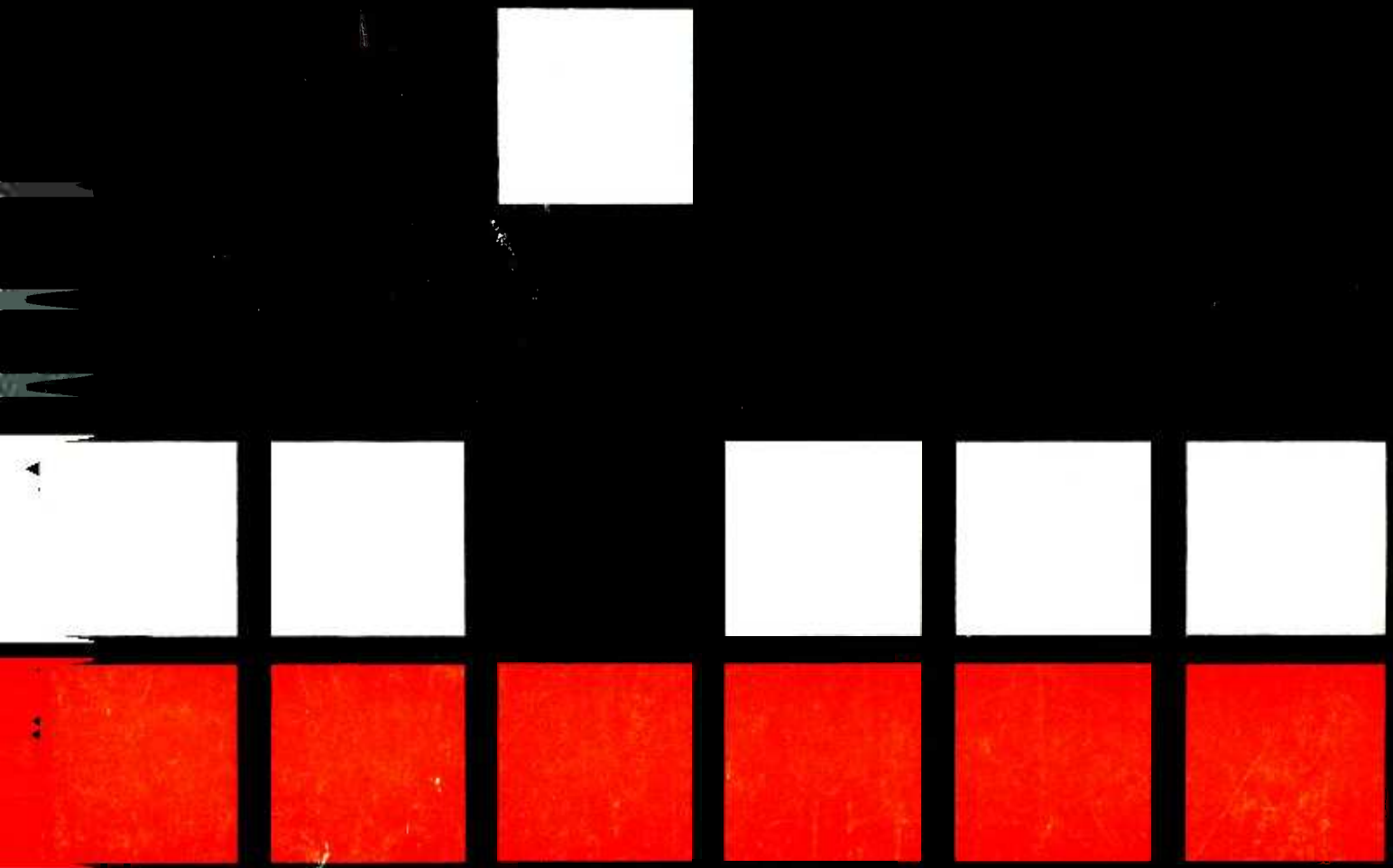
November 1976 35p

studio sound

AND BROADCAST ENGINEERING



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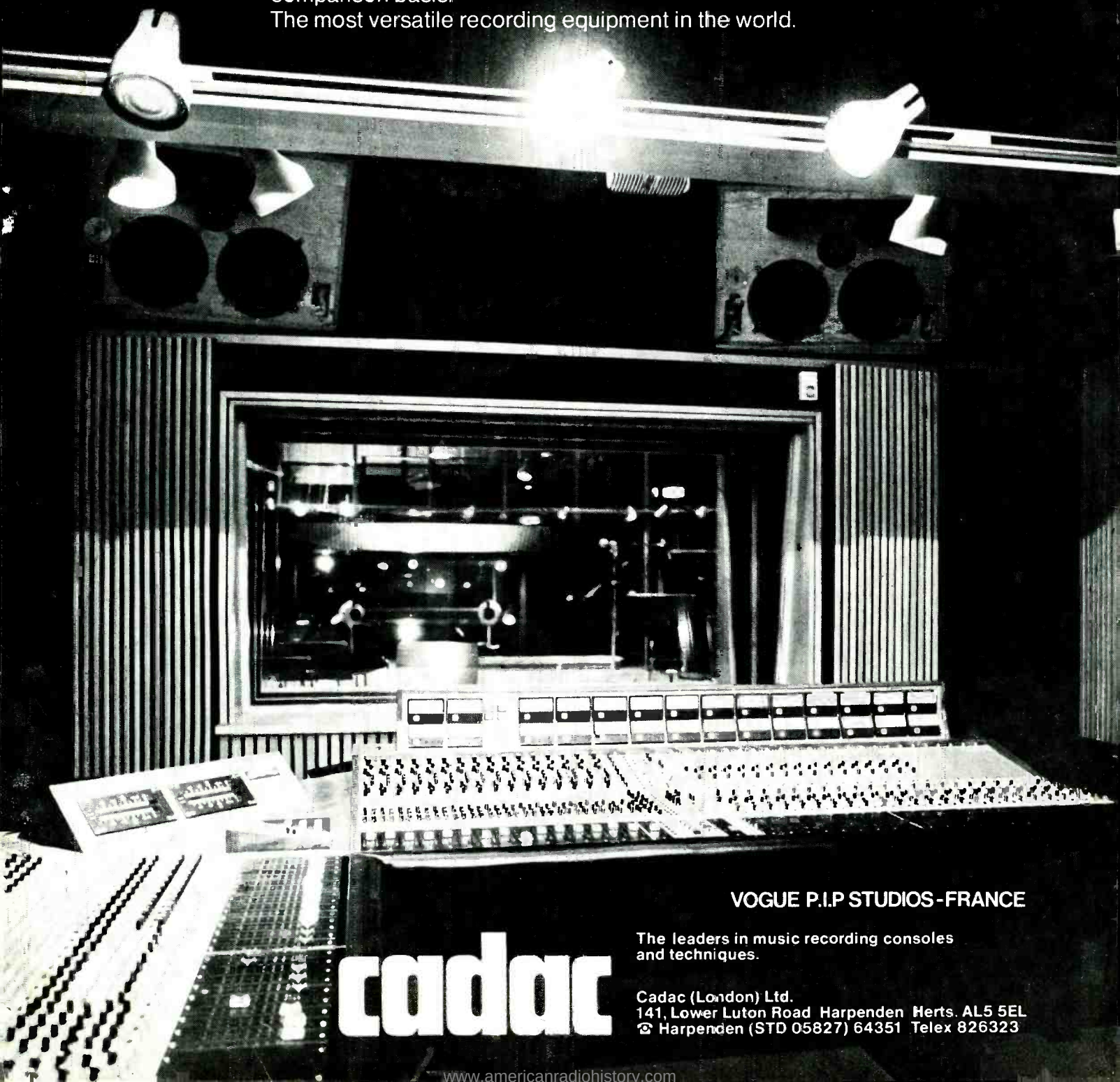

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studio sound

AND BROADCAST ENGINEERING

200,000 travelled by car, train, foot and thumb to Knebworth, England, to see, and presumably hear, six bands performing under the dubious heavens of an English summer. In the event, the unusual tropical weather persisted and most people were quite amiable about the long delays synonymous with an *al fresco* rock show. Thus, when the Rolling Stones took to the stage four hours behind schedule, the only significant complaints arose from the quality of sound from the pa (once again, such hassles seem just as inevitable as those involving the timetable and are dealt with elsewhere in the magazine).

The question that all concerts pose is: what relationship should the performance bear to that derived from the studio environment? It's open to some question as to whether sitting on the grass is the best way to hear a band; after all, the £4.50 entrance will buy at least one favourite lp with the bonus of getting laid back in the privacy of your own home. The only thing an lp lacks is the blast of charisma generated by a live performance, but when the rain comes down, that can be about as comforting as travelling in a lead balloon. Increasingly, the punters are demanding a presentation which comes closer to the tightly edited sound from their hi-fi sets leading to stronger performances from the bands and sound crews.

Neglecting pa system deficiencies, the 10ccs and Floyds have to use a certain, increasing proportion of pre-recorded backing to bridge the inevitable gap; a practice which questions the validity of the live performance. It isn't just the fact that the people could hear the same thing equally well at home, but that spontaneity, one of the great motivations of the live performance, is being sacrificed for authenticity, principally so that the record from which it came will sell a few more. Perhaps a bit cynical, but audience reaction generally bears this out: 'Cor, it was just like the record . . . Cor, it didn't sound like the Zoot Suites at all', etc, etc. The tightest live sounds come from bands that don't try to stick to a recorded format, that don't try to mimic their own performances on record which took a lot more time to make.

A re-arrangement of recorded music for a live gig is far better when it takes into account the limitations of the stage. It makes it possible to concentrate on the musical abilities of the band rather than the expenditure of energy in matching the original. The output from a recording studio is usually only suitable for a vinyl disc, while a subtle variation can well be worth getting a sore bum for . . .

contents

NOVEMBER 1976 VOLUME 18 NUMBER 11

AUDIO DEVELOPMENTS

Hall Lane, Walsall Wood, West Midlands
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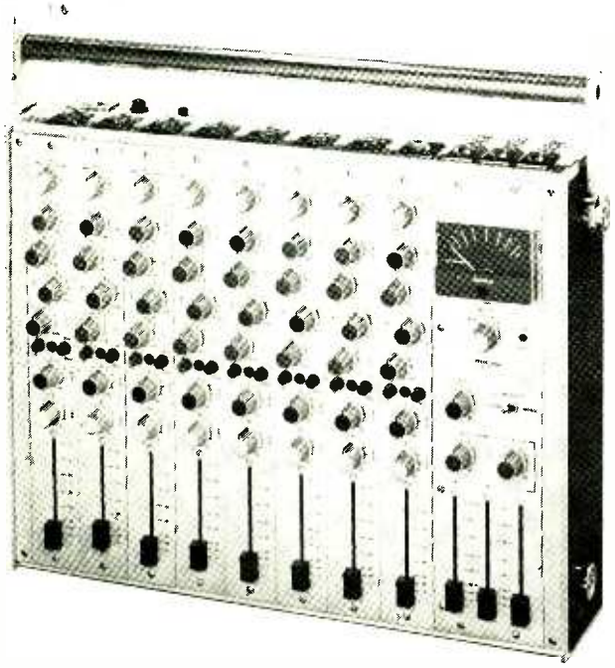
SPECIALISTS IN PROFESSIONAL PORTABLE MIXING



Principal Products:

AD007 MINI Mixer
8/4 battery-powered (with external power option). Modular construction for ease of servicing, MIC or LINE inputs, comprehensive EQ, line up Oscillator, two switched meters and compressor/limiters. Many options including provision for increasing number of inputs to 20 using external unit connected via Extender Socket.

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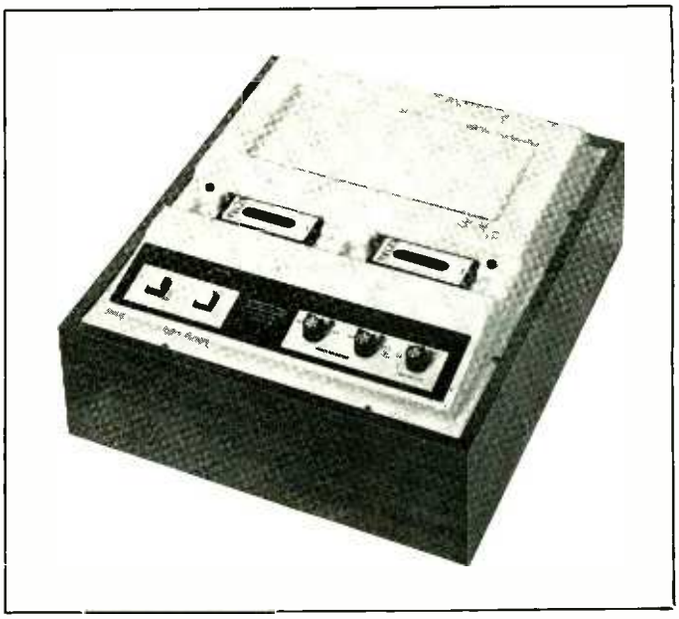
Telex high speed cassette copiers...



functional versatility, operational simplicity.

The Telex two channel Copier I has earned a reputation for fast, easy dependable use. The new Copier IV now adds the versatility of track selectable, four channel operation.

