JUNE 1974 25p

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AND BROADCAST ENGINEERING

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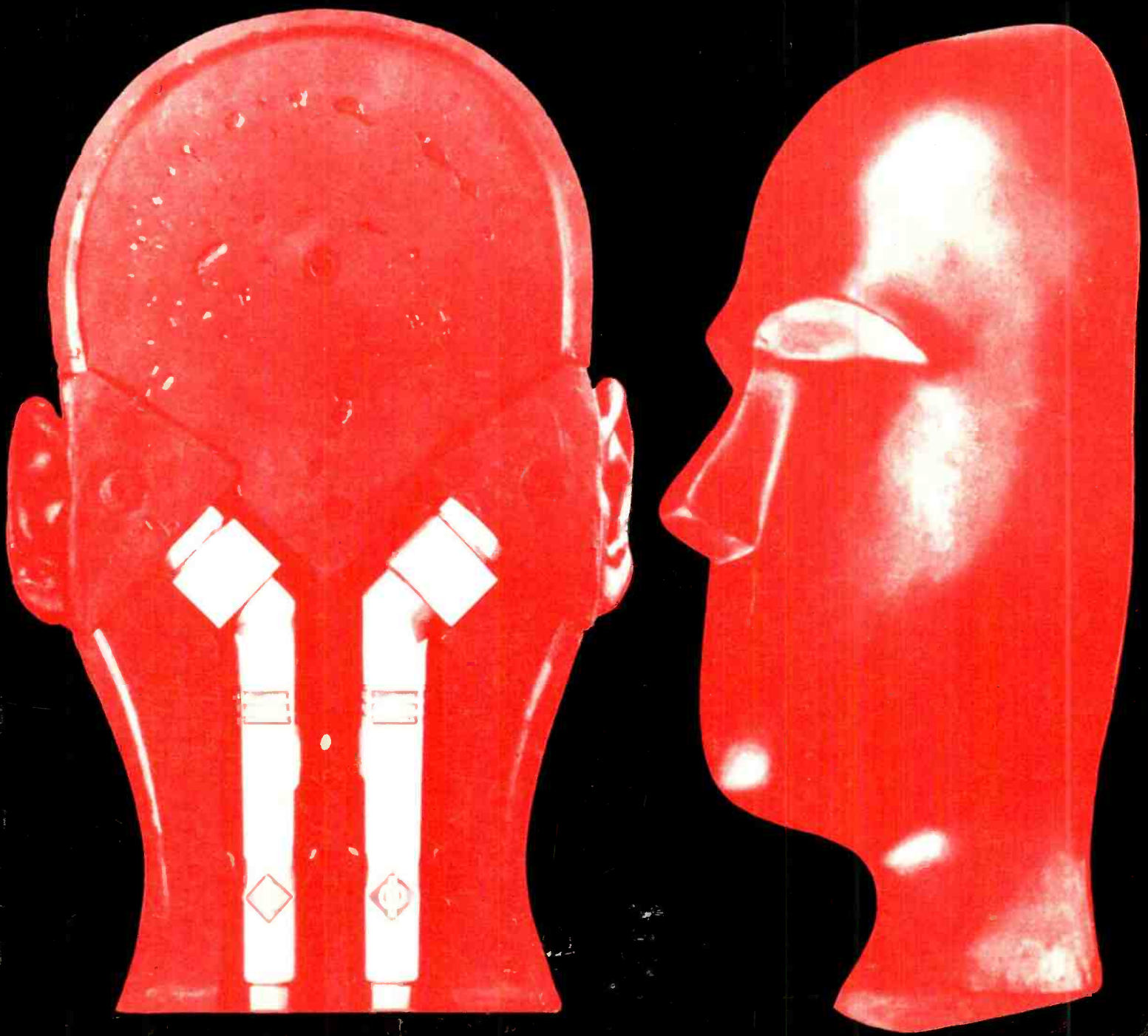
CONSTRUCTING A DIGITAL TAPE TIMER



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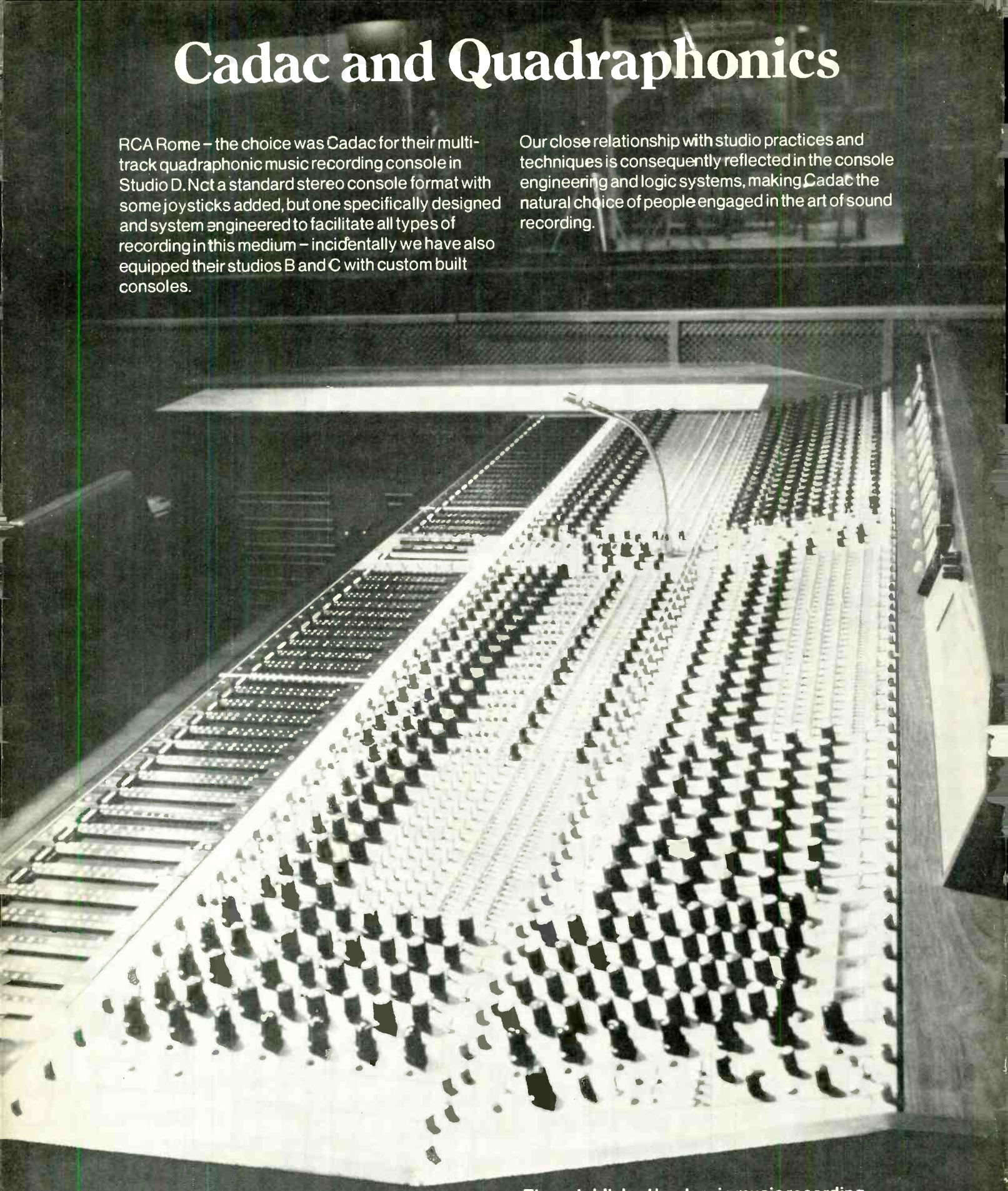

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JUNE 1974 VOLUME 16 NUMBER 6

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REVIEWS

THE ANNOUNCEMENT of a committee of inquiry into broadcasting (see News, page 22) is bound to produce interesting results. It will be surprising indeed if the commercial television companies do not, as on previous occasions, stage a few 'prestige' programmes in an attempt to fend off accusations of pandering to mass taste. In the immediate future, the BBC are just as unlikely to do anything to antagonise the present government.

One problem shared by both the IBA and the BBC is a shortage of money. In periods of economic uncertainty, advertising revenues fall. The BBC's licence revenue has not kept up with inflation. Both these factors have led to lower standards. ITV programmes have had to appeal to larger audiences to attract advertising. The BBC have in turn had to match commercial tv audiences to justify their licence revenue—an organisation that could attract only 20 per cent of viewers would not long be allowed to collect licence money on 100 per cent of receivers.

Broadcasting is inseparable from politics, and falling income increases the broadcasters' reliance on government goodwill. The commercial companies have never had much to fear from the Conservative party. The Conservatives had said they do not consider an inquiry into broadcasting justified, a position they would surely reconsider were commercial broadcasting of as high a standard as their free enterprise principles lead them to expect it should be. The Labour party have an ideological antipathy to commercial broadcasting but, where the BBC are concerned, an enduring persecution mania which will no doubt see its expression in the final composition of the Annan Committee. It was the programme *Yesterday's Men* that spawned the BBC Complaints Commission.

The BBC have said they welcome the inquiry 'because we believe in public accountability', a phrase that is not without a certain irony. But there is little reason for the BBC to be complacent. Their licence fee may be increased shortly to carry them up to 1979 but what then? They will not be allowed unlimited increases in licence fees, which are politically damaging to the government who have to introduce them.

The BBC object to carrying advertising, rightly in our view, and the only other choice is for the Corporation to be financed by a grant-in-aid as, to their cost, the external services already are. It seems likely, that the best the BBC can now expect is a fixed licence fee supplemented by a grant-in-aid. This would allow the government to pry into how the grant-in-aid was spent without having to make the grant itself excessive.

Such a solution would be the disastrous though inevitable result of the BBC's long-standing failure to accept the very public accountability they professed in welcoming the inquiry.

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

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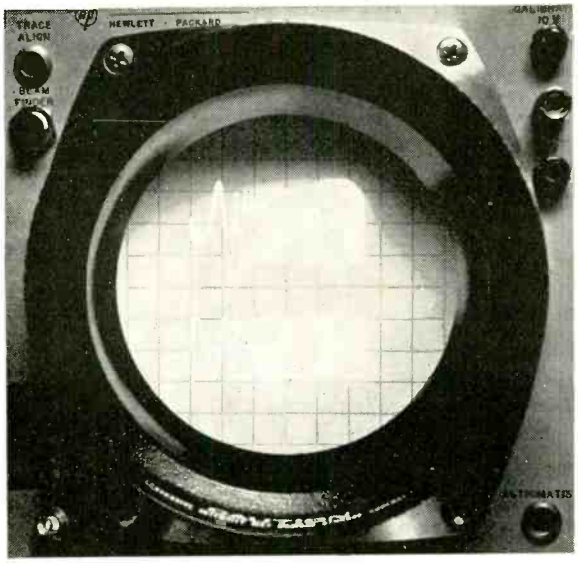

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We use a Hewlett Packard dual trace storage oscilloscope and a Hewlett Packard audio sweep generator. The lower trace on the oscilloscope provides a view of the output signal of the sweep generator. The upper trace provides a view of the same signal having been recorded and played back so you can see the performance characteristics of the tape. In the picture above, Maxell Ultra Dynamic tape is shown against the sweep generator trace. The flare at the right indicates extended high frequency response. The uniformity of the trace indicates an extremely accurate overall response.

Maxell Ultra Dynamic Tape

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1,000 Hz	+1.0
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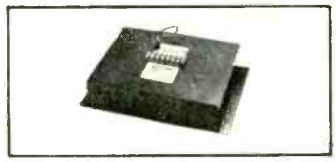

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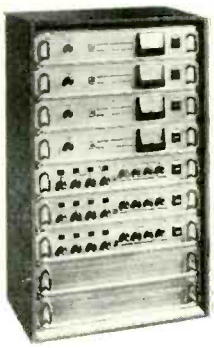

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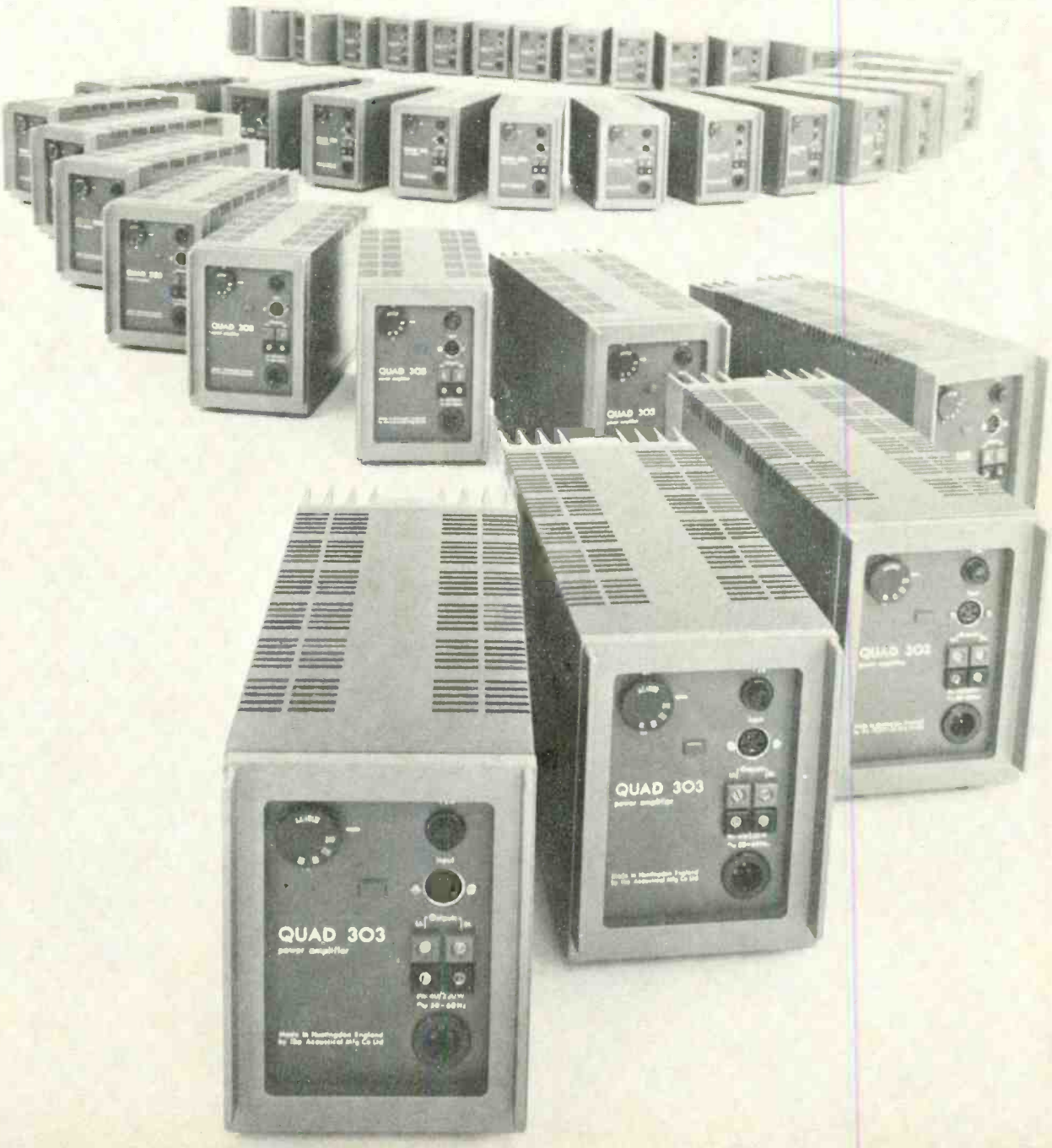

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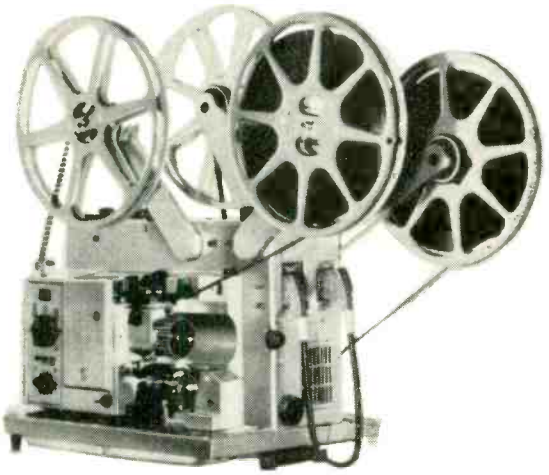

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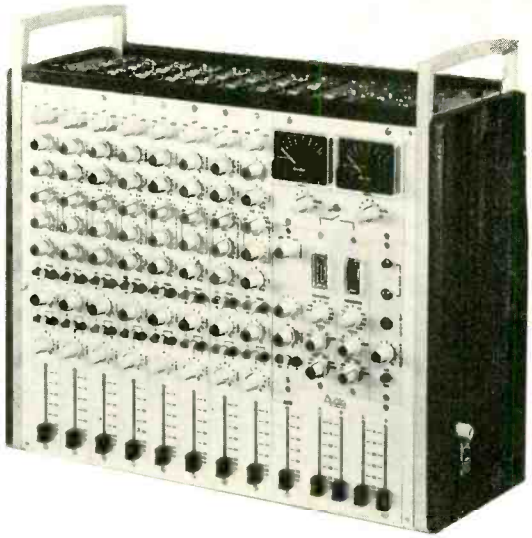

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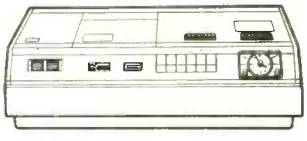

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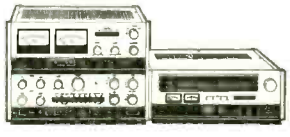

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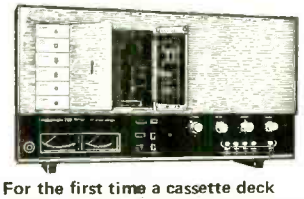

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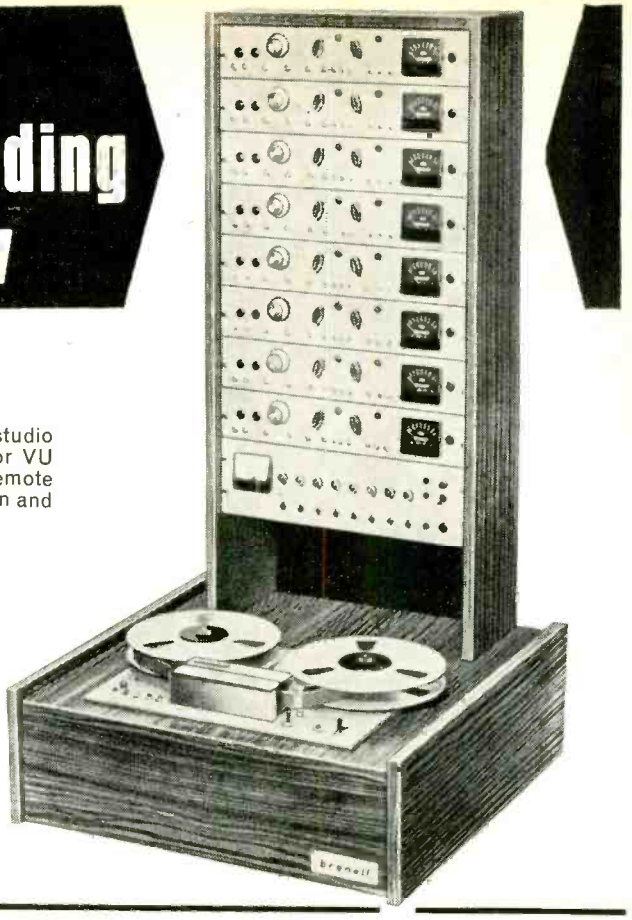

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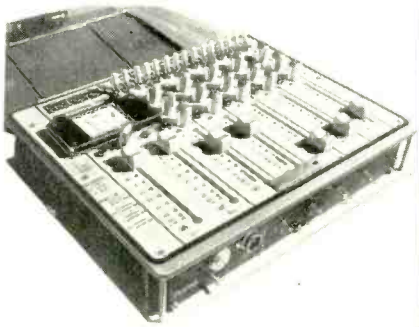

Being comprehensive, it offers not only the classical facilities of conventional big studio consoles, but many exclusive circuits: *powering for any condenser microphones* (parallel or phantom fed 12 V, phantom fed 48 V); very accurate *880 Hz tuning fork reference oscillator*; and the new *limiting circuits type SIL on all inputs and outputs*, allowing easy use of STELLAMASTER technology for extremely low noise recordings.

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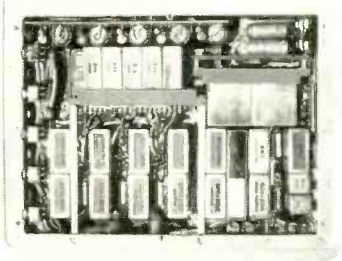

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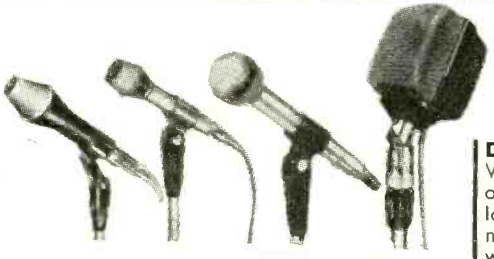

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Offers up to 140 watts from each channel, or 330 watts as a mono amplifier. Again very low distortion, and rugged construction make the D150 ideal for smaller PAs and fold back systems.

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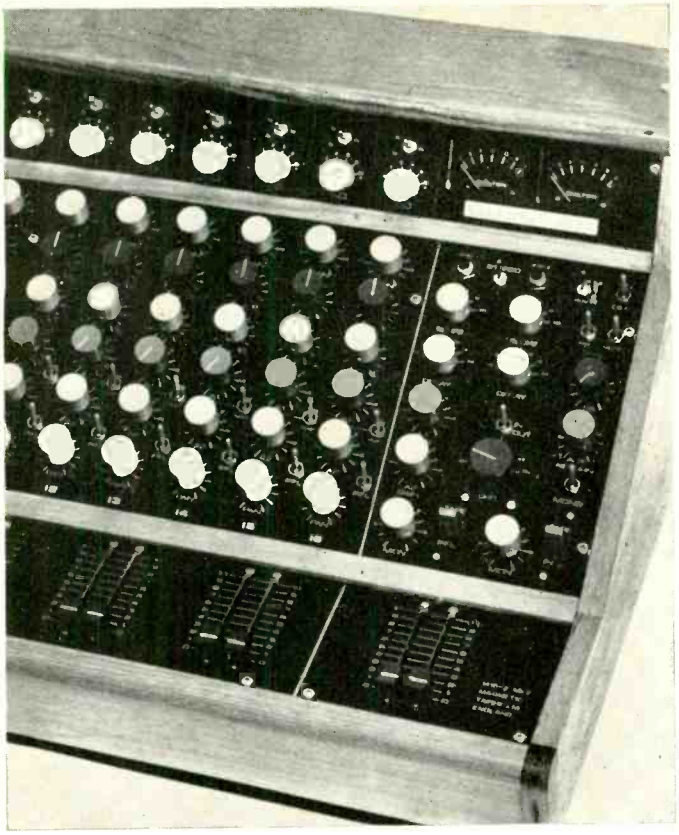
REW Audio Visual Co



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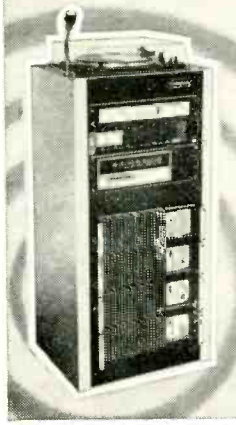

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* EXCEEDS N.A.B. STEREO RUMBLE REQUIREMENTS
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Specifications:

Drive: Outer rim with idler wheel.
Capstan: Phenolic—Ground on Motor Shaft.
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Start up time: 1/16th of Turn (to full speed of 33⅓rpm).
Line voltage: 240V (50 cycles).

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Specifications:

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* Plug-in state electronics.
* Mono or stereo.
* Accepts all size N.A.B. cartridges
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NEWS

Inquiry into broadcasting

LORD ANNAN is to be chairman of a Committee of Inquiry into broadcasting. On April 10 Mr Roy Jenkins, the Home Secretary, who has responsibility for broadcasting, announced that the terms of reference of the committee, whose members have yet to be named, would be: 'To consider the future of the broadcasting services in the United Kingdom, including the dissemination by wire of broadcast and other programmes and of television for public showing; to consider the implications for present or any recommended additional services of new techniques; and to propose what constitutional, organisational and financial arrangements and what conditions should apply to the conduct of all these services'.

There is no mention of any examination of the external services, which operate on a grant-in-aid from the Foreign and Commonwealth Office. The National Union of Journalists and the Association of Broadcasting staffs have made representations to the government to seek assurances that reported cuts of £1,500,000, on top of cuts already announced of £390,000, would not be made.

Some matters are likely to be decided by the government without the committee's help—such as changing the financing of the BBC, Independent Television and the five existing cable television stations. The BBC have been seeking an increase in the licence fee for some time now. The ITV levy will change from a tax on revenue to a tax on profits if a bill going through parliament becomes law, and some help is expected for the five cable television stations now running on a non-profitmaking basis.

