vu metering, group module incorporating ppm monitor module, content monitor, talkback module, limiter, pan module, line equaliser, line-up oscillator, echo channel, line channel, power supply module.

MXT-200
Can be supplied either mono or stereo working. Provides studio mixing facilities together with tone corrections both on the input channels and the master units. A plug-in modular system allows the requirements, additions and variations of each client to be satisfied exactly. Controls have been designed so that true stereo working can be achieved on all modules, inclusive of the master combiner. It is no longer necessary to compromise by using two input channels to achieve stereo working. The mixer is available either as a rack mounting unit or free standing.





MXT-200 Combiner
Can be supplied either as a mono or stereo unit and incorporates vu metering or ppm as well as overall treble and bass tone controls. Where more than one output is required, additional mono combiners can be used in conjunction with an output routing module, thus enabling any input to be routed to any output. A tape record output socket independent of the master fader is fitted to the rear of this module.

Top: Audix *MXT-800*.
Centre: Audix *MXT-6*.
Bottom: Cryslon audio system.

MXT-6
Intended for commercial application where a selection of inputs are frequently required to be fed into one power amplifier. A large selection of input modules can be supplied either as a self powered unit or used in conjunction with power amplifiers. Flexibility is maintained by enabling the client to choose any number and type of input module up to a total of 14 units.

BIAS
Bias Electronics Ltd, 162 Randall Avenue, London NW2.
Tel: 452 6825

BE206 and BE208
Six and eight channel mixers designed to meet the requirements of small recording studios. Facilities include slider faders, prefade listen, twin independent line amplifiers, AB switching, ppm or vu metering and group bass and treble equalisation Talkback and monitoring amplifiers can also be included. Prices from £250.00. *continued 45*

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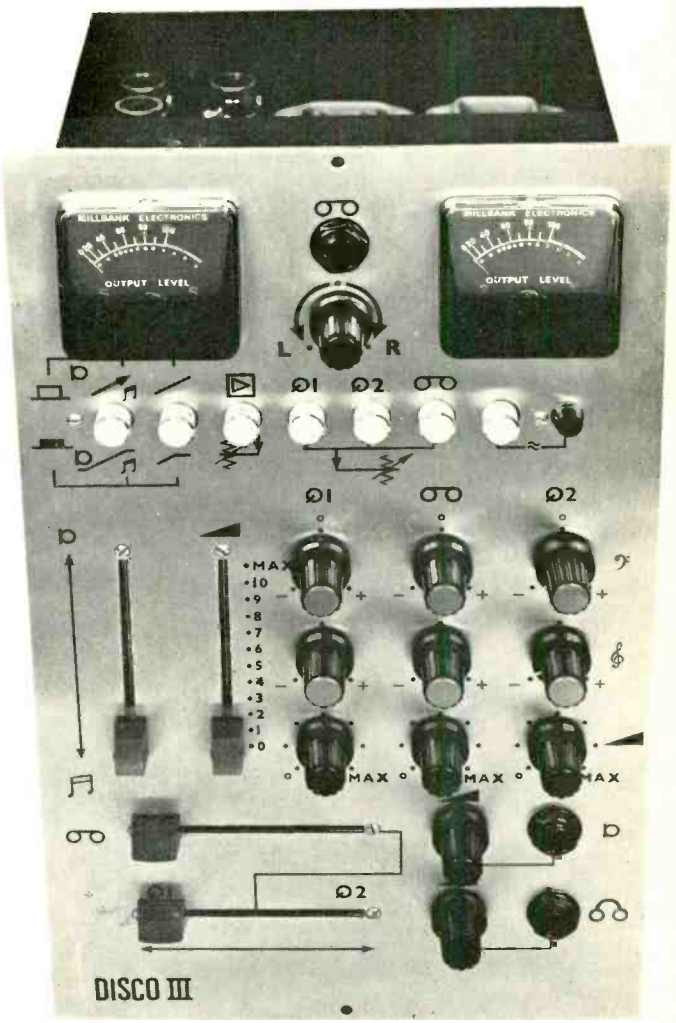
Audio Engineering for Professionals



Four years ago, only a handful of people had heard of the Millbank Electronics Group. Today, our equipment is operating in 25 countries and is specified by most major professional users of audio and communications equipment in the United Kingdom.

Why?

We think the simple answer is that we give our customers exactly what they want. And we're just as anxious to satisfy the small firm round the corner as we are to help the big company.

When Millbank Electronics was formed, but before it started to make anything, we took the trouble to talk to professional sound and recording engineers, and DJ's and listen to their problems. They told us exactly what they wanted; we went away and made it. And that's precisely what we've been doing ever since.

Everything we make is carefully engineered to give a specific performance—and meet a definite need. Take, for example, our new Disco III professional sound mixer. It is based on our very successful Disco II model, but incorporates several major new refinements. For instance, it offers stereo reproduction, as well as mono, and has full audio/visual monitoring, pre-fade and post-fade, of all inputs and outputs, except microphone. That's something many sound engineers and DJ's have wanted for years.

These are some of Disco III's other important new features:

★Switched audio limiters ★Twin peak reading VU meters ★Brand new styling—satin chrome fascia with matt black knobs and fittings ★*Automatic* or manual music/microphone fade to *any* selected level ★Compact, *rugged* printed circuit construction ★Low distortion, high signal-to-noise ratio, wide frequency range and full bass and treble tone correction ★Fully floating outputs, free of earth, to avoid hum loops ★Front panel microphone input mutes rear connected socket ★"Jingle" tape input on front panel mutes rear connected socket. ★DIN standard construction and terminations ★Twin AC switched outlets for turntables, amplifiers, etc. ★Stabilised power supply.

Disco III has been designed and manufactured specifically for professional sound engineers—the people we're in business to help. For full technical specification of this new development in sound mixers, please telephone or write to our General Sales Manager, Bernard Skinner.

Millbank Electronics Group,
Bellbrook Estate, Uckfield, Sussex.
Tel: Uckfield 4166 (0825-4166)

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continued

BE104 and BE106
Four and six channel mixers with compact format. Equipped with vu meter, balanced input transformers on all channels, and 600 ohm floating output. Can be rack mounted or free standing. All inputs switchable to microphone or line levels. Prices: £65 and £85 respectively.

CADAC
Cadac (London) Ltd, Stansted, Essex.
Tel: Stansted 3437 and 3132.

Complete consoles and studio monitors. Typical system: 24 input, 17 output, with four echo send, eight echo return, 17 monitor/metering channels, four monitor groups, four main foldbacks.

CALREC
Calder Recordings Ltd., Regent Street, Hebden Bridge, Yorkshire.
Tel: 042 284 2159

Modular desks for recording and broadcasting applications.
Typical system supplied to BBC:
Mic input unit containing eight fully equalised microphone channels with four group routing. Master group unit. Four stereo subgroups, each with stereo echo facilities, one stereo group master, one stereo main master and two stereo echo returns, both fully equalised. Small group unit (as for Master but with two stereo subgroups, one stereo group master, one main master and one stereo echo return). Monitoring output unit: this contains Tx and ppl stereo ppms, talkback and all other ancillary functions.

A normal operational unit will consist of one or more microphone input units; either a master or small group unit, and the monitor unit, though the system allows for a microphone unit to feed directly to the monitor unit when grouping facilities are not required. In this condition a stereo rotary fader comes into use as a master.

CHADACRE
Chadacre Electronics Ltd, 43 Chadacre Avenue, Clayhall, Ilford, Essex.
Tel: 550 7119

Printed circuit boards, kit or ready built. Mixer modules and consoles.

CRYSLON
Cryslon Electronics Ltd, The Firs, Rother Street, Stratford-upon-Avon, Warwickshire.
Tel: 0789 4797

Range of audio equipment including modules and complete sound mixers. Mixers are manufactured as standard units and to custom requirements. The company also undertake systems for both studio and theatre. A full range of facilities are offered including group switching, pfl, foldback, echo and push-button monitor circuits. Modules available include microphone amplifiers, equalisation units, fader modules incorporating in Preh or Penny & Giles units, star mixers, line amplifiers, and distribution amplifiers.

Above: Studio console by Cadac.
Below: Electrosonic modular mixer.

CTH
CTH Electronics, Industrial Estate, Somersham Road, St Ives, Huntingdonshire.
Tel: 04806 4388

TM50 series of mixers, upwards from a simple 5/1 unit including pfl and ppm.

EAGLE
Eagle International, Precision Centre, Heather Park Drive, Wembley HA0 1SU.
Tel: 903 0144

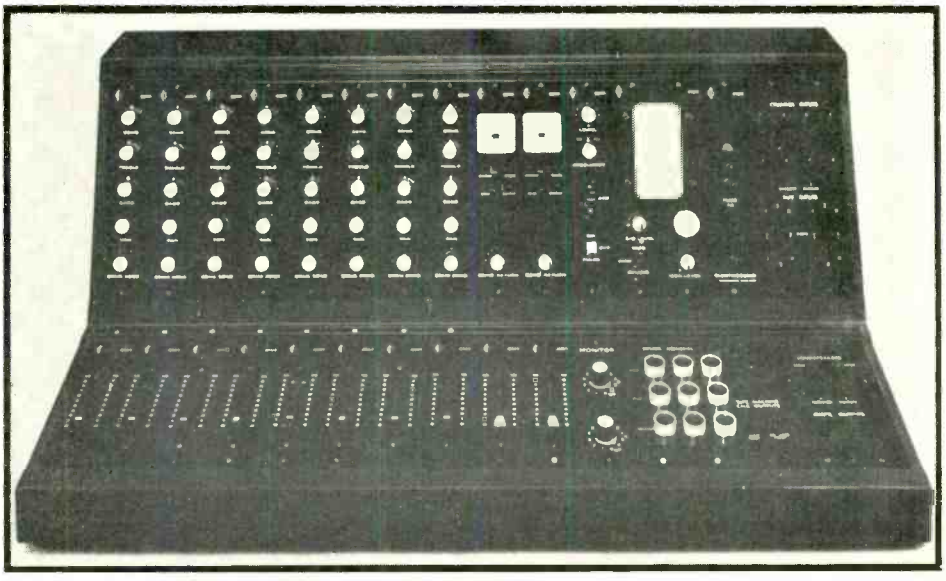
MP12
Small battery-powered mixer with one gram and four microphone inputs. Linear motion input faders. Price: £26·40.

FF1
Small battery-powered mixer with four microphone inputs and master output fader. Price: £20.

ELECTROSONIC
Electrosonic Limited, 47 Old Woolwich Road, London SE10 9PW.
Tel: 01-858 4784/5/6

ES 1200 Series
Designed to operate with *ES 1250* power amplifiers, the Series *ES 1200* is available either in rack-mounting form or free-standing. A complete range of

continued 47



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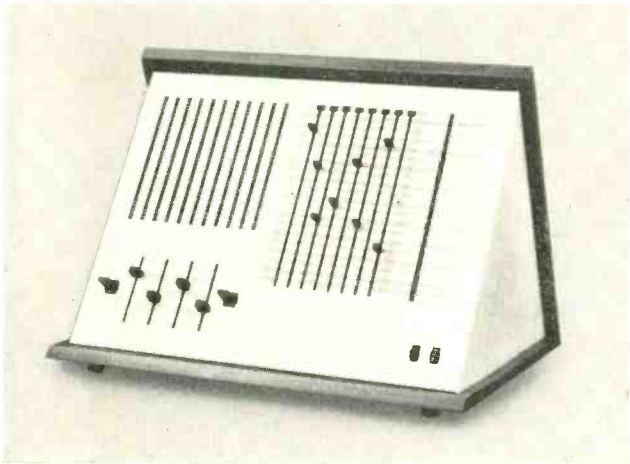
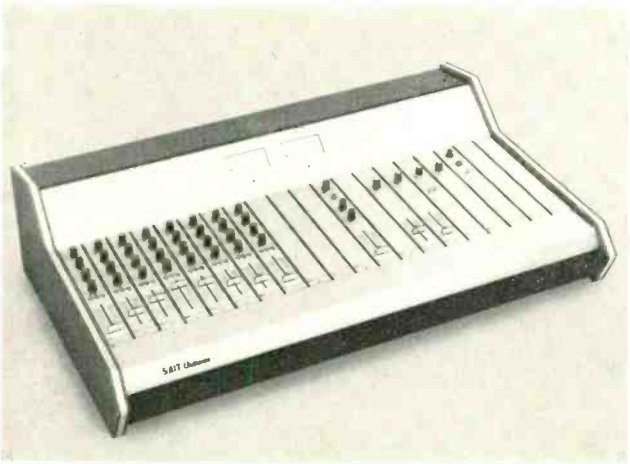
Triadex Inc.
MUSE music synthesiser.