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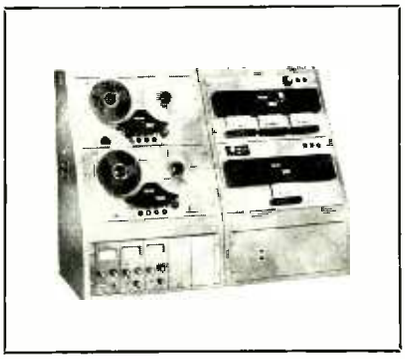
Their compact design and wood grain styling suit the Copiers to desk top use, while optional add-ons can provide up to five copies simultaneously. For higher production capacity, there's the Telex series 300 tape duplicator with modular flexibility to expand as your requirements change. Cassette copiers from £489. Cassette Duplicators from £2,086. For complete information on both products write:



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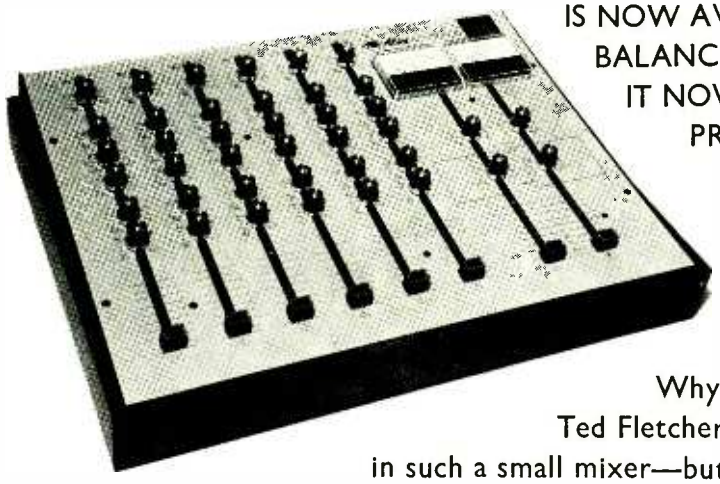

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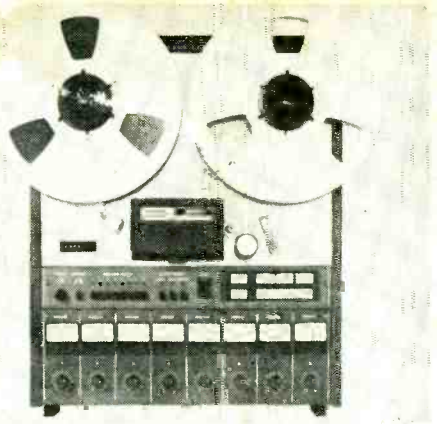

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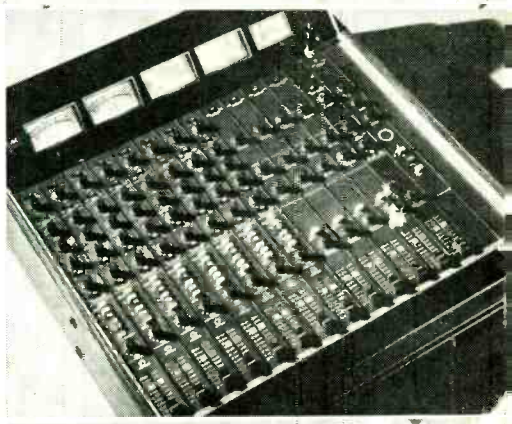

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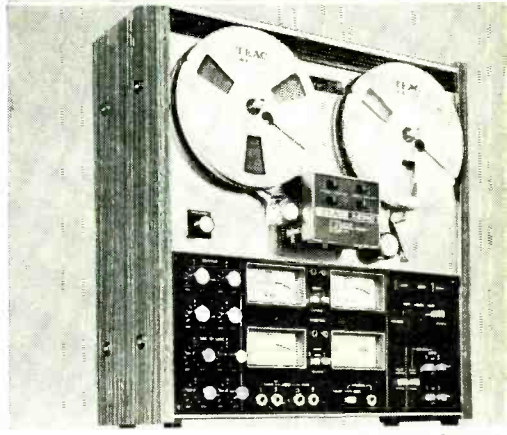

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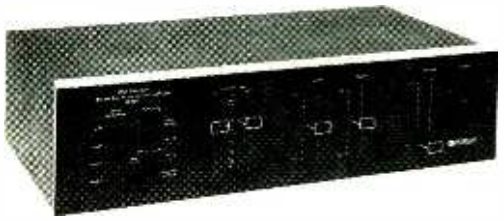

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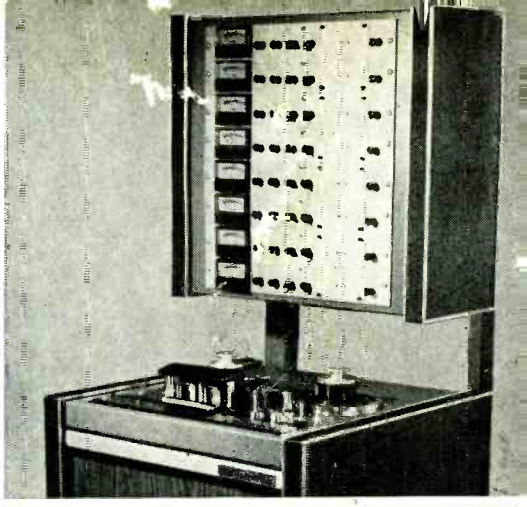

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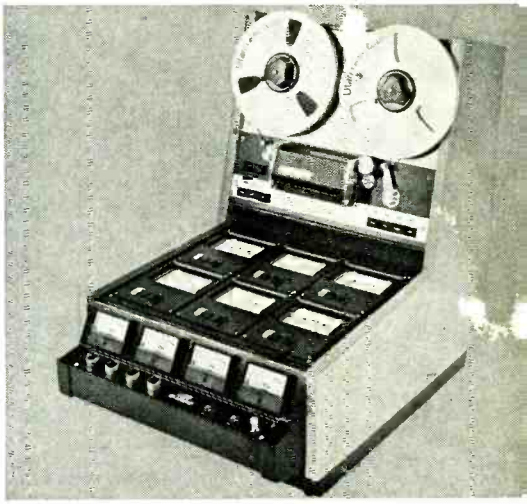

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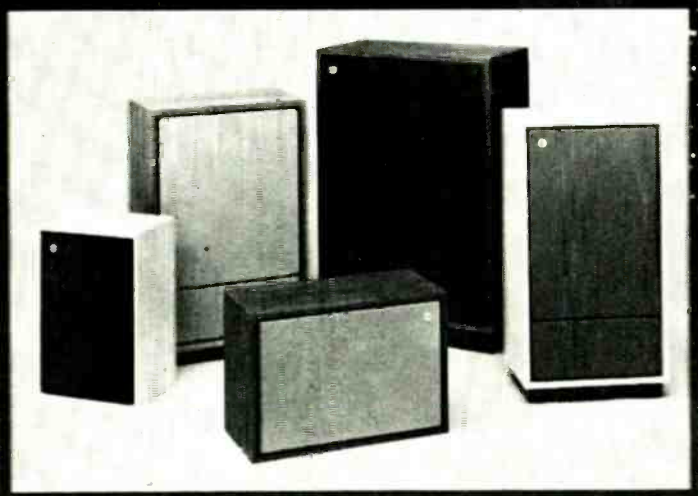


TANNOY. The name says it all

Phonogram Studio London

news

Schlumberger ob van supplied to Zaire as part of their national ob broadcast network 'The Voice of Zaire'. It includes a UPS 4000 console, two F200 tape machines and TD200 turntables plus a full communications interface.

. . . Matrix 'H' ?

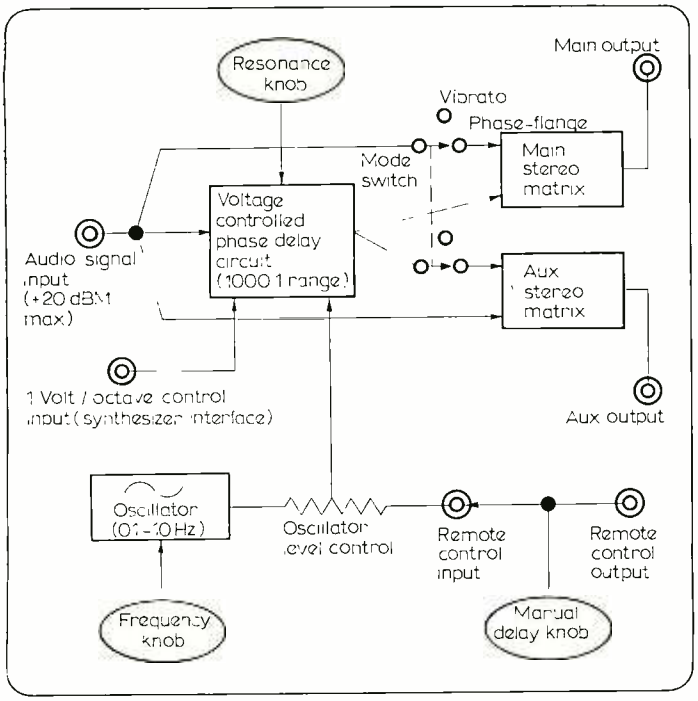
The BBC recently announced its decision over matrix quadraphonic broadcasting, pending the availability of a third or fourth discrete channel by modification of the fm stereo multiplex format. The Sansui QS system had been hotly tipped as the BBC's choice (QS has already been used by the commercial stations Clyde and Piccadilly, and a Capital QS broadcast from the Audio Fair which was to have been held at Olympia had been mooted). But the BBC has in the end backed its own system, Matrix H. Rumours that H stands for Hafler are untrue. H is the eighth letter of the alphabet, and Matrix H was the eighth recipe for phase and amplitude modification that the BBC engineers tried and found most satisfactory during the course of in-house tests. Full details of Matrix H are to be disclosed in an article scheduled for the October *European Broadcasting Union Review (Technical)*, No. 159, but will probably be understandable only to a select few mathematical geniuses. If the *EBU Review* disclosures are favourably received, the BBC will publish constructional details for a suitable decoder and guarantee a short run of entertainment broadcasts in the H system. After that, and according to results and reaction, the system will either be dropped or adopted as a standard, with publication of a definitive White Book similar to that already available for *Teletext* and PAL colour TV.

The BBC has in fact already broadcast at least two H transmissions, both Promenade Concerts. But only ambience information was encoded in the rear channels, and this reproduced almost equally well on Hafler, QS and SQ decoders. It is widely believed that the H matrix most closely resembles the QS matrix, and that only a small phase shift need be introduced to an H signal fed to a QS decoder for correct results to be obtained.

The BBC justifies its rejection of the existing commercial systems in favour of Matrix H by arguing that mono and stereo compatibility is all-important. In the BBC's opinion H represents the best possible compromise between the accurate location of surround sounds and mono and stereo compatibility. The Prom transmissions, while giving no real clue to capability of the system to locate sounds in their intended positions around a listener, suggest the likelihood of no real nasties—unless, of course, the curious fluttery sound heard on the woodwind during the course of the second test (Monday, August 30) was caused by Matrix H in action, rather than faulty or excessively close miking.

Adrian Hope

See Phase Flanger



Phase Flanger

The *SF-3 Stereo Phase Flanger* appears to offer quite a lot of effects for a fairly reasonable price —$369. Manufactured by the Trine Corporation, it offers flanging, phasing, a stereo synthesiser section, vibrato from an internal oscillator, simulated *Leslie* for organ use and external voltage control of major functions. Further, the device features a resonance control which increases depth of phase flanging effects and adds tone coloration to the vibrato mode.

The unit provides suitable levels on the input/output interface for use with other professional equipment. It incorporates an internal power supply. This magazine hopes to review a unit in the near future. The Trine Corporation, PO Box 255, W. Lynn, Mass 01905, USA. Phone: (603) 772 4380.

Education

The Polytechnic of North London has issued a prospectus for a course entitled 'Sound Studios and Recording' organised by Roger Driscoll. The course, requiring one afternoon a week over three terms (one year) is weighted rather more towards the theory and function of hardware than its operational aspect. However, it will include practical work to illustrate some areas of study. Lectures will be held on Thursday afternoons between 14 30 and 16 30 starting on October 28, 1976. There will be an examination towards the end of June. Course fee is £15.

Another course relates to 'Digital Techniques in Audio Processing' and is rather shorter, lasting only one term. It starts on the same date as the above course but at 18 30.

Further information on these and other courses (including degree subjects) can be obtained from Roger Driscoll at the Polytechnic of North London, Department of Electronic and Communications Engineering, Holloway Road, London N7.

It must be pointed out that these, and other courses, will not automatically provide a successful student with a studio engineering job, or even entry to the recording industry. However they could help, but an ability to make a decent cup of tea is still very important.

Backchat

The talkback unit, from Philip Drake Electronics Ltd, is designed for use as a centralised-communications system for recording, office and other environments. It can be used as an intercom and conference talkback system with custom-designed control panels to suit the installation.

The basic unit offers switching between a maximum of eight sources and eight destinations contained within a standard rack mounting unit. Individual cards may be equipped for mic or line

22 ▶

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letters

Dear Sir, I was very interested to read the articles on microphone placement in the April issue of STUDIO SOUND, *and even more fascinated by the letters from Peter Fellgett and Jerry Bruck in the September issue. The original articles appeared genuine attempts by practising recording engineers on their various approaches to music recording of widely different variety. Hence my surprise at Professor Fellgett's comment '. . . but the end of the road is not Bruck's Sputnik but the Craven-Gerzon Collapsar, ie the sound-field microphone'. I did not get the impression that Bruck intended his array to become 'the end of the road' and I am equally certain that the sound-field microphone, as I have seen it and read as much as the inventors have written about the device, is also not the end of the very steep uphill climb.*

As the very learned Professor has agreed, sound location in humans and the ambient surroundings of the source are inextricably linked and I for one am not convinced, from knowledge gleaned from my own experiments and experimental arrays done partly in conjunction with the BBC, that a coincident *(as correctly defined by Professor Fellgett) array is the only answer to decoding spatial location in an ideal, or even a realistic, playback situation. Coincidence of capsules (allied of course to correct signal coding) is not the only parameter to be taken into consideration and until we know much more about our hearing mechanism, from a physiological and biochemical viewpoint, all our microphone theories have an empirical basis. What is needed is not so much a Blumlein but more a Helmholtz who can tie the interdisciplinary knots of mathematics, physics, music, psychology and physiology, and build a foundation for recording technology in the future.*

Yours faithfully, Dr James Crabbe, University of Manchester, Department of Obstetrics and Gynaecology, Whitworth Park, Manchester.

Dear Sir, Even if we committed the entire record collection housed in the Library of Congress to tape cartridge and asked Richard Burton and Diana Rigg to recite the contents of Webster's newest offering into a waiting battery of A77s, tied the whole mess together with a flock of cue tone generators and reel-to-reel tape machines and cartridge players, we could never achieve the sense of spontaneity and the level of art that a dj who's worth his limiter gets, each time he changes his program source.

Muzak and Robot-Rock are poor excuses for live radio. The tightly programmed sound is better left in the disco, than to be permitted to occupy the precious spectrum space allocated to the likes of the BBC, NBC, IBA or ABC.

Granted, the technology is there and the desire to reduce payroll costs is of import, but a 26.7cm NAB tape reel and a push pin matrix board won't get you going in the morning or give you a good laugh when you really need it. It's the one-to-one ratio that makes radio the personal medium that it is. And no slick sound effects segued into a 30-second spot would be allowed to change it.

But let's face it—nobody believed in quad either.