The committee seems likely to sit for some time. The charters of both the IBA and the BBC, which expire in 1976, will be extended to July 1979 'to allow the committee to complete its task'. It is estimated that the committee will take about two and a half years to produce its report. The committee would not normally start its work until the autumn but it seems likely that the sittings will begin in June or July. This is because the Labour government is uncertain of its own future and does not wish the committee to disappear if there is a change of government in the next parliament.

Lord Annan was named as the head of a Committee of Inquiry into broadcasting in the previous Labour government. In May 1970, Mr John Stonehouse, then Minister of Posts and Telecommunications, announced an Inquiry but the committee was scrapped by the incoming Conservative government before the members of the committee had been named.

In September 1972 the House of Commons Select Committee on Nationalised Industries published a report calling for an inquiry into broadcasting and criticising the running of commercial broadcasting. They suggested that, if the commercial companies were to be given the fourth tv channel, they should be prepared to run unprofitable educational or social service programmes subsidised by the existing commercial channel.

In March 1973 the Conservative government published a white paper called 'Observations by the Minister of Posts and Telecommunications and the Independent Broadcasting Authority'. The white paper was seen as an answer to the Select Committee's criticisms. It rejected an inquiry into broadcasting and was seen by many as an indication that the government intended to give the IBA the fourth tv channel, probably as a commercial proposition. At the same time the white paper said the charters of the BBC and IBA would be extended to 1981, by which time technical developments would have made an impact on broadcasting.

There has been pressure from many quarters for an inquiry into broadcasting for some years now. Many politicians have sought to enact changes in television broadcasting particularly, since they regard television as increasingly usurping the functions of parliament. The Labour party have been particularly unhappy with the way broadcasting is run. In a Commons debate in October 1968 the late Richard Crossman complained that television played up the 'gladitorial aspects' of party politics, and in 1970, when Mr Anthony Wedgwood Benn, a former minister of Posts and Telecommunications, said that 'Broadcasting is really too important to be left to the broadcasters', a remark which the BBC described as the thin end of the Wedge.

Broadcasters themselves have called for an inquiry. The '76 Group', named after the year in which the licences would expire, was such a group, comprising a number of people who had resigned from London Weekend Television, including Doreen Stephens, Humphrey Burton and Kenith Trodd. Another group was the Free Communications Group, which was formed in 1968, and was particularly interested in bringing about a measure — varying according to each of its members — of workers' control, as exists in the Scandinavian countries.

In his Granada Guildhall lecture in 1972, Sir Hugh Greene, director general of the BBC from 1960 to 1969 and a governor for the two years following, said: 'A major inquiry into the future of broadcasting should begin in 1977 taking account in particular of the new technical developments which will begin to have considerable influence on broadcasting after 1985, including the opening up of further television channels which will call for allocation. It might be a useful innovation if the chairman of such a Committee of Inquiry could be appointed by the government of the day in agreement with the leader of the opposition and the leader of the Liberal party. A decision should be made as soon as possible to allocate the fourth channel to the IBA . . . The authority should take over the functions of programme planning and selling advertising time, leaving the programme companies with the sole function of producing programmes.'

Lord Annan, a Labour peer—recreation: Mediterranean travel—has been provost of University College, London since 1966. For the previous ten years he had been provost of Kings College, Cambridge. He has been described as 'a tireless commissioner, reviewer and party-goer', and he is a planner of Essex and East Anglia Universities. He was a member of the committee set up by the Monopolies Commission when the then Roy Thomson took over *Times Newspapers* in 1966. He is one of the 13 Directors of Covent Garden Opera House. From 1966 to 1970 he was a member of the Public Schools Commission, and has written a biography of one of the headmasters of Stowe School.

IBA expand

THE INDEPENDENT Broadcasting Authority's sound radio transmitters, with the opening of Independent Local Radio in the Greater Manchester area on April 2, now cover a quarter of the population of Britain.

The programmes of Piccadilly Radio Ltd, formerly Greater Manchester Independent Radio Ltd, will be carried by the Manchester transmitters on 1,151k Hz medium wave and 97 MHz vhf/fm. Initially, transmission will start at 05.00 daily (except Sundays when they will start at 06.00) and run through until 02.00 the following day.

Video

THIS AUTUMN, Link House Publications are to launch a new monthly magazine called *Video*. This is to be edited by David Kirk, along with STUDIO SOUND, and its aim will be to detail the continuing development of audio-visual media with particular emphasis on television and video tape. *Video* will be a professional journal with a controlled circulation, aimed at users of audio-visual communication techniques.

Digital delay line

OUR APOLOGIES to Knowles Electronics for two errors in a December 'New Equipment' item. The *ASD* digital delay line is manufactured by Industrial Research Products (not 'Projects') and gives up to 300 ms storage per panel. The latter figure may be increased by employing panels in tandem.

Obituary

THE DEATH occurred recently of Mr George E. Gadsdon, one of the most widely known personalities in the audio industry. Mr Gadsdon had been in the gramophone equipment industry for more than 42 years and he lately worked for Garrard as a sales manager.

Trident move

TRIDENT STUDIOS are on the move. Until recently at 17 St Ann's Court, Wardour Street, W1, they are now at 35 Brewer Street, London W1R 3FW. Telephone: 439 4177.

BASF prices

FROM MARCH 1 this year BASF increased their prices. This was mainly due to the higher cost of plastic production and the fact that oil is the main feedstock of poly-

styrene. The price of reel-to-reel *LH* tape is now ten per cent more, and other reel-to-reel tapes have been increased by five per cent. Cassettes have gone up by 6p with the exception of Chromium Dioxide (CrO_2) cassettes.

IEA goes to Birmingham

THE 1976 Instrumentation Electronics & Automation exhibition will be held at the new £20,000,000 Birmingham Conference centre. This announcement was made before the opening of the IEA's last exhibition at Olympia, IEA 74, which will be held between May 13 and 17.

On May 1, a statement said, the organisers would go to inspect the facilities at the Birmingham Conference centre and to make plans for the removal of one of the electronics industry's largest exhibitions to a new venue.

Nearly 110,000 m^3 of floor space will be available for the exhibition, which has had to move out of Olympia because that site is being redeveloped. 'By 1976,' the statement continued, 'the first year of its opening, over 90,000 hotel rooms are expected to be available in the Birmingham area, including 700 in the exhibition complex itself'. A railway station would be incorporated in the site.

The move makes it more likely that a venue could be found for a massive exhibition combining smaller exhibitions by the Association of Public Address Engineers, the Association of Professional Recording Studios, and some of the better audio exhibitions. The scheme has met with some opposition, particularly from the committee of the APRS.

Another interested party might have been the Audio Engineering Society, but the exhibition centre will not have been built in time to host the 1975 convention which is at present looking for a home. In any case, as an AES official put it, Birmingham could offer little of interest in the way of studio facilities for the workshops compared with London.

New appointment

HENRY PATTINSON has succeeded Philip Ashworth as chairman of the European Tape Industry Association (formed 1971). Mr Pattinson, who spent two years as Grundig's marketing manager before joining BASF in 1970, is manager of the Audio/Video Tapes Division of BASF (GB) Ltd.

Leevers-Rich *E200*

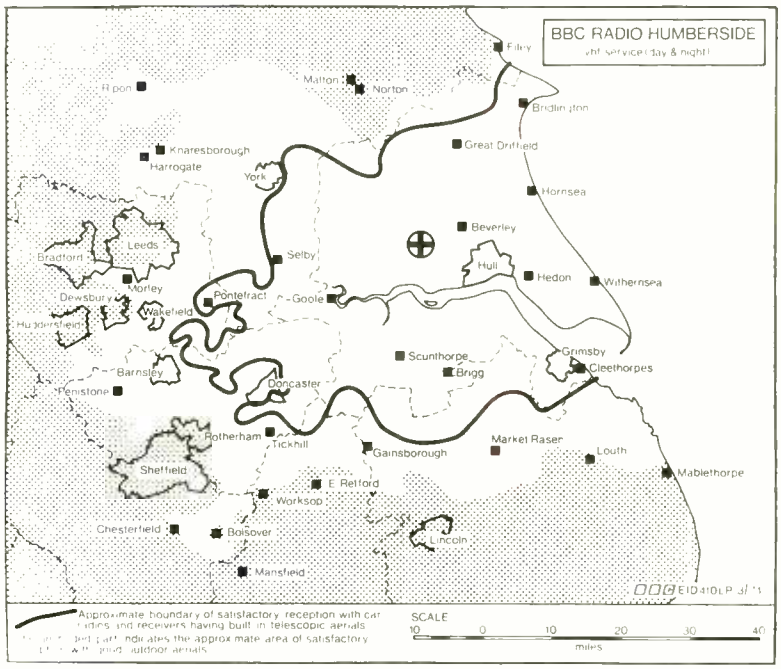
BRITISH INFORMATION Service centres at Ottawa and Canberra have received studio / broadcast tape recorders made by Leevers - Rich Equipment Ltd. The Foreign and Commonwealth Office have specified that this equipment be used and the first batch of machines for Canada was expected to be in operation in March.

The *E200* rack-mounted 6.25 mm machine, to a Central Office of Information specification (which allows 400 radio stations to receive news simultaneously) will be used to monitor news and magazine material received from England by satellite.

MM-1100

AMPEX'S 150TH *MM-1100* second generation multichannel audio/recorder has been sold to Compact Video Systems Inc in Burbank, California. The *MM-1100* is available in eight, 16 and 24 channel versions and is claimed to be the only commercial audio recorder/reproducer available which will accommodate 40 cm tape reels using 50 mm audio recording tape. Ampex delivered the first *MM-1100* in February 1973 and the machines are in service at recording studios throughout the USA and in 22 other countries, including 17 in Britain.

Vhf service **BBC Radio Humberside**
Frequency: 96·9 MHz.
Polarisation: horizontal.
Maximum erp: 4·5kW.
Mean height of transmitting aerial: 67m agl, 231m aod.
Transmitter site: High Hunsley.
National grid reference: SE 946350.



LETTERS

Spacer lengths

Dear Sir, In his entertaining (and, alas, all too true) article 'How to ruin a good recording' in your April issue, Mike Anthony states that 'the APRS . . . recommended length of spacer between items is 4s'.

Not so. The Association's recommendation in its *Information Sheet No. 1* (Procedures to be taken when tapes are submitted for transfer to master lacquers) is that 'Spaces between items should be indicated by 4s (unless otherwise specified) of white leader tape'. This indication is intended for the guidance of the engineer cutting the lacquer: the actual duration of breaks between items is of course a matter to be decided by the producer of the record and not by this Association.

Mr Anthony may be interested to know that the Executive Committee has recently updated this information sheet, a new edition of which will shortly be circulated to our members and affiliates. The paragraph in question now reads: 'Where scrolls are required on the disc a minimum of 4s (unless otherwise specified) of white spacer must be inserted at the desired position in the tape'.

Yours faithfully, Edward Masek, Secretary, Association of Professional Recording Studios, 23 Chestnut Avenue, Chorleywood, Hertfordshire.

Nagra battery recorders

Dear Sir, I have just read your reviews of the Kudelski Nagra *SN* and *4SL* in the April 1974 issue of STUDIO SOUND. It is always pleasant to read such favourable reports. It is also useful, as in general we hear only complaints. In our next model we are tempted to abandon some features that don't appear to be of much use but I don't expect this will please everyone. And it isn't always easy to put back a gadget you've just taken away.

I would like to explain. First the *SN*.

1. *SN* low speed characteristic. I have added the low speed only because it was possible to do so without any audio circuit switching; for recording, the amount of pre-emphasis is determined by the spectral composition of the sound to be recorded: so it is the same at all speeds. For playback, the use of an external postequaliser is necessary. Such a device is included in our accessories. And of course, as we are preparing a special mains-operated playback unit for *SN* tapes, full equalisation is provided.

The low speed was actually considered as an emergency facility for use if the time of recording had to be increased. Switching audio in such a small recorder would be harmful to reliability.

2. The microphone input arrangements were the only solution I have found able to accept capacitor and dynamic mics without switching and without sacrifice on signal-to-noise.

3. We now have a new automatic level control, called *ALC 2*, with manually adjustable maximum sensitivity which provides a better maximum sensitivity and also limits the noise coming back during long silences.

On the Nagra *4:*

4. We have a balanced 1.55V output/input accessory (*QSNES*) to connect model *4S* to a standard Dolby or any other 1.55V balanced insertion device.

5. Input level. I voluntarily kept the maximum sensitivity low; with the present one, when pots are at maximum, the mic noise is stronger than tape noise. Increasing this sensitivity will add nothing to recorded information but will lessen the overload capacity.

6. The modulometer speed may be increased to 1 mS. The basic circuit is faster than that. It is slowed down by a resistor to satisfy average specifications but is easily modifiable.

When we set modulometers to high speed, people under-record monitoring on very short peaks and then complain. It is actually asymmetrical, as we found that for music this was not an inconvenience. Maybe I was wrong but I try to limit the complexity a little.

7. The Nagramaster playback RC is 13.5 μs. It was chosen to give the most neutral noise coloration but of course such a choice is always subjective.

8. We have wide track heads as options but then it is not possible to have a cue track. The signal-to-noise gain is 1.6 dB.

9. Above all, I must give you information on our new recording system. Nagra *4S* recorders produced now are equipped with a new recording amplifier called *CPRS* (controlled pre-emphasis recording system). This device limits without distortion the level of high frequency signals sent to the recording head. Our general philosophy about this is the following:

Statistically the level of high frequency signals to be recorded in audio is lower than that of medium frequencies. As this is specially perceptible at the high end of the spectrum, it is worthwhile to pre-emphasise before recording high frequency signals and to de-emphasise them at playback. This technique is used universally in the audio field, as well as in tape recording, disc engraving and fm transmission. That means that, if a signal contains a level of high frequency exceeding the maximum assumed level, it will be limited; this means that one part of this signal will be lost. Fortunately this limitation is practically imperceptible to the listener, if it is well done of course. If in any case we have to lose this high frequency peak, somewhere between the musician and the listener, it is better to lose it at the beginning of the chain and pre-emphasise all stages to the same amount, so the signal-to-noise ratio will be as good as possible.

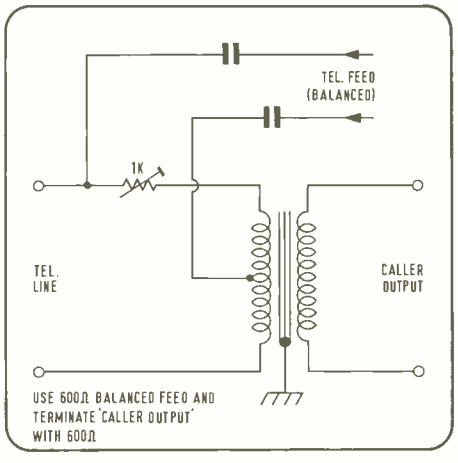
That means that it is not wise to pre-emphasise less in tape recording than in disc engraving or fm transmitting. So I go to the Nagramaster equalisation of 13.5 μs.

All Nagra *4s* whose serial number is followed by *4* and + are equipped with *CPRS*. Old ones may be connected at a nominal price.

Yours faithfully, Stefan Kudelski, CH-1033 Cheseaux-Sur-Lausanne, Suisse, Switzerland.

Telephone balancing

Dear Sir, In the January 1973 issue [*Long time arriving!*—**Ed**]. there was an interesting discussion of the problems of telephone balancing. Radio talkback programmes are popular in Australia and I would like to detail a few of the local solutions to the problems cited. As drawn below, a hybrid transformer is commonly used. The transformer is a 600 CT:600 CT line isolating type (*TA 2566* made by LM Ericcson). Apparently line impedance variations do not exist to the same degree in the local telephone system, for there are no readjustments necessary for different subscriber lines. With the basic setup drawn, rejection is about 35 dB. However this alone is insufficient, for according to the PMG, calls may vary over the considerable range of –40 VU to 0 VU. The minimum level sent to the subscriber is about –5 VU. Anything less (we tried it) causes too many 'didn't hear' comments. As you can see, the example quoted would cause unacceptable sidetone to be apparent (–40 VU caller and –5 VU feed, with 35 dB rejection, gives sidetone at the same level as the caller). To solve this dilemma, a voice-operated ducker is inserted between the amplified caller's signal and the mixer input. The time constants, or constant, of this ducker is fairly critical. Another note: we have not found it necessary to process the caller's signal (8 dB boost at 2k Hz was cited). I make no claim of originality



LETTERS

for the hybrid, incidentally, as it is widely used in Australia.
Yours faithfully, Peter M. Cox, Radio 7HT, PO Box 572F, GPO Hobart, Tasmania, Australia 7001.

DBX 187

Dear Sir, I read Angus McKenzie's field test of the DBX *187* with considerable interest. Many of his comments seem valid and appropriate but I am somewhat surprised by others.

We have frequently made multigeneration copies of encoded material without much of any degradation. We, of course, use well adjusted tape recorders with special care to adjust the bias for minimum modulation noise. Did he use the Philips *Pro 36* referred to later in the field test for the fourth generation dubbing experiment and how did he bias this machine? Why does he presume that professional tape recorders will normally have severe low frequency head waves?

Is the metronome used in the transient attack test the same electronic metronome maintained in the Burwen *2000* review? What is its waveform? Our level sense circuitry will follow transients rising at over 400 dB/ms and yield essentially perfectly complementary decoding. This is faster than the risetime of any physical object struck with a stick or hammer and propagating acoustic waves into the atmosphere. I can only presume that he used an electrically generated pulse with a very rapid risetime. If this is the case, the comment 'If this effect can be produced by a metronome, then surely transients produced in an orchestra could also well be affected and might cause trouble at a later stage in the recording process' seems unjustified.

The disc decoding errors mentioned result from subsonic components due to disc warpage. The equipment designed for disc decoding uses a five-pole low frequency cutoff filter in the level sensing circuit which eliminates this effect.

I wish Mr McKenzie had used a low modulation noise tape such as Maxell *UD* with optimum biasing technique for his listening tests. I think that he might have reached some different conclusions.

I might add that I have been reading your equipment reviews for some time. I am most impressed with the tremendous amount of detailed work which they reveal.
Yours faithfully, David Blackmer, President, DBX Inc., 286 Newton Street, Waltham, Mass 02154, USA.

Angus McKenzie comments

Both a Pro 36 *Philips with ferrite heads and a Teac* 3340 *were used for the evaluation. The Teac's electronic circuitry has had major modifications to improve performance. BASF low noise high output lp tape was used, which has very good modulation noise characteristics, and the machine was biased for an overdrop of 3 dB at 10k Hz. This figure giving the best overall performance and the electronic circuitry*

28 ▶

PATENTS

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

March 6

1350781 Computer Transmission Corporation.
Multiplexer.
1350821 Thomson-CSF.
Acousto-optical modulator systems.
1350859 Hewlett-Packard Co.
Acousto-optic apparatus.
1350907 British Broadcasting Corporation.
Combining companded signals.
1350985 Philips Electronic & Associated Industries Ltd.
Chrominance channel circuit for adjusting the ratio between the transmission factors of the channel for a picture content signal and a burst signal.
1351083 Philips Electronic & Associated Industries Ltd.
Colour television camera including a raster position corrector.
1351135 RCA Corporation.
Colour television receiver.
1351157 Singer Co.
Placement of image on matrix display.
1351211 Motorola Inc.
Colour signal recording.
1351291 Eastman Kodak Co.
Image projection apparatus.
1351296 Siemens AG.
Echo traps for telecommunication channels.
1351328 Telefonaktiebolaget L. M. Ericsson.
Level-control arrangement.
1351352 Philips Electronic & Associated Industries Ltd.
Circuit for a colour television receiver including a chrominance signal amplifier stage.

March 13

1351402/3 Sony Corporation.
Decoding systems for colour television receivers.
1351415 Matsushita Electric Industrial Co Ltd.
CRT display apparatus.
1351610 J & P Eng (Reading) Ltd.
Scanning display devices.
1351620 Eastman Kodak Co.
Telecine apparatus.
1351649 Sony Corporation.
Magnetic recording and / or reproducing apparatus.
1351703 RCA Corporation.
Video amplifiers.
1351705 Sperry Rand Corporation.
Magnetic digital recording.
1351804 Goldsmith, D. S.
Method and apparatus for picking up sounds.
1351807 Philips Electronic & Associated Industries Ltd.
Pulse generator for television for generating at least one pulse series having pulses of different duration and repetition period.
1351817 Magnavox Co.
Apparatus for modifying electrical signals.
1351820 Matsushita Electric Industrial Co Ltd.
Manufacture of magnetic assemblies.
1351835 BBC Brown Boveri & Co Ltd.
Ferrimagnetic garnets.
1351842 Rank Organisation Ltd.
Transducer assemblies.
1351844 RCA Corporation.
High voltage limiter circuit for television receivers.
1351862 Philips Electronic & Associated Industries Ltd.
Control arrangement for character display.
1351899 Pentacon Dresden, VEB.
Slide projection and sound reproduction system.
1351927 De Telecommunications, SA.
Amplifier for telecommunication signals.
1351993 Burroughs Corporation.
Disc file AGC circuit.
1352022 Magnavox Co.
Facsimile system with data compression.
1352031 Pioneer Electronic Corporation.
Recording method.
1352049 Siemens AG.
Method of and apparatus for displaying a series of measured values as a curve.
1352085 Communications Satellite Corporation.
Satellite antenna autotrack system permitting error signals to appear at the earth station.

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1352117 Ricoh, KK.
Data processing arrangements.
1352185 Zellweger Ltd.
Remote control receiver.
1352227 Licentia Patent-Verwaltungs-GmbH.
System for the transmission of binarily coded communications.
1352249 Thomson-CSF.
Combined antenna system.
1352302 Elektromechanikai Vallalat.
Linearity corrector for high frequency amplifiers.
1352406 Lignes Telegraphiques Et Telephoniques.
Antennas with adjustable aperture.
1352407 Pioneer Electronic Corporation.
Electrostatic electroacoustic transducer.
1352425 RCA Corporation.
Signal detecting and latching circuit.
1352431 Matsushita Electric Industrial Co Ltd.
Television signal transmitter.
1352509 International Computers Ltd.
Methods of making ferrite cores.
1352569 Agfa-Gevaert AG.
Recording and reproduction of sound.
1352595 Matsushita Electric Industrial Co Ltd.
Web cartridge ejection arrangements.
1352609 Nihon Denshi KK.
Display apparatus in an electron beam device.
1352670 Standard Telephones & Cables Ltd.
Antenna array.
1352772 Matsushita Electric Industrial Co Ltd.
Colour television signal reproducing system.
1352798 Western Electric Co Inc.
Diversity receivers and frequency locking circuits.

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1352854 International Computers Ltd.
Information storage arrangements.
1352855 International Computers Ltd.
Display devices.
1352859 Siemens AG.
Radio relay network systems.
1352979 Philips Electronic & Associated Industries Ltd.
Process in the manufacture of magnetic heads.
1352987 International Standard Electric Corporation.
Secondary radar system for target identification.
1353002 RCA Corporation.
Active vertical convergence circuit.
1353004 RCA Corporation.
Dynamic convergence circuits.
1353018 Xerox Corporation.
Data-transmission systems.
1353064 Eastman Kodak Co.
Converting metal images to formazan dye images.
1353083 Kawai Gakki Seisakusho, KK.
Production of metallic stringed musical instruments.
1353092 Fuji Photo Film Co Ltd.
Tape cassette.
1353098 Pioneer Electronic Corporation.
Electrostatic electroacoustic transducer.
1353125 Siemens AG.
Representation of characters.
1353128 Zellweger Ltd.
Method of and an apparatus for generating signals.
1353147 EMI Ltd.
Scanning arrangements.
1353217 International Standard Electric Corporation.
Information transmission systems.
1353253 Thomson-CSF.
Single-cable device for transmission between a television camera and its control unit.
1353290 Licentia Patent-Verwaltungs-GmbH.
Aerial arrangements.
1353367 Standard Telephones & Cables Ltd.
Four-wire telephone interconnection network.
1353373 Akademie Der Wissenschaften Der DDR.
Arrangement for the synchronous control of weather satellite picture recording apparatus.
1353396 Xerox Corporation.
Imaging system.
1353416 RCA Corporation.
Luminance to chrominance crosstalk reduction in encoded colour camera.