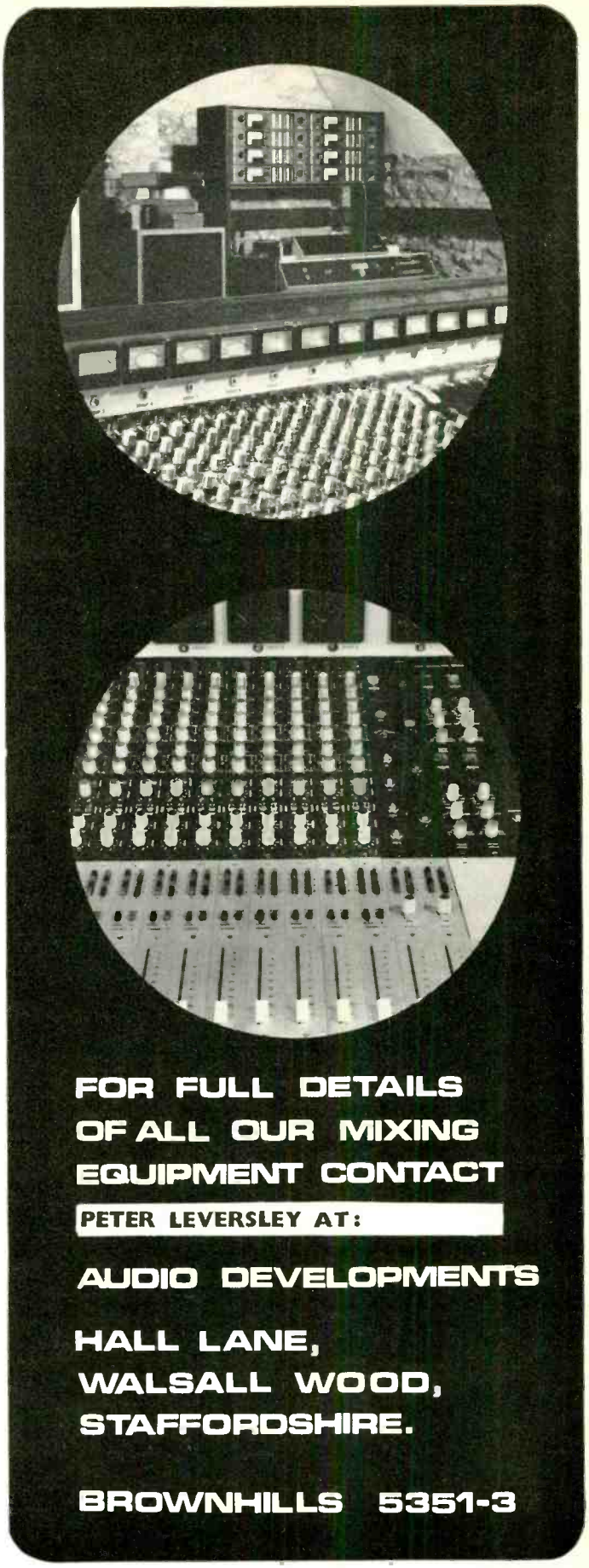


SAIT Electronics
S9 range of portable mixers.

Sole agent for
Pearl microphones.

Allotrope Ltd.

5B Thame Industrial Estate,
Thame, Oxon.
Sales Office: 01-437 1892.



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plug-in printed circuit board based preamplifier/input and output modules are provided with gold-plated edge connectors for absolute reliability and ease of maintenance. Modules:
ES 1201/2/3 modular mixer frames: £60
ES1219/M Twin microphone input: £20
ES1219/L Twin line input: £15
ES1221/M Single microphone module with tone controls: £20
ES1221/L Single line module with tone controls: £20
ES1221/D Single disc module with tone controls: £20
ES1221/T Single tape module with tone controls: £20
ES1239 Combining amplifier/output stage and master gain/tone control module: £20
ES1245/P Monitor module with jack socket for 600 ohm headphones: £22
ES1245/V Monitor module with VU meter: £20

Modular Studio Mixer
Basic eight-channel two group chassis, wired and including all input/output connectors and 1 x PM2 Power Supply Module: £160
Additional module spaces above 11, wired and including all input/output connectors; Per module space: £10

CM1 Input+SM1 slider module: £38
CM1 Input+SM2 slider module: £45
CM2 Input+SM1: £53
CM2 Input+SM2: £60
GM1 Group+SM1: £42
GM1 Group+SM2: £49
GM2 Group+SM1: £42
GM2 Group+SM2: £49
OM1 Oscillator+BM1 (matching blanking panel for lower section of desk): £26
OM2 Oscillator+BM1 panel: £40
TM1 Talkback+BM1: £53
TM2 Talkback+BM1: £57

EMI
EMI Sound & Vision Equipment Division, Hayes, Middlesex.
Tel: 01-573 3888 Ext 2011

8100 Series
This series comprises the following basic units: Channel module *8020*, Group module *8021*, Output module *8022*, Echo module *8023*, Power supply unit *8028*. In addition, any or all of the following units may be used to satisfy a particular requirement: Desk (optional). Blank Module Type *8029*, Preview Module *93432*, Tuchel Patch Panel, Ancillary Control Panel, Compressor *8025*, Mid Lift *8026*, High Level Amplifier *8032*, Power Supply *222/1*, Patch Panel *758/2*, Patch Panel *758/3*.

TV Broadcast Sound Desks
The following modules can be used to build a tv studio sound mixer: *8020* channel, *8021* group, *8022* Output, *8029* Echo, *93432* Video preview, *8025* Compressor, *8026* Mid Lift, *8032* High Level amplifier, *8028* Power supply. This can be as simple or as complex as required. Four versions of a tv sound mixer are available as standard, having eight, 16, 24 and 36 channels.

Note: EMI 16-track studio mixers, not detailed here, are produced for in-house requirements only.

EMT
Agent: FWO Bauch Ltd, 49 Theobald Street, Boreham Wood, Herts.
Tel: 953 0091

EMT 104
Developed for outdoor recordings and location work. Four inputs, each with fader, suitable for dynamic and capacitor microphones or for line inputs. The microphone channels are equipped with switchable bass cuts. Each channel contains a pre-fade listening button which enables each channel to be monitored via the built-in monitor amplifier. If none of the buttons are pressed, the sum signal will be monitored. Up to three mixers can be linked together in which case 12 inputs will be available on one master feeder. The unit is equipped with a compressor/limited which can be switched in or out of circuit, an oscillator and a monitor loudspeaker with its own volume control. Price: £489

GRUNDIG
Grundig (GB) Ltd, London SE26
Tel: 778 2211

420
Small mono mixer with facilities for mixing up to four separate inputs, connection also being provided for a reverberation unit. Price: £24

422
Stereo version of 420. Price: £24

HELIOS
Helios Electronics Ltd., 161 High Street, Teddington, Middlesex. TW11 8HT.
Tel: 977 7841 and 7877

PS.1
Furnished with between ten and 16 inputs, mounted in two sizes of basic frame. These frames allow for a wide selection of ancillaries supplied initially or added later.

Each input channel has a cut off or pre-fade listen key leading to a Penny & Giles slide fader. An 'insert' switch allows instant switching in of a compressor or other device plugged in via the miniature jackfield. A foldback pot is provided before the fader, and an echo send pot switchable before or after fader has its output switched to one or both of two echo systems.

The desk has eight full recording outputs all usable simultaneously. The first four are fitted with slide master faders, the others with rotary potentiometers, but all eight can have slide faders if specified. The mixed echo send from the channels passes through simple equalisation to an overall gain control and sending amplifier. An 'insert' point is provided, and a 'Tape Loop' switch, routing the send signal via jacks into which any tape machine may be plugged for delay effects. A pot marked 'Spin' feeds back a proportion of the tape signal for 'repeat echoes'.

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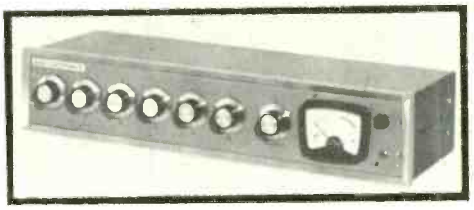

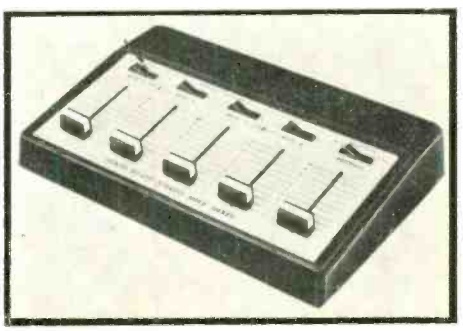

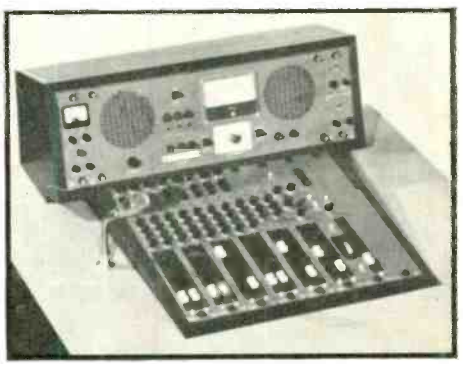

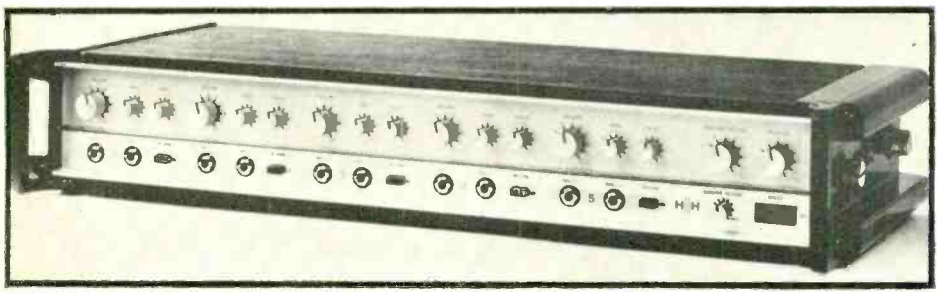

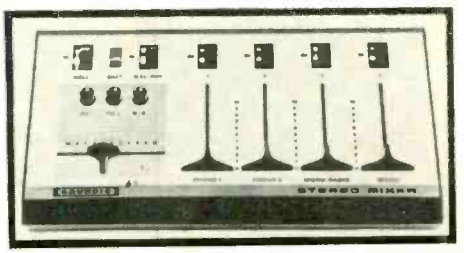

Top right to bottom left: Units by Bias Electronics, Eagle, EMI, Grundig and H/H Electronics.

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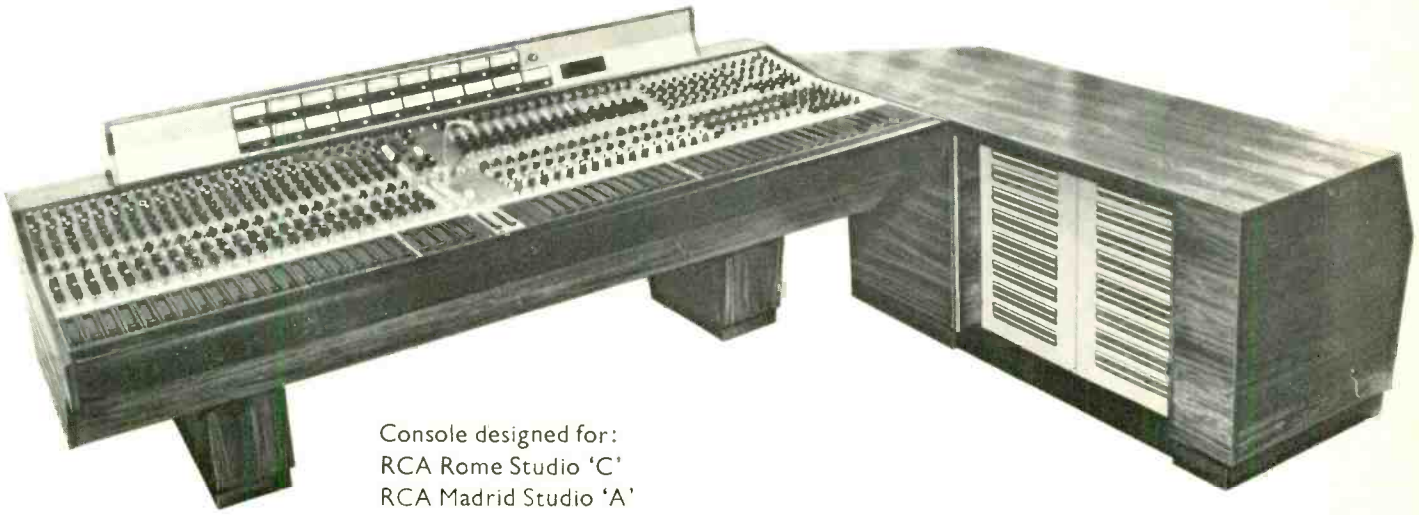
CREATIVE SUCCESS COMMENCES HERE



Console designed for:
RCA Rome Studio 'C'
RCA Madrid Studio 'A'

It is acknowledged by Producers, Artists and Musicians that the operational speed and flexibility of the Music Recording Console in any Recording Studio is a most important contributory factor to its success.