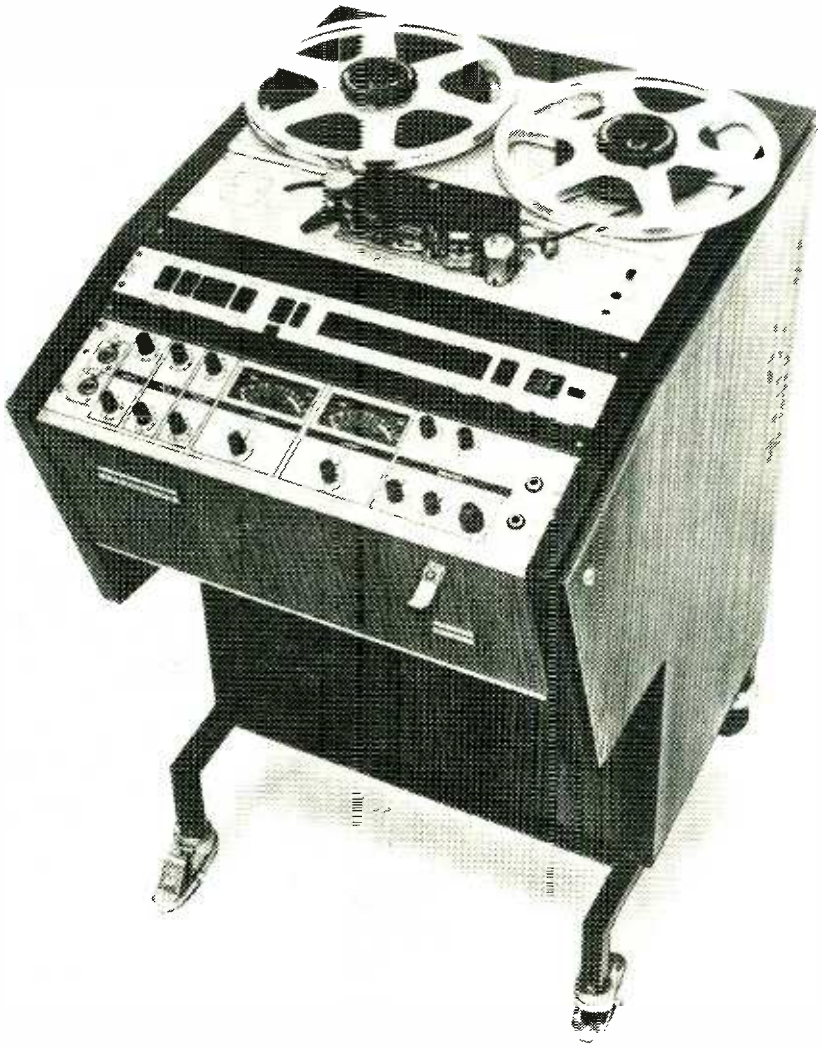
Yours faithfully, Keith Bloomfield, 170 Puritan Drive, Scarsdale, N.Y. 10583.

Dear Sir, Regarding your 'Agony' item in the September issue of STUDIO SOUND, *presumably this was a severe case of miaow and flutter.*

Yours faithfully, R. Turnbull, 30 Abinger Avenue, Cheam, Surrey.

Actually, we were rather hoping that no one would notice . . . **Ed.**

Ferrograph Professional Studio 8 Console



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Quality performance

STEPHEN COURT*

The perceived difference between live and recorded music underlines the lack of appropriate auditoria for the former. Hardware isn't the whole answer; while this gets better, the acoustics remain the same . . .

*COURT ACOUSTICS (Consultants) LTD

THE recording industry has undergone tremendous changes over the last 15 years, both in terms of creative achievement and technical advancement—possibly more so than one would have predicted. The two have accelerated in advancement through a 'chicken and egg' process where artistic requirements urged the application of more sophisticated equipment, and the latter facilitated greater creativity between the musicians and engineers.

Where multitracking was originally conceived for solo instrument overdubbing such as the music created by Les Paul, the increasing financial pressures throughout the industry both in terms of studio time and musicians time, created an instant market for multitrack machines. The major improvement afforded by multitracking was that a far more individual sound could be given to a musical arrangement, and with close miking and improved equalisation equipment the sound became more and more remote from that experienced under live conditions.

With rock music, the title itself covering a vast range of music, even small bands could create sounds that were not even dreamt of under live conditions, let alone be reproduced. In mor music, covering light orchestral to vocal-backing orchestras, the change was even more dramatic since an orchestra with exactly the same line-up could be given an entirely different sound with multitrack.

The point was that when Tschaikovsky and Bach wrote their music they were limited to the natural sound and acoustic balance of conventional musical instruments—a frustration which they frequently expressed. Their music was scored accordingly, and the difference between the sound of a live performance and eventual recordings was minimal, as was the technique involved in presenting classical music.

With contemporary music, however, it was very soon found that simply by increasing the level on one track, a bass guitar could be made louder than the whole brass section of an orchestra.

Although modern live performance systems are generally associated with pop music, the special sounds were not restricted just to pop music. Light orchestral bands such as Bert Kaempfert in the mid-60's also produced sounds that were not only unique musically but they had set a precedent in that they were unique to the recording studio.

Much the same applied to rock music which in the late fifties was generally recorded in the studio in much the same way as it was presented on stage. When the pop revolution occurred in the early sixties, the most obvious difference in the sound was very close miked sounds and especially the 'up-front' drum sound. In virtually any kind of music, since the percussion was acoustically the loudest section, it was set back in the band geographically and sounded accordingly, but the technique of very close miking on percussion is now accepted as the norm in most types of music—a technique very difficult to achieve under live conditions.

The explosive wavefronts involved in this technique brought a whole new way of thinking to the recording industry. The extra requirements of this type of music, which later included synthesisers and electronically created sounds, meant that over a period of only nine years or so, virtually every major studio went through 2, 3, 4, 8, 16 and 24 track equipment. If one includes the vast proliferation of equalisation and general control electronics, the huge financial investment alone presented a formidable change in the recording industry.

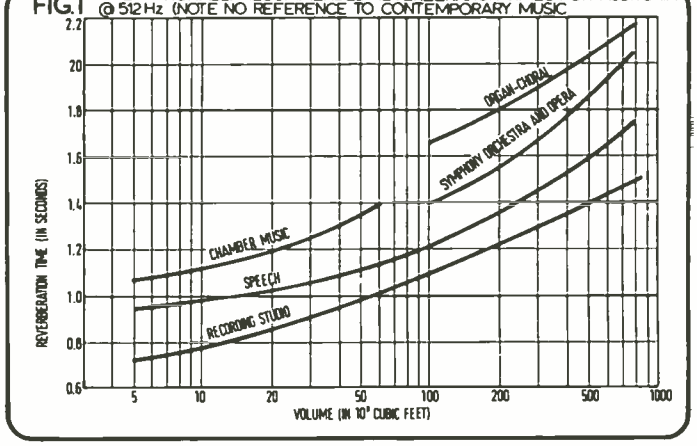
One of the many offshoots of this development was that since the recordings had become more of an artistic creation than a purely 'photographic' process, the engineer no longer had any kind of reference, since the 'real thing' no longer existed. The original sound had undergone so much correction and was so complex in its construction that what may have sounded correct in one studio sounded very different in another. Control room monitoring systems became even more important as a reference source, and had developed from 25 watt valve amplifiers and simple speaker systems to 600 watt triamplified monitors, usually operating at levels in excess of 110 dBA.

The desire for some kind of improved reference suggested the need for improved consistency in control room monitoring. More attention was paid to the correction of monitor systems and was largely satisfied by the use of graphic equalisers. The entire audio spectrum was split into narrow band components, usually 27 third-octave bands, and each section was corrected after measurement to provide a uniform if not linear response characteristic between different studios.

Electro-acoustic correction on control rooms has now been widely accepted throughout the recording industry, and providing certain limitations are realised, it has become an invaluable tool. The essential rules are that if a graphic equaliser is used on each monitor, then the amount of correction should be approximately equal to avoid phase shift between them, and should more than ± 5 dB of correction be needed, then it is largely a matter of structural rather than electrical alterations.

The importance of this tool is that up until now we have been

FIG.1 INTERNATIONALLY RECOMMENDED REVERBERATION TIMES FOR AUDITORIA @ 512 Hz (NOTE NO REFERENCE TO CONTEMPORARY MUSIC



largely satisfied with 'off the shelf' systems, and present requirements can be met by subtle adjustments facilitated by graphic equalisers where the original sound is no longer available.

So elaborate had the whole recording process become, and the equipment involved in it, that a whole new set of problems arose when artists came to perform at a live concert. Since their success was largely due to records, the public naturally expected to hear a live sound the same as they heard on records. No problem if you're performing Bach or Beethoven, but when an orchestra or band played contemporary music the brass section was once more louder than the bass guitar and the percussion was again set back in the acoustic perspective.

From this, the evolution of live performance systems was a relatively logical process. In the case of rock, the vocal mixer was taken off stage, expanded to take the remainder of the instruments and placed in the auditorium with a balance engineer. The same applied to mor music where the orchestra could be balanced as it was in the recording studio. The essential difference between this pa (as it is widely and, I think, incorrectly known) and the studio balance is that in the studio one is using the monitors purely as a reference to feed a tape machine, whereas in a live performance the loudspeakers themselves are the final link in the chain.

One would assume that provided the equipment used under live conditions is the same as that used in the studio, the final sound in the auditorium would be the same as that obtained on record. In fact most equipment used in live performance systems is the same, and designers and operators of the more successful systems originated in recording studios. In practice, to get the same sound under live conditions is a very hard task for a number of reasons.

Technically, the balance engineer has to work under different—and sometimes conflicting—parameters. Firstly, he has to set up and balance the sound to obtain the same results as in the studio, without the benefit of re-takes, overdubbing and environmental consistency. Secondly, since a live performance is strictly a visual affair, he cannot arrange the musicians for maximum separation and is consequently confined to the limitations of the mobile recording engineer without the benefit of an acoustically separate mixing room. Thirdly, as each performance is a one-off affair he is further limited to the restrictions of the broadcast engineer, again without the advantages of the latter where he cannot mix remotely. Fourthly and most importantly, unlike the studio engineer, he has to work under conditions far beyond his control.

In the studio, the environment is fixed both geographically and acoustically, and for all intents and purposes is uncoloured acoustically. Any anomalies in the environment are corrected subconsciously during the recording process and the equalisation is used essentially to derive a particular sound of an instrument.

Under live conditions he not only has to do this but also correct for aberrations in the response of the auditorium which can often be more complex than the equalisation required for the actual performance.

The main reason for this is that concert halls are largely designed for classical music and are acoustically live. In architectural terms there are basically two parameters for the reproduction of sound: music and speech. For music a long reverberation time is considered advantageous since this enhances classical music; and in the case of speech the reverberation time is shortened, the room being more absorbent in order to improve intelligibility. The essential point is that as the sound 'envelope'(ie attack, sustain and decay) reduces as a function of time, the reverberation must be similarly shortened to obtain that intelligibility.

Practical reverberation times are shown in the curves of fig. 1 and certainly organ or choral works are enhanced by long reverberation times, slightly less for classical music and through to speech which, according to architectural terms, requires the least reverberation ie most absorption to avoid spurious reflections reducing intelligibility even further. With this in mind, common sense tells us that since percussion, for example, has a shorter envelope than speech the acoustics of a concert hall for contemporary music should be deader still, with a reverberation/absorption characteristic lying somewhere between that for speech and the recording and broadcasting studio.

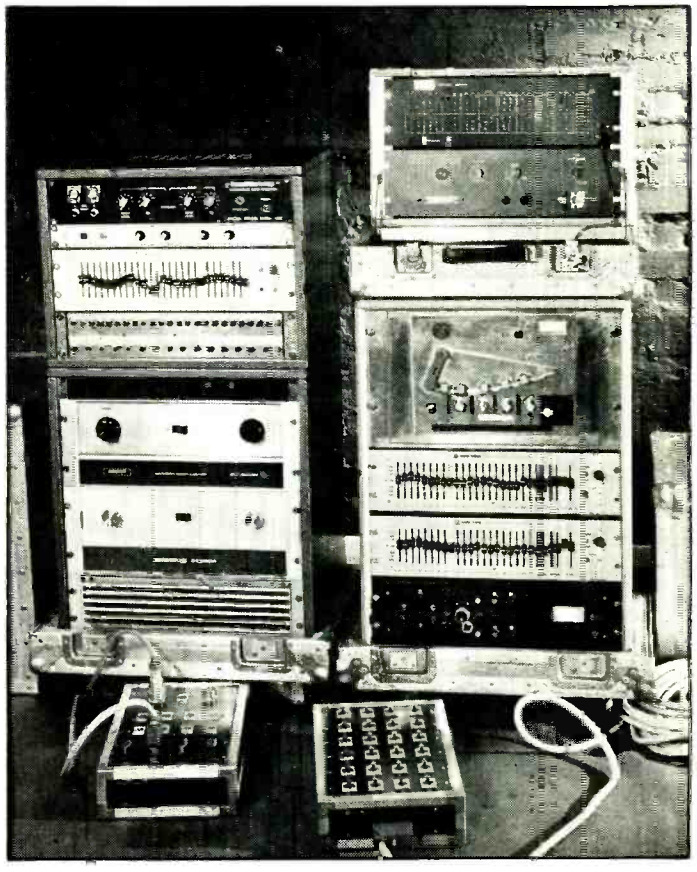
The fact is that in my experience there is not one concert hall in England which is designed with contemporary music in mind, or for that matter very few anywhere else in the world. The Sydney Opera House, although designed for opera or symphony music, is a

Live mixing at the Theatre Royal, London (The Ray Conniff Singers with 35-piece orchestra).

classic example where literally millions of pounds were spent on the structural aesthetics at, it would seem, the expense of the acoustics. A look at the internationally accepted curves for reverberation times in fig. 1 shows no reference at all to contemporary music and I can find none at all in architectural or acoustical literature. One would have thought it in the interests of the recording companies alone that there should be at least one venue in London which is accepted as a major recording centre, where the artist could achieve a satisfactory live sound. At least to compare with the many millions of pounds spent in recording studios.

The situation is aggravated by the fact that even if it were possible to convince the architects of this, because our environment is strictly a visual one, it is very difficult to persuade concert hall

A typical live performance setup referred to by the author



QUALITY PERFORMANCE

and theatre owners that sound is of prime or at least equal importance. One might consider that obvious but all too common statements like 'we can't afford a ten thousand pound system since we've just spent 15 thousand pounds on carpets and chandeliers' pretty ironic, considering the term auditorium means 'a place to listen'.

Even having overcome the gargantuan task of persuading theatre owners to invest in a sound system, there is invariably nobody around to operate it. One very large London hotel recently did a series of concerts with top international recording artists, and as far as I could ascertain, the person responsible for the sound was the banqueting manager!

The apparently obvious set-up of a mixing console feeding a speaker system (and often a recording and broadcasting system) becomes complex mainly through such bureaucratic idiosyncrasies—as if the acoustic ones were not enough. One of the most important points is to obtain an even distribution of sound throughout the auditorium, and the natural place from which to radiate the sound is above the proscenium arch. This has several advantages. Firstly, it assures an equal sound intensity since it is roughly equidistant from all the seats, while the use of radial horns and acoustic lenses ensures that 'hot spots' or 'holes' are sufficiently reduced. Secondly, since our ears are on a lateral plane we have little sense of vertical displacement in a sound source, so the image is retained where it should be—on the stage.