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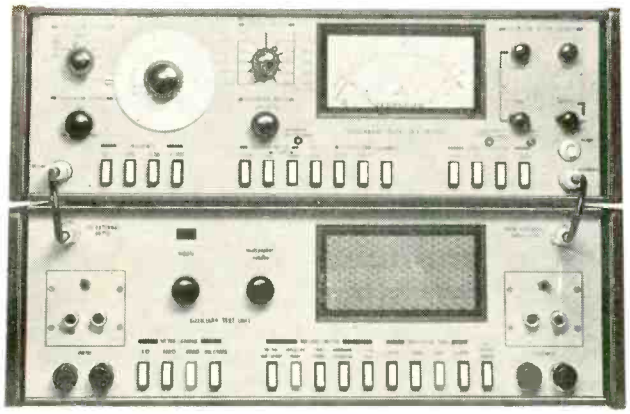
Audio Test Set



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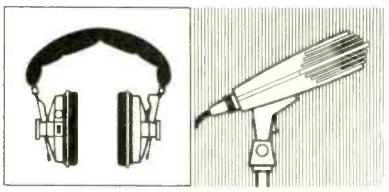

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PATENTS

Vocal pitch processing

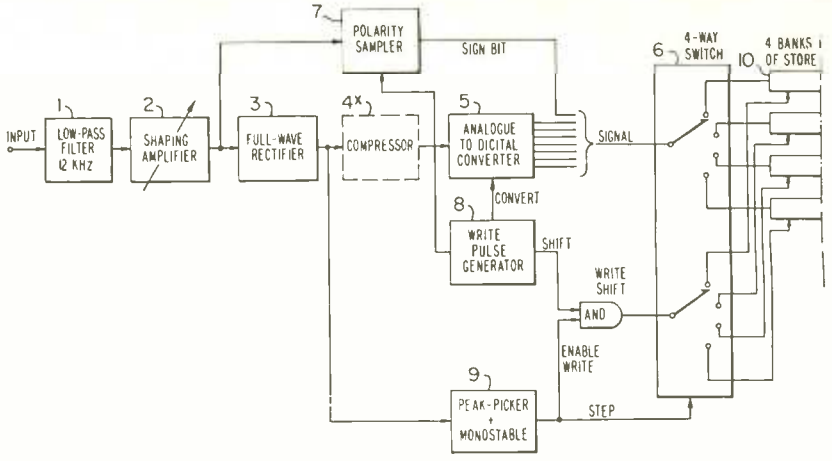
THE NRDC has a new British Patent (BP 1,321,313) which, although it is predominantly concerned with speech processing in underwater diver-communications systems, could well have much wider relevance. Indeed at the end of the patent, speech bandwidth compression/expansion for analogue and digital speech systems, bandwidth reduction and high speed tape editing are suggested as other applications.

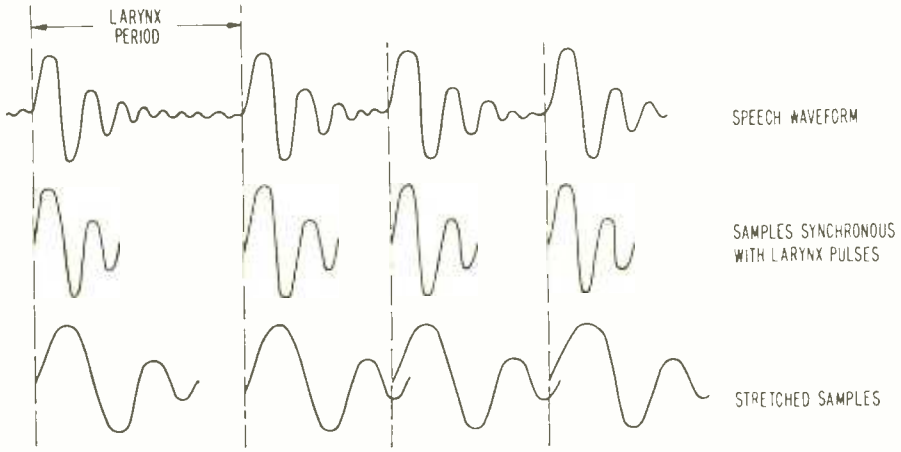
The invention stems from the problem that deep-sea divers often breathe a mixture of oxygen and helium. The increased speed of sound in this mixture causes a rise in vocal resonance frequencies and the speech becomes unintelligible. The idea is to compress the short-term spectral envelope of the diver's speech to restore intelligibility while preserving the larynx periodicity (fundamental frequency or pitch) of the diver's original speech.

The essence of the invention is to use the onset of each larynx period to cause a section of the speech to be loaded sequentially into a storage system and then removed from the store sequentially at a rate different from that at which it was loaded. The stored section length is kept constant by allowing the speech sections to overlap if necessary on removal from the store.

In practice, because larynx periodicity only occasionally exceeds 300 Hz, the duration of the stored samples is usually fixed at 2.5 ms. **Fig. 1** shows in block schematic, one basic circuit with a store in the form of four banks of which each bank is filled in turn via a four-way switch. This way there is always an empty bank available for each new larynx pulse.

In **fig. 2** the upper waveform is speech in a helium atmosphere, the middle waveform shows short samples of speech taken in synchronism with larynx excitation pulses, and the lower waveform shows short samples of the middle curve stretched and allowed to overlap if necessary.





LETTERS

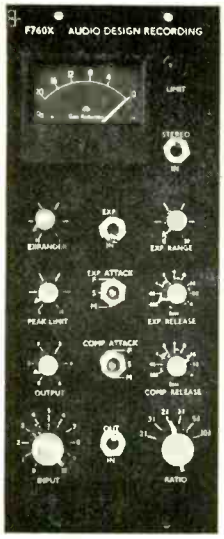
was then preset to give a flat response (NAB). A similar technique was used with the Philips.

Bass woodles to some degree are present in almost all machines available in the UK. My experience is particularly with the Philips Pro 72 *eight track and also with a Scully eight track which I recently overhauled for a client. My monitoring equipment includes loudspeaker amplifiers with distortion content below .01 per cent and the loudspeakers are Spendor* BC3s, *which are noted to have extremely low coloration and therefore show up any faults in a recording process very easily.*

The metronome used was an electronic type, and was identical to the one used for testing the Burwen. I refer you to Hugh Ford's review for the dynamic characteristics found on your unit, and in particular the symptoms produced by fast rise times in tone bursting at frequencies inside normal audible limits. A very low frequency cut off was applied to disc reproduction and very little audible difference was noted.

With respect to the modulation noise problems and your recommendation for the use of a specific type of tape, which is not readily available professionally in the UK, I can only suggest that either this tape should be made freely available here (through your importers) or alternatively specific recommendations for this type of tape should be made both in your advertisements and your instruction books. Since an acceptable alternative type of noise reduction system works satisfactorily with any reasonable type of tape, your comment would in my opinion, and with respect, suggest a shortcoming in your system. In any case the comparison between your system and the Dolby system was made on the same type of tape and with all four tracks biased and equalised identically. Please note that I commented that the recording of the choir used had some extremely difficult waveforms. In any case the results are predictable when one considers the manner in which the noise reduction is achieved. I still say, however, that the DBX system can produce some very fine results on many types of material, and surely my comment that I would use your system if it were not for alternative systems should show you that I have not ruled it out of court.

Finally, before committing my field trial to paper I confirmed my results with other users of DBX and Burwen, and it was the latter system that I finally decided to be rather poor and which failed on far more counts than your own.



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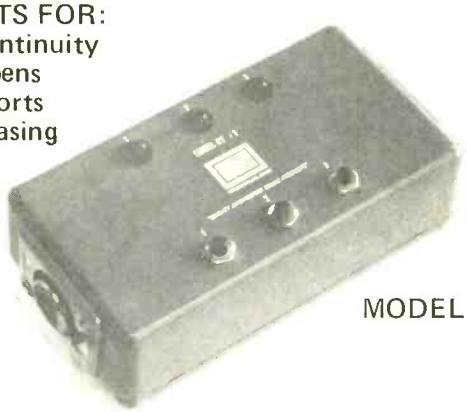

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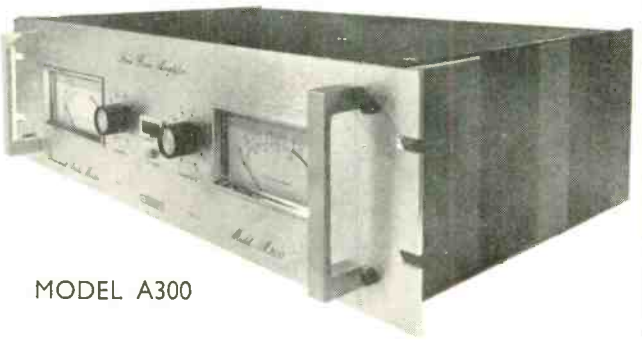

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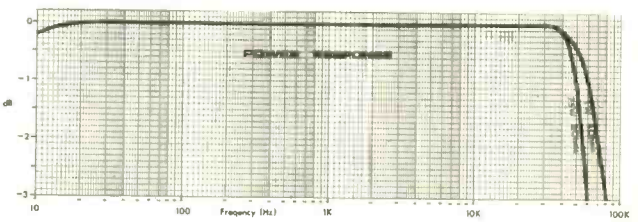

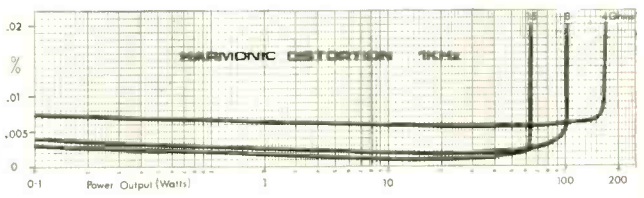

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AES 1974, A report from Copenhagen

JOHN DWYER

THERE IS one thing about Conventions such as this one in Copenhagen: they are a wonderful opportunity to find out how many people you've upset, and that must apply equally to manufacturers as well as to scribes like myself.

You find that the world has split itself into roughly two equal parts: those who think you're doing a great job and those who believe all you deserve is an appearance in the High Court followed by six months' porridge. The 'don't knows' can be counted on the fingers of a horse's hand.

The 47th AES Convention, held at the Scandinavia Hotel in Copenhagen, from March 26 to 29, was a curious affair. The number of papers presented was a record 82. This was one of the reasons the Convention was extended to four days instead of the usual three. Maybe this stretching the thing out accounted for an unusual lack of excitement in the hotel. Perhaps the hotel itself accounted for it, as the architecture was such that there was no need to reach a common point before going to the exhibition. In the previous two Conventions one had had to reach the lobby of the Munich Hotel or the lobby of De Doelen before going into a lecture hall. This year most of the converging conventionites were staying in the Scandinavia Hotel, where the Convention was being held, and they usually went straight to the third (exhibition and lecture) floor by lift.

Because of the number of papers, some way had to be found to avoid last year's difficulties, when lectures over-ran and caused some confusion. The method chosen to avoid this was efficient to the point of harassment. A minute or so before the lecture was supposed to end a bell would ring once, and a minute later speakers in the lecture hall would start playing loudish musak. The irony of an audio lecturer being cut off in mid-sentence in such a way, together with the ruthlessness of the way in which it was done, was almost sinister at times and, I thought, a little tasteless.

I think that the number of lectures was, in one way, self-defeating. At any one time there were three lectures you could go to. We were all spoilt for choice. A surfeit of goodies. That isn't so bad, but it crossed my mind that a condition for giving a lecture should be that a preprint is available. I discussed this with an AES official, though, who told me it was difficult enough to get people to present papers as it was.

The facilities laid on were first class. The main reason the Convention went on for four days was that the workshops were given a day to themselves instead of being held in the evenings; visits were arranged to Denmark Radio, the Technical University, the State Hearing Rehabilitation, the Acoustics Laboratory at Lund in Sweden, 'A visit to some famous Danish organs,' Dr Jordan's acoustical laboratory, the B & K factory, the Music History museum of Copenhagen, Metronome studios in Copenhagen, the Danish Film School (a training centre for film producers, no less), the Ortofon factory, and the Bang & Olufsen factory.

In the Hotel Scandinavia itself there was a room set aside for an exhibition of historic audio equipment. Denmark has had a long association with scientific achievement, and this year the AES made available preprints of ancient papers by Valdmar Poulsen, written after experiments made at the beginning of the century, and by Heegaard, Lauridsen and Schlegel over 50 years later. The exhibition was in honour of P. O. Pedersen, who described, incredible as it may seem, the theory of the Class C amplifier, studied the propagation of radio waves, and started the acoustical laboratory at the Academy of Technical Sciences; of Poulsen, the 'Danish Edison' who first patented magnetic recording in 1898; and of Holger Lauridson, who died aged only 37. He invented the coincident microphone and developed the A-B into M-S stereophony, enabling stereo discs to be compatible with mono. Some of his later work prepared the way for matrix quadraphony, though he died in 1957. The exhibits included a Poulsen Telegraphon, a World War Two wire recorder, and a 1915 Magnavox speaker invented by one of Poulsen's mechanics, P. L. Jensen.

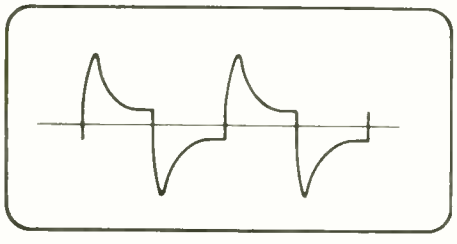
Conventions like this are social occasions. As I reported when I went to my first AES convention in Munich, being in a lounge or bar where four, five or more people, all from different countries, were engaged in earnest though faltering conversation with one another, left a deep impression. This seems to me to be the most valuable part of the whole exercise and not just from the point of view that it benefits audio engineering. The Mayor of Copenhagen invited members of the Convention to a reception at Copenhagen city hall. We trooped into a vast chamber, where the Convention chairman, Mr Madsen, introduced the Mayor herself, and someone remarked how instantly they took to her. She was charming, and engagingly frank—'Copenhagen is not the biggest city in the world, or the richest city in the world. I don't think it's the most beautiful city in the world, but it's a place for human beings. It has a human scale.'

There were, as I have said, so many papers presented this year that I couldn't possibly describe them all, or even the majority of them. Mr Erik Madsen, the Convention chairman, made a number of suggestions as to the most

The Scandinavia Hotel

significant contributions, and I will content myself with describing these.

The most important was given by a Scottish engineer, Mr A. M. Pettigrew. He proposed a new method of magnetic tape recording which would give 50 dB signal-to-noise ratio, and better high frequency response. The disadvantages are that the method is against every standard, and is incompatible with the more usual methods of putting the signal on to the tape. The basis of the system is to add a fixed active zone to the sum of the bias and the signal, and to distort the bias waveform so that it becomes a spike of bias superimposed on the active zone, with a decay rate which determines the distortion at low frequencies.



It has a fast rising edge and a slow falling edge to compensate for the opposite effect in the recording process. The magnetisation in the tape is in the form of skewed semi-circular magnets rather than a series of bar magnets. The method has been patented.

Hugh Ford gave a fascinating lecture on the admissibility of tape recordings as evidence. He replayed some examples of tape recordings which had been made by surreptitious recordings of conversations. I don't think any of us in the audience had expected them to be quite as bad as they were. One conversation sounded like it had been mixed with a recording of the interior of an operating wind-tunnel, and another, made in a briefcase, had a number of clicks on it, presumably the result of movement of the briefcase, which could have concealed any number of edits. Nevertheless these had been accepted in evidence.

Mr Ford had photographs of some of the tapes, one showing a clear edit mark, another showing tape damage which looked as if the tape had crinkled from heating. This tape, if I remember my law reports aright, sent two police detectives to gaol. Mr Ford's conclusion was that he didn't think it was safe to permit tape recordings to be used, as there were too many pitfalls and there was too much room for doubt: 'I believe it wrong to accept this kind of recording in court. The situation is we do: the situation is we don't accept copies.'

I doubt if, at the end of the lecture, there was anyone in the room who disagreed with him, though I wonder if 'known' criminals should be allowed to go free when there is evidence available which could convict them. Perhaps they should go free—a police force or security organisation might not take too much trouble to infringe the privacy of individuals by recording their private conversations if they know that a court will not take the slightest notice of what they might record.

It is a pity that this topical and fascinating insight into the methods of determining the genuineness of tape recordings had to be so short. Although Hugh's lecture was the last of the afternoon, the funereal bell and its clangorous aftermath stopped him in mid-sentence. The chairman announced that questions could be asked after the music had stopped, but by that time, four and a half minutes later, the spell, if I can call it that, had been broken, and some of the audience had decided to move on.

Dr Vilhelm Jordan, the designer of the acoustics of the Sydney Opera House, presented a paper on concert hall criterion. He says that the hall should be divided into two areas—the source area and the audience area. The source area may include areas around the stage as well as the stage itself and there may be two source areas, the stage and the pit, in which case the rest of the hall will be the audience space. Dr Jordan's inversion index is a measure of the acoustic suitability of a location, and is better if it rises above unity. He hopes the index will be adopted by other workers in this field. The inversion index is defined in three ways:

II = Auditorium rise time/Stage rise time
= Stage steepness/Auditorium steepness
= Auditorium EDT/Stage EDT

where the rise time is the pulse length in ms which produces a level of 3 dB below the stationary level; steepness is the slope (dB/ms) of the tangent to the building-up curve of a pulse—it may be measured with long pulses or integrated short pulses—measured at 5 dB below maximum level; and EDT (early decay time) is the slope of the first 10 dB of decay measured from the process of a backwards integrated short pulse. Dr Jordan gave examples of the II in various locations. The stage/audience index of the Sydney Opera House major hall was 1.25 with baffles. The Orchestra/balcony measurement for the New York State Theatre was 1.17 for a rise time of 0.19s. The New Metropolitan Opera House has a rise time of 0.14s and an II of 0.85.

There were a number of papers on loudspeaker measurements. James Moir presented a paper on the measurement of speaker efficiency, Ragnar Lian analysed linear and non-linear time delay distortion in hi-fi speakers, Henrik Staffeldt of the Danish academy tried to relate subjective and objective data for loudspeakers—an unenviable task, one would have thought, and he concluded that there was an uncertainty of six per cent between individual judgements in listening tests—and Jan Hladky described the application of holography to the analysis of the vibrations in loudspeaker diaphragms, particularly those vibrations which occur after the diaphragm has ceased to act as a piston. Possibly the most important paper concerning loudspeakers, though, was that presented by Tomas Salava: Performance Criteria for Sound Sources in Rooms. He said that, while the properties of sound sources could be most accurately described for free field conditions, these were not the conditions normally encountered, and some method had to be devised of relating the free-field parameters to those obtained in listening rooms. The necessary data for deriving a simplified mathematical model of the real situation were the on-axis pressure response, at least one other response at 30° or 45° off-axis, and the radiated power or mean spherical response for the range from 100 to 200 Hz.

Siegfried Dinsel of the Munich Institute für Rundfunktechnik, reviewed two methods of stereophonic transmission for television in his

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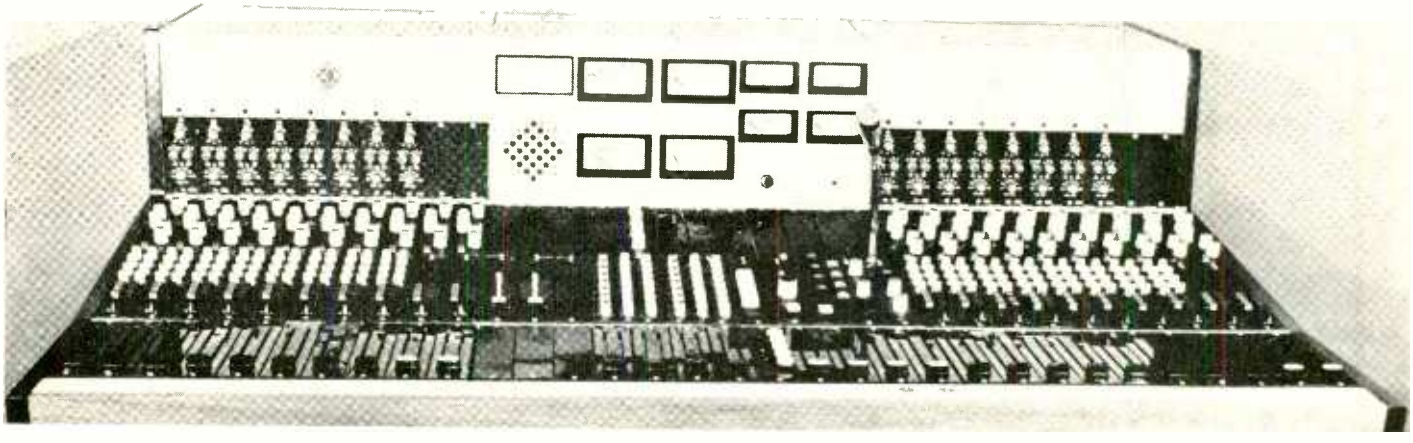
The Neumann console



paper 'Additional Sound Channels and Stereophonic Transmission in Television'. The two methods were those discussed in the EBU subgroup 'Additional Sound channels in Television': the fm/fm multiplex system, developed in Sweden and Japan; and the double carrier system, developed by the IRT Munich. The second sound of the fm/fm system is frequently modulated on a 33k Hz subcarrier similar to the pilot system. The double carrier method modulates the second sound channel on a second sound carrier at 5.75M Hz.

Laboratory tests and measurements, said Herr Dinsel, had shown that the second method had better transmission characteristics. Both sound channels had much the same quality. The additional costs at transmitter and receiver were small and involved only known and readily available components. With two fm/fm multiplex modulated sound carriers four different sound channels could be transmitted, for possible use in quadraphony, though two of the channels had lower quality.

From the point of view of those working in studios two of the most relevant papers were those which were presented on Tuesday morning. Unfortunately I couldn't be at either of them but I understand they aroused some heated discussion.

The first was by John Woram, director of the Institute of Audio Research in New York, and was called 'Preparing for a Career in the recording studio'. Mr Woram considered that there should be an alternative to university education, which I would have thought was something of an understatement. 'Many employers readily admit that they do not seek job applicants with a degree, since these applicants often expect immediate job assignments at a level commensurate with their formal education . . . Some employers contend that the only relevant education is on-the-job training, and that the man with the degree is overqualified.' Others, he said, thought that a formal training was a good thing though they were not sure whether it should be a little electronics with a music education or the other way round. The Tonmeister concept, described by John Borwick in STUDIO SOUND in February last year, was an excellent idea, though there was danger that 'despite a superb theoretical background he may have difficulty if he does not possess those native abilities upon which success is built. His position may be analogous to the singer with an advanced degree, with honours, and a terrible voice.'

As an alternative to the Tonmeister course, he said, the Institute of Audio research ran a shorter course of ten weeks, a total of 60 hours. Little or no time was spent in practical work with recording equipment, which would have to take place on the job. In any case, proficiency on the console would only come after many hours of sessions.

The course was called Studio Technology and Practice, and was divided into five sections: recording fundamentals; magnetic tape recording; studio consoles; signal processing equipment and stereo disc recording. For those wishing to know more about the last section, a separate eight-week course was offered.

The qualifications needed for the course were minimal—in American terms a high school diploma was all that was required, and I suppose our equivalent would be a couple of relevant O levels. Extra tutoring would be available for those who were a bit shaky on maths and physics, and the organisers were thinking about starting a short pre-entry course. The Institute emphasised that students should not expect the diploma to exempt them from starting at the bottom, but the jobs they'd be given when they did have the diploma would me more comprehensible once the theory behind them had been mastered.

For refresher courses the Institute was building a multitrack studio with a Neve console and 'related equipment'.

For once I don't have to say 'Why haven't we . . .?', for the course organised by the APRS in the summer has already, at the time of writing, attracted 100 applicants, and some may have to be turned away.

Erik Madsen, convention chairman, addresses the inaugural session

Quadraphonic interest

There were 54 exhibitors this year, compared with 34 in 1973. One comment is equally applicable to the lectures and to the exhibition, which is that there was a noticeable lack of interest in things quadraphonic. Sansui and JVC both had demonstration rooms, but there were few papers on quadraphonic as such. Most of these presented by manufacturers who wished to introduce a new product, such as Claus Mogensen of B & O, who introduced a new four channel cartridge, or Inoue and Takahashi, who introduced a new *CD4* monolithic ic. Senor F. J. Sanchez Gonzalez seemed to have no axe to grind, and he introduced a method of describing various matrix systems in a mathematical form with particular reference to the preservation of the relative levels of instruments replayed by matrix systems. EMI's E. G. Trendell presented a paper on the choice of a matrix system for quad reproduction from discs, and came to the conclusion, as if he had any choice, that SQ was the best. He did so on the following grounds: there is no dilution of the right front signal into the left front channels and vice versa; the disc can be replayed in mono provided the producer doesn't put anything at the centre back position (!); the phase relationship between front and derived-rear channels tends to subjectively improve the separation, so producing a spacious all-round sound but with a vague location of separate sources—the subjective effect is dependent partly on listening room conditions; and there is no frequency dependent gain variation to give accentuated and pseudo-directional clues.

In conjunction with **Ortofon, B & K** have produced a pink noise test record, the *QR 2011*, for which the specification says the record covers a range from 5 Hz to 45k Hz. The record has 15 bands, the first of which covers the left-hand channel in a log sweep from 20 Hz to 45k Hz at a level of –10 dB. The last band is a mono signal which offers a logarithmic sweep from five to 20 Hz at –20 dB. As I say this is a joint project between Ortofon and B & K but I understand that the project was initiated by Ortofon. Their brochure on electro-acoustic measurements was one of the most beautifully produced brochures I've ever seen.

Gotham: the original *Delta T* was introduced at the Cologne AES Convention. The new version is a second generation version. To give some idea of the improvements in the digital delay, the *102* model has a total noise and harmonic distortion figure of about 0.3 per cent, including quantisation noise, at a level of –34 dB. Its predecessor was the *101*, for which Gotham didn't give an equivalent specification but I understand that it measured something like seven per cent. Another thing about Gotham is that their prices have either

The B & K stand

stayed the same or come down. The *102* is cheaper than the *101*, and I understand that this is because Gotham have 'taken advantage of new technology'.