The new concept of Cadac Console design is one of no compromise, coupled with advanced thinking. The result is a Console with superb systems engineering and logic, setting a new standard of high performance which leaves you no alternative choice.

cadac

Cadac (London) Limited
STANSTED · ESSEX · ENGLAND · Tel: Stansted 3437 & 3132

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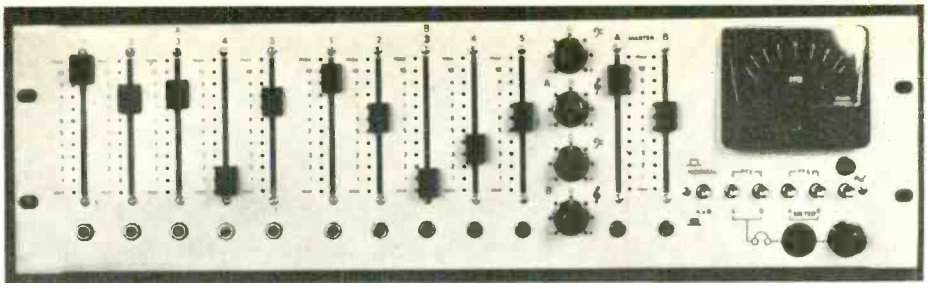


In addition to the channel foldback pots, each tape track has a foldback pot fed from sync out of recorder. These lead to a mix and overall level control.

A built in microphone and amplifier to line level leads to separate volume controls for studio speaker (5 watt amplifier provided) and phones (i.e. injected into the foldback system). Tape ident signal appears on all eight recording outputs. An 11-frequency oscillator with output volume control is provided. A larger foldback mixing panel may be specified, on which up to four different mixes of tape tracks, plus live mikes, may be made. Alternatively, headphone mixer boxes for studio floor use can be supplied.

PS.2
An extension of the above design to allow for 16 track recording. Furnished with 16 input channels and the track monitor panel is expanded to deal with all 16 tape tracks. There are still eight simultaneous main outputs, all with slide faders, and the outputs are paralleled at the jackfield such that, unless patch cords are inserted, track nine will be fed with Group one signal, track ten with Group two, and so on. Metering will normally consist of eight meters switchable to tracks in a similar way.

882 Series
Portable unit modules and circuitry identical to those in the studio units, presented in the simplest way for ease of operation on location. Any unit may be specified by the make-up of the type number, thus: Type *1284* has twelve inputs, 8 outputs, 4 built-in compressors (the largest stock model). Type *420* has four inputs, two outputs, no compressors. Letter suffixes refer to monitoring arrangements.

HH ELECTRONIC
HH Electronic, Industrial Site, Cambridge Road, Milton, Cambridge, CB4 4AZ.
Tel: Cambridge 65945

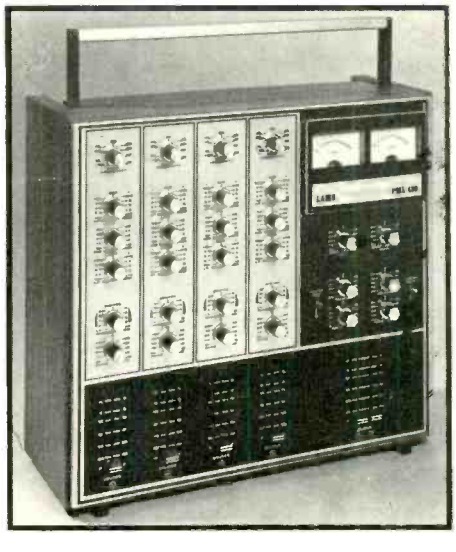
MA100
Combined mixer/power amplifier. Five input channels, each with bass, treble and independent reverberation switches. Master volume, presence, and reverb controls. Price: £119. *(MA100S* without reverb: £100.)

LAMB
Agent: C. E. Hammond, Lamb House, Church Street, London W.4.
Tel: 995 4551

PML 420
Four channel, two group mixing unit designed to operate in conjunction with transportable stereo tape recorders such as the Revox *A77*. All input and output levels are controlled through slide faders, the output pair being positioned for independent or simultaneous operation. Each input channel incorporates input sensitivity preselection, separate low, mid and high frequency equalisers, panoramic potentiometers and echo send controls. Limiters may be switched into each output group and adjusted to the desired threshold and release time, either for special effects or to prevent overmodulation. Separate left and right echo return controls and illuminated group vu meters.

MAGNETIC TAPES
Magnetic Tapes Ltd, Chilton Works, Garden Road, Richmond, Surrey.
Tel: 01-876-7957

Chilton M10/2
Input channels separated into two stereo channels with independent but closely spaced faders (may be used as four mono channels) and six mono channels with panoramic pots. Bass and treble equalisation is independently variable on all channels. For monitoring with headphones, there are two 600 ohm outputs which are switchable pre and post fade. In addition there are two outputs suitable for driving power amplifiers with a maximum of +12 dBm available. Both of these outputs are variable on the front panel. Peak reading meters, dB scaled. Line-up oscillator with five spot frequencies. Price: £220.



MIDAS
Midas Sound Concessionaires, 128 High Road, East Finchley, London N.2.
Tel: 01-444 7707

Modular Mixing System
Chassis: *Type B* (12 channels). Spaces: 16 lower modules and four upper modules: £110. *Type C* (16 channels). Spaces: 20 lower modules and five upper modules: £140. *Type D* (20 channels). Spaces: 24 lower modules and six upper modules: £170. *Type B/2, C/2* and *D2* have a third level for extra upper modules: £20 extra.

Modules
Channel module *CH/001:* Level fader, sensitivity control, mute switch and indicator, pan control, bass, treble and presence filters, echo/reverb control, monitor level (pre-fader): £30. Channel Module *CH/001:* Level fader, sensitivity control, mute switch and indicator, pan control, output dividing switch (for four output system), bass treble and presence filters, echo/reverb control monitor level and pre-fade/post fade switch: £34. Channel Module *CH/003:* Level Fader, sensitivity control, mute switch and indicator, pan control, output dividing switch, bass, treble and presence filters, monitor level and pre-fade/post fade switch, small ppm: £40. Channel modules incorporating roll-off filters, special equalisation effects, multiple foldback mixing, incremental pan switches, equalisation and pan over-ride, and output routing and programming switches may be designed to special requirements. Output Module *OP/1:* Master level control, ppm meter with fast rise and slow decay. Accurate to 5 dB. Variable limiter and operating indicator: £40. Auxiliary Module *TB/HP:* Pushbutton channel selectors for headphones, jack socket and volume control. Talkback mike input and volume control mixed into monitor output). Intercom facilities may be included if required: £25. Send/Return Module *SR/1.*

MCI
Agent: Feldon Equipment Ltd, 126 Great Portland Street, London W1.
Tel: 580 4314

JH-416 modular consoles. Standard 24 in, 24 out with 16 channel bus selection. 240 jack patch bay.

Top: Millbank *MCC Mk 3.*
Centre: Chilton *M10/2.*
Bottom: Lamb *PML 420.*

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Studer 16 Channel 8 Track Mixer

F.W.O. Bauch Limited
01-953 0091

SONIFEX

SOUND EQUIPMENT

93. STANWELL WAY
WELLINGBOROUGH
NORTHAMPTONSHIRE
TELEPHONE : REDWELLS 2142

MONOPHONIC
STUDIO MIXER
TYPE B1000.

SIX CHANNELS:
Inputs Balanced Line-
Microphone, Equalisation
HF and LF, Echo Send,
Prefade Listen.
Master with 10 dB Further Gain,
Echo Return.
Approved V.U. Metering
Cannon XLR Connectors
Mains Powered.
Desk Top or Inset Mounting.
Dimensions: 435 x 370 x 90 mm

SOUND BROADCASTING EQUIPMENT & STUDIO SYSTEMS

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continued

MILLBANK
Millbank Electronics Group, Unit 8, Bellbrook Estate, Uckfield, Sussex.
Tel: 0825 4166

MCC Mk 3
Ten input channels arranged into two groups of five, each group having overall bass and treble tone controls and a group fader. Linear motion faders are provided for each channel and group and it is possible to operate the mixer as either a five channel stereo or ten channel mono unit.

Comprehensive monitoring facilities. Groups A and B may be fed to left and right-hand outputs or to both. Visual monitoring by broadcast type ppm, standard vu, or peak reading vu. Price: £180.55.

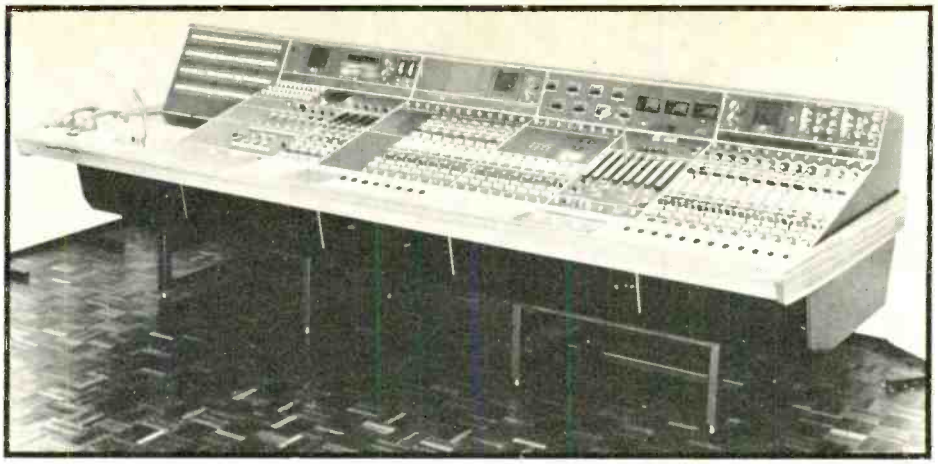
NEVE
Rupert Neve & Co, Cambridge House, Melbourn, Royston, Herts SG8 6AU
Tel: 0763 60776

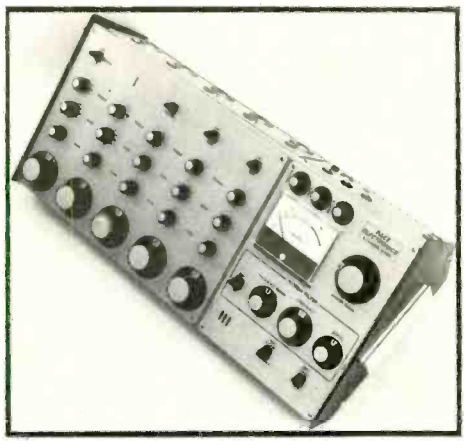
BCM 10/2
Transportable sound mixing console for mono or stereo broadcasting and recording. Ten input channels with equalisation and two output groups each controlled by horizontal faders. Echo, studio foldback and communication, cueing, two-speaker monitoring, equipment control interlock and signalling facilities are included. Modular amplifiers are used throughout. A choice of input amplifiers is available giving a wide choice of filters and frequency response control.

S 16/4
16 input channels, each having line and microphone inputs and comprehensive equalisation. Horizontal slider faders. Four output groups—with reduction to three track, stereo and mono modes of operation. Four limiter/compressors, with pairing of control lines for stereo operation. Two reverberation groups, send and return. Pan pots and group selectors on returns. Two foldback or cue groups. Four speaker monitor system with eight track playback to monitor matrix. Four studio playback outputs. Five vu meters. Playback to foldback matrix. Selsync to foldback. Pre-fade listen available on all input channels. Extensive patching facilities, all inputs, outputs and insertion points balanced and earth-free and at line level (normally +4 dBm). Fully stabilised power supply. Pan pots on all input channels. Line-up Oscillator. Talkback facilities. Reverberation on monitor. All inputs and outputs on Cannon XLR.

S.24-8
24 input channels with full equalisation. Eight output groups. Four reverberation groups. Two foldback groups. Talkback communication. Pre-fade listen or cue speaker. 16 track reduction monitoring. Four monitor speaker circuits. 13 meters. Integral patch panel. Line up oscillator. Four limiter/compressors. Four high pass/low pass filter units.

PACE
Pace Electronics, 338 London Road, St. Albans, Hertfordshire.
Tel: Bowmans Green 3452
Five input portable mixer with bass/treble eq and notch filter on each channel. Peak reading vu meter. 400 Hz reference tone oscillator. Remote tape start. Battery or 12 to 18V dc powered. Price: £520





Top: Control desk by Neve.