In practice it is impossible to do this, again because concert halls are just not designed this way, and the proscenium arch is either obstructed by the fire curtain, lighting beams, or more usually a coat of arms or other artistic creation which again cannot be sacrificed just for the sake of good sound.

The only place left for the speaker system then is at the sides of the stage. The problem here is that no matter how careful one is with dispersion the audience in the stall wings, if they can see around the speaker system, are given a distracting off-centre sound image as well as a very loud one.

There are a number of partial solutions to these problems. On the main sound system, graphic equalisers can be used to eliminate aberrations in the response of the auditorium. This is convenient, since in order to achieve the sound pressure levels needed for a large auditorium, bass horn enclosures are generally used, and because they are limited in physical size, the horn cut-off is usually around 60 Hz. Graphic equalisers can be used to augment the system below that, careful system design providing sufficient headroom to allow for this.

In the foldback system, which is considered of prime importance, where the artists and musicians can be fed whatever part of the sound they wish, a separate mixer is used to control the levels and foldback groups. Again extensive equalisation is required here, firstly to avoid feedback, and secondly to improve separation by reducing overspill on the microphones. The third mixer shown in **fig. 2** is used to obtain submixes on string sections etc, leaving the first engineer to concentrate on the main mix.

The method of equalising the main sound system is to place three microphones around the auditorium and multiplex their outputs to avoid standing wave effects in the room, reading the output on a spectrum analyser. This is convenient since the change in response can be continually observed whilst the graphic equalisers are being adjusted. The spectrum analysis is on ISO standard frequencies from 31.5 Hz to 20 kHz, as is the equaliser, so this method of adjustment is quick and simple. Some experience is needed for this as the whole process has to be carried out before the audience is seated, and the characteristics are changed by the increase in absorption which occurs when the auditorium is full. The spectrum analyser is also used throughout the concert with a single microphone strategically placed, and this allows the engineer to adjust for any peaks that may occur in the actual music.

So far as the reverberation is concerned there is very little that can be done although absorbent drapes around the stage help to reduce reflected energy, from the percussion especially.

The BBC and others have experimented with portable drum traps and screens but again, since a live performance is a visual affair, they need to be transparent and there are few if any materials which are visually transparent without being acoustically transparent also.

One apparently simple solution is to provide a separate sound system placed farther back in the auditorium, with delay lines to obtain a coherent time sound source. This also reduces the level of the individual sound systems and improves the quality of the overall sound by reducing the high frequency losses caused by molecular air absorption which occur when a sound source is required to radiate over long distances. The low frequency end is also improved since at lower levels one is less likely to excite acoustic anomalies in the auditorium. Having said that, it is only an apparently obvious solution, since experience tells us that a well designed central cluster directly over the stage usually performs better.

Another solution is to provide an entirely separate vocal system which need not be very large, above the stage itself, and have the main sound system each side of the stage handling instruments only. Experiments show this method to be very satisfactory. Firstly the human voice has a very different dynamic characteristic to most

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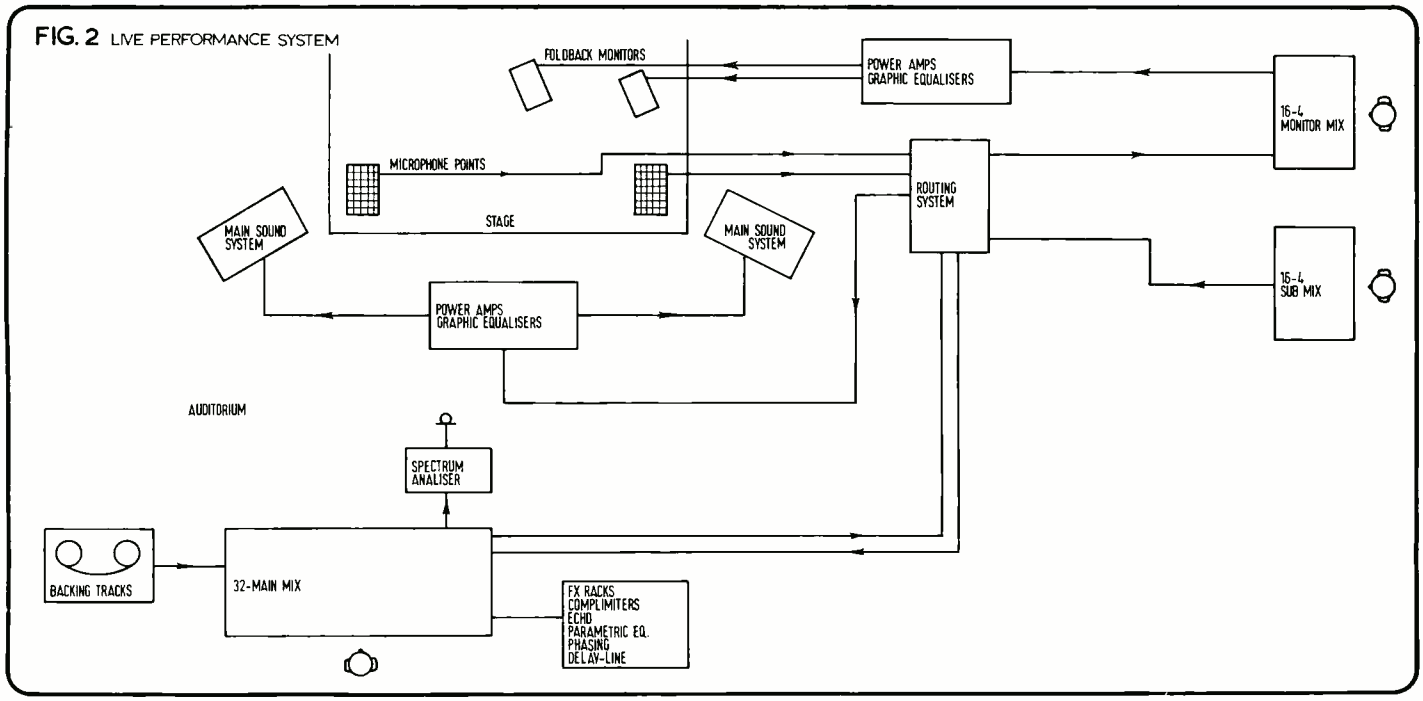
FIG. 2 LIVE PERFORMANCE SYSTEM



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Mayfair Studios
Maximum Sound Studios
Midland Sound Recording Coventry
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Sound News Productions
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SWM Recording Studios
Tangerine Recording Studios
Templar Film Productions Glasgow
The Manor Oxford
Tony Pike Music
TPA Studios
Trident Studios
Victor Buckland Derby
Warren Recordings
Welsh Recording Llanelli
Wessex Sound Studios
Zella Recordings Birmingham

AKG

instruments, so entirely separate control over that provides a considerable increase in quality (and probably as much improvement is afforded by the reduction of intermodulation distortion created in a single sound system). This method also allows a central placing for the vocals, which is desirable, and still retains a good stereo image for the instrumental section.

It is possible to write a book on this subject, there being so many aspects to consider when you combine the efforts of a recording studio, a mobile recording, and a live broadcast. There is still an undesirable stigma attached to live performance systems, not helped by the use of the title 'PA'. This is very sad, because it only slows down the advancement of this side of the industry. In fact it is very creative and satisfying to do a live mix with instant audience response around you, and I see no reason why the recording and live performance fields should not work alongside.

I remember discussing the subject of a custom-built concert hall with somebody in the live performance field (but a person who had not worked for the recording industry at any time). His attitude was that nobody would use it, since bands preferred to use their own equipment. Although they generally hire it anyway, this is only true because the standard of 'in house' equipment and facilities is abominably low. If there was one single concert hall purpose-built for music, his statement would be as ridiculous as saying a band would take their own equipment into a recording studio. The point is that a band usually go to a particular studio because the equipment is good and the engineer is capable, so there is no reason at all why the same should not apply to a concert hall. I shudder to think of the amount of money spent on hiring equipment, carting it about, and paying for repairs to damaged equipment (the failure rate of identical equipment used in live performances and studios is around 20 to one).

One would have thought that such a venue for live performances would have been a very commercial venture since the record companies could save on hire equipment and it could easily be turned into an acoustically live concert hall for classical music, either mechanically or electronically. This has been done with some success, although it was not necessarily intended for contemporary music. 'Ambiophony', as it is called, is not a new idea but it means that optimum conditions can easily be achieved for all types of music.

Also, a concert hall with good acoustics and a well designed sound system could also be used in the daytime for recording purposes or for broadcasting, so there is no financial reason why a live venue could not be built to the standards we expect in a recording studio.

As a consultant and design/manufacturer where my work is now concerned with live performance as much as studios, I believe it fundamentally wrong that one should have to wear two hats since the ultimate objectives of both fields should be the same—there is no reason at all why the parameters for quality should be different.

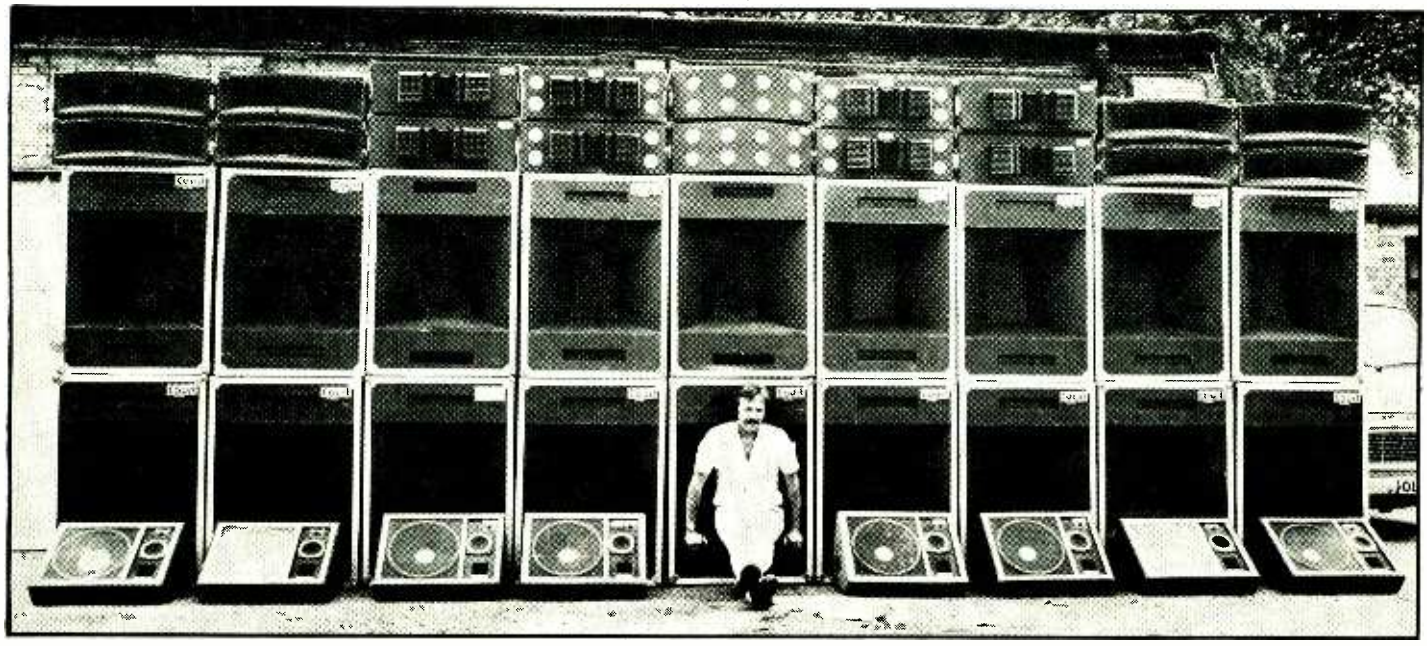
I do not think it fair to apportion the blame to any particular body since the live performance industry as it stands, for reasons mentioned earlier, is only a few years old. Theatre designers are simply unaware of modern requirements. Acousticians working in both studio and live performance fields such as Ken Shearer (responsible for the Albert Hall flying saucers) will generally agree that it is harder to correct an existing situation than it is to start from scratch, but in both cases poor sound costs more in the long run.

In existing concert halls the addition of sound diffusing and absorption panels is required and in new venues they should be built acoustically deader with extra reverberation introduced, mechanically or electronically, should it be desired. Mechanically, involves the use of moving panels which offer different amounts of absorption, and electronically the use of delay lines with multispeaker arrays around the auditorium. A space in the auditorium itself for mixing console and general control, recording equipment etc (which should also serve the broadcast, television and recording media). Finally space for a centre speaker system should be made available above the proscenium arch. All these facilities would cost no more if they were allowed for at the outset of building and designing especially in view of the amount spent later in repairing, updating and hiring sound systems.