The **NTP** stand featured their range of led meters, including the *177*, which has a 148 mm scale and contains 69 leds. Also on the stand was the Lyrec multitrack tape machine. This has direct capstan drive from a brushless dc motor, controlled by a 1000 division strobe disc. The machine was designed for 50 mm tape and is now available for 25 mm tape. Lyrec supply eight, 16, 24 or 32 track recorders. The meters were described to me as 'expensive but reliable'.

Leonhard were showing a studio audio frequency test set, the *240*, which has an ac voltmeter that measures from microvolts to volts, a noise voltage filter to ccir standards, a band pass of 30 Hz to 20k Hz, a harmonic distortion, and an af signal generator. This Zurich firm produces a lot more on this piece of gear but room forbids me to go into too much detail. It's like a Ferrograph test set, only much more so.

Schoeps: I'm told that the French radio station ORTF believe in stereo broadcasting to such an extent that they produce what they regard as the best stereo signal obtainable and broadcast it—and to hell, as one informed observer put it, with compatibility. Schoeps were showing the microphone they had developed with ORTF for such broadcasting, the *75*, along with many other Schoeps microphones.

AKG were showing a perspex version of their *BX20* spring—a demonstration model to show the inside of the thing. They also showed their first move into the mixer field, a new portable mixer which sells for at least £700, I'm told, but is very rugged.

Roger Arnhoff Studio are a Norwegian firm who import MCI, Scully, Allen & Heath and H & H amplifiers. They were on stand ten and, among other things, showed the small Allen & Heath mixer.

Italtel showed an eight track desk which was interesting for the Tuchel connectors used for patching. I understand that this kind of patching is not usual in Scandinavia, though Phonogram in London have standardised on it. The desk on show was a *24/8* for Fonorama in Milan. Also on show was the Italtel graphic equaliser. To me it looked less graphic than some I have seen, having six rows of push-buttons, but still . . .

On the **EMT** stand was a cartridge which has I understand caused a great deal of interest, largely because it is extremely flat, without any resonances in the treble end. The type is the *TSD15*.

Schlumberger showed a mobile tape recorder which a Swede told me he regarded as too fiddly for a northern climate, many in such circumstances use a Ferrograph. The reason for his remark was that in a cold climate you're likely to be wearing thick gloves, and I think you can see what he's getting at. The machine is intended for use in reporting for radio, tv and film work.

CCA of Greece market everything from ten-channel consoles (though these seemed to me to be a little inflexible) to cartridge players and transmitter equipment. Their stand had a number of disc players and cartridge machines as well as two types of audio console, *10/2* and a *6/2*. The disc players can run to full speed in $\frac{1}{16}$th of a turn at any of the three usual speeds (33, 45 and 78).

Trident Audio Developments took up a whole wall in their part of the exhibition. Barry Porter told me they had intended to show a 3M long desk but it had been shipped to South Africa—it was a *32/24* quad model. Instead they had rigged up a demonstration dummy. They had one desk for real, though, one of four which is going to South America. Barry said they had had a good many enquiries and two definite orders.

RCL produced and explained such a wealth of gear related to film sound I left the stand a little dizzy. They're a German firm who operate from Hamburg. Among the stuff I was shown was a variable tape delay and a very interesting and very cheap spring echo device. I was told, with marvellous candour, that this was not as good as an EMT but was quite good enough to justify its price. There was also a number of audio modules which could be used in film sound synchronisation. The manner in which the equipment was shown to me indicated that this firm was very competent. Particularly interesting was a pilot tone memory which kept a film running at a constant speed when the pilot tone had disappeared.

The spring, incidentally, is made by Hammond to RCL's specification: 'They make it only for us'.

Ampex showed their new AG *440C*, which is available in the usual formats up to 12.5 mm. Ampex say this 'incorporates significant performance improvements' and is more convenient. There is a motion-sensing feature which eliminates 'the problem of switching from fast forward-rewind to play'. Ampex say there is a better signal-to-noise ratio, better controls, tape guidance, tape editing and serviceability. Also on the stand was an Ampex *MM1100*, and the *VPR7903* video tape recorder, which was demonstrated with the Ampex 'time code system' for synchronising audio and video recording. The video recorder is a helical scan recorder which Ampex say is built to broadcast standard. It has PAL colour timebase corrector. The VPR *7903* is available in PAL SECAM or monochrome.

Philips had a very interesting prototype mixer console shell which will be available in a number of formats by the end of this year. The customer buys the console as a set of blank

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panels which are made up to his own specification: a number of standard modules are available. The interesting thing about this system is that the panels are constructed so that no drilling is necessary into the console. The fixings connect to mounting rails behind the module so that either 3 cm or 4 cm modules can be used. On the next stand **Philips Broadcast Equipment** showed a 40-channel audio mixer of the wrap-around type that had gone to STV in Glasgow. The first of many?

Agfa Gevaert had a small stand with their range of tape on it and an inflatable chair. That's right, an inflatable chair, and if you don't think it beats T shirts you can hiss off.

The **Beyer** stand featured their range of microphones and two new items: a receiver for portable wireless microphones, and a portable three-channel receiver. The second can be connected directly to a Nagra machine for reporting work.

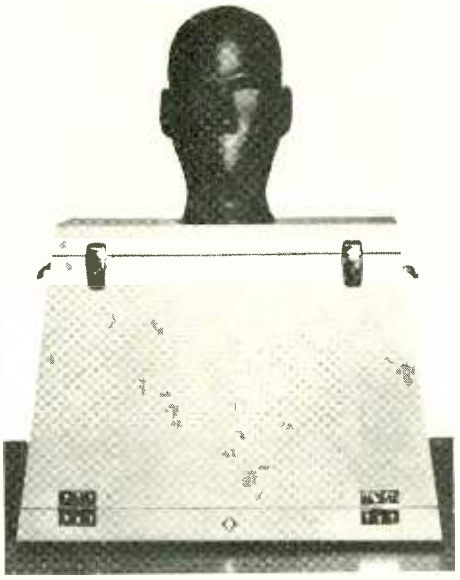
On the **Studer** stand was the recently-introduced *A67*, the studio version of the Revox. It has the same transport as the *B62*. We may be seeing a lot more of this machine in future. Among its features is digital tape control.

Neumann had a studio mixing console on their stand as well as their range of microphones (see photos). Interesting, among the latter was a dummy head stereo microphone apparatus. This technique, once discredited and disused for many years, is arousing new interest, probably as a symptom of the unsatisfactory progress of quadrophonic recording. Also among the range was the new *KMS851*, which Neumann developed for rock music. It has a multistage mechanical filter to prevent popping. The case is double-walled and the capsule has an elastic suspension. There is a bass roll-off and the condenser mic is powered by 48V phantom powering.

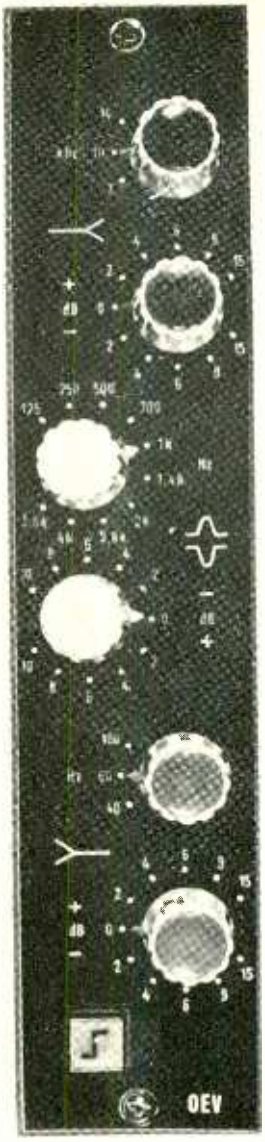
Auvis Asona showed an Abe machine, made by a South German firm. Since my German extends only to passing the time of day, and that provided it's before midday, all I can tell you about it is that it's available in four or eight track configurations on 25 mm tape, or 16 or 24 track on 50 mm tape. If what it says here means what I think it says they also have a 32 track version on the way, for 50 mm tape.

Our own **Allotrope** were on the next stand, showing a new family of three Pearl microphones. The *VM41* is a 48V phantom-powered microphone with a four-position ring switch. The positions are marked M (music: flat), V (voice: bass cut), 10V (10 dB attenuation plus bass cut), and 10M (10 dB attenuation and flat). The *VM12* is a longer version of the same microphone with dc to dc conversion, allowing it to be powered with a phantom supply between 10 and 48V. The *SP85* is similar, but with an internal 15V battery. Pearl have also upgraded their *DC63*, which used to have one switch round the bottom. There are now two ring switches round the bottom, offering a wide range of frequency responses, as well as polar responses continuously variable from cardioid to figure eight and from cardioid to omni.

Neve had both a stand in the exhibition and a room in the hotel to demonstrate mixdowns. The desk in the exhibition was built for Studio Clarens in Paris. It has 32 inputs and outputs and simultaneous four track operation. There are six limiter compressors and eight reverb sends. Neve's Alan Foster told me they considered the 5m long desk a standard model since they had two more being built in their workshops. They had sold one at the exhibition to Berlin, and it would be delivered in May.



Above: Neumann's dummy head microphone assembly



Right: Neumann filter module

Tonographie Apparatebau, a German firm, were showing a rather interesting 40 kg portable desk with ten channels. This could be built up, though it would make it rather less than portable, to 64 channels and 16 tracks. All the modules are plug-in, the wiring is done in straight lines on long busbars and the connections are taken out to a 50-pole plug on the back. The faders were by Donner, and the input channels four frequency low cut filters, gain adjustable in steps and a 12 dB vernier gain, muting, panning, two reverb sends, mic/line switch and led overload indication. There were many other things on each 30 mm wide channel module. The amplifiers used in the channels were NTP linear amp modules. The price would be around DM 45,000 for this particular set-up, which could be enlarged easily, I was told, because of the busbar wiring.

Nagra showed a range of accessories for instrumentation as well as their famous range of recorders. What can I say about them that hasn't been amply said elsewhere.

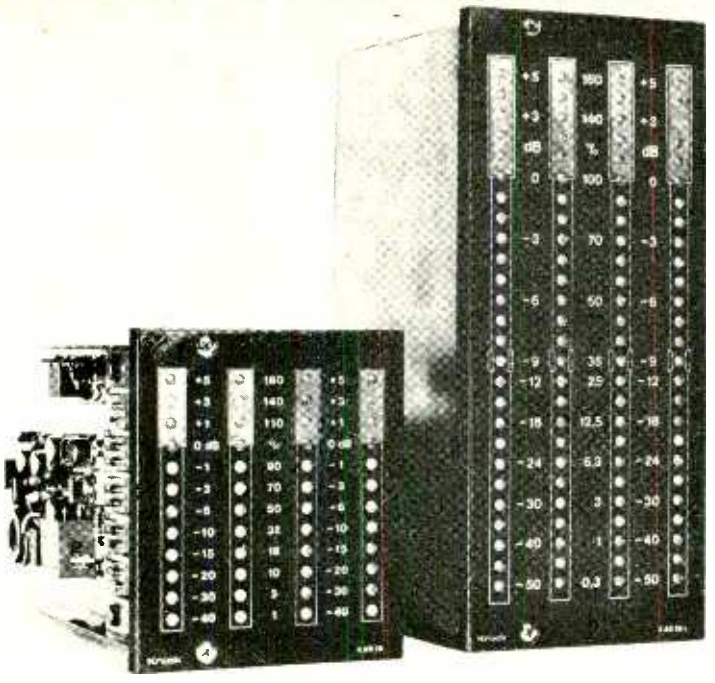
Radiometer are a Copenhagen instrumentation firm who were showing elegant-looking chart recorders and an automatic distortion analyser, the *BKF10*. There are three meters on the front which show distortion, input/output ratio and input frequency, and the unit also has a built-in oscillator.

Sansui announced, after what they described as 'a period of silence and apparent non-activity' the newest version of the professional monitor decoder. The unit, say Sansui, makes use of the new three-band split ic version *QS* vario-matrix circuitry, which enables more accurate monitoring of the encoded *QS* signals. The new monitor decoder, the *QSD4*, was shown in the Sansui hotel suite along with the newest consumer *QS* vario-matrix decoder/synthesiser. A simplified encoder has been developed for broadcasting, the *QSE5B*.

EMI were displaying their range of tapes and, next door, the **Keith Monks Audio** display included the highly successful disc cleaner, KMAL microphone stands, speakers and the laboratory pickup arm.

Bruno Woelke showed a very large range of magnetic recording heads in various formats, as well as their measuring apparatus. They sell in this country through Lennard Developments.

You couldn't go very far at this year's Convention without running into a **3M** machine; Neve used two—a 16 and a two track—to do their mixing demonstration, and the two mobile recording trucks parked outside the Scandinavia Hotel (Doug Hopkins's Team mobile and the Island truck) each had two



Knick *4AD12* and *4AD26* four channel led meters

M79 machines. On the 3M stand itself *M79s* supported examples of **Automated Processes** mixing equipment. Automated Processes are distributed in Europe by 3M. A number of standard desk formats are available, either fully or partly automated, including the *2488*, a modified version of which Doug Hopkins has fitted in his truck; the *2824;* and the *3224*. They also demonstrated their automated mixing equipment.

The newest piece of equipment 3M showed was their Mincom 50 mm layback head assembly. This will only fit the *M79* machine, typically the 360 mm reel version, and allows audio tracks to be put on to a video tape by running it through an audio machine. The video from an edited video master is replayed from a Quad VTR machine on to a helical scan recorder while the audio goes on to an *M79* multitrack tape. An SMPTE code from the Quad VTR is recorded both on the helical scan machine and the multitrack tape. Then dialogue, music and effects are added to the multitrack tape and mixed down on to another track, while the audio machine's speed is controlled by a combination of signals from its own SMPTE track and that of the helical scan machine used for vision monitoring. The combination is made in the Mincom synchroniser, or the API *Maglink* system, which synchronises the two coded signals and sends out control signals to the multitrack machine's capstan. The final audio track is then recorded on to the original QVTR master tape, which has its sync track sent to the synchroniser with that from the multitrack replay machine, and the comparison signal is used to control the capstan of the *M79* as the audio track is rerecorded on to the video master.

Machinenfabrik Wiesbaden used a Bauer movie projector to illustrate the working of their automatic cartridge and cassette archive. A paper was presented on this by Saurborn and Volkmann of Machinenfabrik. This completely automated system will select, play and return cartridges or cassettes. The 'find' or 'return' operations take only 10 to 20s. One unit takes 350 Telefunken cassettes or 480 BASF, and is 500 by 600 by 2,500 mm high.

Bang & Olufsen have introduced a new quadraphonic cartridge, and on their stand was a model of the stylus tip, which has been made a special shape for this application. It is not the usual elliptical stylus, but in cross-section is roughly diamond-shaped, and was designed at B & O by S. K. Pramanik. B & O say the stylus is able to follow the *CD4* frequency modulations from 20k Hz to 45k Hz without any difficulty. The type number of the cartridge is the *MMC 6000*.

Quadracast Systems of California have been operating in England for about a year. They were showing integrated circuits among which was the *5022*, a *CD4* disc demodulator circuit. I was told that, although these are slightly more expensive than some other equivalent ics, they needed fewer external components, and so the cost of the finished system was lower. Quadracast have an office in Cadogan Place, London.

BASF are hoping that their tape cassette for 6.25 mm will be used for professional recording work. The problem is, of course, that the amount of tape available in such cassettes is restricted; long play tapes in the cassette allow a playing time of 3.8 minutes at the standard playing speed for such applications of 38 cm/s, though they probably aren't designed for that speed. There is also the problem that, despite the current lack of interest in quadraphony, four track tapes may be used increasingly as the standard output of recording studios. Nevertheless, the tapes could be used in broadcasting, and it would be nice to think that this cassette might be used instead of the 3.125 mm cassette to supersede the disc at far better quality with the better possibility of having a greater number of channels than is now available. How much would the thing cost, though?

DBX told me their intention in appearing at the Convention was to consolidate the promotion work they had done in Europe, though it turned out that they received substantial orders from people they had been chasing back in England. Dave Hawkins told me that about half a dozen 16 track studios in France had been equipped with the DBX noise reduction system, and great interest had been expressed by other European countries. Their voltage-controlled amplifiers had been selling to instrumentation manufacturers such as NTP and B & K, and to Norwegian Radio. The DBX *216* 16 track noise reduction system is a simultaneous record and replay system equivalent to two Dolby *M16* units, and Dave Hawkins says the price is about the same as an *M16*. The noise reduction offered by the DBX is about 30 dB. The DBX system is about to be used in disc production, and I understand a great many people from the audio world were impressed by the DBX disc demonstration given in JBL's suite. DGG have shown an interest in the system, which might do something to counteract the decreasing quality of the vinyl which manufacturers have available for pressings. DBX say the surface noise can be reduced to −95 dB (a weighted, unmodulated groove) for a quiet pressing compared with −58 dB for normal RIAA corrected groove. For a noisy pressing the figures they claim are −87 dB and −51 dB respectively. Also on show was the DBX test meter, which shows a range of −70 dB to +10 dB on the same scale.

MCI were showing the machine they introduced at last year's APRS. They say that since they introduced the machine, which took two years to develop, they have made constant small improvements but that there are no major changes. In England the machine is in use at Advision, Dick James's studios, and a couple of others.

On the **Helios** stand the good Mike Beville was showing his new **Audio & Design** *F760X RS*, which sells for around £493. This is a stereo peak limiter compressor expander which has been reduced to 87.5 mm of a 483 mm rack rather than 137.5 mm. Its most important feature is a very versatile band-splitting network, which allows the audio signal to be processed over a very small selected section of the audio spectrum. 'For the first time,' Mike Beville told me, 'you can pick out a particular part of the music, an instrument, and process just that part. An obvious use is in getting rid of sibilants.' There is no phase shift through the unit, which can be used as a straight filter.

Helios were showing a typical desk. Although they don't make standard desks they have a semi-standard range, the *PS* series, which includes a console with ten to 16 inputs, four or eight groups and eight track monitoring, and the *PS4*, which has 24 or 28 inputs, eight groups and 24 track monitoring. Helios have just equipped the Universal Sound dubbing theatre (next 'Diary') and the non-appearance of the Island truck until the evening before the Convention ended must have been a consider-

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able disappointment to them. Dick Swettenham presented a paper on multitrack mobiles.

Dolby Laboratories, having established their noise-reduction system almost to the exclusion of all else, though there are stirrings in the wings, are now concentrating on the establishment of the cinema noise reduction unit. The first Dolby-processed film, Stanley Donen's 'The Little Prince', is now ready for release—it must surely merit a farewell party at The Music Centre. Dolby have sold 400 of their *M* Series units worldwide.

Telefunken showed their *M15* and *M12* tape machines.

The usual range of **Shure** small professional mixers was on show, along with their range of microphones. Many studios seem to use these, although they do so a little shamefacedly for some reason, as though Shure aren't to be taken seriously—perhaps there's room for a little image adjustment here.

Tore Seem are a Norwegian firm, some of whose modules are shown in our photos. They showed a portable mixer, the *TSM 6-2/1*, which has six inputs and two outputs. It is powered by internal batteries, and there is also an internal supply for phantom powering. The mixer is made from a welded steel frame with aluminium panels and measures 460 by 250 by 115 mm. An attache-type case can be supplied which weighs 2 kg and adds 10 to 30 mm to each dimension. The firm were established in Oslo in 1957. They make sound mixing equipment, power supplies, and television sub-titling equipment. They employ 45 and their factory is 1,500 m².

JBL took a hotel suite to demonstrate three new speakers they have added to their already massive range. These speakers are designed to overcome the prejudice that exists against JBL in some classical music quarters. The cones of their low frequency drivers have been made of a very stiff material and, in the case of the midrange unit of the biggest speaker, the *4340/1*, the 25 cm cone is driven by a 10 cm voice coil. The most important feature of the speakers, though, is that the bass units have been designed to cover a very wide range, well above the crossover point. They are then cut off above this, and the result, say JBL, is a much smoother response.

In the **Team** mobile I had a chance to see the *Maglink* system at work. Each system can sync up to six slaves. SMPTE is not used, since there is a danger of misreading if the edges of the pulses become rounded or if there is a loss of level. In addition SMPTE does not allow reading off the heads. *Maglink* uses two frequency-shift keyed modulations, one at 3.2k Hz and a second on a carrier at 60 Hz; these amount to fine and coarse control signals, and it is possible to get readings from hand-slipping the tape machine. An interface is available for SMPTE. Seventy-six cues can be held in the random access memory, with a basic one master plus one slave setup, and up to 1,200 cues can be stored with random access printed circuit boards, each of which adds 100 cues. The system provides a fixed offset between machines and a search facility.

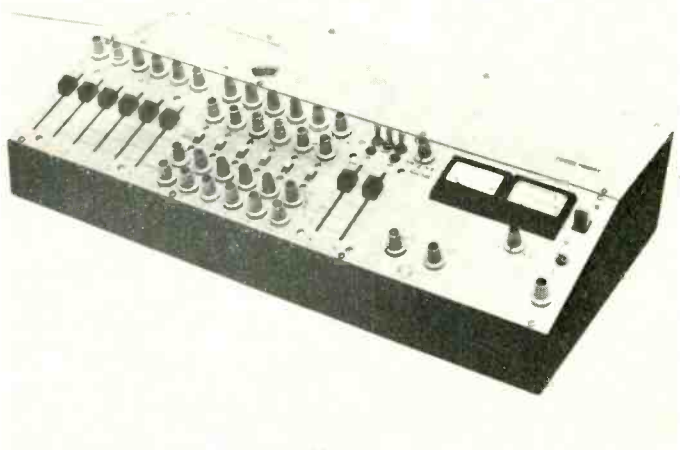
Doug Hopkins played two master tapes, each with the same recorded programme on them, so that the master ran continuously and the slave synched up at a predetermined point, ran with the master for a minute or so, then ran ahead to wait for the master and synched up when the master caught up. This is a pretty stiff test for a sync system, as any differences in speed will produce distinct phasing effects—the system would rarely be used in such a way anyway, particularly in the Team mobile. There was little swishing that I could detect, and the demonstration was very impressive. Doug had not shown the truck in public before, and when I saw it it was being swarmed over by tv executives.

The **Island** mobile was held up in Paris at the beginning of the Convention. It arrived at about 1700 hours on the day before the Convention closed, and the next morning the queue to see it was so long I decided I'd have to hope readers would be satisfied with the account I gave of the mobile in the April issue. Reaction from those at the Convention to the Island truck, as well as to the Team truck, was highly favourable: someone remarked that it seemed to have a whole lot of ancillary gear for a mobile, so much so that it listed slightly to port.

While I was in Copenhagen I accepted an invitation to look round the new Ortofon factory. Ortofon have just introduced a new cutter head to suit the year old Ortofon cutting amplifier. The cutter head is available in two types: the *DSS731*, an extended range cutter for cutting four-channel discs at half speed; and the *DSS732*, for standard stereo cutting. Together with these new cutters they have

Tore Seem mixing equipment

Tore Seem portable sound mixer *TSM6-2/1*



introduced a 500W per channel amplifier of a new design. Together, the systems represent a departure from the usual setup, say Ortofon. The current through the cutter head at high frequencies usually falls because the impedance of the drive coil rises. This has been counteracted by a negative inductance circuit which steps up the voltage to maintain a constant current.

The amount of feedback at 5k Hz is 12 dB. There is a slight lump at the higher frequencies, which could be eliminated by lowering the amount of feedback, but the higher feedback produces better crosstalk figures. At 10k Hz the separation is 40 dB, and more than 30 dB at 20k Hz, pretty extraordinary.

The frequency response of the four-channel version is quoted as 25k Hz and, I am told, is nearer 27k Hz. The Ortofon correction amplifier, *CPS691*, has four channels, two for the stereo pair and two more, ganged, for the advance head. Recording and monitoring levels can be adjusted, and the right and left channels have independent bass, treble, presence level and presence frequency controls. Phase can be inverted, and there are among other features a high pass and a low pass filter. Ortofon also produce a two-channel regulated filter, the *STL732*.

Walking around the factory, and peering over various shoulders, I was amazed by the intricacy of the work involved in making the mechanical parts for the head. All the coils are wound by hand, using the finest wire available, and there is no mass-production involved in turning or machining the small coil formers or suspensions. Microscopes abound, and I'm sure I couldn't do such fine work without going mad very quickly.

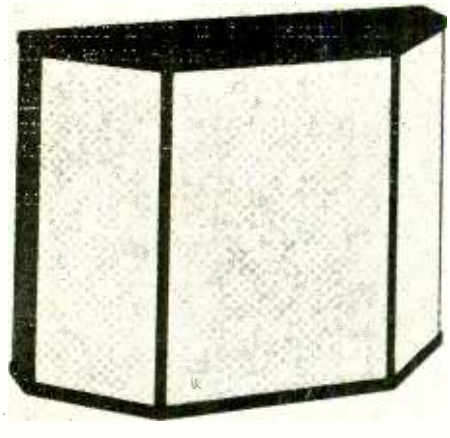
It's difficult to assess what people made of the Convention. It could not be considered as anything other than a great success, although, as I have said, I didn't encounter the enthusiasm I met in the previous two years, though I must say the Scandinavia Hotel was considerably more comfortable. Perhaps the AES is paying the penalty for having set such a high standard in previous years.