Adjacent: Pace five input mixer.

PHILIPS
Agent: Pye TVT Ltd, PO Box 41, Coldhams Lane, Cambridge CB1 3JU.
Tel: 0223 45115

MP4
Portable four channel unit, mains or internal battery powered. The four channel faders are in a row left of the level meter, master fader on the right. A rotary sensitivity switch, pushbutton bus-bar switch, and a key switch for input terminal selection and muting, are mounted above each of the channel faders. The rotary switch above the master fader selects the various monitoring, pre-listening, and cue points. The outer rim of this switch knob controls the level of the monitoring/pre-listening channel. Incoming cues are signalled by a lamp to the right of this switch. The level meter is calibrated in volume units. Vu is standard, ppm optional. The *MP4* has two separate bus-bars enabling two different programmes to be handled simultaneously, e.g. the left and right channel of a stereo programme. Bus-bar selection of both input and master channels is by pushbuttons. Two *MP4* units must be interconnected when handling a two-channel or stereo programme, to provide the necessary two master channels.

A 1 kHz test oscillator is provided. The pre-listening facility allows the operator to monitor the signal before it is fed to one of the channel faders. Dimensions are 140 x 515 x 360 mm. Weight is 14.2 kg. Price: £500.

MD-Range
Maximum of 24 inputs to minimum of 12 input channels. Up to four independent output channels. Reverberation send and return. Current dependent mixing with resistive networks. Monitoring and pre-listening. Optional equaliser block with four equalisers, switchable to eight input channels. Four models are normally supplied with two line outputs, but any number up to four is possible without delivery delay or high additional cost. Plug-in blocks can be supplied separately for those who wish to make up their own desks. Standard models:
MD 8R: with eight line inputs and eight microphone inputs.
MD 8RF: similar to *MD 8R*, but has a block with four equalisers switchable to eight input channels.
MD 12R: has 12 line inputs and 12 microphone inputs.
MD 12RF: similar to *MD 12R* but has a block with four equalisers switchable to eight of the input channels.
All the above models have: (a) one reverberation channel with return input and send output; (b) two monitor channels with special facilities for monitoring auxiliary equipment; (c) one public distribution output for studio distribution; (d) four talk-back outputs; (e) a signal contact on each sliding fader.

SSM 14
Standard stereo mixing desk with 14 to 56 inputs. Incorporated in the desk are, from left to right: 14 microphone channels, four group/output channels, four equalisers, two monitoring/metering channels, one talkback channel. Price: £3,000 to £4,000.

MM11
Audio consoles based on 40 x 95 x 126 mm modules. The operating panel comprises a honeycomb construction of module mounting rails fitted into a frame assembly which is bolted together. The module rails are separated at 9.5 cm intervals for standard modules and at 19 cm for sliding faders. Separation between the rows of modules is by means of rods at every 4 to 8 channels. The number of rails in a console depends on the number of modules in the largest audio channel. The number of separating rods depends on the grouping of the channels. For the moderate to larger type of consoles, the complete operating panel with all modules in place is hinged to allow lifting into a vertical position. For small, lightweight consoles this is done by hand, but for large and heavy versions a

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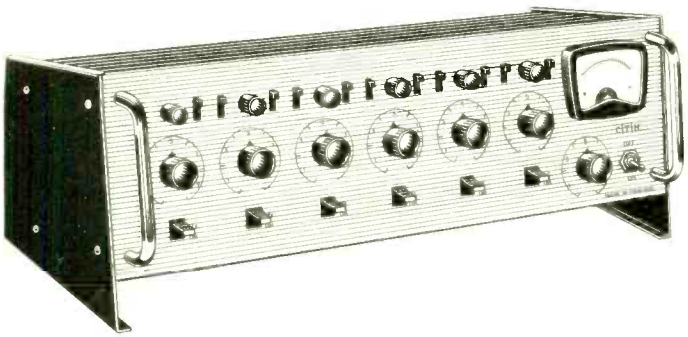
A CTH STUDIO QUALITY MIXER FOR FIELD USE...



TYPE TM61 MIXER

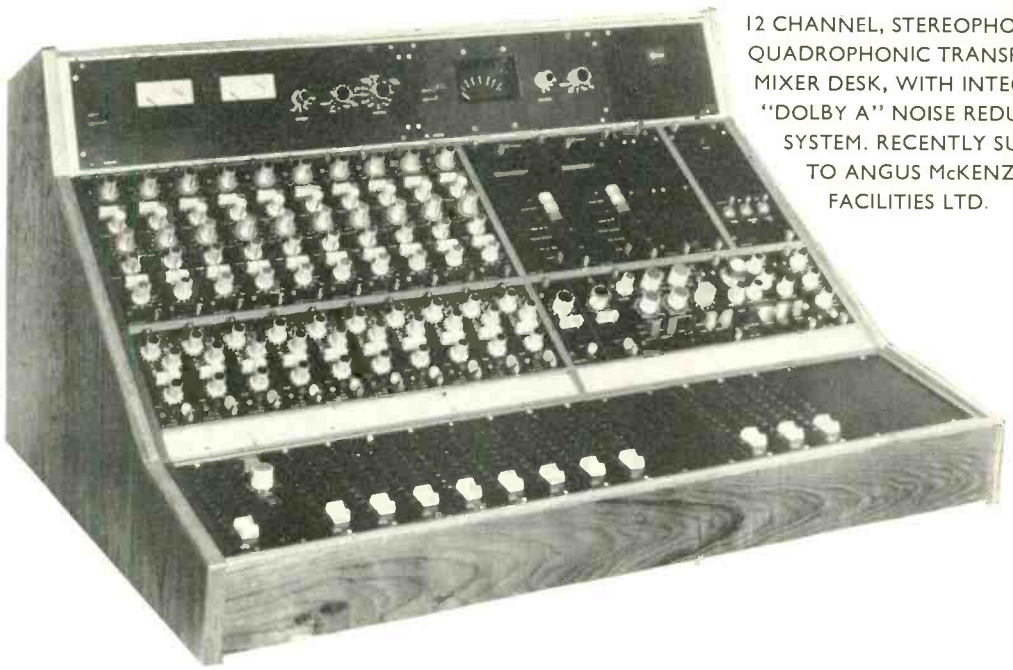
- ☐ All silicon six-way mixer.
- ☐ +12 dBm output on mains or 12v battery.
- ☐ Adjustable for 30Ωmic, 200Ωmic or 600Ω lines.
- ☐ Sensitivity –85 dBm to +20 dBm.
- ☐ VU meter (PPM available).
- ☐ Muting switch on each channel.
- ☐ Bass and treble cut on each channel.
- ☐ Master gain control.
- ☐ XLR type input connectors.

Send now for complete details.

This studio quality mixer is available fitted with an internal 12V battery and with a wooden carrying case, giving you an easily portable mixer of true studio quality for use in general field work.

CTH ELECTRONICS

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



12 CHANNEL, STEREOPHONIC/ QUADROPHONIC TRANSPORTABLE MIXER DESK, WITH INTEGRAL "DOLBY A" NOISE REDUCTION SYSTEM. RECENTLY SUPPLIED TO ANGUS McKENZIE FACILITIES LTD.

CALREC MIXER DESKS — THE PROFESSIONAL'S CHOICE

CALDER RECORDINGS LIMITED, REGENT STREET, HEBDEN BRIDGE HX7 7DG Phone 042-284 2159

Southern Distributors: **Beyer Dynamic (GB) Ltd., 1 Clair Road, Haywards Heath, Sussex** Phone 51003

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mechanical or push-buttons operated hydraulic device is used. In its vertical position, all wiring is directly accessible after removal of the protecting cover plate which is held in position by quick release fasteners. The metering hood and inclined panel can be tilted forward, over the operating panel, for easy access to all connecting points. Price: £500 per channel, depending on facilities.

MD Range
The design is based on the use of channel blocks to provide good flexibility, to give more assembly and switching possibilities, and to ensure ease of maintenance and servicing. The number of units making up a desk has been kept to an absolute minimum. Any mixer in the range is built up as a combination of four standard plug-in blocks (one of which is optional) and three amplifiers for secondary circuits, mounted together in a standard frame. Price: £3,000 to £5,000.

RADON
Radon Industrial Electronics Co Ltd, Brooklands Trading Estate, Orme Road, Worthing, Sussex.
Tel: Worthing 34934-6

DL6 CM
Six input, single output mixer measuring 355 x 175 x 105 mm. Mains powered. Price: £35.

RICHARDSON
Richardson Electronics, 57 Jamestown Road, London NW1.
Tel: 267 0723

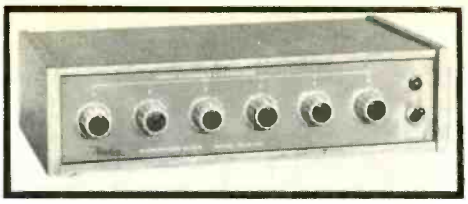
Custom built mixers. All basic facilities available. Range of amplifier cards and modular mixers. Standard input module: £50.

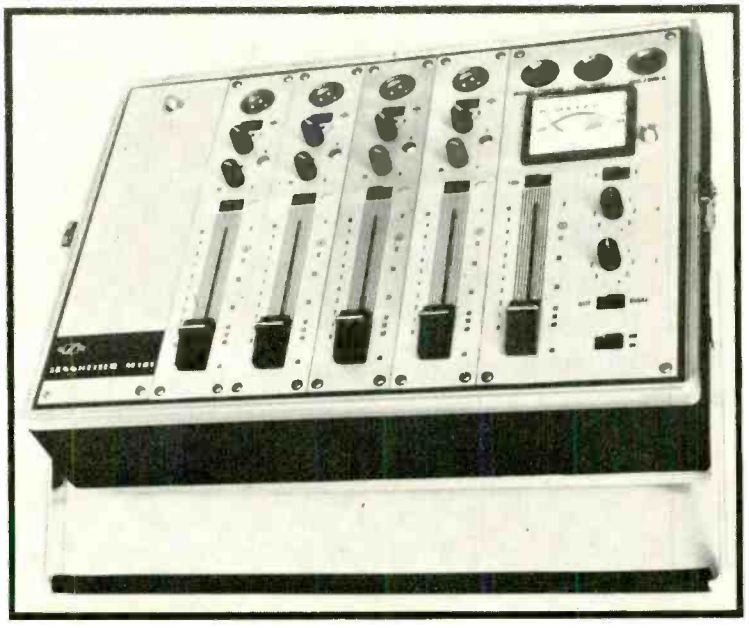
ROSSER
Rosser Electronics Ltd, Electro-Acoustic Laboratories, BBC Building, Alexandra Road, Swansea.
Tel: 0792 53461

Range of modular units built to European standard dimensions. Services also available on a consultancy basis. Advice in the areas of studio installation, disc cutting processing and pressing.
Modules: *DR70 E/B* Microphone amplifier/equaliser. *CR3* Console output line amplifier/auxiliary channel amplifier. *FM 1/4* Function/facilities module. Tone Generator. *1500 Series* Conductive plastics linear motion studio fader. *BA 2-15* Mix bus amplifier. *R 600-N* (Audio & Design Recordings) limiter compressor.

SAIT
Agent: Allotrope Ltd, 5B Thame Industrial Estate, Thame, Oxfordshire.
Tel: 01-437 1892 (sales)

3S Range
Comprises a range of standard modules, each module performing a specific task within the mixing desk. The four basic modules are as follows: Mic/line input module *5E36*, equaliser module *7A52*, Mix modules for multi-track: *5E32, 5E55* and *5E66*, Output module *5E37*. Other modules include: Pre-fade listen *5E39*, talkback *5E41*, test tone generator *7924*, fader module (Danner), ppm, bu and cu modules. The modules consist of Sait-made cassettes with DIN standard front panel dimensions of 40 x 190 mm. A range of standard desk frames with integral power supplies and connections is available. Special facilities can be designed and built in by Allotrope and each desk is designed in consultation with the customer.





Top: Radon *DL6 CM.*

Centre: Soundex *Studio 4.*

Adjacent: Sennheiser *M101.*

SENNHEISER
Agent: Hayden Laboratories Ltd, Hayden House, 17 Chesham Road, Amersham, Buckinghamshire.
Tel: 02403 5511

M101
Designed for use with the Nagra and similar recorders. The total unit is 347 x 233 x 126 mm and weighs 6 kg. Power supply is from two built-in 9V batteries. Alternatively, the power may be supplied to the mixer from the Nagra tape recorder. The *M101* has four balanced microphone inputs each having a sensitivity of 0.1 mV. The outputs of the four microphone channels are fed to one master slide-fader. The junction is brought out to a socket to allow the possibility of connecting a second mixer in parallel to give eight channels. The tone controls in the summing amplifier can, if required, also be switched into the fourth microphone channel. The output voltage is measured by a peak reading meter capable of being switched to read battery volts. A built-in oscillator provides line-up tone controlled by the master slide-fader and its level is shown directly on the meter. A switch situated on every microphone channel makes it possible to pre-fade listen, if the mixer is used in conjunction with the ML 101. Price: £450. Monitoring Unit: £234.