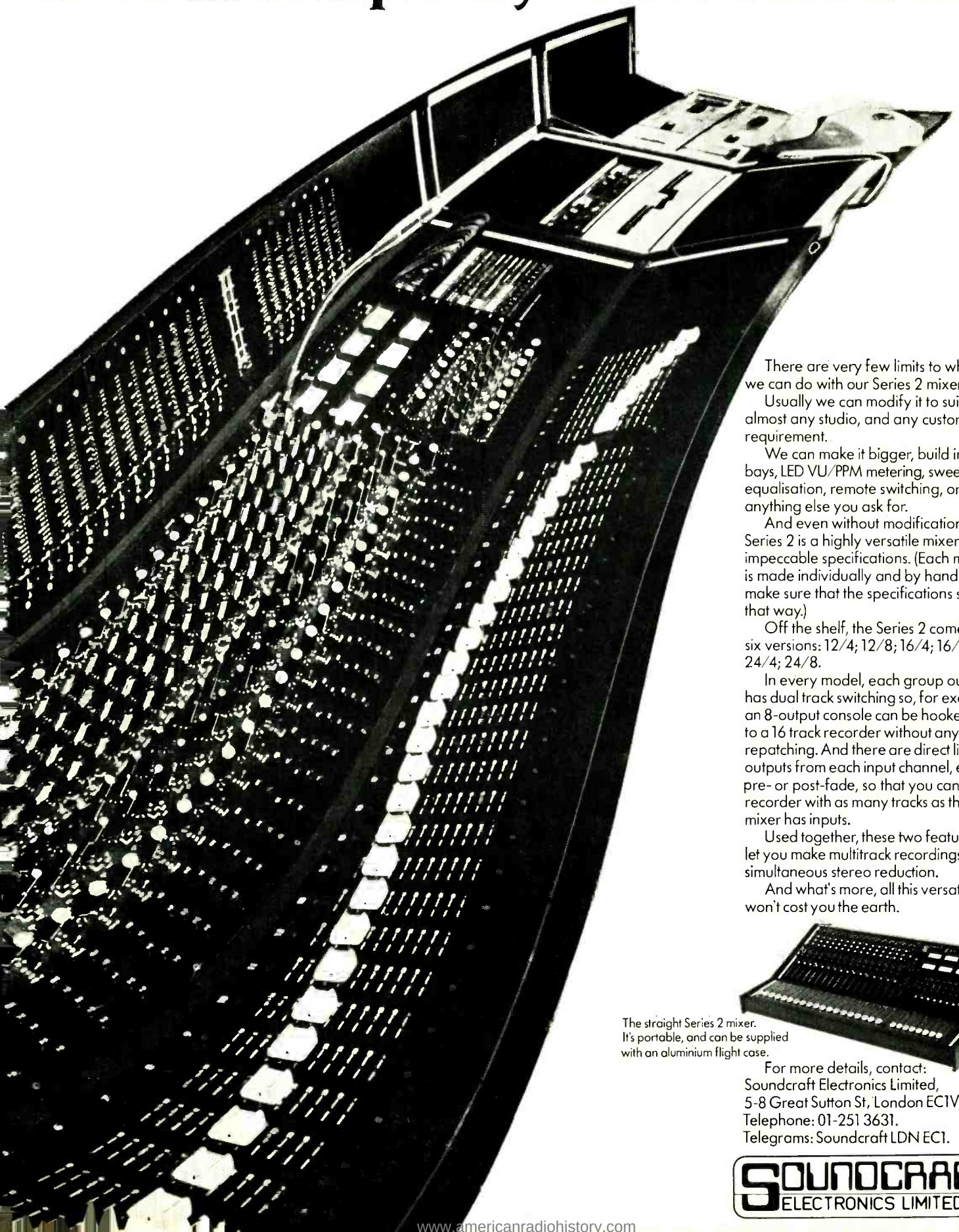
As far as the equipment itself is concerned one of the major reasons for the low standard in live performance systems is the huge cost variation of audio equipment. When tenders are put out for lighting and furniture etc the cost and quality range is relatively small. In sound, however, the mixing console can be purchased for £1000 or £15 000. Similarly a single speaker/amplifier combination can cost £100 or £1000. Inevitably those people reviewing these tenders, since they have no knowledge of sound, will go for the low price bracket even though (as usually is the case) they will have to spend much more in the long run. As the management of a very well known London nightspot said: 'we know the sound is bad but we are full every night so a new sound system would not improve our situation'. It is hard to argue against that, but the fact is, as a direct result, artists have to cart literally tons of sound equipment with them all over the world, which is slightly ludicrous to say the least.

The approximate sum of three million pounds spent in the UK alone over the last six years on hiring sound systems suggests that a little forward thinking on the part of recording companies, theatres and others involved in the live performance industry could have channelled some of that money into concert halls so that the sound was up to the standard of modern recording studios.

A 5 kW triamplified studio quality loudspeaker system (foldback monitors shown at front).



Some of our customer's orders drive us completely round the bend.



There are very few limits to what we can do with our Series 2 mixer.

Usually we can modify it to suit almost any studio, and any customer's requirement.

We can make it bigger, build in patch bays, LED VU/PPM metering, sweepable equalisation, remote switching, or anything else you ask for.

And even without modifications, the Series 2 is a highly versatile mixer with impeccable specifications. (Each model is made individually and by hand to make sure that the specifications stay that way.)

Off the shelf, the Series 2 comes in six versions: 12/4; 12/8; 16/4; 16/8; 24/4; 24/8.

In every model, each group output has dual track switching so, for example, an 8-output console can be hooked up to a 16 track recorder without any repatching. And there are direct line outputs from each input channel, either pre- or post-fade, so that you can use a recorder with as many tracks as the mixer has inputs.

Used together, these two features let you make multitrack recordings with simultaneous stereo reduction.

And what's more, all this versatility won't cost you the earth.

The straight Series 2 mixer. It's portable, and can be supplied with an aluminium flight case.

For more details, contact:
Soundcraft Electronics Limited,
5-8 Great Sutton St, London EC1V 0BX.
Telephone: 01-251 3631.
Telegrams: Soundcraft LDN EC1.

SOUNDCRAFT ELECTRONICS LIMITED

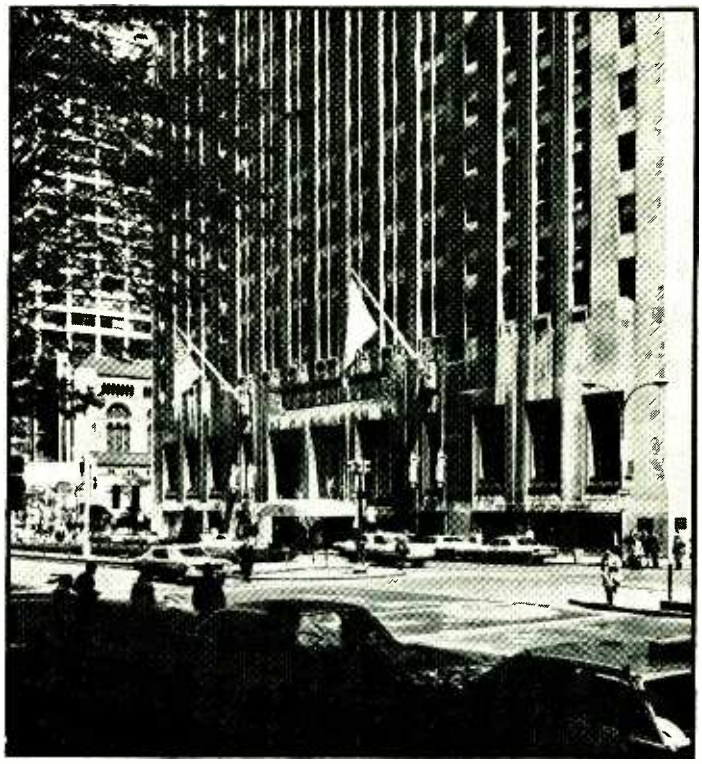
AES 55th Convention, a preview

The AES 55th Convention will be held from October 29 to November 1 at the Waldorf-Astoria Hotel, Park Avenue and 49th Street, New York City. The Convention follows the usual format of a lecture programme with accompanying exhibition.

Exhibition times: October 29, 1300h to 2100h; October 30, 1000h to 1900h; October 31, 1200h to 2000h; November 1, 1000h to 1700h.

Further information may be obtained from the Audio Engineering Society, 60 East 42nd Street, New York, NY 10017. Phone: (212) 661 8528/2355. Also: 11916 Salem Drive, Granada Hills, Ca 91344. Phone: (213) 363 5111.

Adapted from information supplied by the AES.



Cutting

The Lathe for record mastering will be displayed by **L J Scully Manufacturing Corp.** This system combines outstanding qualities of conventional lathes with computer technology. Features include digital LPI readout for precise and repeatable settings, single motor servo feed system 150x Nikon microscope with vertical illuminator, swarf removal system with variable vacuum, and quick change cutter head mount. Also on show will be the *Preview Master* for sensing level changes in the master tape. This unit uses solid state, logic controlled circuitry. It can work in conjunction with *The Lathe* or with other disc cutting equipment.

Duplication

The tape duplication facility shown at the AES 54th Convention in Los Angeles will be presented by **Infonics Inc.** Instruction will also be given on duplicator testing, maintenance and master preparation.

The *Alpha 21* cassette copier will be exhibited by **International Audio Inc.** This system copies at 76 cm/s, has slave add-on capability allowing it to be expanded, and a precision cassette tape transport drive with four direct motors to eliminate pulleys and belts. Synchronous capstan drive motor is designed to maintain accurate tape speed control.

Capable of producing between 640 to 840 eight track cartridges or 320 to 420 cassettes per slave in eight hours, the *LT-1600B* duplicator from Liberty/UA Duplicating Inc has a master unit that will drive up to ten slaves. The system will accommodate master reels up to 25 cm with 12.5 or 25 mm eight track and 12.5 and 6.25 mm tape and slave reels up to 36 cm with 6.25 and 3.2 mm tape. Also on show will be the *CW15S* cassette tape winder and *CW25* cartridge winder. These units have two takeup spindles, automatic cutter, rolling tape guides, adjustable takeup tension, capstan-driven tape with split capacitor motor and loudspeaker for hearing cue tone and high speed programme. Speeds are 300 cm/s for cassette and 600 cm/s for cartridge tape.

The *C-4* stereo cassette copier will be introduced by **Pentagon Industries.** This copies all four tracks simultaneously and includes track select enabling any combination of the four tracks to be copied. It operates at 76 cm/s, contributes less than 0.2% (weighted) wow and flutter to copy, and has a crosstalk rejection of better than 50 dB at 1 kHz.

Microphones

Two head-worn microphones will be shown by **Shure Brothers Inc.** These are ideal for 'hands free' public address, dispatching and broadcast applications and feature unidirectional pickup patterns that reject unwanted background noise and miniature screens to block wind and explosive breath noise.

Mixers and consoles

The *Minus Noise Mixer* will be featured in **ARP Instruments'** booth. This system has balanced input preamplifiers with selectable gain settings, carbon film precision resistors, gain sliders calibrated in 1 dB steps, peak reading led vu meter and a dynamic noise filter designed to eliminate noise from any programme signal.

Using a digital data cartridge to store automated programming information, the **Automated Processes** model *1024* has more than 1000 control channels. Programme tapes made with it are compatible with other automation systems and it is designed to be easily retro-fitted into current installations. Also on display will be a new model *560* ten-band modular graphic equaliser.

Three new mixing systems are being introduced by **Edcor.** Model *M82B* is designed for broadcast applications, each channel featuring two line and a microphone input selected on the input attenuator. Model *M82C* is designed for institutions where inexperienced operators may be at the controls. Mid frequency equalisation control is eliminated and an EQ in/out switch fitted. High and low controls provide ±8 dB adjustment. Model *M821* is recommended for pa and sound reinforcement. Unbalanced inputs will accept signals from any microphone, or line source, balanced or unbalanced, low or high impedance. Also on show will be the company's series of microphones, transmitters, receivers and amplifiers.

The model *1616-25* studio recording console with 16 input channels will be shown by **El-Tech.** The system also includes 16

monitor cue channels, two cue busses, two echo busses, eight mixing busses, eight direct outputs, 96-point patch bay and 15-frequency equalisation.

Modular, flexible mixers intended for modest recording studios or sound systems will be exhibited by **Interface Electronics.** The *Series 104* and *108* mixers are available with 16 to 32 inputs. *Series 104* provides four track and four echo outputs or, optionally, four stereo submasters, while series *108* provides eight track and eight echo outputs or optionally eight stereo submasters. Both series also have four pre/post cue outputs. Mainframes include masters, large lighted vu meters, mixdowns and other options. Stage monitor version provides eight independent stage monitor mixes for feeding back to musicians on stage.

One hundred segment 'plasma display' meters are a feature of the *JH-500* series automation-ready console being shown by **MCI.** The meters have two primary modes of operation: vu and peak. A 'peak accumulate' function is also selectable. A scale illumination indicates the selected primary mode. Vu is displayed and calibrated as per asa standard; peak voltage is displayed in ½ dB increments from −46 dB to −6 dB. Rise and fall times are adjustable between 2 ms to 20 ms (rise time) and 0.5s to 3s per 20 dB (fall time), but calibrated at the factory for 10 ms rise time and 1.5s per 20 dB fall time. These displays are also used in connection with the company's *Spectra Vue* spectrum analyser. On automated consoles, these meters can also display the 'VCA de-status' levels.

Rupert Neve Inc will be exhibiting two consoles, the model *5305* broadcast range which is available with up to 36 channels with three different types of equaliser, and four sub mixing groups with simultaneous mixdown to stereo and mono, plus four track tape inputs and outputs. The *8058* compact desk will also be featured.

The *Audikon Series 1200* disc mixer will be displayed by **Pearson Electronics.** Features of this system include illuminated peak-rms reading digital output level indicators, independent left and right stereo output level controls, left and right maximum programme output level adjustment, full ±18 dB treble and bass equalisation, and tape recorder or special effects line outputs.

Featuring 12 inputs and eight outputs, the model *1280* console from **Sound Workshop** provides for 8 x 2 control room monitor mix, 8 x 1 musicians cue mix and independent two track mixdown buss. Each of the 12 inputs has three band equalisation, 35 dB trim control, eight track pushbutton track assign matrix, full panning, echo send buss, mute and solo functions, 26 dB mic pad, mic/line switching, straight line faders and pre and post patch points.

Three principal products are being shown by **Spectra Sonics.** The model *610* Complimiter has a new non-glare vu meter, bi-polar power supply and improved electronics over the previous model. Other design improvements include the incorporation of the model *110* audio amplifier and consolidation of other functions. Model *1026-26* audio control console is a modular system that may be configured in up to 26 inputs and 26 outputs. Model *1006-1*, a rack-mounted audio mixer, has six switchable inputs (line or microphone), a mono output, two-frequency equalisation, vu meter, xlr connectors, self-contained power supply, headphone monitor and transformer isolation on all inputs.

The model *XXI Stereo/Wafers* headphone will be introduced by **Stanton Magnetics Inc.** This unit has rare earth magnets designed to give good frequency response. It measures 110 dB spl at 2V input, has a frequency response of 20 Hz to 22 kHz ±4 dB and has less than 0.5% distortion at 110 dB spl. Also on display: the stylus wear gauge which measures actual stylus wear time from 0 to 1000 hours in increments of 100 hours. It resets easily for long-term use.

Studio ancillaries

The model *1500* automatic equaliser will be displayed by **Audio Developments.** This system can equalise studios, stages, halls and rooms without any other instruments. A real time spectrum equaliser, the model *1000*, will be shown complete with calibrated microphone, gated noise source and two independent memories.

A vocal stresser, model *F769X-R*, will be shown by **Audio Design Recording**—it combines the *F760 compex-limiter* channel and the *E900* parametric sweep equaliser. A routing switch enables equaliser to be switched before or after the compressor or into the compressor side chain. This allows the compressor side chain to be modified for de-essing and the reduction of modulation effects. In the out position, the equaliser is available on a separate input/output connector for use on another channel.

Dolby Laboratories Inc will introduce the *M Series* of noise reduction systems which are available in eight, 16 and 24 track modular assemblies. Remote control is available enabling all channels to be operated from the mixing desk. Controls are duplicated on the front common facilities panels of the units.