Everyone remarked on the price of things—for many it was the first experience of sinking exchange rates. One representative of an international company remarked to me that he was disappointed at the size of the British contingent, and indeed the number of familiar faces was smaller, even though there had been 860 registrations this year, compared with 600 at last year's Convention. European membership has grown from 270 in 1971 to 840 this year. The intention now is to encourage local sections to form within the European organisation, which has always been considered as a framework within which it was hoped local activity would flourish. The first local section was formed in London and has been active for many years now. The second was formed in Belgium on November 16 last year, the third in Paris on February 28, and Erik Madsen formed a fourth in Copenhagen on the first day of the Convention. A Netherland section would be next, followed by sections in Austria, Switzerland, Italy, two or three in Germany and one in Berlin.

Regretfully I have to return to the theme with which I ended last year's report. The AES had hoped to hold next year's Convention in London, but it looks as though London hotels, despite all the subsidies they received from the British taxpayer in recent years, are unwilling to offer conference facilities for anything less than extortionate amounts of money in advance. Apparently, too, the number of hotels able to offer such facilities is in any case small, for the hotels were being subsidised at £1,000 a bedroom, and if you're being offered £1,000 a bedroom you don't build conference facilities. The idea of the subsidies was to build cheap accommodation for the thousands of not-so-rich tourists who spend much of the summer on park benches. The money went, nevertheless, to the luxury hotel groups, with the result that we now have a far greater number of luxury hotel beds than we need, while American students are still sleeping on the streets and there are no conference facilities to attract those who might possibly fill those spare beds.

The AES organisers, under the chairmanship of John Gilbert, have an unenviable task, though I'm quite sure they're equal to it. They may now hold the Convention in Brighton, which offers a good train service to London. It would be a great pity if what is arguably the recording centre of the world were to make it so difficult for the organisers to provide the right degree of hospitality that the London Convention was remembered as less than a success—a pity, but very British.

The Acoustic Research *AR6* (top left), AR7 (bottom right) and LST (bottom left), which AR showed at the convention. AR say these are now in use at the world's leading opera houses for their musical performances, including the Danish Opera House, Covent Garden and La Scala, Milan. The speakers were demonstrated with a B&M real time analyser, which showed the variety of spectral distribution patterns available in a normal room using the speakers' balance controls and the tone controls of the driver amplifier.



BOOK REVIEWS

ELECTRONIC MUSIC PRODUCTION by Alan Douglas. Published 1973 by Sir Isaac Pitman & Sons Ltd, 39 Parker Street, London WC2. 148 pages, hardback. Price: £2.75.

IT IS REALLY only in the last few years that electronic music has emerged from its infancy into a precocious adolescence and an art-form of its own. Alan Douglas has already written books on the technical aspects of electronic musical instruments; in this book he deals more with the raison d'etre of the most flexible one, the electronic synthesiser. Mr Douglas is a senior member of the IEEE and an associate of the Incorporated Society of Organ Builders.

Alan Douglas introduces his subject in a happily down-to-earth way, via a backward glance at the history of music in relation to the instruments available. He reminds us that Wagner was once considered unacceptably avant-garde and he considers that electronic music may in its turn become as established and accepted. He does, however, draw attention to the danger of merely exploiting the art-form's novelty potential and, while asserting the greater flexibility of synthesisers in creating the essentials of conventional music—pitch, intensity and duration—I am relieved to see he feels that the human touch is still essential if the sound is to appeal as art, and that it would be disastrous (boring) if music were to become completely automated.

In the first section he gives a detailed analysis of the physics of sound, the relationship between sounds and music, and various types of music. He also deals, with the effect of age on hearing.

From here on the book gets down to synthesis, examining ways of generating approximations to conventional instrumental tone and ways of shaping the sound 'envelope'. The text makes full use of circuits, though I suspect it would be equally interesting to the reader with no knowledge of electronics.

By little more than half-way through, one has left conventional instruments and their restraints behind. I can only say that in a quiet way Mr Douglas's enthusiasm for his subject is rather infectious. He deals with various forms of audio synthesiser and how they are programmed and, although his description of the Oramics system covers only a few pages, I confess I learned more from it about Oramics than from reading the whole of Daphne Oram's book on the subject. Alan Douglas is clear and concise; perhaps too concise occasionally, as when he asserts that the string of the piano contributes *no* energy to the total sound, but that is a detail.

The final chapter deals with the scope of electronic music, with the machine and the composer. The author stresses the flexibility which the medium gives the composer/interpreter and the limitations of even the best machine music. He also deals with the mechanics and programming language of composing, and the storage of composition. An appendix gives a comprehensive specification for the EMS *Synthi 100* synthesiser, to illustrate the potential, and another appendix deals with programming in the MUSYS language described earlier and the necessary discipline in using it, together with a sample composition (a Haydn sonata) programmed for the *Synthi 100*. The book concludes with an extensive bibliography and adequate index. It is well produced and well written but ends a bit abruptly, if topically, with a reference to the inconsistencies of the electricity supply!

This is by far the most effective treatment of the subject I have yet seen and it is a pleasure to recommend *Electronic Music Production* to the curious, the sceptical, and the converted alike. **J.H.F.**

RAPID SERVICING OF TRANSISTOR EQUIPMENT by Gordon J. King. Second edition (October 1973) published by The Butterworth Group, 88 Kingsway, London WC2B 6AB. 172 pages. Price (limp cover): £1.90.

GORDON KING'S service books and manuals are surely well known to many readers. They complement each other and do not attempt to cover every possible aspect under a particular topic. Rather they serve as readable and practical introductions to the subjects in question and their problems.

Although first published some seven years ago, there is no sign of the book becoming dated and hardly a trace of the editing for the second edition. The book reads well as a composite whole, once one is over the hurdle of why to exclude valves.

The particular emphasis of the book is on servicing domestic rather than professional equipment, though in general the same principles apply, and the author sets out by assuming no prior knowledge of the transistor and draws no parallels with valves. He therefore caters both for the complete novice who needs to know how the transistor works, and avoids the pitfalls of parallels with the valves for readers brought up on thermionic devices. Indeed I think the book would make a good introduction to contemporary electronics for anyone with a basic knowledge of electrical physics.

The first chapter deals with the fundamental principles of transistors and other semiconductor devices, including the various diodes, field effect devices and integrated circuits. The second chapter deals with elementary tests on circuits and transistors. By this stage the author is assuming some familiarity with circuits, although basic circuit configurations are explained; it is reasonable to assume that someone concerned with servicing will have acquired or be acquiring the necessary familiarity and practical experience elsewhere. Chapter Three deals with the signal as it passes through various amplifiers, and the problems of impedance and matching. Chapter Four deals with faults in audio and video circuits, distortion and its causes, equalisation, noise, low-level distortion and its causes, stability, and video faults. Obviously there is a lot to cover under the latter heading and some reference is needed to the companion volumes *Radio, Television and Audio Test Instruments* and to *Colour Television Servicing*, also by the author. Chapter Five deals with fault-finding in rf circuits, particularly at vhf and uhf, and with aerial preamplifiers. Chapter Six deals with faults in oscillator circuits, from tape bias oscillators up in frequency to video oscillators, though again readers particularly concerned with television are also directed to the author's *Television Servicing Handbook*. Receiver alignment and ferrite rod aerials come under Chapter Seven on transistor radios and domestic hi-fi equipment, which some may feel an appropriate choice of companions! Surprisingly, little attention is paid to the particular problems of tape amplifiers and gramophones, though some consideration is given to one very modest gramophone reproducer. Interference is not dealt with at all. The final chapter deals with the practice of equipment servicing and the basic equipment required, and there is an adequate index.

The book contains five fault-diagnosis summary charts. These appear towards the ends of chapters and are invaluable as quick summaries of what has been covered in the preceding chapter and as quick reminders, when servicing, of the possible causes of the fault being investigated. They cannot be exhaustive but are nevertheless an important part of the book; in a way it is a pity they were not lumped into an appendix for easier reference.

To sum up then, a well written and produced book, which does what it sets out to do, and that is to provide an introduction to the systematic diagnosis and servicing of faulty transistor equipment. It is not an exhaustive standard work but has the advantage of being very readable and well illustrated. I suspect that the worst criticism of it may be that the limp cover may not stand up to the amount of use it gets. **J.H.F.**

The need to have available an accurate elapsed time readout for 25 mm running masters in the high speed duplication of tape cartridges and musicassettes prompted A. Anderson to make a device that would hold its calibration with reference to the start of the tape in forward and reverse winding as well as play modes

Constructing a digital tape timer

A. ANDERSON

THE DESIGN of the timer was necessitated by the need to have an accurate elapsed time readout on a professional tape machine that would hold its calibration with reference to a zero mark at the start of the tape. It would have to do this during spooling in both forward and rewinding modes, as well as normal replay mode. The author's application was in making 25 mm running masters for high speed tape duplication in eight track cartridge and musicassette manufacture, where track timings were to be accurate to within ±500 ms over 20 to 30 minutes.

Since ICs that will count up and down are now freely available, it was possible to design such a timer. The most critical area was found to be the sensing head and steering logic. Mechanical methods of sensing tape direction and pulse counting were tried and discarded, mainly because of lack of reliability and because all methods tried introduced a certain amount of mechanical drag on the sensing idler. Drag would cause inaccurate timing results due to tape slip. A photoelectric pulse counting and steering system was eventually chosen, mainly because there is no direct contact between idler and sensors and direction sensing is electronic.

The main requirements for the idler is that it: (a) has an accurately known circumference (in the author's case 76.2 mm); (b) that it turns smoothly and freely, with as little momentum as possible (it is thus not possible to use an existing idler if a flywheel is attached); (c) that the idler turns with reasonable tolerance in eccentricity etc.

Studio machines that have mechanical timers can usually be modified to fit the sensing head on the timer idler shaft, by removing the mechanical part of the tape timer as the author did. If a home-built idler is to be fitted, it should be placed in the tape path, so that there is at least one guide between it and the heads. Provided that there is a reasonable area of tape in contact with the idler and a, b and c above are observed, no problem should be experienced. The idler can be placed on either the oxide or backing side of the tape, the only difference being in the direction of rotation for up or down count. If the timer counts in the wrong direction, reverse the inputs to the counter section.

Head construction

A piece of 25 mm matt backed tape is taped around a 25 mm former and has slots cut in it The idler shaft is then attached to the 25 mm former and the number of slots cut into the ape is calculated from the circumference of the idler. The idea is to get 1 p/s (pulse per second) to *IC15* in the main counter section. In the prototype, the idler had a circumference of exactly 76.2 mm, which produced 15/3 or 5 p/s at 38 cm/s for one slot, or 10 p/s for two slots, at the output of the head logic.

It can be seen that the circumference of the idler should be made divisible into the product of the tape speed in cm/s and the number of slots cut into the mask for a whole number of pulses per second to appear per second from the head outputs. For those people who are converting machines with existing tape timers, the mathematics are as follows:

$$\frac{S\ A}{\pi\ D} = N$$

where S = tape speed in cm/s.
A = number of slots in the mask.
D = diameter of idler in centimetres.

It is important that the number of pps from the head logic outputs be less than ten. See modifications a and b for the method of setting the correct division ratios on *IC4* and *IC15*.

If a light-tight box is used, ventilation holes must be drilled, especially if the lamp used is of high wattage. The author used a 24V 20 MA lamp and in fact did not find it necessary to use a light-tight shield in the prototype as the off axis sensitivity of the *TIL63* phototransistors used drops at least 40 per cent at 60° off axis. As the whole head assembly was placed under the deck of the tape machine anyway, extraneous light was not a problem.

The sensing head prototype shown was built on a timer plate, off a Leevers Rich eight track deck, and has been working very successfully for some time. For those constructors who wish to build the head electronics, the photograph gives an idea of the layout on 25 mm Veroboard. Construction is straightforward. The multiway cable leading to the counter board is epoxied on to the board for rigidity.

Head Electronics

Both timing and steering pulses are derived from the phototransistors and are produced by means of a photoelectric light interruption system. As described, the slots on the original were cut into a piece of 25 mm matt backed tape and are just wide enough to allow both phototransistors to see the lamp at the same time. The edges of the slot are approximately 1.6 mm past the edge of the lens of each phototransistor. The phototransistors are separated enough to allow one transistor to be completely cut off from the lamp while the other is in the middle of the slot.

The sequence of illumination is as follows:

FIG. 1

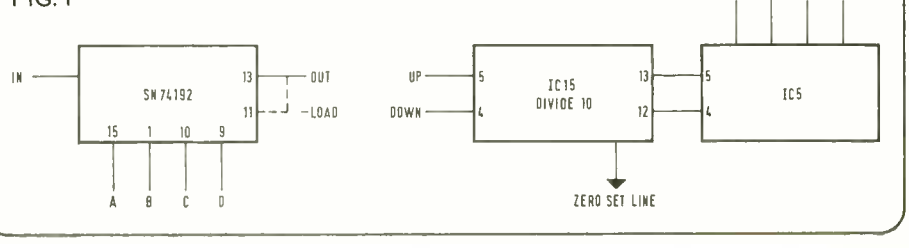
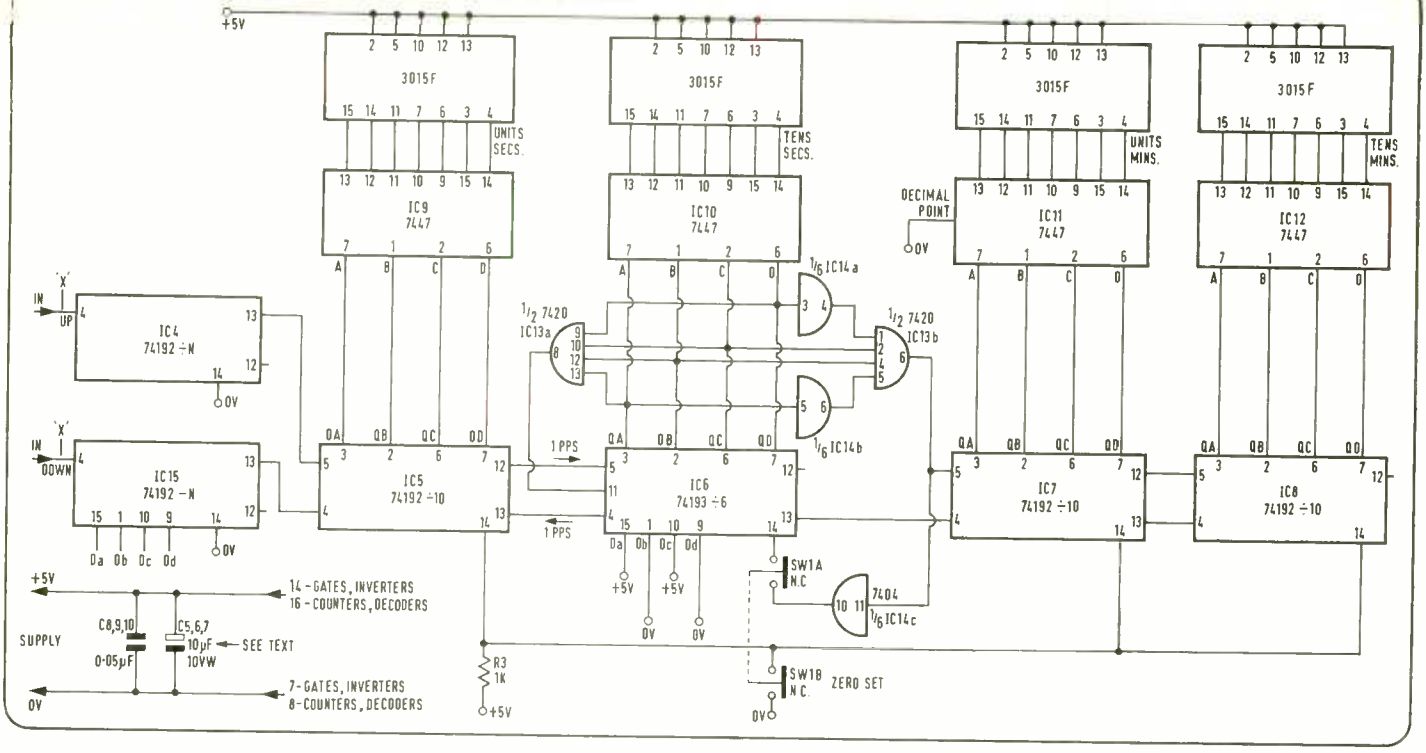


FIG. 2 COUNTER AND READOUT BOARD - DIGITAL TAPE TIMER



Turning in a clockwise direction, the lamp illuminates *Tr1* first, then both *Tr1* and *Tr2*. As the idler turns, *Tr1* is cut off, then *Tr2*. The opposite happens when the idler turns backwards, i.e. anticlockwise. *Tr2* is illuminated first, then *Tr1* and so on. When *Tr1* is illuminated, it draws current through the emitter at *i/p* of the NAND gate which is part of *IC11*, Schmitt Trigger *SN7413*. The other emitters go to the logical one through *R1* a 1.8k resistor. As the waveform is not rectangular (sensed by the phototransistors), the Schmitt Trigger sharpens the waveform to a good rectangular wavefront with fast rise and fall times which is a prime requirement for reliable operation of *TTL ICs*.

As *Tr1* collector goes low, *IC1a* output goes high and sets the flip flop (*IC3a* and *c*) so that the output to gate *IC3d* is high. *Tr2* is not yet illuminated, so *IC3c* pin No 1 is low, thus *IC3a* output is low. The result is that gate *IC3d* is enabled and gate *IC3b* disabled. Clocking pin No 4 of *IC3d* would clock the output.

If at this stage, however, *Tr2* becomes illuminated, this sets *IC1b* pin 8 high. The flip flop will stay set to the original state.

However, with both Schmitt outputs high, *IC2a* becomes enabled and *IC2a* output goes to logical 0, which causes the output of inverter *IC2b* to go high. With *IC3d* enabled, a single output pulse is obtained at *IC3d* output. Thus whichever phototransistor is illuminated first will enable the opposite output gate, and when both transistors become illuminated an output pulse will occur from one gate only. In this way, tape motion is sensed and output pulses proportional to tape speed are steered to the appropriate output.

Counter section

Various IC s for up down counting are available and the Texas *SN74192* programmable BCD up-down counter and *SN74193* four bit binary counters were chosen. These counters can be cascaded for up and down counting and have two clock inputs, one for up counting, the other for down counting. They also have presettable data inputs that enable them to be made into modulo *N* dividers, i.e. they can divide by any number from one to 16 for the *SN74193* and one to ten for the *SN74192*. Each counter stage is described:

SN74192: **10 stages. Truth table**

decimal	A	B	C	D	carry	borrow
0	0	0	0	0	0	0
1	1	0	0	0	1	1
2	0	1	0	0	1	1
3	1	1	0	0	1	1
4	0	0	1	0	1	1
5	1	0	1	0	1	1
6	0	1	1	0	1	1
7	1	1	1	0	1	1
8	0	0	0	1	1	1
9	1	0	0	1	1	1
0	0	0	0	0	0	0

Operation of ÷ 10 stages

The counters are connected in ripple borrow/carry mode, i.e. the 'carry' output is connected to the following stage 'up' input and the 'borrow' output to the 'down' input. As the *SN74192* is a binary coded decimal counter, it will cycle normally to give ÷ 10 operation. The 'data' and 'load' inputs are thus not needed as the data inputs are usually used only for division by a number other than ten. Using the counter in the normal ÷ 10 mode, we also get a symmetrical ÷ 10 for both up or down counts.

Both inputs and the corresponding outputs are usually at logical one. The counter will count up on negative going pulses, applied to the up input, and will produce a negative going pulse at the carry output when the counter overflows. Similarly the counter counts down on the negative going edge of each pulse fed to the 'down' input, and produces a negative going pulse at the 'borrow' output only when the counter underflows.

It can be seen, therefore, that it is possible to cascade successive stages.

Divide by six operation

A problem arises, however, when the counter is asked to divide symmetrically both up and down by a number other than ten. If, for an example, we preset the data inputs to divide five, i.e. to binary five, we would get this situation:

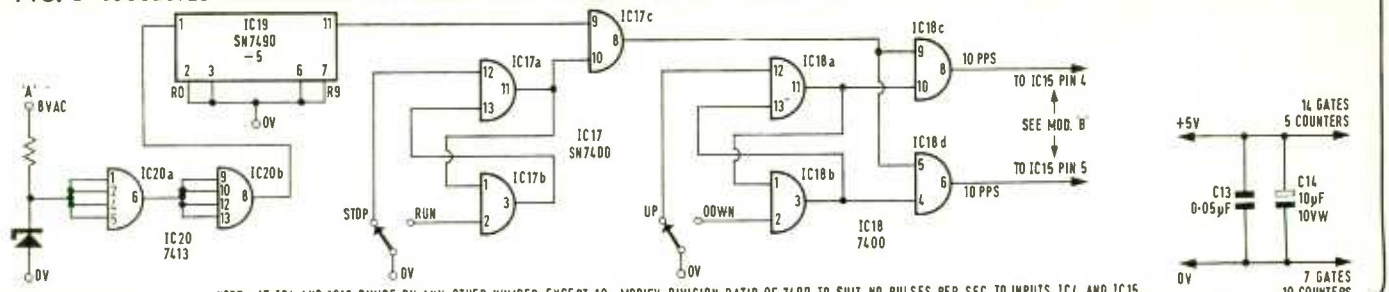
Count down	Count up
preset 5	5
4	6
3	7
2	8
1	9
0	—carry
—borrow	(0)5
÷5	÷4

This gives a divide by four situation on the up count, as the carry pulse (and thus the reset to five) occurs on the wrong side of the 0 (or five) reset, giving only four counts. Whereas in the count down mode the carry occurs *after* the zero and thus includes the zero, giving a five count.

To force the counter to count symmetrically both up and down (in this case a 6 ÷stage), the author used an *SN74193* four bit binary up down counter, with logic, around the counter to force the IC to count correctly both up and down. The *SN74193* differs from the *SN74192* in that it has a maximum count of 16, in accordance with four bit binary code, and was used because it was available.

42 ▶

FIG. 3 SUGGESTED MODIFICATION TO ENABLE TIMER TO DERIVE TIMING PULSES FROM 50Hz MAINS



NOTE: IF IC4 AND IC15 DIVIDE BY ANY OTHER NUMBER EXCEPT 10, MODIFY DIVISION RATIO OF 7490 TO SUIT NO PULSES PER SEC. TO INPUTS IC4 AND IC15

DIGITAL TAPE TIMER

To illustrate the ÷6 operation, refer to the truth table and circuit diagram. Assume the counter is set initially to zero and is counting up. At the count of six, *IC13b* and *IC14a* and *b* sense the binary count of six, and force the 'clear' input of the *74193* to go from logical zero to logical one, thus forcing the counter back to zero. On the up count, the counter never overflows (at the count of 16) so no carry pulse is produced. The carry pulse is therefore derived from the output of *IC13b* which goes from logical one to logical zero on a count of six and this gives the carry pulse needed for the succeeding stage.

Truth of *SN 74193* four bit binary counter

Normal four bit Binary					*SN74193 + ÷6*					
	A	B	C	D	QA	QB	QC	QD	clear	load
0	0	0	0	0	0	0	0	0	1	1
1	1	0	0	0	1	0	0	0	0	1
2	0	1	0	0	0	1	0	0	0	1
3	1	1	0	0	1	1	0	0	0	1
4	0	0	1	0	0	0	1	0	0	1
5	1	0	1	0	1	0	1	0	0	0
6	0	1	1	0	0	0	0	0	1	1
7	1	1	1	0	x	x	x	x	0	1
8	0	0	0	1	x	x	x	x	0	1
9	1	0	0	1	x	x	x	x	0	1
10	0	1	0	1	x	x	x	x	0	1
11	1	1	0	1	x	x	x	x	0	1
12	0	0	1	1	x	x	x	x	0	1
13	1	0	1	1	x	x	x	x	0	1
14	0	1	1	1	x	x	x	x	0	1
15	1	1	1	1	1	0	1	0	0	0
0	0	0	0	0	X—not used this application Data inputs set to Binary 5					
3	1	1	0	0	x	x	x	x		1
4	0	0	1	0	x	x	x	x		1
5	1	0	1	0	1	0	1	0		1
6	0	1	1	0	0	1	1	0		1
7	1	1	1	0	1	1	1	0		1
8	0	0	0	1	0	0	0	1		1
9	1	0	0	1	1	0	0	1		1
0	0	0	0	0	0	1	0	1	0	0
Data inputs preset binary 5 1010									—reset 5 through 'load' and data inputs.	

Turning to the 'down' counting mode, the counter will cycle past zero to 15 and produce a borrow pulse so we can connect normally to the succeeding 'down' input. However, on the count of 15 *IC13a* senses the binary 15 on Qa-Qd, and the output of *IC13a* (normally at logical one) goes to logical zero. This is connected to the 'load' input and causes the binary five on the data inputs Da-Dd to be entered on Qa-Qd. The net result is that binary 15 causes the counter to reset to binary five and thus give a ÷6 down count.