SHURE
Shure Electronics Ltd, 84 Blackfriars Road, London SE1.
Tel: 928 6361

M668E stereo microphone mixer. Four microphone inputs. Price £63.
M672E Add-on microphone mixer. Four mic inputs, one switchable to line level. Oscillator, vu meter. Price £88.80.
M675 Broadcast production master for use with the above. Two line/gram inputs and line/hi-Z inputs. Monitor speaker. Price: £79.80.
M68 Four mic and one high level inputs. Price: £49.80 or £63.60 with reverb.

SONIFEX
Sonifex Sound Equipment, 93 Stanwell Way, Wellingborough, Northamptonshire.
Tel: Redwells 2142

B1000
Six input channels which may be individually selected as 200/50 ohm balanced microphone input, switchable to 600 ohms balanced line input, or optional unbalanced gram input. Equalisation is controlled by two continuously variable controls. Fading is achieved by flat slide faders. Pre-fade listen. Each channel has a post fade auxiliary or echo send control, continuously variable. Vu meteror ppm as required.

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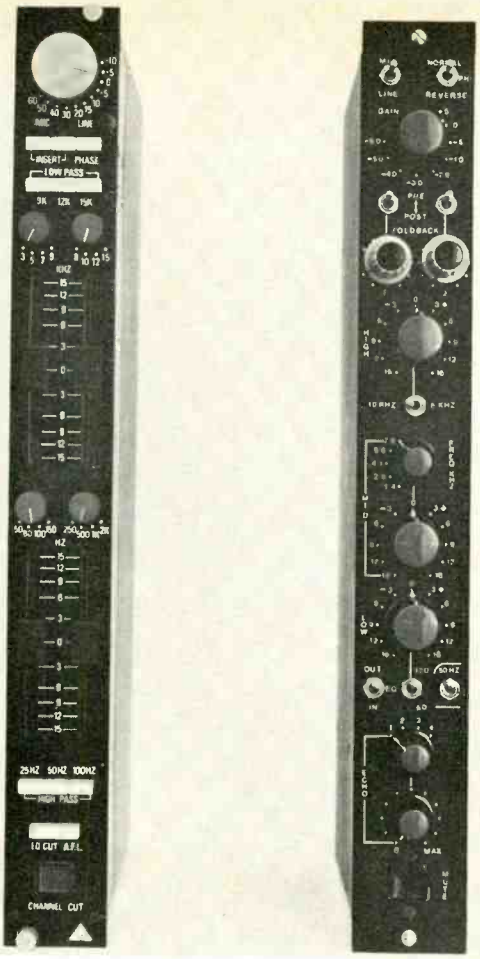

OUR MIXER DESIGNS USE A THIRD KIND OF FEEDBACK

We call it "Engineer Feedback", and in addition to the more usual positive and negative types, we have used an awful lot of it in the design of our two mixer ranges. Associated, as we are, with a major recording studio, we are in constant touch with some of the leading recording engineers in the country. Engineer Feedback is the continual flow of information, comments, likes and dislikes that they pass on to us, and is based on their using just about every type of desk known to man. From this, we have learned just what these engineers require of a desk—whether a particular E.Q. curve is steep enough, whether the monitoring facilities offer enough flexibility, or the routing system is comprehensive enough—the list is endless . . .

After many hours of discussion, designing, prototype building, throwing away and starting again, we have introduced two ranges of mixing consoles, designed to cater for the needs of everyone.

Our 'A' Range, the channel module of which is illustrated top left, is a no compromise, extremely comprehensive range of desks, designed for larger studio installations. It features an equalizer section with a choice of sixteen frequencies, four being variable at any one time; completely free routing so that any channel can be assigned to any group, or panned across any two or more groups; full monitoring facilities with equalization; dual scaled meters which can be switched to either V.U. or P.P.M. operation and automatic selection of machine returns to either monitors or to the appropriate channels for re-mixing.

The highest quality components are used throughout, with metal oxide resistors and cermet potentiometers being the rule rather than the exception. Every module has a voltage stabilizer built in, and phase shifts have been kept to a minimum by using as few transformers as possible. An average channel will weigh in at less than ·01% distortion, with a signal to noise ratio of -87dBm (Line input to channel output with fader at maximum.) The drop in level when switching up to 30 channels to one group is less than .1dB, and the noise at a group output with ten channels selected to that group is -75dBm. Frequency response from input to output is ±1dB from 20Hz to 20KHz, and at any attenuator setting, a 20dB overload margin is allowed.

The console construction is of metal with cladding to suit individual requirements. The modules are totally enclosed, with all panels easily removable for ease of servicing.

Maybe this all sounds fine, but if you're just starting a small studio, and your bank manager isn't an old school friend; or even a friend of any kind, you are more likely to be interested in a somewhat simpler type of mixer—so let's talk about our "B" range. These have been designed to the same standards as the "A" range, and use the same sophisticated circuitry. They offer slightly less in the way of facilities, and the module and console construction has been simplified—that is all. The channel module (top right) contains an equalizer section with three frequencies variable at any one time, high pass filter, echo and foldback sends, input attenuator etc. Monitoring facilities are similar to the "A" range except that no equalizer is included.

Routing is also simplified, but is as comprehensive as on many large studio desks. V.U. meters are fitted as standard, although the A type dual meters can be supplied upon request. Full patching facilities are available on a 9X20 G.P.O. jack bay.

Interested? Then whatever your requirements, we would be pleased to discuss them with you and give you our quotation. Contact either Malcolm Toft or Barry Porter.

TRIAD

CREATED FOR ENGINEERS BY ENGINEERS

Trident Audio Developments Division
Trident House. 17 St Anne's Court, Wardour St., London, W1
01-734 9901/4

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continued

SOUNDEX
Soundex Ltd, 18 Blenheim Road, London W4 1ES
Tel: 995 1661

Studio 4 and Studio 6
Four and six channel mixers for studio and location recording work. Each channel can be switched to accept five different inputs—one input also providing 48V phantom power for capacitor microphones. Slide faders are incorporated and each input has a 'pan' control, enabling mono and stereo recordings to be undertaken. Tone controls and a ppm are available as optional plug-in units. Pre and post fade listening facilities. Test and line up oscillator. Prices start at £87 (4-channel) and £108 (6-channel).

4S
Four input stereo microphone mixer with rotary faders and pan pots. Price: £45.

SOUND TECHNIQUES
Sound Techniques Ltd., Industrial Estate, Mildenhall, Suffolk.
Tel: 0638 713631

System 12
Consoles centred around the system 12 series 2 range to meet the increasing need for an ex-stock desk. There are two standard System 12 formats; both have 18 input channels with full equalisation, foldback and echo facilities, 16 track monitoring with pan, monitor echo and foldback, 18 direct outputs and full ancillary facilities including talkback, built-in oscillator, vu meters and a self contained modular jack bay.

Version 1 with four mixed outputs: £5,377.

Version 2 with an extra four mixed outputs: £6,568.

Since the whole system is fully modular, *System 12* desks can be delivered to customers in more basic forms, allowing them to increase their facilities at their own convenience. Similarly, larger desks than the standard formats can rapidly be built to customers' own requirements.

Sound Techniques can also offer systems built for a customer's own special needs.

SPECTRA SONICS
Agent: Feldon Equipment Ltd, 126 Great Portland Street, London W1.
Tel: 580 4314

1020-8/16
Audio control console. 16 inputs, four group. Illuminated pushbutton routing, 15 illuminated vu meters.

SPECTRASOUND
Spectrasound, Box 24, S-183 21 Taby 1, Sweden.

IC 40 1
Portable unit (350 x 167 x 105/42 mm) mainly intended for the Nagra recorder. Four mic/line inputs, one parallel mixer input; two line outputs (one to Nagra). EQ, phase reversal and level controls on all channels.

STUDER
Agent: FWO Bauch Ltd., 49 Theobald Street, Boreham Wood, Herts.
Tel: 953 0091

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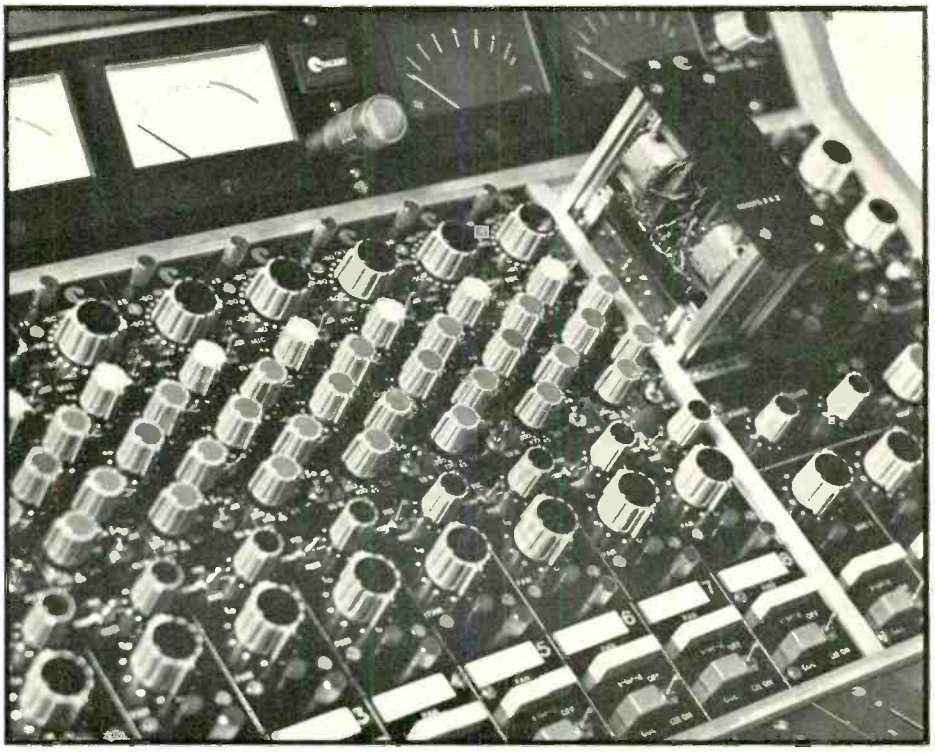
Above and adjacent: Studio and portable desks by Sait.

Below: Section of a Calrec console.



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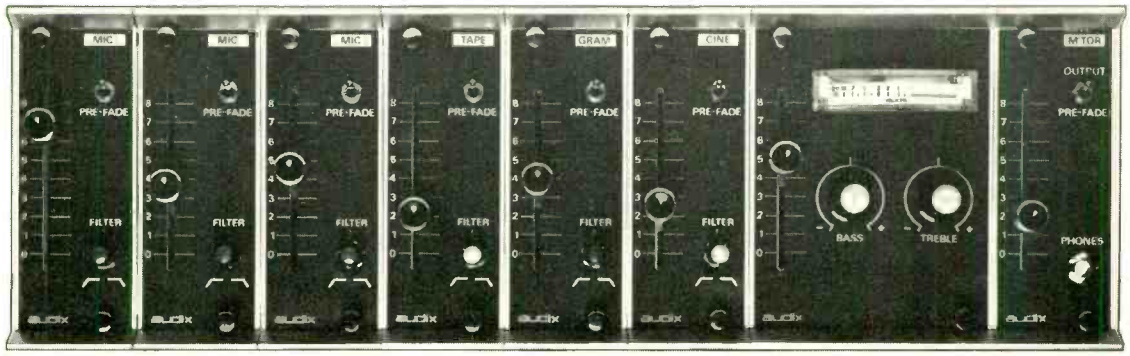
audix

SOUND SYSTEMS AND ELECTRONICS

MODULAR AUDIO MIXER



MODEL MXT-200

The MXT-200 is the latest addition to the range of modular audio mixing units available from Audix for public address, theatre, broadcast and recording studio applications. Designed for either mono or stereo working the MXT-200 incorporates high and low frequency filtering per channel as well as overall treble and bass tone controls. A pre-fade listen miniature toggle switch is fitted to all plug-in channels; the maximum number of inputs being 16. The wide choice of modules including output routing, monitoring facilities, P.P.M. or V.U. metering units can be fitted within rack mounting or free standing cabinets.

audix MANUFACTURERS OF SOUND SYSTEMS AND ELECTRONICS

AUDIX BB LIMITED
STANSTED · ESSEX
TELEPHONE: STANSTED 3132/3437 (STD 027-971)

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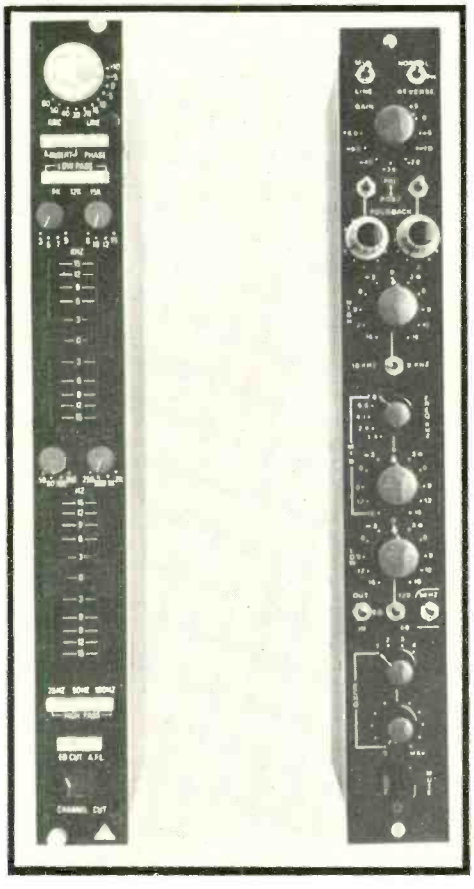
continued

089
12 input units with selector and phase switches. Sensitivity can be selected by means of a six 12 dB step switch and a potentiometer. High and low pass filters, presence and fan equalisers. Fader with magnet-catch pre-fade listening button. Two separately controllable reverberation/playback outputs, switchable before or after fader. Isolating jacks for insertion of external filters or compressors. Two sub-master channels for grouping desired inputs and two master buses selectable by push-button switches and pan potentiometers. Two master units with fader and pre-fade button. Two auxiliary channels for reverberation or playback. Two ppms and two vu-meters serve for optical control of the master and auxiliary channels as well as after tape observation.