Joel Associates will show products from several different manufacturers: Inovonics tape recording electronics, limiters, noise suppression and Tentol systems; B M Long Associates mixdown monitor loudspeaker model *MDM-4*, with individually calibrated frequency response curves; Magnetic Reference Laboratory precision test tapes with calibration graphs, featuring the rapid frequency sweep series.

A special effects instrument called the *Harmoniser* is being shown by **Eventide Clockworks Inc.** This unit combines in a single chassis a digital delay line, pitch changer with a two-octave range and an anti-feedback unit which allows boosting of sound levels. It can also be used to speed up or slow down tapes, and to create bizarre sound effects.

The new *Delta-T 102-S* digital delay system will be featured by **Lexicon Inc.** Incorporating two independent delay channels plus VCO in a single unit, the unit makes possible a host of new time-base effects. Also on show will be the *Varispeech 26/27* speech compressor/expander. An application note Studio Applications of Time Delay will be available.

Three new products will be presented by **Micmix Audio Products Inc.** The *Master Audio Meter* is an led stereo device featuring both peak and rms readout capability with sensitivity to −50 dBm. The Unit can capture and display peak level of a one-cycle burst of a 15 kHz sinewave. *Time Warp* delay line and effects generator features a continuously variable 1.5 to 100 ms delay control, direct/delayed mixing, vibrato/polytone, fm modulation, rate and depth control. *Super C Master Room* stereo reverberation chamber has both peak and shelf EQ controls along with its natural sound ambience performance.

A dual channel reverberation unit, the model *111B*, will be featured by **Orban/Parasound.** This unit has a four-spring array per channel reverberation element, delay time of about 300 ms between direct sound and first reflection, and input impedance of 10k ohm unbalanced. It will accept input levels between −30 and +4 dBm. Limited attack time is less than 100 ms. Also on show: model *418A* stereo limiter/compressor, a complete limiting system consisting of a pair of ganged broadband compressor/limiters and a high frequency limiter with four different time constants, user selectable by means of a front panel switch.

Tape machines

The *ATR-100* series professional audio recorder will be shown by **Ampex Corporation.** The user can select any pair of speeds from 4.75, 9.5, 19, 38 or 76 cm/s. Recorders have less than 0.3% distortion at a recorded flux level of 370 nWb/m (0 vu), s/n better than 80 dB at 76 cm/s and frequency response ±0.75 dB between 100 Hz and 15 kHz.

Designed for either quad or stereo eight track cartridges, the model *QC-8/Q* control playback from **David Lint Associates** will be displayed. This unit allows accurate playback quality of either standard or quad eight cartridges on the same equipment. Digital readout will indicate automatically whether it is stereo or quad as well as showing the programme number being reproduced.

Three new professional recorders are being introduced by the **Otari Corporation.** Model *MX-5050-8* recorder provides eight tracks on 12.5 cm tape, 38 and 19 cm/s tape speeds and a variable speed (±10%) dc capstan motor. Features include front panel edit and cue, motion sensing and synchronous replay. Model *MX-5050-QX* compact four track recorder has integral dc capstan servo and offers ±10% speed correction, motion sensing and selective replay. Model *MX-5050 FL* full track recorder has three full track heads plus a half track replay head and replay channel to play back half track stereo tapes.

A new auto locator will be shown by **Stephens Electronics Inc.** It is designed to be used with the company's capstanless two to 40 track recorders.

The model *11* series battery portable tape recorder with dc servo drive system, built-in limiter and monitor loudspeaker, 600 ohm balanced output and electronic speed selector will be shown by **Tandberg of America Inc.**

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AES 55th CONVENTION, A PREVIEW

Test equipment

A multipurpose test set, the model *4400*, will be featured by **Amber Electro Design Inc.** The generator section features a multi-waveform generator, pink noise generator, comb generator, and three-decade log sweeper with balanced output capability to +30 dBm. Step and variable output attenuator and gating circuit complete the generator. Receiver section has a spectrum analyser, wave analyser and dual digital memory. Used in conjunction with any triggered dc oscilloscope, it will provide log frequency and 10 to 60 dB amplitude scales. Also on display: *4550* audio spectrum display, used to analyse programme material to spot potential spectral energy unbalance.

An instrument that measures the phase angle between two voltages alternating at the same frequency between 2 Hz and 200 kHz, the *Type 2971* phase meter, is being exhibited by **B & K Instruments Inc.** Features include direct phase indication, digital display in degrees and radians, analogue meter display in radians, triggering on positive or negative slope to permit measurement on any waveform and voltage range of 10 mV to 15V with 'cut of range' indication.

The model *1710A* distortion measurement system is being shown by **Sound Technology.** This is a distortion analyser and oscillator simultaneously tuned in one system. It has a 0.001% distortion balanced and floating oscillator for testing from 10 Hz to 110 kHz, fully automatic nulling which eliminates balance controls and balanced input that measures floating or balanced sources and reduces ground loop and noise pickup.

Modular test and measurement instruments from the *TM 500* series will be shown by **Tektronix Inc.** The system has more than 30 compact plug-in instruments which can work individually or be combined into systems. These range from general purpose devices like multimeters and power supplies to such specialised units as oscilloscope calibration units and a digital trigger generator. Users can assemble a package of instruments to meet his own needs or can choose a standard combination suggested by the manufacturer.

The *Tentelometer* hand-held tape tension gauge from **Tentel** will be shown. Designed to measure or detect torque, tension, capstan servo error, time base errors and signal distortion, the *Tentelometer* is mechanically shock protected and balanced for accurate readings with the gauge in any position. Standard gauge may be used for tape 3.1 mm to 25 mm wide—a 50 mm model is also available.

Turntables and cartridges

A series of five phono cartridges is being introduced by **AKG Acoustics**, a division of Philips Audio Video Systems Corp. Included is model *P8ES* with a tracking force of 0.75g, channel separation of 30 dB at 1 kHz and a frequency range of 10 Hz to 28 kHz, and model *P6R*, designed for applications where a spherical stylus is considered essential and engineered to withstand back cueing for broadcast and presenter work.

The *SP-10MkIII* quartz controlled, direct drive turntable will be featured by **Technics by Panasonic.** This unit has a speed accuracy within ±0.036s for each lp side. It reaches its rated speed of 33⅓ rpm within 0.25s.

Monitoring systems

Designed for use as a monitor amplifier in bi- and tri-amplified speaker systems, the model *100* from **BGW Systems** can also drive electrostatic or conventional headphones. Features include accurate clipping indicators and simple mono/stereo switching capabilities. A professional broadcast version is available with Cannon-style input connectors and eight-pin octal connectors for input matching transformers.

The *Sentry V* two-way professional monitor loudspeaker system will be featured by **Electro-Voice Inc.** Designed for home and professional use, this system has a frequency response of 45 Hz to 18 kHz (32 Hz to 18 kHz, step down mode with equalisation), normal impedance of 6 ohms and half-space efficiency of 1.6%.

The *Creative Controller* mixer/preamplifier from **GLI Inc** will be featured. This is a modular system made up from the model *3880* mixer module and a variety of satellite signal processing modules.

US Pioneer Electronics Corporation will show a variety of products. These include the *LS-1* loudspeaker system designed primarily for use as a studio monitor or disco system. It consists of a carbon fibre woofer exponential horn with acoustic lens, and 50 mm diameter beryllium driver diaphragm. Other products on show are the *PC-1000 II* stereo cartridge, *M-22* class A stereo power amplifier, *C-21* stereo preamplifier, *U-24* programme selector and *D-23* electronic crossover network.

The *Mark 2500* stereo power amplifier will be shown by **Scientific Audio Electronics.** This system is designed for continuous use with low impedance loads and any other form of worst case signal or load conditions. It delivers not less than 300W rms per channel into 8 ohms and 450W into 4 ohms and 150W into 16 ohms, both channels driven from 20 Hz to 20 kHz with no more than 0.1% total harmonic distortion.

Recommended for studio monitoring, high quality reproduction and public address systems, the *A-68* power amplifier from **Willi Studer America Inc** provides 100W per channel into 8 ohms. It is designed to be fully complementary from input to output, which minimises transient intermodulation distortion (less than 0.1% at all power levels up to rated output).

LIST OF EXHIBITORS
B=Booth, D=Demo Room

Agfa-Gevaert	83 (B)
AKG Microphones	565 & 567 (D)
Allison Research	32 (B)
Amber Electro Design	44 (B)
Ampex	85-88 (B), 5E (D)
Aphex Systems	592 (D)
Arp Instruments	52 (B)
Audico	6 (B)
Audikon Audio Components	27 (B)
Audio & Design Recording	26 (B)
Audio Designs and Manufacturing	— 505 (D)
Audio Developments (ADI)	82 (B)
Audiologic	70 (B)
Audiomatic	90 (B)
Audio Processing Systems	75 (B)
Audiotechniques	45-47 (B)
Audio Transport Systems	20 (B)
Automated Processes	41 & 42 (B)
Bazzy Electronics	5C (D)
B & K Instruments	7 & 8 (B)
BGW Systems	62 & 63 (B)
Bozak	509 (D)
Capitol Magnetic	64 (B)
C-K Algo Rhythm	West Foyer
Dbx	5V (D)
Dolby Labs	15 & 16 (B)
Edcor	72 & 73 (B)
Electronic Technology	2 & 3 (B)
Electro-Voice	5G & 5H (D)
Elpa Marketing Industries	76 (B)
Ferrofluidics	89 (B)
Eventide Clockworks	54 (B)
Frazier	
GLI	511 (D)
Gotham Audio	5R & 5S (D)
Grandy	13 (B)
Infonics	580 & 582 (D)
Interface Electronics	5 (B)
International Audio	19 (B)
IVIE Electronics	1 (B)
Joel Associates	59 (B)
JVC Cutting Center	502 (D)
Lexicon	21 (B)
Liberty/US Tape Duplicating	80 (B)
David Lint Associates	18 (B)
Martin Audio/Video	71 (B)
MCI	48-50 (B)
Micmix Audio	53 (B)
Rupert Neve	39 & 40 (B)
Orban Parasound	24 (B)
Otari	29-31 (B)
Pandora Systems	55-57 (B)
Pentagon Industries	84 (B)
Pratt-Spector	28 (B)
Quantam Audio	4 (B)
Revox	58 (B)
Sansui	507 (D)
SAE	11 (B)
Scientific Consultants	43 (B)
L J Scully	5K (D)
Sennheiser	5D (D)
Sescom	77 (B)
Shure	36-38 (B)
Sierra/Eastlake Audio	5W (D)
Sontec	25 (B)
Soundcraft	5K (D)
Sound Technology	35 (B)
Sound Workshop	17 (B)
Spectra Sonics	33 & 34 (B)
Stanton Magnetics	51 (B)
Stephens Electronics	12 (B)
Willi Studer (America)	5P (D)
Tandberg (America)	61 (B)
Tapemaker Sales	79 (B)
Teac (America)	501 (D)
Technics by Panasonic	591 (D)
Tektronix	81 (B)
Teledyne Acoustic Research	579 & 581 (D)
Tentel	14 (B)
Urei	22 & 23 (B)
US Pioneer	5L (D)
Westec Audio/Video	9 & 10 (B)
Yamaha (Musical Instruments)	503 (D)

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The new Quad/Eight Modular Series mixing consoles reflect the identical technology and quality of their internationally accepted custom console line . . . and are priced to fit every budget.

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- Conductive plastic full-travel attenuators.
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SIERRA—16 to 36 inputs, plus 4 echo send/return modules, four selectable mixing busses and separate quadraphonic outputs.

PACIFICA—16 to 36 inputs, plus 4 echo send/return modules, eight selectable mixing busses and separate stereo outputs.

VENTURA—24 to 36 inputs, plus 4 echo send/return modules, sixteen selectable mixing busses and separate quadraphonic outputs.

BRENTWOOD—24 to 36 inputs, plus 4 echo send/return modules, 24 selectable mixing busses, separate quadraphonic outputs and VCA design with 6 sub-groups.

BEL-AIRE—24 to 36 inputs, plus 4 echo send/return modules, 24 selectable mixing busses, and separate quadraphonic outputs. Automated fader design with 6 sub-groups, including Compumix III processor.

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Master class

ARUN CHAKRAVERTY*

Producers and musicians often complain that their work receives a less than subtle treatment in the cutting room. A greater understanding of the transfer process should result in a final mix involving fewer problems for the cutting engineer.

*CBS STUDIOS

THE quality of the finished vinyl disc depends as much upon the disc cutting equipment as on the skill of the cutting engineer. Disc transfer no longer consists of a simple tape recorder and cutting machine, but includes a chain of sound processing hardware to enable the best performance to be obtained from what is, after all, a mechanical process. Many of those people whose responsibility concerns the updating of existing disc cutting installations fail to appreciate the improvement in cost efficiency that modern mastering equipment can give. Equally, the inverse is true. Old and unreliable equipment is a source of perpetual frustration to both the mastering engineer and the artists and producers who normally use the facility; much time and many record blanks are wasted in the process of trying to make antiquated systems work.

The central piece of equipment in any cutting suite is the cutting lathe; however, its performance can only be as good as the signal supplied by the recording console. Facilities for this should include:

ppm and vu meters, phase and channel reversal switches, mono/stereo switches, line level controls, master faders, line outputs for monitor and meter circuits, outputs for second tape machine to enable a tape copy to be made in parallel with the disc cutting process, tracing equalisers, stereo separation controls (to balance amplitude and phase discrepancies at low frequencies), test oscillator and, finally, a phase correlation meter.

No mention has been made of vari-pitch since its application and operation is a whole subject in itself.

Whereas the studio control room standard line level is 0 dBm (0.775V), the equivalent in the disc cutting field is 1.55V (+6 dB above 0 dBm). This level is used to calibrate full-scale deflection on the cutting console peak programme meter. Naturally peak programme levels have an absolute value in the disc cutting process since any undue excursion above them can lead to groove wall break through, intermodulation products, and other ills. Since ppm meters give little indication of the programme 'loudness' vu meters are also used to give some idea of the average programme level after such processes as compression and limiting and equalisation, necessary for proper disc transference. It is perhaps worth mentioning that 0 vu corresponds to -6 dB on the ppm scale or 0 dBm in the disc cutting convention.

Part of the cutting engineer's job is to check that a newly cut blank represents a true and faultless copy of a master tape. The one and only way to check is by having a playback system which is adjusted for a flat frequency response. A NAB standard reference disc is quite suitable for this purpose. Pickup level is usually adjusted at -10 dB on the ppm, playing back 1 kHz tone cut at 5 cm/s. No matter what kind of cartridge (usually velocity magnetic types) we use in the playback system, it will never give a flat enough response for use in a mastering system unless there is a wide range of pre-set eq controls on the monitor pre-amplifier. Often producers, artists and balance engineers like to listen to a cut record against the master tape sound in order to check the one-to-one transfer capability of the entire system, bearing in mind the limitations of disc (tracing, distortion, pinch effect, etc).