Divide by five truth table

To illustrate *IC4* and *IC15* operation on division other than 10

Normal BCD					SN74192 ÷ 5 IC4, IC15				Load
	A	B	C	D	QA	QB	QC	QD	
0	0	0	0	0	x	x	x	x	1
1	1	0	0	0	x	x	x		1
2	0	1	0	0	x	x	x	x	1

Operation of divide by five up down counter

Only the down inputs and the borrow outputs are connected, i.e. the counter only counts down. The counter counts five to zero underflows and produces a negative going borrow pulse which enables the 'load' input connected to the borrow output, thus enabling the 'load' presets to count to the BCD number selected, in this case binary five. The load input overrides all other inputs and thus the counter is forced to binary five at the underflow point.

We thus get a ÷5 stage. Two *SN74192* are used here to get a symmetrical ÷5 up or down, as the pulse from the head is steered automatically to the right counter.

Modification 'A'

Method of presetting *IC4* and *IC15* to division ratios other than ten to suit other derived head pulses.

(a) Refer to truth table for ÷10 stages described.
(b) Select division integer on LHS.
(c) Tie logical ones to +5V, logical zero to 0V as shown on the truth table opposite the number required.

Connect load inputs, pin 11, to pin 13.

Example: to divide by four, connect *IC4, IC15* Pin No's 15 to 0V, one to 0V, ten to +5V, and nine to 0V.

Modification 'B'

To circuit for *IC4/15* to divide by ten only. *IC4* not needed. Refer to **fig. 1.**

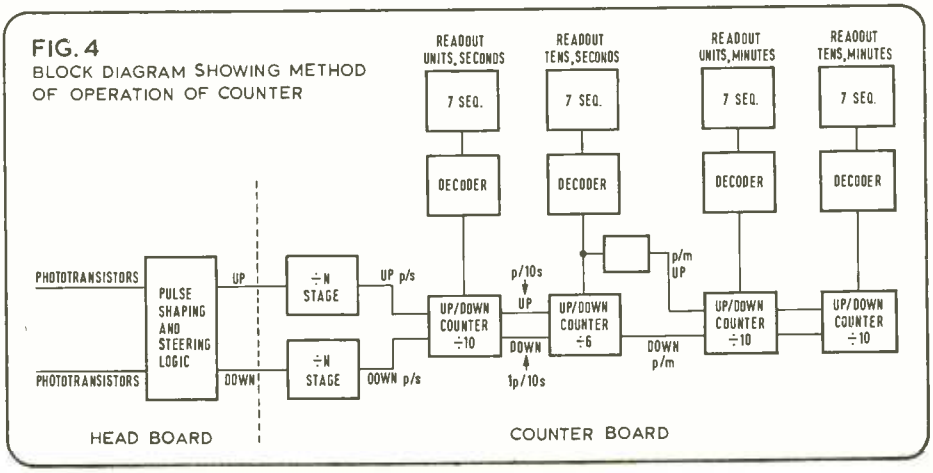
Decoders and readouts

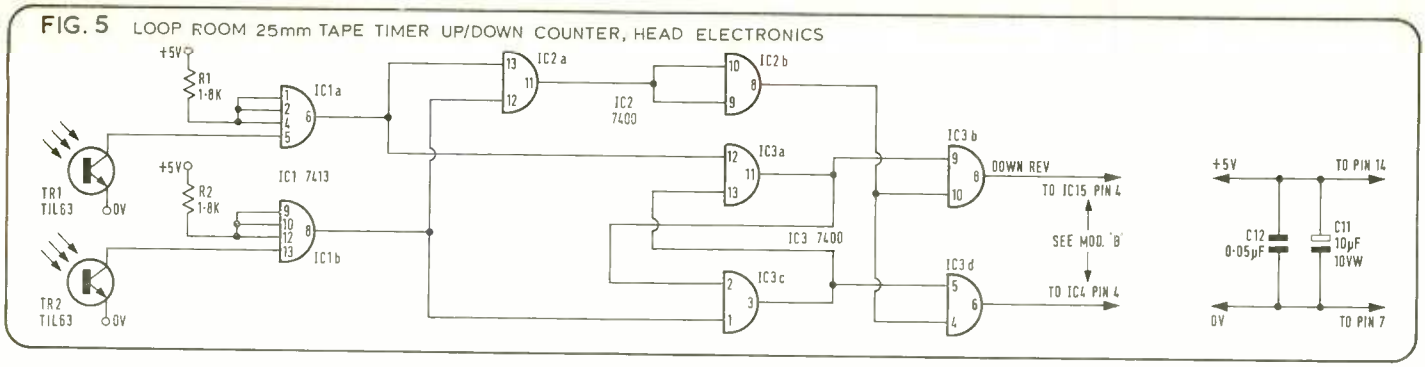
Normal BCD outputs are picked off the counters and fed into *SN7447A* BCD to seven segment decoders. The outputs of the decoders are fed in turn to Minitron *3015F* seven-segment readouts which give a maximum 'readout' of 99 minutes 59 seconds. This was considered more than adequate time for the application. The decimal point on the minutes stage is connected to provide separation between minutes and seconds. Other seven-segment readouts can be used with the *SN7447A*, as long as each segment does not draw more than 40 MA at 15V (absolute maximum). Decoders type *SN7441* or *SN74141* can be used with Nixie readouts, in which case a high voltage supply must be provided for the Nixie tubes.

Power supply

The electronics (excluding the lamp) draw approximate 1A. Regulated 5V is provided by full wave rectification and an *LM309* mono-

FIG. 4
BLOCK DIAGRAM SHOWING METHOD OF OPERATION OF COUNTER





lithic voltage regulator in a *TO-3* package is used. Provided the regulator has an adequate heat sink, no problem should be experienced as 12V input to the regulator would allow a max of 1.8A to be drawn without a heatsink. The *LM309* has the enviable feature which allows it to be bolted directly to the heatsink, which allows good heat transfer. The sensing lamp must run off smoothed dc as any ac component could cause unwanted switching in the logic. C and C2 provide smoothing, C3 through C7 remove switching spikes, and are important especially if a long lead to the head electronics is used. The supply should be firmly decoupled, if possible, on the ht branch going to each line of ICs on the counter board, and at the start and end of the head lead.

Counter board construction

The author used a Vero *DIP* board for ease of mounting the 12 counter and logic ICs. The readouts were mounted on a piece of 25 mm pitch Veroboard on the front of the *DIP* board. **Photo 4** shows board construction. Starting from the rear, l to r, the ICs are *SN74192* ÷5 up stage, *7420* NAND gate, *7404* hex inverter, *74192* ÷5 down stage, two *74192* ÷10 stages, *74193* ÷6 stage, and *74192* ÷10 stage. At the front are the *7447* decoders and readouts. Wiring is point to point. Connection to head and power supply is by a dual 22-way edge connector.

Operation from mains

For producers and engineers who wish to have an accurate timer for timing takes etc, **fig. 3** gives the circuit diagram, which replaces the head assembly. Operators can either time takes or count down to cue etc, and with a remoted readout for the studio, cueing might become much easier for artists.

Conclusion

The time is accurate to ±500 ms over 30 minutes, which is the maximum time to which we usually take it. There are certain multitrack machines on the market which have timing and tape sensing outputs built in and, with a little ingenuity, I am sure that this timer could be adapted for such use. We now have two timers running and this machine, installed in the studios, is indespensible for overdubs.

Finally, my thanks to Texas Instruments for the information obtained from their excellent book *Integrated Circuits and Optoelectronics Data.*

Parts list: Head

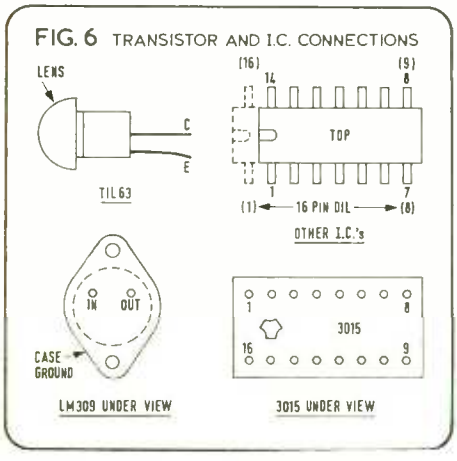
Transistors and ICS
Tr1 *TIL63*
Tr2 *TIL63*
IC1 *SN7413* Texas Instruments
IC2 *SN7400*
IC3 *SN7400*
Resistors
R1, R2 1.8 kΩ ¼w.
Capacitors
C11 10 μF 10V tantalum
C12 .05 disc
Mics
Veroboard offcut 25 mm matrix, 22 x 24 holes.
Lamp 24V 20 mA or similar.
Lamp holder to suit 1A used.
Mask as per **Fig. 2.**
Four-core cable to suit.
3 x 14 pin DIL sockets (if needed)

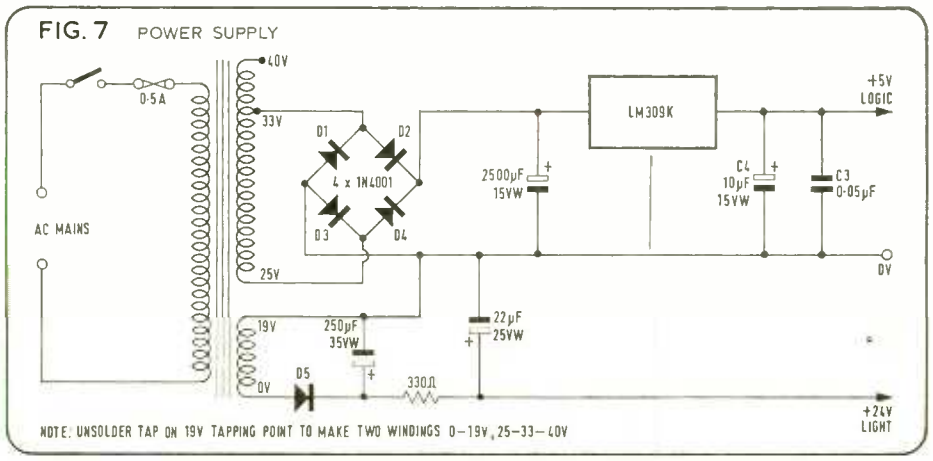
Parts list: Counter

ICs IC4, 5, 7, 8, 15 *SN74192*
IC 9-12 *SN7447A*
IC13 *SN7420* Texas Instruments
IC14 *SN7404*
IC6 *SN74193*
Readouts Four Minitron *3015F.*
Resistors R3: 1 kΩ
Capacitors C5-7 10 μF 10V tantalum.
C8-10 0.05 μF disc ceramic.
Misc Switch SW1 1 x 2 pole N.C.
Board Vero DIP board *11824*: Vero UK
6 way polarised plug for head lead
Vero edge connector to suit *11824* board
Veroboard 2.5 mm matrix to suit readouts
16 x 16 pin DIL sockets (if needed)
Power supply Regulator: *LM309k*, *To-3* pack: Fairchild
Transformer 240V/0, 19, 25, 33, 40 2A Douglas: G. W. Smith
Diodes D1-D5-*IN4001*-or any diode to take current and PIV
Capacitors C1 2,500 μF/*15V-30V*
C2 250 μF/35V
C3 0.05 disc
C4 10 μF/10V tantalum
Fuseholders Fuses 1 x 2A
1 x 200 mA

Parts list: Mains pulse unit

ICs IC17, 18: *SN7400*
IC19 *SN7490* Texas Instruments
IC20 *SN7413*
Capacitors C13 0.05 μF disc
C14 10 μF/10V tantalum
Diodes D6 4.7V Zener
Resistor 330Ω ½W
Misc Veroboard
SPCO switch
3 x 14 pin DIL Holders (if needed)





The film industry is passing through one of the most critical periods in its history. The age of the film giants is over

Inside Twickenham Films

NIGEL WOOLGROVE

THE FIRST impression that one gets of Twickenham Studios is of an efficient family business that has all the time in the world to look after your every need. While this impression is accurate in that they would do all they possibly can to make you comfortable, it should not be taken to mean that they have nothing else to do; rather that they are always prepared to make the effort. The family atmosphere is something which happens to be the case, it is not contrived.

Guido Coen, the head of this 'family', is a man who in the true tradition of the movie industry lives for films. He entered the industry some 30 years ago as a young assistant to Halean Phillipo Del Giudice of Two Cities Films, in an era when the cinema industry had 'giants' that seem to be sadly lacking today. When Guido Coen talks of this period in his life, it is obvious that he has many fond memories: of the personalities that towered over the industry, and also of the films made at that time. In particular, when he mentions the name Korda, he assumes a far-away expression and it is possible to see that here is one man who not only appreciates the abilities of these giants but who regrets their passing. He does make this point, however, that the industry can no longer afford the giants of yesteryear. In fact, during his career in the industry he has seen a revolution. He believes that the film world should not regret the passing of this age, for in its wake have come many of the technical developments that have enabled the cinema to progress. He illustrates this point by mentioning several items of equipment: the microphone, Nagra recording systems, the size of cameras, and the improvement in sound generally.

Once you get Guido talking in this way, it is difficult to stop him. He naturally goes on to talk of the future. '16 mm must come' (some would say it has already done so). 'There is no point in saying that 35 mm is better. If 16 mm is what the distributors want to buy, that is what the film makers must provide. When talking of distribution, Mr Coen has very firm views, and he believes that radical changes are necessary. He thinks that this sort of thing should not be resolved by public criticism but by private consultation—a very refreshing view when one considers the haste with which too many people rush into print. But it is his attitudes to the future that are the most interesting; he does not see a dying industry; rather one which is facing a tremendous challenge and which could result in a return of the halcyon days. The Common Market is one thing that he believes will have an even more marked effect on the British film making industry. He believes that the British film maker has a lot to offer his European customer, not least of which is the expertise of the technicians and directors at present working in this country.

When talking of the present generation of directors, Guido Coen once more reels off a list of names—all of whom have worked at Twickenham at one time or another: Zefferelli, Siegel, Lester, Peckinpah, Polanski, Huston, Losey, Schlessinger, Tony Richardson, Peter Hall, and a host of others. This habit of mentioning people is not an example of name dropping but is a further indication of the importance that he attaches to individuality.

Because of his love of people, Guido Coen attracts tremendous staff loyalty. His present secretary, Enid Webster, has been with him since the time he was with Two Cities Films, and he left there to join Twickenham in 1959. It is difficult to keep him talking about the past, however, for his eyes are very firmly set on future horizons.

'Attitudes are changing and every film is a new challenge. Of course people make mistakes, they misjudge public demand, but nobody sets out to make a bad film. Many people complain that films like *Clockwork Orange* and *Last Tango in Paris* should never have been made but it's a free world. People do not have to watch. I do think though that some directors forget that the job of the cinema is to entertain—we must remember that it is an escapist medium and not the University of the Air or a message medium. Of course making films is a bit like a game of poker. What works today may not work tomorrow. But of two things we can be sure: that audiences are more intelligent and that they still enjoy (and will pay a lot of money to enjoy) a good cowboy film.'

When I asked why the film studios were having such a hard time of it at the moment, he did not need to think of an excuse. 'Because the public are more intelligent they demand more realism even in their "escapist" films. At one time we could have built five sets to recreate five locations fit for James Bond. If a film-maker now wants to show a star having a picnic on top of St Paul's Cathedral, the public want to see them there and not sat in front of a cardboard replica.' He points out that television is in part responsible for this requirement which inevitably means higher production costs and higher admission prices at the cinema. 'If a person wants to eat at the Ritz, he doesn't expect to pay local cafe prices. If people want realism, they must pay for it.'

If this seems like a snipe at television, that is certainly not the way that Guido Coen feels for he suggests that television is in fact the saviour of the film-making industry. 'Within the very near future, nearly every feature film that has ever been made will have been shown on British television. With this voracious appetite, there is a tremendous demand for films and film makers should be excited at the prospect; they should get stuck in!' He does not expect that the film studios will necessarily benefit from this increased demand, however, but believes instead that the sound department will prove to be the expansion area for his own operation.

'We have all the facilities that film makers will need; for example we have some 30 cutting rooms to cater for postproduction requirements, and some of the best sound facilities in the world. As television grows, with the advent of a second commercial channel for instance, there will also be new technical developments. There will be a tremendous growth in the video field and I am sure that, before very long, video for rushes will be a must. I think it is also possible that film cassettes will prove to be a big thing in the future.'

Far from bemoaning the influence of television, he believes we have a lot to thank the television industry for and indeed a lot that feature film makers can learn from tv commer-

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Gerry Humphreys and Robin O'Donaghue inside the control room.

cials. 'This field of operation has developed a whole host of new techniques. Feature film directors are used to taking their time and many would find it impossible to get a complete message into 7s of screen time. A second benefit from television has been its ability to produce a new generation of art directors, all of whom have a lot to offer the feature maker.'

Twickenham Film Studios are working very closely with people in the tv commercial field. Their three stages, 30 cutting rooms, and dubbing facilities are heavily booked for some six months ahead. And while forward planning is difficult, with companies like Ridley Scott, Sierra, Gillie Potter, Eyeline, Barry Myers, Signal, Moving Picture Company, and James Garrett & Partners, this demand seems sure to continue. A tour of the dubbing theatre showed the extent to which Guido Coen is confident of growth, and the confidence that film makers have in the staff and equipment.

Just before Christmas, two particularly interesting films were in the course of production at the Twickenham Dubbing Theatre. A 'first' in more ways than one was a Rolling Stones film *Ladies and Gentlemen the Rolling Stones* which had been directed by Roland Binzer and Marshall Chess. I was shown round by Gerry Humphreys, the director of sound, who warned me that the volume of sound would be rather high. This proved to be the understatement of the year, for we were assaulted by some 110 dB of *Brown Sugar*. During a lull in the proceedings (the sound level had dropped to a mere 70 dB) Roland Binzer explained that they had decided to dub at Twickenham because of the facilities and the co-operation they knew they would receive from the company. In view of the very high standard that the Rolling Stones set, for them to come back from the USA to do the dubbing of this—the first full length feature in quadraphony — was a tremendous recommendation.

Later I was to have the pleasure of watching Gerry Humphreys driving the 36 channel Neve desk during a dubbing session of *Tito—The Fifth Offensive*. For this film a total of some 1,000 effects were used, including 50 different machine gun tracks.

Chris Greenham, the dubbing editor—who won the first sound editing 'Oscar' for *The Guns of Navarone*—explained that he had done a lot of research among all sorts of library stack to find the effects that he wanted. 'We will spend about 160 hours dubbing this film which will run for two hours 14 minutes.' I could understand why when he pointed out that the reel they were working on included 130 effects which had been premixed to a more conventional six tracks.

During the session, Gerry Humphreys was assisted by Robin O'Donaghue. Later over lunch I attempted to discover how it is that Gerry Humphreys has come to be one of the most respected names in the sound recording industry. Our conversation went something like this:

'How long have you been in this business, Gerry?'

'*Well I'm just over 21 so it must be a little bit more than a few years.*'

Perhaps you could tell me then how it was that you got started?'

'*Ah well, I was a backward child you see, so I took a job as a sound trainee at Walton Studios. Later on they let me near a sound camera, and sound booms and things like that, and about three weeks later I was allowed to give a hand with some mixing.*'

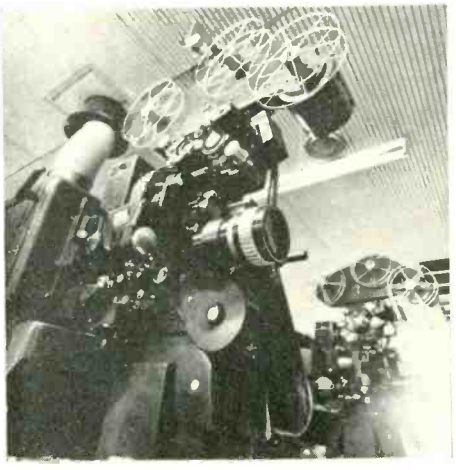
Despite this irreverent sense of humour, or perhaps because of it, Gerry has been something of a rising star ever since. He spent 12 years at Walton before leaving to become assistant dubbing mixer at ABPC (EMI) at Boreham Wood for 12 months, following which he went to Star Studios at Hampstead as the dubbing mixer. The next 18 months he spent working mainly on tv commercials until he joined Twickenham in 1964 as assistant to Steve Dalby. He took over the dubbing mixer's chair in 1965 and in 1966 was appointed to his present position of director of sound.

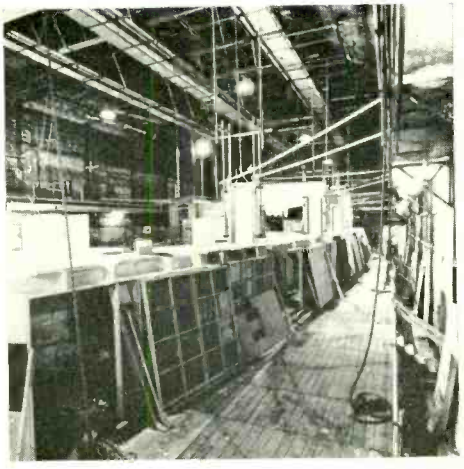
Since the dubbing theatre opened in 1960, the list of films dubbed there reads like a resume of box-office 'top ten': *Tom Jones*, *Cul-de-Sac*, *Accident*, *Up The Junction*, *Charge of the Light Brigade*, *Lion in Winter*. The Beatles films *A Hard Day's Night* and *Help*, and more recently *The Italian Job* and *Oh What a Lovely War*. Even more recent productions have included *Nicholas and Alexandra*, *Sunday Bloody Sunday*, *The Ruling Class*, *Brother Sun Sister Moon*, *The Black Windmill* and *The Three Musketeers*. That award-winning films of this calibre have been produced via the Twickenham Dubbing Theatre speaks volumes for Gerry Humphreys and his backroom staff, and indeed a walk through that labyrinth of backrooms is like a stroll through a manufacturer's showroom.

The eye hardly has a chance to take in the two RCA Optical cameras before it flies to the two six track RCA *FR10* recorders for 16 mm and 35 mm, and four other recorders for one, three, four or six track, depending on which head block is used, and of course the other RCA recorder for standby. There are also a further eight RCA recorders in various other rooms. Together with two AEI *Fedi* rock and roll installations and a 50W VitaVox monitoring system with a roll-off filter, and of course that 36 track stereo Neve desk. And it is perhaps here that we find the reason for the undoubted success that Twickenham enjoys: efficiency and flexibility.

I left Twickenham feeling that, if the future of the British film industry is in the hands of people such as these, then it has nothing to fear from recessions or foreign competition.

Below: Projection room.
Bottom left: Exterior of Twickenham Film Studios.
Middle: Control room.
Right: Inside Stage Three.





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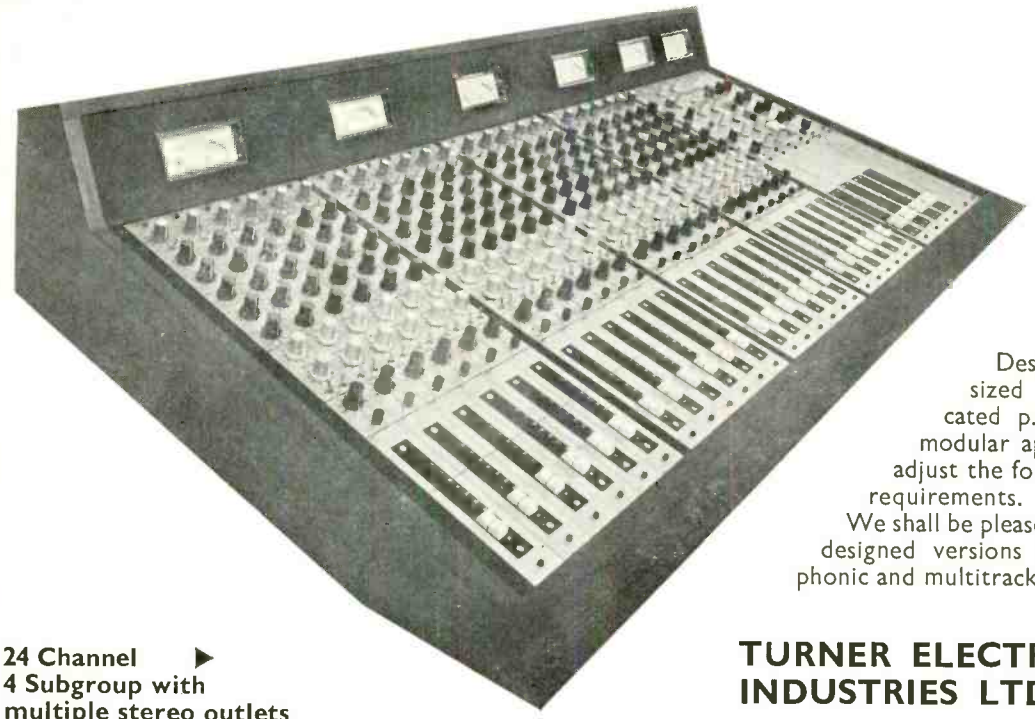

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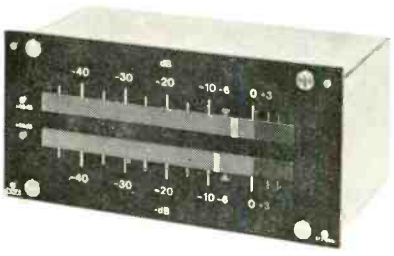

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NTP ELEKTRONIK A/S, 44 Theklavej DK-2400, Copenhagen NV, Denmark
Telephone: (45 1) 10 12 22 Telex: 16378 ntp dk.