Talk-back circuit with microphone, speaking button and three watt power amplifier. Test oscillator (20 Hz to 20 kHz) selectable at each input unit. Two 20W monitor amplifiers. Signalling and remote control switching available from each fader. Spare fuses, stereo ganging bars and marking tabs located in hand rest.

189
18 input channels equipped with separate high level input and universal input (adjustable from microphone to line level). Phase switch. Extensive filter facilities with high and low pass filters, presence, absence and equalisers. Fader with magnet-catch pre-fade-listening button. Two separately adjustable reverberation sends. Two reverberation modules each with a master control and variable bass roll-off for the send channel, stereo reverberation return channel with low cut-off filter, top equaliser and presence filter, and remote control for the EMT 140 reverberation plate. Four master bus bars and two sub-master buses, selectable by pushbutton switches and pan potentiometers. Four master units with fader and pre-fade listening button and pre-fade isolating jacks. Two cue auxiliary outputs for playback mixing of the input and sync channels and for feeding to headphones. Four ppms or vu-meters (according to choice) for control of master outputs. Three vu-meters for observation of auxiliary channels. Monitoring circuit with two rows of 11 pushbuttons for source selection, two faders M-S matrix, and, according to choice, 20 watt power amplifiers or line amplifiers. Monitoring mixer for mixing and adding echo to the four channel masters or replay channels. Remix circuit for simultaneous switching of all input units to the tape replay channels. Pre-listening circuit with built-in three watt amplifier and loudspeaker. Talkback circuit with microphone, amplifier and pushbutton set for selection of studio monitors, cue channels, or slate onto the master channels. Test oscillator 20 Hz to 20 kHz, selectable on each input unit.



Right: Triad audio control modules.

TRIAD
Trident Audio Developments Ltd, Trident House, 17 St Anne's Court, Wardour Street, London W1. Tel: 734-9901/4

'A' range consoles
Input channel module: incorporates microphone, line and machine re-mix inputs, input level being controlled by rotary attenuator variable from +10 to —60 dBm. Remix selection drops out at —15 and below, and microphone input is automatically returned. A phase-change switch is fitted. Routing module: the standard routing system allows a given channel to be assigned to any group or combination of groups. It consists of two rows of illuminated pushbuttons, each row having the same number of buttons as the console has output groups. Auxiliary module: this module, normally mounted immediately above the channel fader, gives provision for four independently controlled foldback sends, echo send to any of six routes and selection of the channel to monitor only. It also contains a stepped pan control monitor module: four independent foldback sends and six echo routes are provided. Equalisation may be applied to the monitor signal and the gain controlled by a calibrated fader. Four pushbuttons select control room speakers, and the studio playback level is controlled on this module. A sync switch is fitted, and also a monitor check button which mutes all other monitor channels. Machine select modules: these automatically select the machine outputs to either the monitor modules or to the input channels for remixing. Meters: dual scale meters which can be switched for either vu or ppm operation. In either mode, the calibration of each meter may be adjusted to suit individual requirements.

'B' range consoles
Input channel module: incorporates microphone and line inputs controlled by a rotary attenuator variable from +5 to —60 dBm. The equaliser section consists of a bass control, switchable to either 60 or 120 Hz, a mid control which may be selected to one of five frequencies, and a top control which switches to either 8 or 10 kHz. A 50 Hz high pass filter is also provided. Two independent foldback controls may be switched to either pre or post fader, and the echo send can be selected to one of four routes. Routing module: contains pushbuttons for routing the channel to any group, and a pan control which can be used to pan the signal between any odd numbered group and any even numbered group. Monitor module: Also containing four independent foldback sends and echo routing to any one of four groups, this module also contains the echo return control, speaker select pushbuttons and monitor gain potentiometer. Various auxiliary modules contain the machine return selection, monitor master control, lining up oscillator etc. Performance of B range consoles is virtually identical to the 'A' range, due to the same circuitry being used.

UHER
Agent: Bosch Ltd, P.O. Box 166, Watford, WD2 4LB, Hertfordshire.
Tel: Watford 44233

A 122
Small five channel battery mixer for mono and stereo operation. Internal level tone generator. Linear motion faders. Every stereo channel can be individually regulated or the controls mechanically ganged with each other. Price: £49.90.

VORTEXION
Vortexion Ltd, 257/263 The Broadway, Wimbledon, London SW19.
Tel: 542 2814

Range of mono and stereo mixing units for mic or gram. Ppms and bass/treble equalisation.

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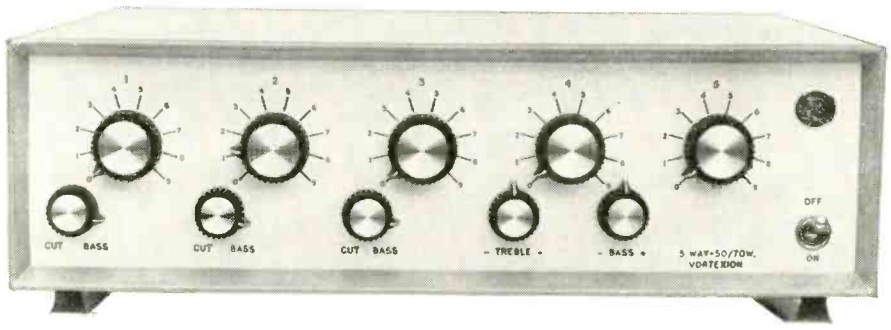
Vortexion

50/70 WATT ALL SILICON AMPLIFIER

WITH BUILT-IN 5-WAY MIXER USING F.E.T.s



THIS is a high fidelity amplifier with bass cut controls on each of the three low impedance balanced line microphone stages and a high impedance (1·5 meg.) gram stage with bass and treble controls, plus the usual line or tape input. All the input stages are protected against overload by back to back low self capacity diodes and all use F.E.T.s for low noise, low intermodulation distortion and freedom from radio breakthrough.

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Sound in the Theatre

Part two By Keith Wicks

THEATRESOUND designer Ian Gibson and sound operator/lighting designer John Becket continue their discussion with Keith Wicks. This month they talk about attitudes to the use of sound equipment in the theatre.

KW In general theatre sound is bad. Why?

IG It is bad because there is no sound equipment designed specially for theatre use. There is a fashionable craze at present to install, both for individual shows and in new theatres, studio type equipment and cinema speakers. What is required is theatre type equipment of studio quality. This equipment can be designed only by someone who has worked with many different directors. The person must have a certain amount of knowledge of electronics, experience in making up show tapes and, above all, a feeling for and an interest in drama. Such a person will know the type of sound and the effects required and will have some idea of the ergonomics of the system.

JB There are not many directors who are able to use the potential there is in sound. For example if, in the script, there is some sort of car effect required, don't just say 'car effect'; there are so many different types.

Audiences have not yet been educated to expect good sound in the theatre. It's strange that they want the highest possible quality at home, yet they don't seem to notice how bad the quality is when they go into a public place of entertainment. On the other hand, good sound surprises and impresses the audience. For example, on *Catch My Soul*, almost every night members of the audience came to talk to me about the sound and the system I used. And on *Journey's End*, the majority of the audience were talking about the effect of the sound as they left the theatre.

KW What does the sound equipment consist of in a typical theatre?

IG In established repertory theatres, the system is usually made up of components bought when funds have been allocated. Generally they use Ferrograph or Revox recorders with home-made mixers and speakers. Thus, the sound is frequently limited by the equipment. Installations in new theatres are usually custom built but using available equipment. All the new systems I have seen in recent months were not very comprehensive and very inflexible. Increasing the system's scope and flexibility does not necessarily imply spending more money. The majority of West End theatres don't have permanent sound installations. The system is brought in for each show.

KW That's a ridiculous situation, rather like a group going to a studio and having to take their own mixer and microphones with them.

JB Yes. The trouble is there is very little money in theatre budgets for sound equipment. If a building is going up and they find they are running out of money, one of the first things to suffer is the sound budget.

IG It is the same with productions. Sound is usually the last thing to be considered and one of the first things to be cut. I understand from colleagues in the US that the situation is exactly the same there.

As you know, sound takes a while to get right. If you don't go into a theatre and immediately get the effects and levels right, the director's reaction is to forget it and do without it.

JB One of the greatest problems is that the lack of standard equipment for sound in the theatre in the sense that standard equipment exists for lighting. The Ferrograph used to be the favourite tape machine in the theatre. Since the equipment is always being moved around it has to be robust, and the Ferrograph was very good in that respect. Then the Revox moved in and, at the moment, that is the favourite machine in the theatre. Ian uses a TRD.

KW Why do you prefer the TRD?

IG The mechanically-operated *VR* series has a super deck and could hardly have been improved upon had it been designed specifically for theatre use. It is the quickest deck I have come across, and it is very sensibly priced. I dislike using solenoid decks.

KW Too noisy?

IG Well, the Revox solenoid deck is fairly quiet but the TRD solenoid deck is very noisy and the manufacturers claim they can't do much about that particular model. Be that as it may, I don't like solenoid decks anyway, because there's a lack of sensitivity about them. The only way I can describe it is to say that it's like the difference between playing a piano and an organ. With a piano, the dynamics are at your fingertips. The mechanical TRD deck gives you the absolute control that is necessary for sensitive control of the sound where split-second timing is so vital.

JB Unlike the Revox, the TRD has a pause control. The way we work, the pause control is an essential feature. The cues are lined up and held with the pause control. When this is released, the cue comes straight in and there is no wow at the beginning of the item.

IG With the Revox, you press the button and the cue is in. It is not possible to inch the tape when required. Because of the remote start facility with the Revox, in many of the new installations the tape decks are being situated not only out of reach but also out of the operators line of vision, making it absolutely impossible to line up cues accurately. In a sensitive theatrical situation, this lack of precise control often stands out like a sore thumb.

Ideally the sound control position should be in the auditorium but unenclosed. In a situation like this, the solenoid noise of even a Revox is very audible. I recently did a production of *Love's Labours Lost* in which I had to use the company's own equipment. Because of the nature of the control required, I had to have the equipment in a front-of-house box. Every time the Revox operated, a click was heard all over the auditorium, thus warning the audience that a sound cue was imminent. Exactly the same situation arose in last year's production of *Rabelais* at the Round House, but this time, every sound cue came in and went out not only with an audible mechanical click but also with an electronic switching transient. Despite the fact that the manufacturers claim that their decks are suppressed, I've never yet come across a solenoid deck on to which I can hang a 100 W amplifier and be absolutely certain that no switching transient will be heard over the loudspeaker. One way to overcome this is to put the gain at zero, switch on the machine, and then bring the gain up, but it is not always possible to do this. There are many occasions when you want to come crashing in with a 100 W cue and the timing has to be spot on. One is likely to get a crescendo at the start if a fader has to be operated as well as the 'on' switch. There may not even be time to operate both controls with one pair of hands in a difficult and complex sequence of cues.