Any monitor system with a performance capability of the monitoring chain in a studio control room should be adequate in the disc cutting application. This is a reference standard, not only for the cutting engineer who has to operate the lathe but also for the client who needs to listen to his, and their, handiwork. It is therefore important that the overall response should be as flat as possible and it is recommended that the system should be equalised through the well-known pink noise and microphone technique.

The monitor chain requirements are not quite as stringent as those of the recording studio. What is, perhaps, more essential is that uniformity of performance should be maintained at a given standard from day to day since the cutting engineer listens for relative quality between programme material rather than its absolute value.

Although the potential performance of modern cutting installations is exemplary, the reality very much depends on meticulous attention to detail in both adjustment and actual operation. One of the most variable parameters is that of frequency response; it should be frequently checked by monitoring the equalised output from the feedback coils within the cutting head. It is these same coils which provide the programme monitoring point during the cutting operation since their signal output is proportional to cutting stylus excursion. Regular checks using this output tend to show up any kind of malfunction whether it be in the equalisers, compressor limiters, line amplifiers or even the cutter heads.

Modern cutter drive amplifiers can deliver in excess of 300 to 500W without distortion. Such high reserves of power make it possible to cut velocity peaks well in excess of 30 cm/s within the high frequency range without any risk of intermodulation distortion, providing they are used with a suitable cutter head. At these levels, it is essential to use helium cooling with the cutter head. Cutters are very expensive and complicated pieces of equipment which, under the right conditions, can transfer a range of programme information well in excess of the capabilities of the consumer replay stylus.

Naturally, the correct installation of a cutting stylus is the prerequisite for the perfect cut: a special microscope is necessary for this job. It is not often realised that a stylus should never be touched on its tip by fingers since the grit and corrosive elements present on the surface of the skin can do much damage to the cutting facette. Further, when the stylus is changed, the suspension system may be subject to changes and the following checks should be carried out:

1) The mounting of the stylus in the cutterhead should be checked to confirm that it is correct.
2) The heater current must be adjusted for maximum signal-to-noise ratio.
3) The groove cutout must be checked with a microscope.
4) The frequency response and the sound quality must be evaluated.

The sound quality of a disc also depends on the quality of actual recording blanks used during a transfer. The basic construction is a thin coating of nitro-cellulose lacquer on an aluminium

substrate. Aluminium substrates normally called blanks, are made from highest quality aluminium alloy; this must be free from any impurities which could cause undesirable chemical reactions with the lacquer coating. The blank must be smooth, perfectly flat and free from dirt and oils.

Hf response also depends on how the master lacquer has been electroformed and finally pressed. Clicks, surface noise, hf distortion, hf loss and rumble could be found on a commercial record, although the original master lacquer may have been perfect in every respect. . . The only thing that does not change on a pressed record is the level of the original cut. It is perhaps worth remembering that record manufacturing is a difficult and complicated process. It is therefore surprising that over 80% of commercial records coming out of the factories appear to be satisfactory.

It is a source of perpetual headache for the cutting engineer to find that the master tape does not incorporate the standard reference tone, ie absolutely level, Dolby tone, as well as azimuth alignment tone. Naturally any discrepancy caused by the absence of such essential aids will be transferred along the accompanying programme material to the disc. The situation is not helped since a fair proportion of master tapes are made up from tapes of different sources. When such an assembled master consists of a hotch potch of different recording standards etc, then each section of the master will need to be optimised and redubbed to a single tape to enable a straight run in the cutting room.

An essential attribute for a cutting engineer concerns the ability with which he can judge the optimum cutting level from the master tape. If there are only one or two places which could cause problems over the length of the tape, it is possible to process or otherwise modify these uncuttable blemishes by simple limiting. This enables the effective cutting level to be raised without an overall tonal discrepancy. For this task, spectrum analysers are finding increasing use since they provide both frequency and amplitude readouts of the programme material.

Equalising a master tape at cutting stage used to be a common occurrence. Slowly, artists and producers began to appreciate that it made an overall difference to the transferred sound. With this in mind, more and more people are starting to make allowances for the cutting process when doing the final mixdown at the recording studio. Even so about 40% of master tapes and over 60% of copy masters still require some degree of equalisation at the cutting stage, mostly in the high frequency range. Generally, the most common faults with copy masters include an indifferent frequency response, high frequency intermodulation and aberrations in the bass registers. There are two principal reasons for the large number of poor copies presented: 1) The importance of tape machine alignment for both master and slave is often neglected and, occasionally, barely understood. 2) The importance of the dubbing engineers' job is very much overlooked and definitely underestimated within the recording industry; dubbing is sometimes considered to be on a par with tea making.

Fortunately, many studios such as the California based Warner Brothers facility appreciate the importance of the dubbing process and habitually make excellent copies of their product for use by mastering engineers for international release.

To enable a straightforward disc mastering session, producers and engineers should, during the final mix, pay particular attention to the high frequency content of their tapes. This may provide only a minimal audible contribution to the finished mix; these frequencies, occasionally in excess of 18 kHz, can cause severe problems with groove deformity. Although producers may insist on their presence in the master, it may force the cutting engineer to wipe or otherwise attenuate them by heavy use of an hf limiter. Since the responsibility for tonal balance should rest with the producer and artists, it is far better that this be done at mixdown stage. Similarly, frequency bands below 40 Hz also cause problems when present at high level on the master. A sharp filter around 30 Hz can certainly improve the groove shape in this condition resulting in better mechanical tracking without apparent loss in quality of the bass registers.

Assuming that the master tape has been transferred to the recording blank, the most important process of all involves inspecting the lacquer for groove deformity. If all is satisfactory it should be sent away and processed at the factory as quickly as possible.

Case histories

It has previously been mentioned that the responsibility of equalisation rests in the greater part with the producer in the recording studio. It is very difficult to define in absolute terms the limitations within which he has to work for eventual transfer to disc. It seems a better idea not to quantify (for that would be a nearly impossible task) but to simply offer examples of good studio mixdown technique which resulted in absolutely straightforward disc transfers.

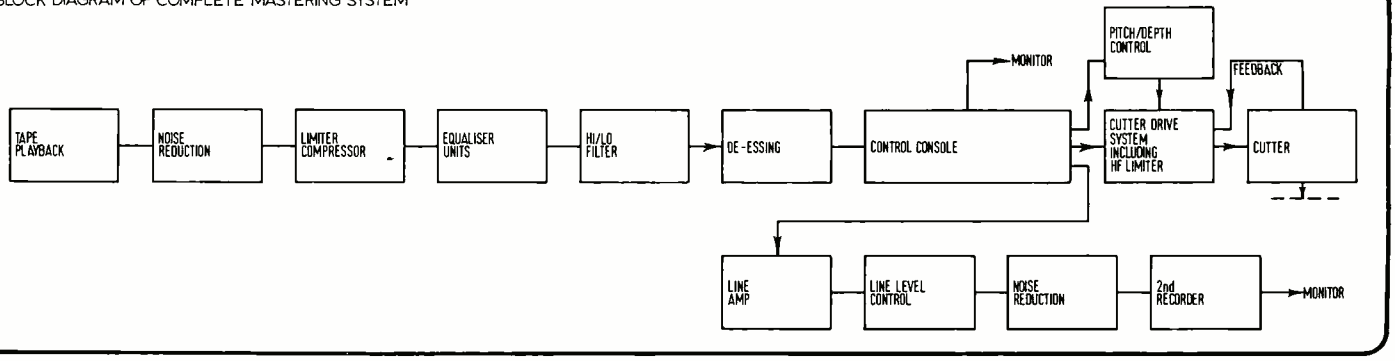
Elton John-Kiki Dee: *Don't Go Breaking My Heart*
The producer of this record had to make an equalised and limited stereo production master in the studio since there was no time he could waste trying different things at the mastering stage. The record is fairly long but there was no problem whatsoever to get the maximum possible level on the disc without any limiting or altering the overall equalisation. Effective equalisation on upper bass frequency range, correct amount of 6 to 8 kHz hf equalisation and balanced amplitude of vocal tracks brought out clarity, definition and exciting musical quality on the master mix. It took hardly any time to disc master.

Steve Harley & Cockney Rebel: *Make Me Smile*
I often use this particular record to check my monitor system for consistency. The very clever mixing of the vocal tracks and equalisation on rhythm tracks is excellent. Sounds great on am and fm broadcasts, at discotheques and at home on average domestic hi-fi equipment. Good engineering work.

Some 45 rpm single by The Carpenters (one example is *Only Yesterday*) have been mastered at lp level in order to maintain the extremely bright vocal sound quality on the disc undistorted. Due to the nature of intelligent stereo mixdown of the multitrack with extended bass and hf frequency response, the apparent level often sounds much louder and exciting than most average singles cut at a fairly high level.

38 ▶

BLOCK DIAGRAM OF COMPLETE MASTERING SYSTEM



MASTER CLASS

Four Seasons: *Who Loves You*
Correct compression and limiting of the vocal tracks and bass rhythm sections, absence of very low frequency out of phase components and correct amount of hf equalisation on the stereo mixdown made it possible for the master tape to be transferred to disc at a very high level without any danger of the commercial record sounding distorted on an inexpensive domestic playback system.

Playing time

When it comes to album cuts, the question is often asked if it is possible to maintain a high level over an extended time while keeping the transfer sound directly comparable to the master tape. The answer is simply yes provided that the stereo mixdown is designed accordingly. The basic requirements have already been outlined. In practice they imply no out of phase low frequency components, consistency of the peak amplitudes (particularly on the vocal tracks) and the partial elimination of transient peaks containing large amounts of hf modulation. A good example of this technique is *Here and There*, a live album by Elton John. One side is about 28 minutes with an average level only 2 to 3 dB below the loud 45 single. It has to be the ideal mixdown for a long album side. Other good engineering examples include records by Eagles, 10cc, Queen, John Denver, David Bowie, O'Jays, Abba, Barry White and Simon and Garfunkel.

Just as it is unlikely for a well engineered master tape to sound very different when transferred to disc it is likely that a stereo mixdown without an essence of professionalism will sound inferior when transferred to disc no matter where or how it has been mastered. In spite of what has already been said, even the best producers and engineers may find it difficult to produce the required formula for the disc cutting engineer. Many simply do not have the time to devote to the technical aspects of production with the inevitable result that there will be some work to do in the cutting room.

Finally it is worth pointing out that the foregoing article only concerns the production and transfer of popular rock records. Techniques for classical records concern themselves far more with obtaining a quiet cut since programme peaks are rare and the dynamic range is much greater.

agony

The session was marred only by the presence of a famous name MD, noted for his lack of humility and dictatorial approach. "Do this, do that, bring me this, give me that, hold that there . . ." so it went on. Just before the end of the inevitably exhausting session, one of the musicians was despatched out of the studio to find the MD a taxi, so that not a moment of his precious time would be wasted. Obediently the delegated musician threaded his way through the music stands to the studio door, turning only at the last minute to ask loudly across the crowded studio, "Is there any particular colour taxi you'd prefer?"

The local radio phone-in programmes all have their own black list of potentially abusive callers. Troublemakers are recognised by voice now as well as by name, and weeded out at the switchboard since most stations prefer not to use a delay tape loop if at all possible. Recently one broadcaster was asking for listeners to call in with tales of what they most regretted in their lives. A nice sounding 'safe' girl came through and was put on the air.

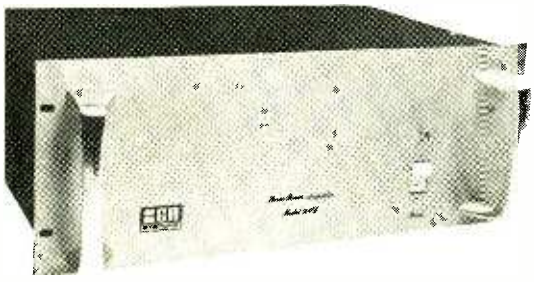
'Hello,' she said, 'what I regret most in the world is never having gone to bed with Harry before now. Isn't that right Harry?'

Telesco International present

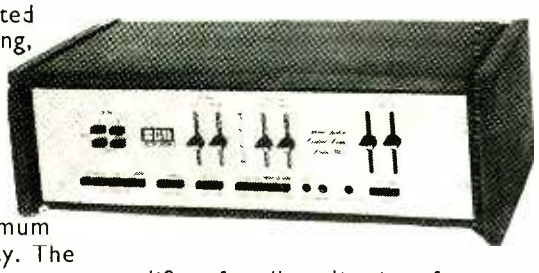
BGW systems

Ramco Research

Professional stereo and monaural audio power amplifiers with power outputs ranging from 85 watts RMS to over one kilowatt. Extremely fast response IC operational amplifier front end. Single-diffused high dissipation power transistors with high degree of redundancy for extremely rugged and dependable output stage. Circuit breaker and fast acting electronic crowbar for protection against overloads and potentially destructive surges or output transistor failure.

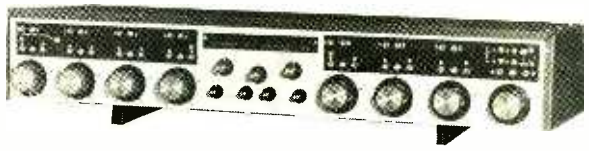


Automatic power line current inrush limiter prevents line circuit breaker tipping when amplifier is turned on. Modular construction for ease of maintenance. Wide frequency/power bandwidth with minimum distortion. The use of highest grade components such as all hermetically sealed can transistors, carbon film resistors, teflon insulated harness wiring, epoxy glass circuit boards, and huge fan cooled heat sinks all assure maximum dependability. The perfect audio power amplifiers for all applications from rock groups to your own parlor.



In addition, BGW has commenced production of a stereo control preamplifier with all the outstanding features and performance that characterise all BGW Products.

Broadcast stereo and monaural audio input control consoles featuring silent C/MOS Solid State touch pad switching with LED status indication, noiseless DC controlled attenuators, LED type VU meters, mon-mix outputs on stereo consoles, full cuing, muting and monitoring.



Ramko also manufactures a full complement of turntable equalized preamplifiers, audio line and distribution amplifiers, monitoring amplifiers, and automatic tape cartridge and cassette loaders.

Telesco International Corporation manages international sales for RAMKO RESEARCH and BGW as well as for the following: GLI Discotheque Speaker Systems and Mixers, ROBINS Broadcast and Sound Equipment Reverberation Generators, Portable and Studio Recording Mixing Consoles, Slide Attenuators, Equalisers and other Audio Modules, MARTIN Speaker Systems (except Europe), POTOMAC AM, FM and Broadcast Field Intensity Meters, RODELCO TV Translators, CAPPS RECORDING styli, NODAC AM-FM-TV Broadcast Transmitters and Accessory Equipment, also AGC and Limiting Amplifiers and Communications Technology Television Production Switchers and Audio/Video Routing Switchers.