Survey: Tape/film Synchronisers

ALBRECHT

Wilhelm Albrecht GmbH, 1 Berlin 44, Maybauchufer 48/51, West Germany.
Agents: F.W.O. Bauch Ltd, 49 Theobald Street, Boreham Wood, Hertfordshire WD6 4RZ. Phone: 01-953 0091.

MB 23/1A

Magnetic sound recorder available in three basic forms. Model *35A* handles 17.5 and 35 mm magnetic film. Model *36AM* records and reproduces centre track 16 mm, and Model *16AR* edge track 16 mm magnetic film. Other formats to order.
Dimensions: 440 x 410 x 1,750 mm.
Weight: 85 kg.

MB 21/1W

Magnetic sound reproducer available in three basic forms. Model *35W* handles 17.5 and 35 mm magnetic film. Model *16WM* reproduces centre track 16 mm and Model *16WR* edge track 16 mm magnetic film. Other details as *MB 21/1A*.

MB 41

Magnetic sound recorder with facility for synchronous operation of up to 50 machines between 0 and ±100 frames/s. Model *MB41/16* handles 16 mm magnetic film; Model *MB 41/35* 17.5 and 35 mm.
Dimensions: 440 x 410 x 1,750 mm.
Weight: 106 kg.

AUTOMATED PROCESSES

Automated Processes Inc, 80 Marcus Drive, Melville, New York 11746, USA.
Agents: 3M (UK) Ltd, 3M House, Wigmore Street, London W1. Phone: 01-486 5522.

Maglink

Synchroniser designed to couple an audio tape recorder (atr) to sprocketed magnetic film, to Quadruplex or helical vtr, or to another atr. Uses SMPTE time code to phase lock master and slave. Operates in either frame-lock (Address) mode or manual offset (Flywheel) mode.
Code generator output: +4 dBm nominal.
Required bandwidth: 30 to 4k Hz (±6 dB).
Minimum speed: Approx 1/10 normal.
Maximum play speed: 4 times normal.
Maximum slewing speed: 400 times normal.
Sync accuracy: 3.4 ms.
Search accuracy: Determined by stopping time of machine. 200 ms at 38 cm/s.

CRESTA

Cresta Electronics, 72 Loom Lane, Radlett, Hertfordshire WD7 8PA. Phone: 01-779 5342.

R1

Record only, unit for projectors or cameras. Powered by PP3 or equivalent. Input from camera DIN three pin plug, output 3.5 mm jack. Cinepulse cassette (below) plugs into output socket.
Price: £9.46.

TT1

Transcription unit for transferring pulses from cassettes or from reel to reel when making sound track copies, or when transferring from pulse to sprocketed tape.
Price: £9.46.

CS/2 mark 3

Record playback unit. Control circuit operates via isolating transformer and a thyristor in the motor circuit. Suitable for manual or automatic transfer to stripe in sync.

Cinepulse cassette

Compact cassette with built-in head which records pulses as well as sound, so that portable cassette recorders can be used for pulse sync sound without modification.

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Automated Processes *Maglink*

WHO'S WHO IN SOUND

RUPERT NEVE

Anyone who is anyone in sound knows, if professional audio control and distribution equipment is to do its job, only the best is good enough. They know what they want. The highest standards of quality and reliability and technical performance as near the theoretical limits as possible. Plus the fact that Neve equipment is custom built to individual requirements and tailored to fit neatly into limited studio space. Naturally it all goes to produce a very impressive list of Neve customers.

Here's a list of some of their 1973 customers:

Radio and TV: RTV Romania; Link Electronics; B.B.C.; Marconi; Granada Television; Radio Luxembourg; Tyne Tees Television; Damascus Radio; HTV Ltd.; Radio Telefis Eireann; Greater Manchester Radio; Gospel Radio Fellowship; HSV7, ATN7, ATVO, Australia; B.F.B.S. (British Forces Broadcasting Service); R.T.V. Singapore; Yorkshire Television; Capital Radio; Ampex; Rediffusion; London Weekend Television; I.B.A.; Radio Sofia; Nigerian Broadcasting; United Evangelistic Church; WGBH; WRMF; Encounter Ministries; KBYU; KHOF TV; WSM; WBZ; CBC.

Theatres: Royal Opera House; Congress Hall, Bucharest.

Communications: Pye Business Comms.; Fernseh GmbH.

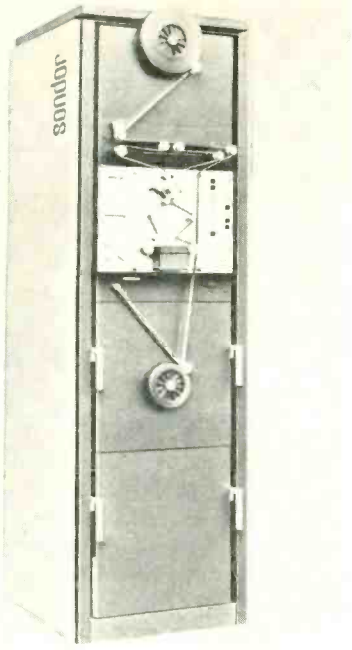
Film: Shepperton Studios; Felix Acaso; Pinewood Studios; Consolidated Film Industries; Imperial War Museum; Zaar Films.

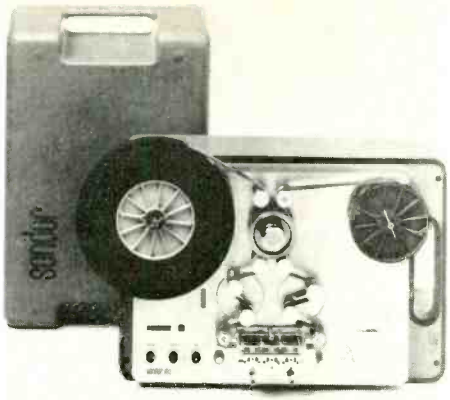
Recording: J. Albert; Metronome Records; Preview Sound; R.C.A.; Radio Triunfo; C.T.S. De Lane Lea; Federal Records; CBS-Sony, Japan; Cockatoo Sound; R.G. Jones; Music for Pleasure; Pye Records; Weir Sound; Polydor; West of England Studios; Maritime Studios; EMI; Festival Records; Bavaria Atelier; Arne Bendiksen; Gallo; Belter Records; Carbo; Elliot Mazer; CBS Records; Decca; Iyanda Records, Nigeria; Multi-Media; Creative House; Caribou Ranch; Eastman Kodak; Harcourt Brace; His Masters Wheels; PAC Inc.; Sound City; Track Recorders; Whitney Recording; Griffith Gibson; Les Productions Paul Baillargeon; Marc Productions; Mercey Brothers; Jeff Smith Interchange; Linkage Sound; Studio Marko; Studio 3; Intervideo; Mahogany Rush; Sound Toronto; Chatham Square; Neil Young; Belafonte Enterprises; Air Studios.

Universities and schools: Syracuse University; University of Surrey; Plymouth Polytechnic; Yale School of Music.

Neve internationally sound people

Rupert Neve, Cambridge House, Melbourn, Royston, Herts. Telephone: Royston (0763) 60776. Or Cambridge (0223) 53454. Telex 81381.
Cables Neve Cambridge. 2719 Rena Road, Malton, Ontario L4T 3K1, Canada. Telephone: 416 677 6611. Telex 0696 8753.
Berkshire Industrial Park, Bethel, Connecticut 06801, U.S.A. Telephone: (203) 7446230. Telex 969638. Hollywood Office: Telephone: (213) 465 4822.





Above: Sondor *OMA3* 16 mm.
Right: Sondor *M3* 16 mm.

SURVEY

FARNELL-TANDBERG

Farnell-Tandberg Ltd, 81 Kirkstall Road, Leeds LS3 1HR. Phone: 0532 3511.

11.2M.

Comprises Tandberg *11-2M* battery tape recorder, Farnell *FT1* sound sync indicator, *FT2* tone generator, and *FT5* pulse counter. The *FT2* generator is for use with 8 mm cameras, *FT3* being for all 16 mm cameras fitted with pilot tone generators, and the *FT4* for use with converted Bolex *MCE 17B* motors.
Price: £442.38 basic.

15.2M

Comprises Tandberg *15.21M* tape recorder, Farnell *FT1* sound sync indicator, *FT2* tone generator and *FT6* synchroniser.
Price: £182.26 basic.

KUDELSKI

Kudelski S.A., CH1 033 Cheseaux Lausanne, Switzerland.
Agents: Hayden Laboratories Ltd, 17 Chesham Road, Amersham, Buckinghamshire.
Phone: 024 03 5511.

QSLI

Sync and pilot playback voltmeter. This plug-in accessory for the Nagra *4* may be used for measuring the amplitude of the pilot playback signal or for modifying the Nagra tape speed so as to synchronise the pilot playback signal with a pilot reference signal. In conjunction with *QGX* quartz crystal generator, the average playback speed can be held to within ±0.001% of the average recording speed.
Dimensions: 100 x 48 x 10 mm.
Weight: 0.035 kg.
Input & Output: Characteristics via internal connections in Nagra.

SONDOR

Sondor Export AG, Dachslerenstrasse 11, 8702 Zollikon, Switzerland.
Agents: Hayden Laboratories Ltd, 17 Chesham Road, Amersham, Buckinghamshire. Phone: 02403 5511.

M3

Portable magnetic film recorder available in 16 and 35 mm formats. Specification relates to 16 mm.
Number of tracks: Two (interchangeable plug-in head assemblies available).
Meter: Switchable VU-meter for sound, pilotton and battery control.
Indicator: Flat battery warning lamp.
Spooling: Fast forward and reverse.
Cue track: Automatic.
Speed: 24 or 25 frames/s.
Counter: Built-in footage counter.
Interlock: (a) 1V 50 Hz pilotton. (b) Rotary pulse generator. (c) Built-in crystal oscillator. (d) Signal output for interlocking further *M3*s.
Starting time: Less than 5 ms.
Loudspeaker: Built-in switchable.
Power requirement: 12V car battery or equivalent (7 Ah) (24V model on request).
Input voltages: (Pilotton): 1V 50 Hz. (Audio): 0.775V or 4.4V 600Ω.
Output voltages: (Audio) 0.775 or 1.55 or 4.4V 600Ω.
Dimensions: 420 x 280 x 250 mm.
Weight: 18 kg.
Spool capacity: 310 m.

OMA 3

Magnetic film recorder available in 16 mm, 17.5/35 mm and dual gauge formats. Automatically interlocks to 50 or 60 Hz pilotton signals from separate tape. Up to eight track record/play. Operates up to 20 times normal speed (5 ms start of stop). Vtr sync facility optional.
Power supply: 110, 120, 220, 240 V ±10%. 1 phase, 1kVA.
Input voltages: (Pilotton): 10 μV to 10V, 50 or 60 Hz; (Audio): 0.775V, 1.55V or 4.4V 600Ω.
Output voltages: (Audio): 0.775V, 1.55V or 4.4V 600Ω.
Frequency response: 40 to 12k Hz ±1.5 dB.
Signal-to-noise ratio: 60 dB, 20 to 20k Hz.
Distortion at 1k Hz: 1.5%.
Wow and flutter: 0.05% using BASF polyester film.
Dimensions: 1,890 x 635 x 543 mm (lwd).
Weight: 170 kg.

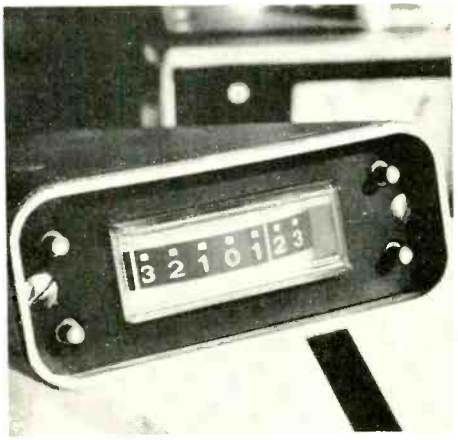
STELLAVOX

Georges Quellet, 2068 Hauterive/Ne, Switzerland.
Agents: AV Distributors (London) Ltd, 26 Park Road, Baker Street, London NW1 4SH. Phone: 01-935 8161.

ARU

Battery powered synchroniser designed for Stellavox *SP7* portable tape recorder. The *SP7* can thus be locked to the *ARU*'s quartz oscillator, to an external reference, camera pilot or vtr. Facility for accelerating recorder by ±1 frame/s.

Left and Below: Stellavox *ARU*



QUAD 303
POWER AMPLIFIER

By Hugh Ford

MANUFACTURERS' SPECIFICATION

These figures relate to either channel, with or without the other channel operating.

Power output and distortion (with unrestricted bandwidth): 70 Hz 0.03%, 700 Hz 0.03%, 10k Hz 0.1%. At any level up to 28W 16Ω load. At any level up to 45W 8Ω load.

Frequency response: —1 dB (ref 1k Hz) at 30 Hz and 35k Hz into 8Ω. —1 dB (ref 1k Hz) at 20 Hz and 35k Hz into 16Ω.

Output source impedance: 0.3Ω in series with 2000 μF and 6 μ H.

Input level: 0.5V rms for 30W into 16Ω.

Input impedance: 22 kΩ in parallel with 60 pF.

Hum and noise: —100 dB below full output.

Interchannel crosstalk: 30 Hz to 1k Hz better than 60 dB. Input load 1 kΩ.

Stability: Unconditionally stable with any load.

Power input: 100 to 125 or 200 to 250V 50 to 60 Hz. 40-200W depending on signal level.

Weight: 8.2 kg.

Dimensions (w x h x d): 120 x 159 x 324 mm plus 38 mm for connectors).

Other applications: For music in the home the amplifier is suitable for use with speakers of all impedances between 4 and 25Ω. For high level sine wave duty and other special applications involving reactive loads the load impedance should be not less than 8Ω.

Price: £62.

Manufacturers: The Acoustical Manufacturing Co. Ltd, 30 St Peter's Road, Huntingdon.

IT HAS ALWAYS struck me that many engineers in the recording business regard the Quad *303* as a domestic amplifier and have not bothered to read the specification or really investigate its possibilities.

The mechanical construction of the amplifier is to a very high standard, with the connectors and other facilities completely recessed such that dropping the amplifier on to the floor is more likely to damage the floor than the amplifier. In fact the rear of the amplifier comprises a substantial cast heatsink with the output transistors mounted between the fins, and the front of the amplifier is a further casting which is joined to the rear casting by a solid chassis.

The input/output connectors, mains voltage selector and fuse are located on a plate set into the front panel which also accommodates a mains pilot lamp. Mains input is by a miniature Bulgin three-pin socket which is associated with a rotary-plug type voltage selector covering the standard European and American input voltages. Overall amplifier protection is by a 20 mm fuse which is also located on the front panel and identified by the symbol *T2A* which in fact means a 2A Time lag fuse and is the symbol in accordance with British Standards 415:1972 and 4265:1968. Personally I find this identification confusing, and I apologise to Quad for accusing them of not identifying the fuse rating on the type *50E* amplifier which I previously reviewed, when they had in fact included a similar identification.

Inputs are by means of a single four-pin DIN socket which does not have its connections identified on the front panel, and outputs consist of two pairs of 4 mm banana sockets which are not on the standard 19 mm spacing. These two features could be improved, as the screw terminal combined with a 4 mm socket on 19 mm spacing is a much more convenient device and I have a peculiar hate for wiring-up DIN plugs [*You're not alone*—Ed]. There is however plenty of space to accommodate alternative types of plug and socket, including enough space to mount *XLR* type plugs if one so wishes.

The accessibility of the components for servicing is really excellent, as each of the two channels has its own printed board which can easily be hinged out from the bottom of the amplifier. A third printed board is occupied by the dc voltage stabiliser which feeds both channels, the series stabiliser transistor and the output drive transistors being mounted on the rear heatsink.

There are a total of five preset controls in the circuitry, the first of which adjusts the stabilised dc voltage and the remaining four being used to set the quiescent current and the operating point of each of the two channels.

Output power and distortion

While the Quad *303* is basically designed as a stereo amplifier with a rating of 28W into 16Ω or 45W into 8Ω for each channel, it may also be used as a single channel amplifier with a rating of 90W into either 4Ω or 16Ω by running the channels in series or parallel. These configurations can be accomplished with very little modification and mean that the amplifier offers more than adequate power for most applications where a high quality monitor amplifier would be used.

The measured output clipping point at 1k Hz was found to be as in the following table, and was found to be constant when either or both channels were operating and also constant when the incoming mains voltage was reduced until the incoming mains fell to –6.7 per cent on the nominal setting. This is of course a great advantage for many purposes, as with an unstabilised power supply the output power potential would have fallen by 13.4 per cent.

Load resistance	Output clipping point at 1k Hz	
	Channel One	Channel Two
16Ω	28W	28.1W*
8Ω	48W	48W
4Ω	34.8W	28.6Wt

*Ω loads are outside the manufacturers' specification so far as distortion performance is concerned, but these figures exceed the performance indicated in the manufacturers' graphical data.

The distortion performance of the amplifier was measured in terms of second and third harmonic components at 1k Hz and at 10k Hz at various power levels, because it is inevitably difficult to measure total harmonic distortion at very low levels in the presence of any hum and noise. The following figures demonstrate an exceptionally good performance which puts the Quad *303* into the very best class of amplifiers:

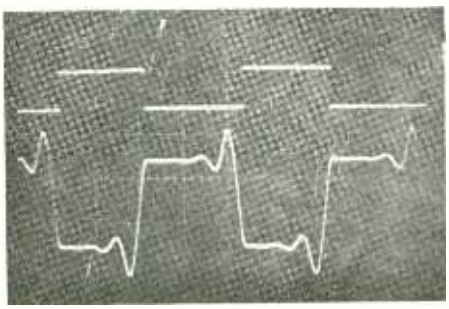
Because both channels demonstrated a very similar distortion performance, the results (below) are only quoted for the average channel, as is also the case with the following figures for intermodulation distortion as measured by the SMPTE method with 50 Hz and 7k Hz tones in the amplitude ratio 4:1.

Equivalent peak output into 8Ω	Intermodulation distortion
45W	1.95%
4.5W	0.028%
450 mW	0.02%
45 mW	0.012%

Clearly the above intermodulation distortion figures indicate a high standard of performance, and while the distortion at 45W is not all that it might be, reduction in output power to 40W gave a figure of 0.03 per cent and investigation around the rated 45W output showed the expected steep rise in distortion that is normally

54 ▶

FIG. 1

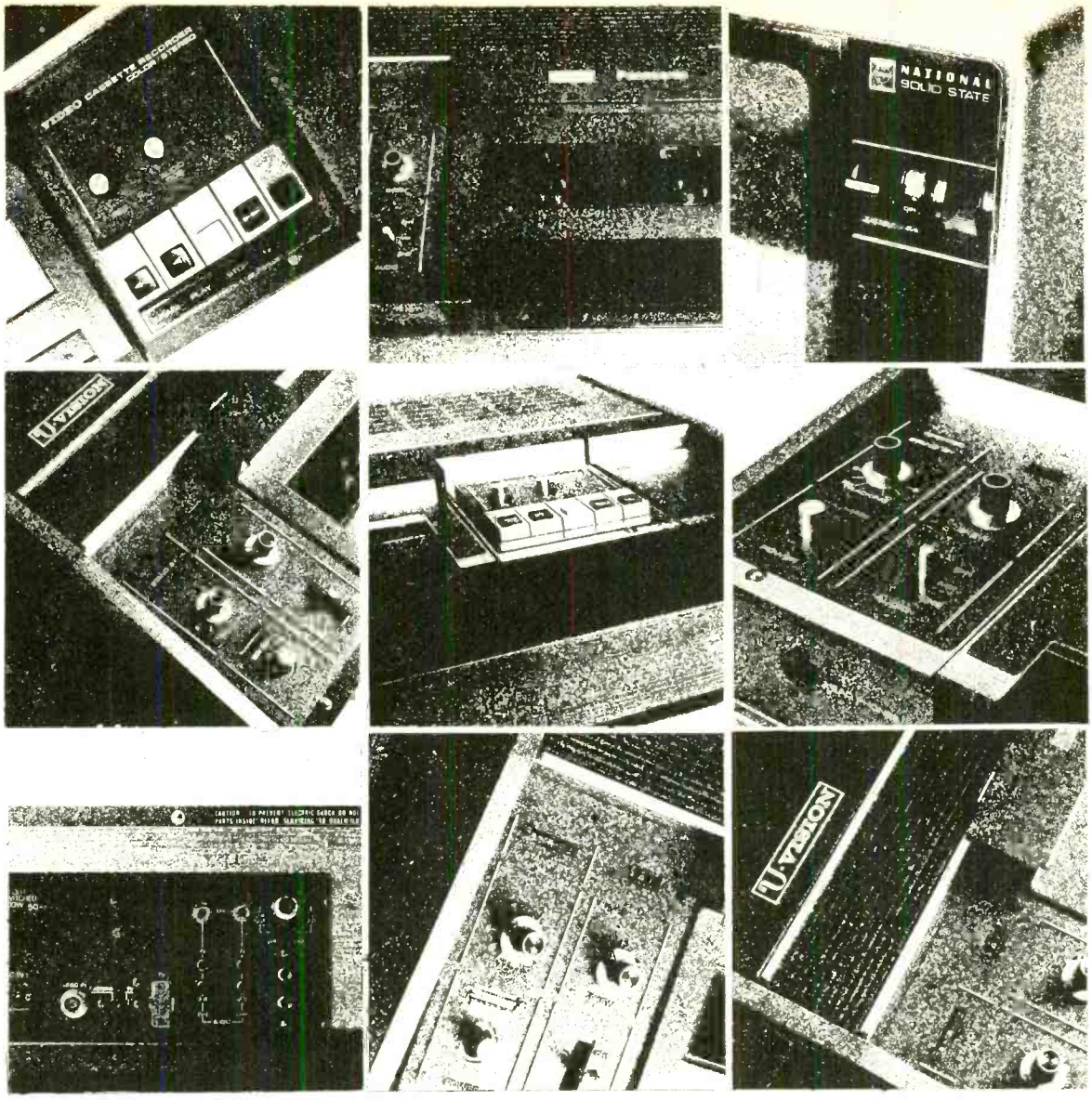


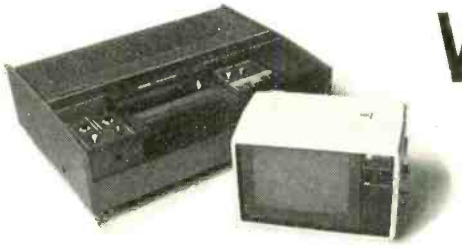
Output power into 8*R*

45W
4.5W
450 mW
45 mW

Testgear residential

Distortion at 1k Hz		Distortion at 10k Hz	
Second	Third	Second	Third
0.014%	0.016%	0.046%	0.07%
0.014%	0.009%	0.056%	0.034%
0.012%	< 0.005%	0.04%	0.032%
0.006%	< 0.005%	< 0.008%	0.005%
0.005%	0.005%	0.008%	0.005%





Whichever way you look at it, it's great.

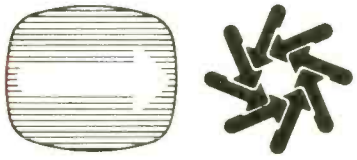
The NV3000E/AV colour video cassette recorder produced by Action Video and based on the National Panasonic U-matic standard is now available.

It is compatible with the Sony VO1810 and JVC CR6000 U-matic colour cassette recorders but offers a number of additional features not found on these models. The major difference is that the NV3000E/AV comes complete with a 9" monochrome receiver that gives full off air recording facility in colour. The 9" receiver plugs straight into the cassette recorder via a single lead which carries video and sound to the recorder. A colour detector light on the recorder lights up when a colour input signal is being received. If the set is tuned in in the normal way this enables high quality colour recordings to be made straight off air.

The recorded tape may be played back into any conventional colour receiver* from the UHF output of the recorder. Video inputs and outputs are also standard to accept camera or CCTV monitor connections.

Other unique features are automatic colour lock and automatic loading. The recorder is easy to use even by an unskilled operator.

Price is £815, including the monitor, excluding VAT.



Action Video Part of the Action Group
45 Great Marlborough Street
London W1V 1DB
Telephone: 01-734 7465/7

*If you do not already have a colour set, the National TC85GA is recommended at £365 excluding VAT.

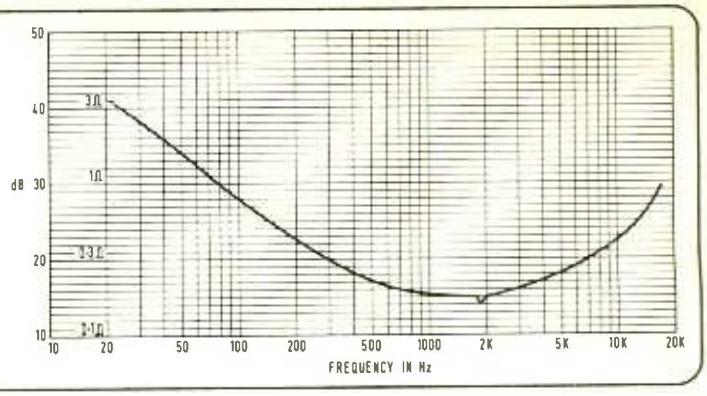
associated with transistorised amplifiers. once the rated output is exceeded.