JB In the theatre, when a sound cue is put on 'standby', you can sometimes hear a click, and you usually hear the channel come open. (This of course depends on the position of the loudspeaker in relation to the audience, and it also depends on the amount of gain.) An aware theatregoer realises immediately that a sound cue can be expected, so the cue loses all its surprise or shock element. Ian has managed to get over this problem so that, no matter how complex a cue sequence may be or how loud the cue, when the TRD pause control is released the cue comes straight in without any warning from system noise. This problem is very acute when a number of speakers are being used in the auditorium and when they are situated only a few feet from the audience. In *Journey's End*, some members of the audience actually used the loudspeakers as head rests!

Another problem occurs at the end of a cue. With something like bells, the reverberation eventually 'cross fades' with tape and system noise. How do you fade out a cue so that one can convince the audience they haven't been listening to a tape?

When you are talking about sound there is a problem with terminology. Everyone calls sound effects 'effects'. It shouldn't be 'effects', it should be 'sound'. We've managed to stop the 69 Company's directors from saying 'sound effects'.

IG 'Sound design' is preferable or, to use an expression of the General Manager of the Prospect Theatre Company, 'acoustic environment design'. This is the way I prefer to think now.

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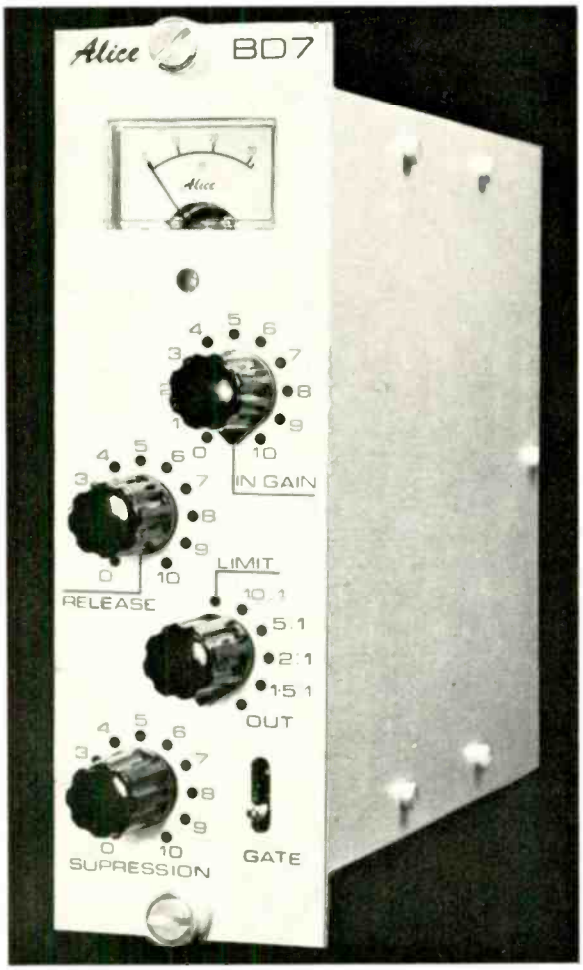

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A Synchronous Tape Recording System

By Dr J. A. Archer-Hall

MANY METHODS have been used for the recording of sound which is to be reproduced in synchronism with film, but the system described here has the advantages of great simplicity and economy. The system was designed to be used with 16mm cameras driven by synchronous motors for the live recording of sound, which is ultimately to be copied on to film edge track by a machine also driven by a synchronous motor.

The system uses ordinary non-perforated tape on a twin track (or stereo) tape recorder, which requires no mechanical modification, but only the provision of an external electrical connection to the transport motor. The recorder must be one in which tape transport is provided by an induction motor, as is the case in nearly all mains operated machines. This type of motor develops a torque, which is proportional to the square of its ac supply voltage, and also depends on its speed of rotation in a manner which is shown in the graphs

Fig. 1 is a general graph plotting T/V^2 versus S where T = torque, V = supply voltage and S = speed.

It will be seen that the torque falls to zero at a speed S_0 which is equal to that at which a synchronous motor with the same number of poles as the induction motor would run.

Fig. 2 shows how T varies with S for two different values of V. These curves become very nearly straight lines passing through a common point, for values of S approaching S_0.

Fig. 3 shows the graph of **fig. 2** in the stable region of operation simplified as straight lines. These lines are given by the equation:

$$T = AV^2s$$

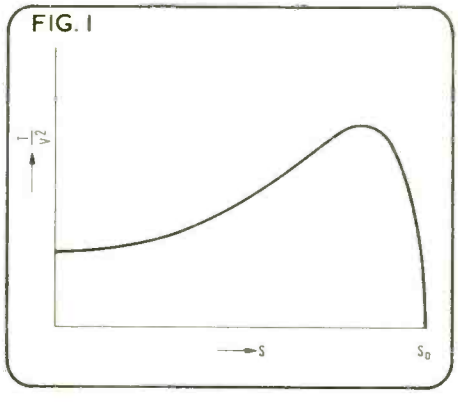
where s, the slip, is: $\left[\frac{S}{1-S_0}\right]$

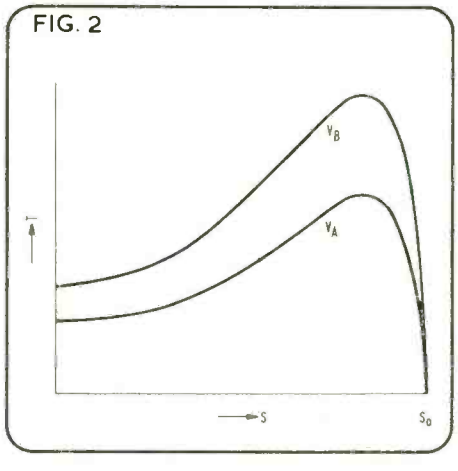
Hence when the slip is small the torque is proportional to the product of the slip and the square of the voltage.

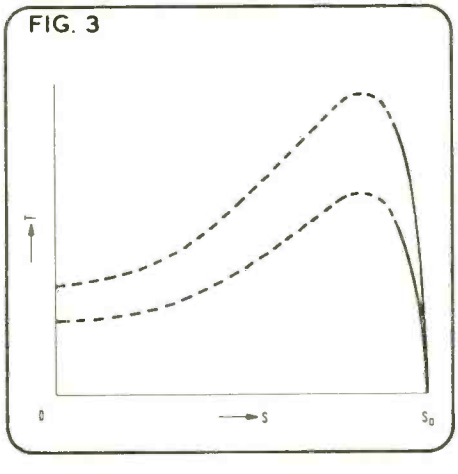
Behaviour of this form makes an induction motor suitable for tape transport as it tends to run at a very steady speed when it is supplied with an adequate ac voltage, and the mechanical loading is light.

Thus if the loading should increase slightly, or the supply voltage decrease slightly, only a very small increase in slip, that is a very small decrease in speed, will take place to provide the extra torque required, and vice versa.

Hence an induction motor is inherently stable, but nevertheless its speed can be varied in a simple control system, in which the voltage







to the motor is varied, to provide a precisely locked speed of tape replay.

Apart from the recorder, the only other apparatus required is a small power amplifier with a suitable output transformer and the means to provide a voltage somewhat less than the mains value. For this an auto-transformer is preferable, but a resistance dropper might prove satisfactory.

The tape recorder modification consists of finding the live mains lead to the transport motor, cutting this, and extending the cut ends with short lengths of insulated wire to a socket which is to be mounted at a convenient point on the recorder box or case. The recorder can be used in its original form as a non synchronous machine by inserting a dummy or shorting plug in the socket.

During recording the tape transport motor is supplied via the socket described above with a voltage rather less than the full mains value, for example 160 to 180 volts, where the mains voltage is 240 to 250. This is done so that the motor will run at a speed one or two per cent slower than its normal value, so that the speed on replay can, if necessary, take up a value slightly in excess of the recording speed for a short period (i.e. one or two seconds) until locking is achieved. This reduced value of the mains voltage will later be referred to as V_1. Recording is carried out in the usual way with the required sound signal being fed to one track of the recorder.

While this is being done, a signal of suitably low voltage at mains frequency is fed to the second track of the recorder. It is convenient to obtain this 50 Hz signal from a separate secondary winding on the auto-transformer providing the motor with the reduced voltage. A suitable secondary winding is easily made by threading one or two turns of insulated wire around the 'side leg' of the auto-transformer. The 50 Hz signal should be recorded at a fairly high level.

Thus we have:

Track one —required sound recording
Track two —50 Hz signal from the mains at a fairly high level taken at the same time as required sound.

The circuit used for recording is shown in **fig. 4** and that for replay in **fig. 5**. For synchronous replay the output of track one is fed via suitable equipment to loudspeakers, or film copying apparatus. The output of track two is fed to the small power amplifier, and the gain adjusted so that the voltage at the secondary of its output transformer is about 40 volts. This will be referred to as V_2. The voltage which is now used to drive the tape transport motor is obtained by putting the secondary of

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continued

the small amplifier output transformer in series with the lead from the auto-transformer originally used to provide V_1. Hence the supply voltage to the motor is now

$$V = V_1 + V_2$$

It should be realised at this point that if the tape is replayed at exactly the right speed V_2 will be a 50 Hz signal, that is of exactly the same frequency of the mains, hence of V_1.

To simplify the explanation of replay locking it will be assumed that the frequency of the mains remains exactly constant at all times. If for some reason the tape should begin to go slightly faster, the frequency of V_2 will change, but to begin with the change in V_2 can be regarded as a phase advance of V_2 with respect to V_1. Similarly if the tape should tend to go slower on replay than on recording, then V_2 will suffer a phase retardation with respect to V_1.

The voltage V supplying the motor must hence be regarded as a vector sum of V_1 and V_2, which can be illustrated geometrically in **fig. 6**. V is the resultant of V_1 and V_2 where ϕ is a phase angle by which V_2 is in advance of V_1. If ϕ is expressed in degrees, then the actual time lag of V_1 behind V_2 for 50 Hz mains is:

$$\frac{\phi}{360} \times \frac{1}{50} \text{ seconds}$$

The magnitude of V is given by:

$$V^2 = V_1^2 + V_2^2 + 2V_1V_2 \cos \phi$$

If the magnitudes of V_1 and V_2 are 160 volts and 40 volts respectively then: $V^2 = 160^2 + 40^2 + 2 \times 160 \times 40 \times \cos \phi$.

It may well happen that on replay of the tape the frictional loading is exactly the same as when recording took place, and if this is so then V must be able to take the values of the original motor supply namely V_1 of 160 volts. For this to occur it follows that ϕ must take up a value given by:

$$\cos \phi = -\frac{40^2}{2 \times 160 \times 40} = -0.1250$$

giving $\phi = 97^\circ 11'$ or about $97\frac{1}{4}^\circ$. For this the vector diagram will become an isosceles triangle, **fig. 7**. It will thus be seen that for ϕ less than $97\frac{1}{4}^\circ$ the value of V will exceed 160 volts for V_1 and V_2 as given, while for ϕ greater than $97\frac{1}{4}^\circ$, V will be less than 160 volts. The maximum possible value of V, for $\phi = 0$, is $160 + 40 = 200$, with V_1 and V_2 exactly in step, and the least value of V, for $\phi = 180^\circ$, is $160 - 40 = 120$ with V_1 and V_2 exactly out of step.

It is thus possible for locking to occur between the two sine (or cosine) waves which constitute V_1 and V_2, when the phase angle ϕ between them takes up a value between 0° and 180°, which will give a value of V such that the torque is just sufficient to balance the load, for the same value of motor slip s which occurred under recording conditions. In general V decreases as ϕ increases for ϕ between 0° and 180° and V increases as ϕ decreases for ϕ between 180° and 360°.

Thus if a value of ϕ should exist between 0° and 180°, and a disturbance such as a lowering of frictional load on the tape tends to cause the tape transport motor to speed up slightly ϕ thereby tends to increase, and hence a decrease in V will result. The consequent reduction in torque will cause the speed to fail until ϕ reaches a new stable equilibrium value.

Similarly if the motor loading should increase or if some tape stretch should have occurred between the time of recording and replay the value of ϕ will tend to decrease and an automatic stable increase of torque will take place. If a value of ϕ should occur on starting up the tape replay, which lies between 180° and 360°, will be unstable, and the motor will either speed up or slow down momentarily so that ϕ 'topples' through about $\pm 180^\circ$ until the stable region is reached.

It might be, though, that a system such as this would inevitably cause an oscillating speed change of the tape with consequent severe wow of the reproduced sound recording and indeed this can occur if the magnitude of V_2 is made too large. However it has been shown both by theory and experiment that suitable values for the magnitudes of V_1 and V_2 can be found for any induction motor so that stable locking can be obtained which is free from any oscillating speed changes.

Checking of correct operation of the system is easily carried out by measuring the value of V_1 the net voltage applied to the induction motor, with a good quality, high resistance ac voltmeter. If the system is functioning properly on replay this voltage V will remain very nearly constant with the recorder running freely, but if an extra load is imposed on the transport system as by lightly putting a finger on the tape supply spool the voltage V will be seen to rise. V will continue to rise as the load is increased until the limit is reached when V becomes its maximum value. Further increase in the load will cause the locking to fail and V will sweep up and down between its extreme possible values.

Alternatively the load on the tape motor may be reduced by manual 'on winding' of the take up spool when the voltage V will be seen to decrease.

A simple device, which can be fitted to the recorder to show the existence of locking, is a miniature neon lamp with its series ballast resistor, connected across the motor. If locking exists the brightness of this lamp will remain steady, but if locking is lost the lamp brightness will fluctuate. It is interesting to see that when this phase locking synchronisation system is operating correctly it is more difficult to produce wow on play back by fingering the tape spools, than it is when the recorder is playing back under its ordinary direct mains operation.

A further important point concerns the power range of the simple servo mechanism and the power output of the amplifier which provides V_2. As the motor runs at constant speed the load it presents to the electrical circuit can be treated as a resistance of R ohms say.

The power taken by the motor in general is given by:

$$W = \frac{V^2}{R} \text{ watts}$$

The maximum power Wmax $= \frac{(160+40)^2}{R} = \frac{40{,}000}{R}$ watts

continued ove

FIG. 4 CIRCUIT FOR RECORDING

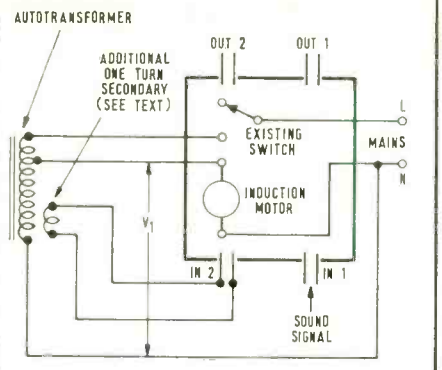

FIG. 5 CIRCUIT FOR REPLAY

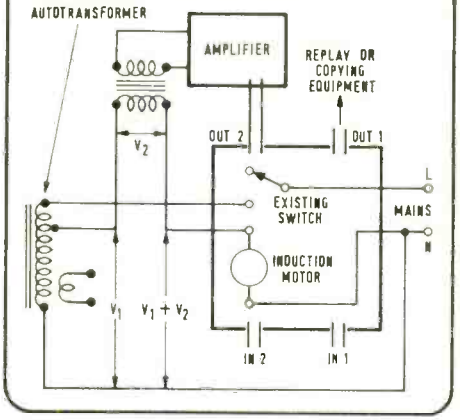

FIG. 6

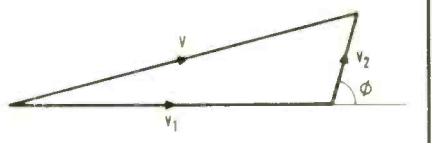

FIG. 7

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A SYNCHRONOUS TAPE RECORDING SYSTEM

continued

and the minimum power $W_{min} = \frac{(160-40)^2}{R} = \frac{14{,}400}{R}$ watts

so the power range ratio $\frac{W_{max}}{W_{min}} = \left(\frac{200}{120}\right)^2 = \left(\frac{5}{3}\right)^2 = \frac{25}{9}$

However the contribution made to the maximum power by the amplifier is:

$\frac{(V_1+V_2)\times V_2}{R} = \frac{200\times 40}{R} = \frac{8{,}000}{R}$ watts

which is only one fifth of the maximum power. This means that the amplifier output power needs to be only about one fifth of that normally required to drive the motor, and yet this is capable of controlling the power to the motor over a power range of 25:9 or nearly three times.

Lest one should think that power is being obtained for nothing, it should be pointed out that the contribution to the maximum power made by the amplifier is:

$\frac{(V_1+V_2)\times V_1}{R} = \frac{(160+40)\times 160}{R} = \frac{32{,}000}{R}$ watts

and to the minimum power:

$\frac{(V_1-V_2)\times V_1}{R} = \frac{(160-40)\times 160}{R} = \frac{19{,}200}{R}$ watts

Thus although the voltage V_2 makes a contribution to increased or reduced power requirement brought about by changing conditions, it works partly by causing more or less power to be supplied from the mains. Thus it has been shown that with the values of V_1 and V_2 already taken, that a maximum power output from the amplifier of only five watts is all that is needed to control the total power supplied to the tape motor over a range from nine watts to twenty five watts. If, as happens most of the time, the magnitude of V is required to be almost the same as V_1 the amplifier is called upon to do very little work.

So far only variation in frictional load and tape stretch have been mentioned as factors which could cause the replay time of a given passage to be different from that taken for its recording. In addition to these, there can be a variation of tape creep at the pinch roller, and also a variation in the mains voltage. Hence the value of V_1 may not be the same on replay as when recording, nevertheless the servo system described ensures that the recorded 50 Hz signal on one track locks in phase with the mains supply on replay.

It has been shown that no audible wow is produced even if a recorded tape is cut and spliced with the removal of a length corresponding to a half cycle of the recorded 50 Hz signal.

SOUND IN THE THEATRE

continued

KW Why object to 'effects'.

IG It is the general philosophy behind it. People generally think of having an effect here and there. I've seen directors 'plan' their sound. They flick through a script. 'Let's try this here —wouldn't it be nice to have that there'—et cetera. There is so often no relationship between the sounds and the play and, in cases like this, the sounds add nothing to the work. On a 69 Company production, the directors, the lighting designer, sound designer, composer and the set and costume designers usually all meet each other so that the whole production is a team effort and is thought about in total right from the word 'go'. In other words, it's a total conception. This obviously shows in performance. In fact some critics have been surprised at the integration and attention to minutiae in this company's productions.

I usually try to have tapes ready for a production two to three weeks before rehearsals finish so that errors can be corrected and the sound can be integrated into the production.

JB Sound and vision in particular must be matched—they cannot be separated.

IG In some ways the acoustic environment can be more important than the visual environment. Isn't it true that, generally, aural sensations have a more powerful effect on the senses and emotions than visual ones? To my way of thinking, a thing like a sea-gull can somehow summon up a whole atmosphere — something which it might take a hundred lanterns and a lot of scenery to produce. Sound is the only element of theatre which can create for the audience a three-dimensional situation. That is, it is the only way of surrounding them and drawing them into a play.

IG We both saw a production of *King Lear* at Nottingham which provided a glorious example of non-integration in the theatre. The long storm scene in this play was accompanied by kettle drums! I'm told that, by adopting this technique, the director was able to hear the actors. Had all the sounds been symbolic this could have been acceptable, but attempts were made at other times to have realistic 'effects'.

The battlement scene in *Hamlet* can be quite chilling and yet, in one recent production I saw, this scene became quite comical because of the sound track. Sea and/or wind had been synthesised, so obviously, probably on a *VCS 3*. As this was a rather long sequence, the recordist's patience had run out before the end of the cue, so a tape loop had been made. This gave a very amusing 'hiccough' each time the join went past the playback head.

What conclusions must we reach when an audience is expected to accept this level of work in a professional theatre? Other people were also aware of these instances I've described, so I'm sure I can't be accused of just listening to the sound cues.

JB When the 69 Company did *The Tempest*, we had the actors struggling against the storm and 20 tons of sand. I had 27 sound cues in the first 40 seconds and, at one point, it was so difficult for one of the actors to shout above the storm that we had his lines on tape.

IG The Professor of Drama at Massachusetts Institute of Technology remarked that the production 'had a soundtrack of a scope and conception one normally associates with film'. John nearly had a nervous breakdown operating on *The Tempest*.

This discussion continues next month and deals with the choice and operation of sound equipment in the theatre.

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Printers Error

★ **F. W. O. Bauch Ltd,** wish to point out that the model number featured on their advertisement which appeared on page 30 in the July 1972 issue of *Studio Sound* should have read U47 fet i. and regret any inconvenience caused.

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g	Akai AA6300	£100.75
f	Akai AA6200	£74.50
e	Alpha R200	£58.25
e	Alpha R500	£65.75
e	Alpha R150	£49.90
e	Alpha FA3000	£74.10
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e	Armstrong 525	£69.70
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e	Rotel 130	£49.95
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g	Akai M10L	£169.95
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g	Akai X2000SD	£229.50
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h	Ferrograph 704	£195.75
f	Grundig TK121	£47.80
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g	Grundig TK146	£56.90
f	Grundig TK3200	£101.15
f	Grundig TK147	£79.05
f	Grundig TK246	£112.10
e	Philips 4307	£40.15
e	Philips 4308	£46.90
e	Philips 4407	£79.50
e	Philips 4404	£65.75
	Revox prices on application	
e	Tandberg 1521	£69.40
e	Tandberg 1541	£74.80
e	Tandberg 1721	£55.35
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e	Tandberg 4041X	£143.80
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e	Tandberg 1641	£79.50
e	Tandberg 64X	£119.50
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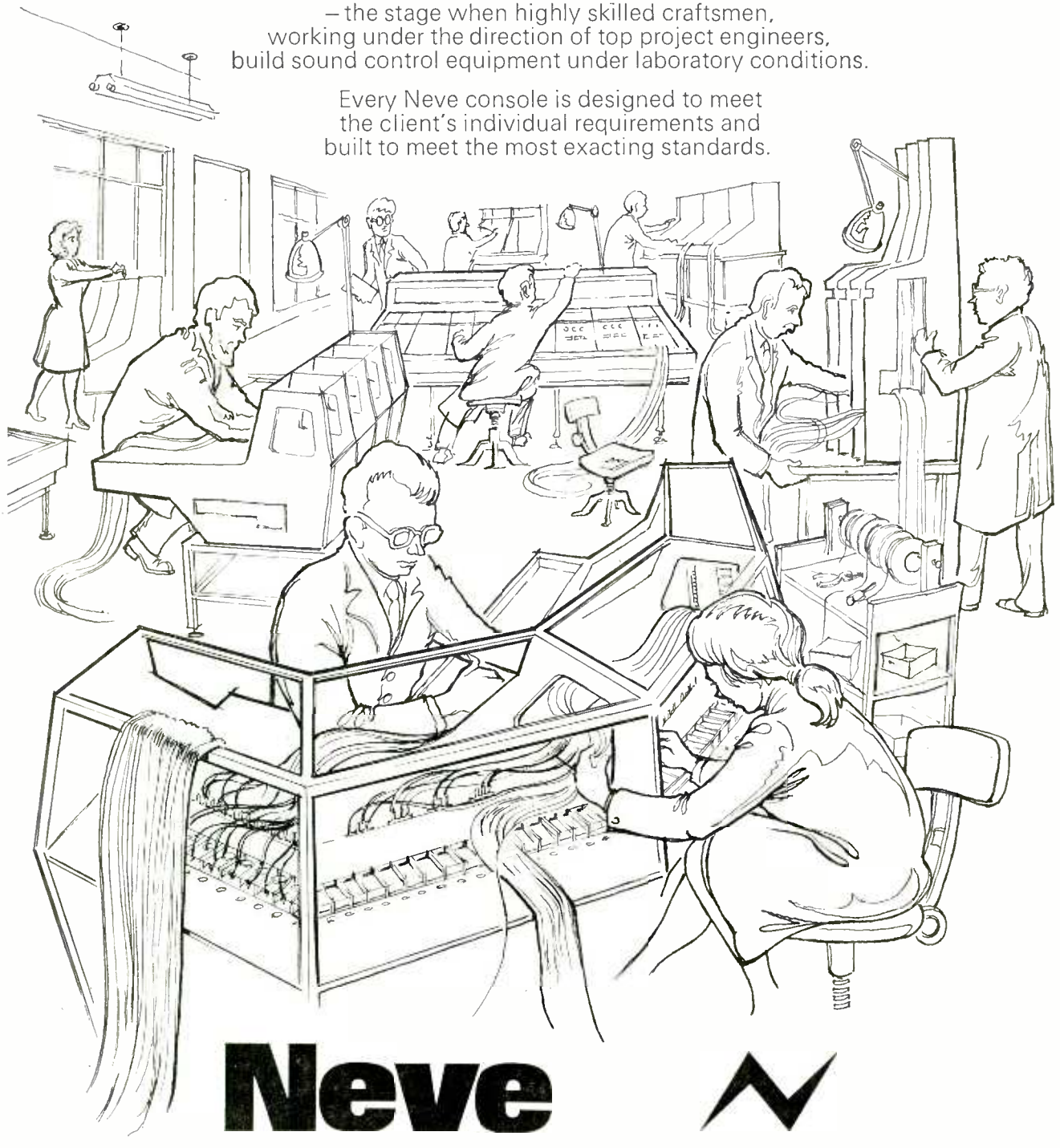

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