The application of fast risetime squarewaves gave a measured slew rate of 2.5 V/μs with a rise time of 6 μs when working into resistive 8Ω loads. The addition of 2 μF of capacitance in parallel gave the waveform shown in **fig. 1** which does not show any tendency towards instability and shows a well controlled overshoot.

Likewise, tone burst testing did not show any visible distortion during recovery from severe overload, even when the amplifier was over-driven by 10 dB with both channels operating.

FIG. 3
QUAD 303
POWER AMPLIFIER
OUTPUT IMPEDANCE

PEN. 260mm/S
PAPER: 3mm/S



Frequency response and noise

Fig. 2 is a plot of the power response at a 1k Hz output of 45W into 8Ω, and also includes the frequency response at 10 dB below this output level. Over the audio frequency band the two responses are virtually identical, and for practical purposes there is no point in exceeding this performance which has a healthy roll-off outside the audio frequency band.

The manufacturers' specification states that amplifier noise is 100 dB below full output, without stating what (if any) weighting network was used for measurement. The measured noise in the output with the input shorted and the output loaded with 8Ω, relative to 45W per channel, was found to be as follows:

	Channel One	Channel Two
Unweighted 2 Hz to 200k Hz	—94.4 dB	—92.3 dB
Unweighted 20 Hz to 20k Hz	—97.3 dB	—96.6 dB
'A' weighted	—101.5 dB	—102.3 dB

Mains hum and its harmonics was well below the above noise and there was no sign of any rf in the output.

Inputs and outputs

The measured input sensitivity at 1k Hz for an output of 45W into 8Ω was 464 mV for the left channel and 483 mV for the right channel, a reasonable difference of 0.34 dB, while the input impedance of both channels was within 0.5 per cent of 20 kΩ.

Fig. 3 shows the relation between output

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FIG. 2 QUAD 303 POWER AMPLIFIER POWER RESPONSE AND FREQUENCY RESPONSE PEN: 1mm/S, PAPER: 1mm/S

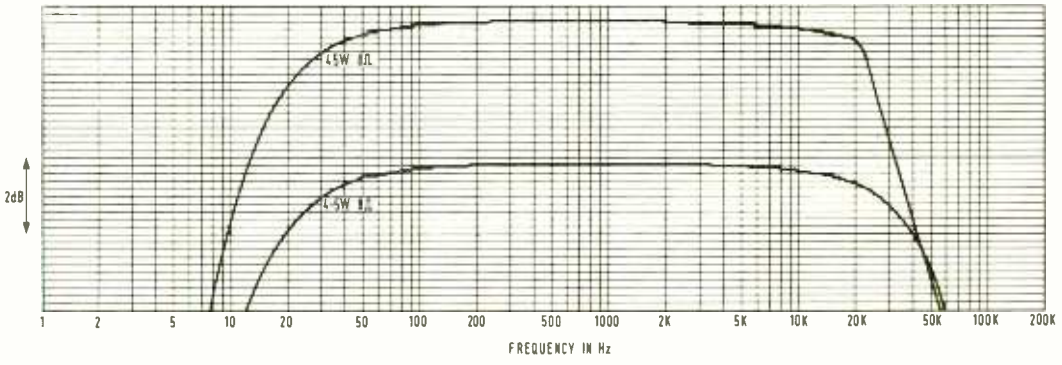
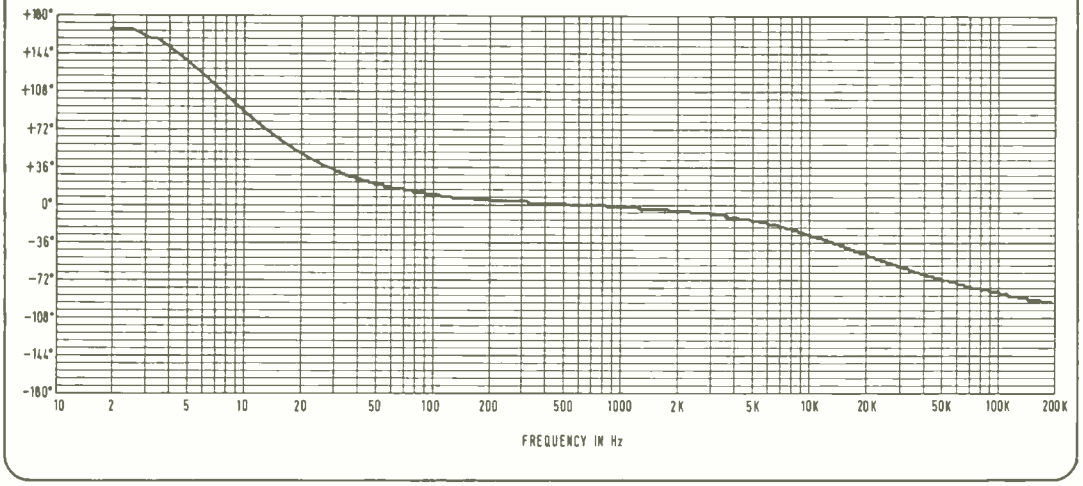


FIG. 4 QUAD 303 POWER AMPLIFIER PHASE SHIFT AT 1W INTO 8Ω PEN 200mm/S, PAPER: 3mm/S



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■ QUAD 303

impedance and frequency, which is fairly typical of capacitor coupled outputs but perhaps offers a rather small damping factor for some loudspeakers.

The measured inter-channel crosstalk with one channel delivering 45W into 8Ω and the input to the other channel shorted, was almost constant at a level 62 dB below 45W from 40 Hz to 20k Hz.

Other aspects

The final matter which may be of interest is the phase shift characteristic of the amplifier; this is shown in **fig. 4** for frequencies between 2 Hz and 200k Hz (with thanks to B & K Laboratories for letting me borrow the demonstration model of their new phase meter —a delightful instrument) which confirms that the amplifier should be inherently stable and does not exhibit excessive phase shift at audio frequencies.

As with other mains-operated equipment, the Quad *303* was inspected for electrical safety in terms of British Standard 415:1972 and I am pleased to report that no faults were found in this direction.

Summary

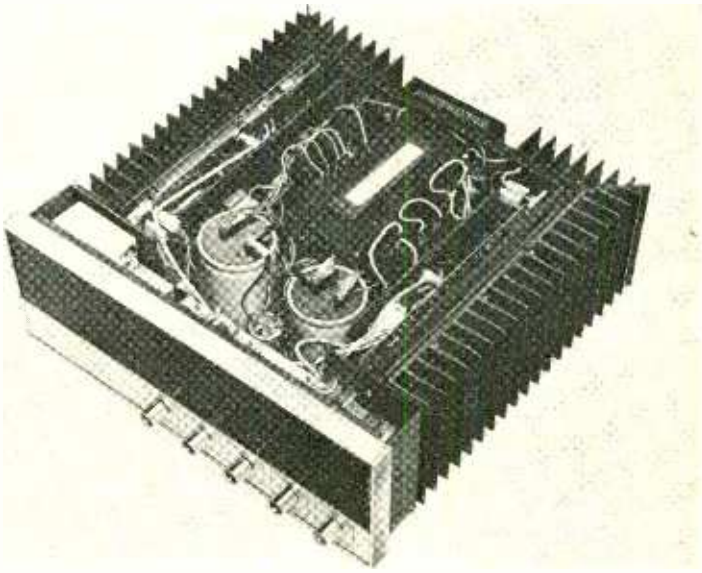
This is a fine amplifier with unusually good distortion performance, good signal-to-noise ratio and a flat frequency response in the audio spectrum with what I regard as a desirable roll-off outside the audio spectrum.

Every parameter was within the manufacturers' specification which, while it is not particularly detailed, does provide the basic performance figures which the majority of manufacturers quote. The only area where I have some reservations is that the potential damping factor is on the small side and might be troublesome with some designs of loudspeaker.

Having regard for the *303*'s performance as a stereo amplifier rated at 45W per channel into 8Ω, or as a mono amplifier capable of delivering 90W into 4Ω or 16Ω, the Quad offers very good value for money and has quite adequate output capability for the majority of high quality monitoring uses.

BOSE 1801
POWER AMPLIFIER

By Hugh Ford



MANUFACTURERS' SPECIFICATION

Frequency response: Audibly perfect (±0.5 dB, 20 to 20k Hz).
Distortion: Inaudible (less than 0.5 per cent).
Hum and noise: More than 100 dB below full output.
Damping factor: Greater than 40.
Power output: 250W (rms) per channel into 8Ω, both channels. 400W (rms) per channel into 4Ω, both channels.
Input impedance: Greater than 50 KΩ.
Input sensitivity: 1.5V rms for 250W into 8Ω.
Minimum load impedance: 4Ω.
Dimensions w x d x h: 483 x 381 x 210 mm (Requires 222 mm of standard rack space. Dimensions do not include handles).
Weight: 36.28 kg operating. 41.27 kg shipping.
Heat sink area: Greater than 0.84 m^2.
Power consumption: 1 kW nominal. 2 kW peak.
Line voltage: 105 to 125V ac (120V ac nominal). 210 to 250V ac (240V ac nominal) (export version). 50 to 60 Hz.
Connectors:
Input: 6.35 mm phone jacks.
Output: Dual banana jacks (five-way binding posts).
Protection: Electronic current limiting protects amplifier from all passive loads; resistive, inductive, capacitive or short circuit. Ac line fuse protects amplifier and power line from internal faults.
Indicators: Led array instantaneous power indicator.
Price: £498.
Manufacturers: Bose Corporation, The Mountain, Framingham, Mass 01701, USA.
Agents: Acoustico Enterprises Ltd, Unit 7, Space Waye, North Feltham Trading Estate, Feltham, Middx.

IN ALL RESPECTS the Bose *1801* can be described as massive. It weighs 36 kg, has a specified power output of 800W, potential power input of 2 kW and enormous heatsinks.

Other than in respect of power output the specification is not particularly impressive by modern amplifier standards. The amplifier is however far better than the specification suggests and both the sales literature and the owner's manual go to great lengths to explain the 'Bose specification philosophy'. This in essence is that attempts to meet better specifications than those quoted are unnecessary because they lead to no audible improvement and reduced reliability. While I agree with part of the 'philosophy', I take exception to some of the sweeping statements made. For instance it is stated: 'Harmonic distortion above 10k Hz is not important, because all the distortion products fall above 20k Hz and are, therefore, inaudible'. To my way of thinking this is clearly not so: if one takes the two tones 10k Hz and 11k Hz and considers their harmonics at 20k Hz and 22k Hz, the mixture of the harmonics will beat at 2k Hz. Furthermore, the third harmonics at 30k Hz and 33k Hz will beat at 3k Hz. It clearly follows that harmonic distortion above 10k Hz does matter and will produce audible results if an amplifier does not include a low pass filter at 20k Hz, which the Bose *1801* does not!

In other respects the literature supplied gives very little information about the circuitry of the amplifier, but a look at its efficiency leads one to think that class-A techniques must be used in the output stages, each of which uses some 14 output transistors.

Each amplifier channel is mounted on a single fibreglass printed board which is plugged in by flying leads for the most part, and a number of other connectors. The output transistors are included on the printed board assembly, and the complete assembly is bolted to the main amplifier chassis which is made of black anodised 3 mm thick alloy. Both sides and most of the back of the main chassis are surrounded with massive finned heatsinks; thus, the complete chassis acts as a large heatsink.

Power is supplied by a very large transformer, which is said to weigh almost 19 kg—perhaps not surprising when one realises that it must handle up to 2 kW of power, and that it is of

the conventional laminated form of construction. This appears to be followed by a single bridge rectifier which provides positive and negative rails to both channels in conjunction with 14,000 μF smoothing capacitors.

While the wiring and general standard of the two printed boards gives no cause for complaint, the general appearance of the internal wiring is rather untidy, and in particular there are two resistors (one of which is a wirewound type) dangling in mid-air on their long leads.

As for the external appearance, this is well styled with a 'Pop group' image front panel. This is occupied by two large illuminated integrated VU meters and a led output level indicator which works in 6 dB steps and also gives an indication if the amplifier is driven into clipping. The front panel controls comprise two rotary gain controls (one for each channel) and three rotary switches which perform the following functions:

(1) A two-position input selector which selects either of two pairs of identical inputs.

(2) A speaker selector for switching to main speakers, remote speakers or both pairs off.

(3) A five-position switch which not only switches power on/off but also selects the level indicators to off, led indicator only, integrated VU indicator only, or both forms of indication. The final front panel facility is a legend type indicator which is illuminated when either the thermal trip switches the amplifier off, or when the main fuse fails.

At the rear of the amplifier there are the two pairs of inputs in the form of unbalanced 6.25 mm jack sockets, the two pairs of output terminals in the form of banana sockets/terminals, the mains input lead, mains fuse and auxiliary mains output in the normal American form.

Power output and distortion

During measurements on the power output, very great care was taken to ensure that the incoming mains supply was at the nominal 240V unless otherwise stated; with an amplifier such as this which can draw almost 10A from the mains, it is even necessary to correct the input voltage under load because of the voltage drop down normal house wiring.

The output clipping points at various mains supply voltages varied over wide limits, as is to be expected, but even when the mains was reduced to 210V the clipping points were just at the rated output level with both channels driven. This provides a very good margin on the rated power output when the nominal 240V mains power is available, and furthermore the onset of clipping is not too abrupt.

However, these tests showed up one of the serious shortcomings of the Bose *1801*. While it is not designed for running with sinewave signals, it was incapable of delivering a constant sinewave power into either 4Ω or 8Ω without the thermal trip operating. This occurred at any power above 16W into 4Ω or 20W into 8Ω with sinewave or white noise inputs. Before anyone accuses me of being unfair by using continuous signals, I took the precaution of feeding Radio Two into the amplifier loaded with 4Ω—it then tripped when the peak power was set around 40W per channel. These tests were done at an ambient temperature of 18°C with the amplifier set on an open bench, and measurement of the heatsink temperature showed a reasonable 40°C at tripping point. It can only be concluded that this sample of the amplifier would be completely useless for work as a PA music amplifier.

The next point of investigation was the distortion characteristics of the amplifier which proved to be a somewhat irritating measurement because of the amplifier tripping all too frequently. The eventual results of measuring harmonic distortion produced **fig. 1,** which shows good mid-frequency performance but somewhat poor high frequency performance. The latter became an even more tiresome measurement because it was found that the high frequency distortion depended upon the heatsink temperature, the figure quoted perhaps verging on the worst case.

Measurement of the intermodulation distortion by the SMPTE method using tones at 50 Hz and 7k Hz mixed in the normal 4:1 voltage ratio, gave the following results, which, while they are quite good, make no comparison with such amplifiers as the Amcron *DC-300A* which is at least an order of magnitude better.

Equivalent sinewave power into 8 Ω	IM distortion (SMPTE) Left	Right
250W	0.055	0.055
25W	0.058	0.068
2.5W	0.032	0.082
250 mW	0.032	0.110

The power response of the amplifier is shown in **fig. 2** and shows that the output has fallen by 3 dB at some 40k Hz which is more than adequate for audio applications. But, as already explained is an undesirably wide bandwidth where high frequency distortion is at a high level.

The delivery of squarewaves into resistive loads did not show any defects, the maximum slew rate being 3.7 V/μs. Furthermore, working into 8Ω in parallel with 2 μF did not produce any instability but showed a slight tendency to ringing as shown in **fig. 3.**

While there was some variation of the dc offset between the output terminals, this was

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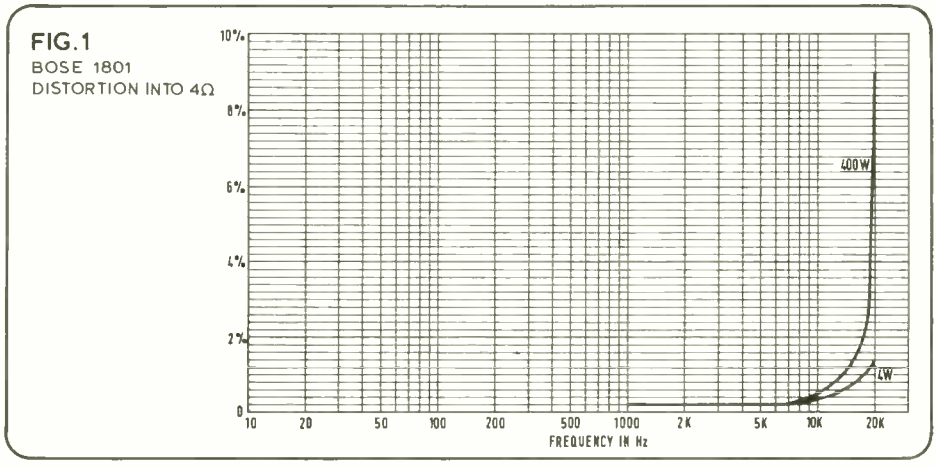
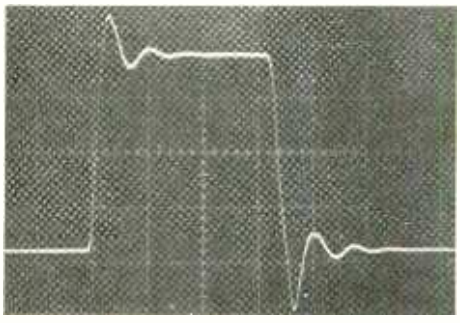
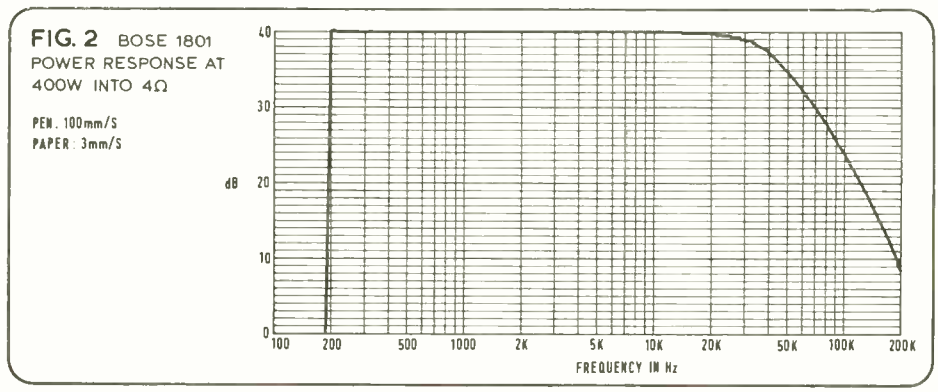


FIG. 3





of little practical significance as at no time did this offset exceed 14 mV on the left channel, and 27 mV on the right channel.

Frequency response, crosstalk and noise

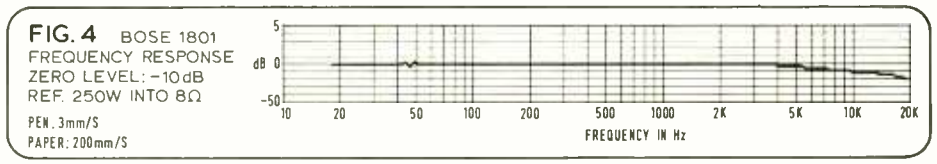
Fig. 4 shows the frequency response at audio frequencies and demonstrates a response within ±0.2 dB from 20 Hz to 20k Hz, the extended response above 20k Hz is very close to the power response shown in **fig. 2.** The overall response is certainly as flat as can be desired within the audio band.

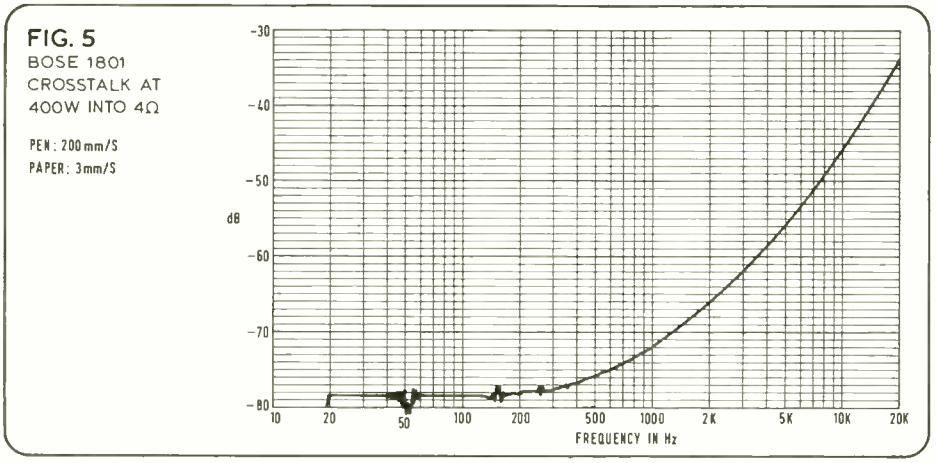
Likewise, the crosstalk between channels as shown in **fig. 5** offers more than is required in the audio band. However, the rate of degradation in crosstalk performance at high frequencies was quite surprising and was found to be associated with cross coupling in the low level stages.

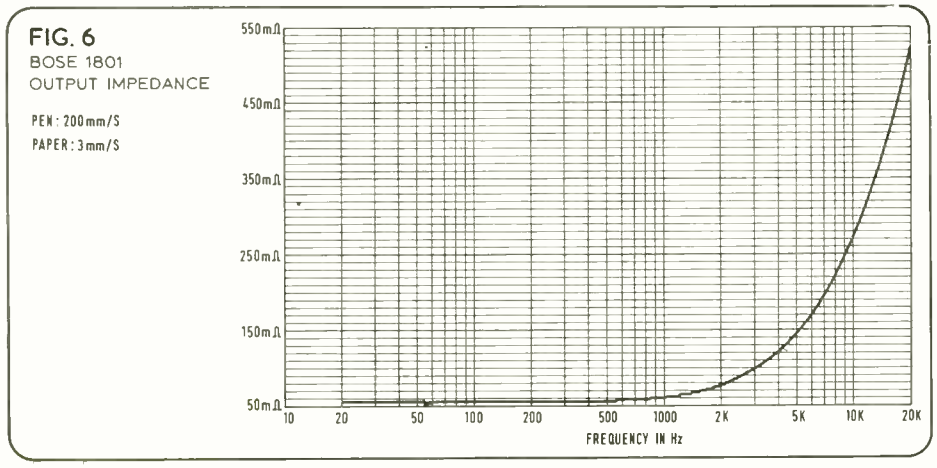
Noise and hum in the output were found at a respectably low level (after discarding one sample of the amplifier which was noisy in one channel), being measured at the levels shown below:

The hum and noise measured with reference to 400W into 4Ω was found to be approximately 1 dB worse in the cases of the band limited and the 'A' weighted figures, and to be virtually identical with the wide band measurement.

Hum and noise reference 250W into 8*R*	Left	Right
Wide band 20 Hz to 200k Hz	—97.0 dB	—96.5 dB
Band limited 20 Hz to 20k Hz	—101.5 dB	—104.5 dB
'A' Weighted	—104.5 dB (A)	—104.5 dB (A)







Other aspects

The input impedance was found to vary between 94,000Ω and 49,000Ω in parallel with 94 pF or 240 pF depending upon the gain setting, while the input sensitivity measured at 1.33V for 400W output into 4Ω or 1.50V for 250W into 8Ω. **Fig. 6** shows the relation between the output impedance and frequency, which is generally satisfactory for audio purposes.

Likewise the phase shift was satisfactory from 20 Hz to 20k Hz, being with reference to 1k Hz +8° at 20 Hz and −28° at 20k Hz. Other than the maximum input power which could reach some 2300 VA, the remaining items of interest are the metering systems.

The led display of peak power was a particularly nice feature in that its operation was for all purposes instantaneous, such that a single cycle of 10k Hz sinewave operated the appropriate led. The nominal 6 dB interval between the individual indicators was also quite accurate, so it is very easy to determine the true peak output power. In addition to indicating output power, a further two led indicators are used to show if the amplifier is driven into clipping; not only are these instantaneous indicators but they are arranged to indicate actual clipping independent of the mains supply voltage—a very sensible feature.

The two integrated VU meters were aligned to the correct VU meter practice, in that 0 VU corresponded to 8 dB below maximum output. However, rather than being integrated VU meters, they were in fact faster than the standard VU meter in that they reached an indication of 0 VU in 190 ms as opposed to the standard 300 ms. Furthermore, they overshot the 0 VU mark on the standard test and bounced upon return to zero. To my way of thinking, the peak led display is an excellent idea but I do not see any point in the addition of the so-called integrated VU meters.

Summary

This is the most expensive amplifier that I have had the opportunity to review in STUDIO SOUND and one would expect in this price bracket to have really first-class performance.

Using this criterion I find it very difficult to say much good of this review sample of the Bose *1801*. Certainly it meets its published specification by a very large margin, and complies with the advertised 'Bose philosophy', but it has a number of defects and a number of shortcomings when compared with other high quality power amplifiers.

In particular, the fact that it will not deliver a continuous signal of speech and music at its peak output even at a room temperature of 18°C, is a very serious shortcoming. While the frequency response and stability are good, distortion is not to a high standard and the noise performance could be improved, not that this is of practical significance with many loudspeakers.

On the credit side I very much like the peak level led display and think that other manufacturers could follow the idea of a led-type clipping point display.

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APRS 74

7th Annual

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