Telesco International Corporation

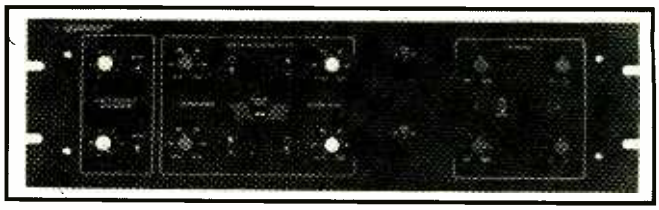
One Dupont Street South. Plainview, L.I., N.Y. 11803

Cable:Telescomm Plainview NewYork

Telex 143112 Telephone 516 433 6210-1-2

Survey: equalisers

Future surveys will comprise Broadcast and Sound Re-Inforcement Mixers (December) Multitrack Recording Consoles (January) and Test Equipment (February). Manufacturers and agents are invited to submit product details for publication to reach the magazine office (address p3) at least six weeks before publication date.



Audio & Design E500 band processor.

ADC

Audio Dynamics Corporation, Pickett District Road, New Milford, Conn 06776, USA.

ADC 500
Number of channels: two.
Band centre frequencies: 30, 50, 90, 160, 300, 500, 900, 1.6k, 3, 5, 9, 16k Hz.
Control range: ±12 dB.
Distortion: 0.035% thd at 2V output.
Signal interface: max 9V output (21 dBV).
Power requirements: 120/240V ac.

ALTEC

Altec Sound Products Division, 1515 South Manchester Avenue, Anaheim, Ca 92803, USA.
UK: Theatre Projects Sound Ltd, 10 Long Acre, London WC2E 9LN.
Phone: 01-240 5411.

729 ACTIVE FILTER SET
Number of channels: two.
Band centre frequencies: 24 ⅓ octave rejection filters on ISO centres from 63 to 12.5k Hz.
Control range: up to 14 dB of attenuation at centre frequency. Internal amplifier provides up to 17 dB of make up gain.
Distortion: less than 0.5% thd.
Noise: 80 dB below rated output.
Signal interface: +15 dBV.7 maximum on input and output driving loads greater than 10k ohms.
Power requirements: 120V ac.
Dimensions: 14.6 x 47 x 20.3 cm.

1650 ACTIVE EQUALISER
Number of channels: one.
Band centre frequencies: 28 ⅓ octave rejection filters based on ISO centres 31.5 and 16k Hz.
Control range: 15 dB of attenuation. Make up amplifier gives up to +20 dB of gain.
Distortion: less than 0.5% thd.
Noise: 90 dB below rated output.
Power requirements: 120/240V ac.
Dimensions: 13.3 x 48.3 x 20.3 cm.
Weight: 7.7 kg.

9860A
Number of channels: one.
Band centre frequencies: ⅓ octave ISO centres from 40 to 12.5k Hz. Highpass filter at 40, 80, 120 Hz, lowpass filter at 6, 12.5, 16k Hz.
Control response: 15 dB of pass band attenuation. Filters slope at 18 dB/octave.
Input level: —2 dBm.
Input overload point: +18 dBm.
Signal-to-noise ratio: 82 dB.
Distortion: 0.5% thd at +15 dBm.
Power requirements: 240V ac, 24/28V dc at 1A.
Dimensions: 134 x 483 x 204 mm.
Weight: 7.7 kg.

9062A
Number of channels: one.
Band centre frequencies: 50, 130, 320, 800, 2k, 5k, 12.5k Hz.
Control response: ±8 dB.
Input level: 16 dB insertion loss. —70 to +24 dB.
Input overload point: passive.
Optional extras: escutcheon panel.
Dimensions: 89 x 254 x 134 mm.

API

Automated Processes Inc, 789 Park Avenue, Huntington, New York 11743, USA.
Phone: (516) 427 6024.
European representatives: 3M company in individual countries.

550A
Number of channels: one.
Band centre frequencies: three knob operation gives continuous coverage from 50 to 15k Hz in 15 steps.
Control range: ±12 dB in 11 steps.
Filter response: peak or shelf at hf and lf by push button.
Distortion: 0.07% thd at +18 dBm.
Power requirements: ±18V max at 70 mA.
Dimensions: 3.8 x 13.4 x 14.6 cm.
Price: $360.

553
Number of channels: one.
Band centre frequencies: lf and hf shelves with a mid range bell based at 3 kHz.
Control range: ±15 dB.
Other data as for *550A*.
Price: $120.

554
Number of channels: one.
Band centre frequencies: three parametric sections 30 to 600 Hz, 200 to 5k Hz, 800 to 16k Hz.
Control range: ±15 dB. Toggle switch for each section gives an octave or notch response bandwidth. Switchable shelf response for hf and lf sections.
Other data as for *550A*
Price: $360.

560 (new model)
Number of channels: one.
Band centre frequencies: ten octave centres between 31 Hz and 16k Hz.
Control range: ±12 dB. Centre click zero.
Other data as for *550A* including dimensions.
Price: to be announced.

954
Voltage controlled version of the *554*; intended for use with the API programmer.

APSI

Audio Processing Systems Inc, PO Box 365, Fayville, Mass 01745, USA.
Phone: (617) 481 6656.
UK: Scenic Sounds Equipment, 27/31 Bryanston Street, London W1H 7AB.
Phone: 01-935 0141.

559
Number of channels: one.
Band centre frequencies: 35, 75, 160, 350, 750, 1.6k, 3.5, 7.5, 16k Hz.
Control range: +15 to —12 dB in 12 steps selected by lever switches with numerical readout.
Distortion: less than 0.35% thd at +24 dBm out. Typically less than 0.05%.
Noise: —90 dB below rated output.
Power requirements: ±15V dc at 80 mA.
Signal interface: 0 dBm.
Dimensions: for console mounting 3.8 x 13.3 x 15.3 cm.
Price: $300. £186.

561
Number of channels: one.
Band centre frequencies: 125, 500, 2.5k, 10k Hz.
Control range: ±10 dB continuously variable.
Other information: as for *559*.
Price: $125. £78.

562
Number of channels: one.
Band centre frequencies: four section fully parametric 20 to 200 Hz, 100 to 1000 Hz, 500 to 5k Hz, 2k to 20k Hz.
Control range: ±12 dB.
Other information as for *559*.
Price: $200. £125.

AUDIO & DESIGN

Audio & Design (Recording) Ltd, St Michaels, Shinfield Road, Shinfield Green, Reading RG2 9BE.
Phone: (0734) 84487.
USA: Gregg Dixon, 1019N Winchester, Chicago, Illinois 60622.
Phone: (312) 252 8144.

SCAMP SO3 PARAMETRIC EQUALISER
Each section has a control range of 40 dB with three position 'peak-out-dip' switches; an attenuator input switch and 'in/out' function switch.

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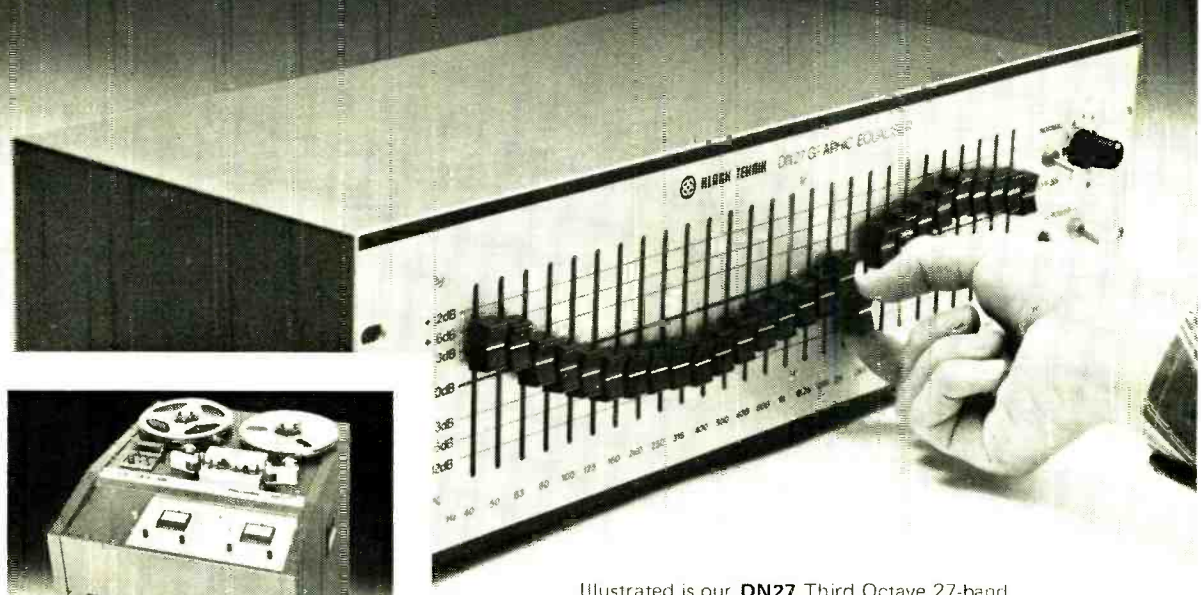
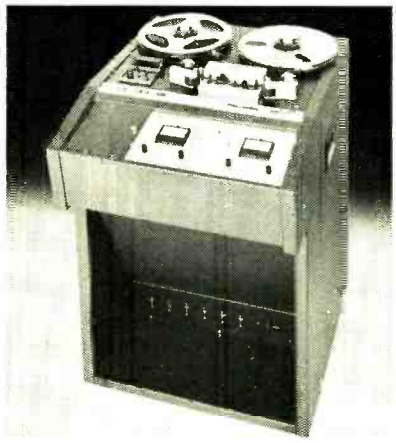
At the BBC, Thames Television, Capital Radio, Granada, Air Studio, Rockfield, Decca, EMI & Strawberry ... they have...

PERFECTION AT THEIR FINGERTIPS



Illustrated is our **DN27** Third Octave 27-band **Graphic Equaliser.** Also available is our DN22, dual-channel, 11-band unit. Both have many technical plusses which our literature describes.



Illustrated is our **SM2S Stereo Tape Recorder.** Also available are SM2T (Twin Track) and SM2M (Full Track). Their many superior features include: no high voltage on deck, servo-controlled D.C. spooling motors, variable spooling control and twin varispeed servo capstans.

It's not surprising to find our equipment with these and many other users: after all, we are technically superior - as both operator and engineer can testify, and you may be surprised to learn that we are no more expensive.

This perfection can be yours. Give us a ring !

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Telephone (0562) 64027

Technical Innovation Award 1976 The Winner

Now available in U.S.A through LANG LABORATORIES Syosset New York Tel: (516) 364 1900

SURVEY: EQUALISERS

Section 1: 20 Hz-1 kHz at Q of 2.5.
Section 2: 75 Hz-7.5 kHz at Q of 1.5.
Section 3: 400 Hz-20 kHz at Q of 2.5.
Input: balanced 10k ohm.
Output: balanced <1 ohm source impedance.
Distortion: less than 0.05% thd over bandwidth.
Noise: less than —90 dB ref. +8 dBm.
Range: ±20 dB lift and cut.
Clip level: better than +24 dBm.

SCAMP SO4 PARAMETRIC EQUALISER

The high and low bandpass sections can be switched to provide variable slope filtering. The unit has an amplitude control range of 40 dB with push button peak/dip and section in/out functions. A peak level indicator is provided on each bandpass section. 50 mm *Scamp module.*
Section 1: 20 Hz-1 kHz; bandwidth variable from 0.5-5 octaves.
Section 2: 75 Hz-7.5 kHz; bandwidth from 0.5-5 octaves.
Section 3: 400 Hz-20 kHz; bandwidth from 0.5-5 octaves.
Sections 1 and 3 (peak-dip curves) are asymmetrical; section 2 is symmetrical.
Other specifications as for *SO3 module* above.

SCAMP SO7 OCTAVE EQUALISER

A ten section unit with standard octave frequencies between 31.25 Hz and 16 kHz.

SCAMP SO5 and SO6 DYNAMIC FILTERS

Hi and lo pass filters for selective noise reduction; as input level falls, so filter increases its effect. Above threshold, system response is flat. Preselect variable slope from 0 to 18 dB/8ve at three turnover frequencies: 100, 200 and 400 Hz (*SO5*) and 2, 4 and 6 kHz (*SO6*).

E900 SWEEP EQUALISER

Four frequency sweep ranges, each pair covering the audio bandwidth and providing two Q options. Each section has control range of 40 dB with a 'peak-off-dip' selector switch.
Section 1: 40 Hz-1.4 kHz at Q of 3.
Section 2: 80 Hz-1.6 kHz at 1 or 1.5.
Section 3: 400 Hz-14 kHz at Q of 1.5.
Section 4: 800 Hz-16 kHz at Q of 3.
Input: 10k ohm unbalanced (balanced to order).
Output: <1Ω source, clip level +18 dBm unbalanced (balanced to order +24 dBm clip level).
Response: ±0.5 dB 30 Hz-20 kHz.
Noise: <—88 dB ref. +8 dBm.
Distortion: <0.05% thd.
Range: ±20 dB peak/dip.
Power: +24 volts dc

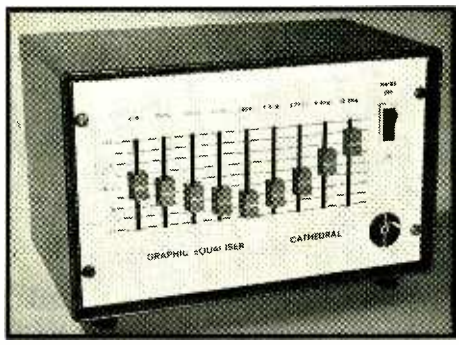
E500 SELECTIVE BAND PROCESSOR

The unit can split an audio signal for routing to an external signal processor (limiters, compressors or whatever). It combines high and low pass filters with division from 100 Hz to 10 kHz, and a single section parametric equaliser covering the range 20 to 20k Hz. Control range is +20 to —35 dB. The unit is available in stereo rack format only.

The company manufactures several combinations of equalisers and limiters which find applications in sibilance control etc. For this, equalisers and other frequency response modifiers are placed in the side chain of the compressor/expander causing it to act on a predetermined part of the spectrum only.

B&B AUDIO

Baskind, Bissot & Associates, 7801 Melrose Avenue, Los Angeles, Ca 90046, USA.
Phone: (213) 653 9200.
UK: Scenic Sounds (see APSI).



Cathedral graphic equaliser

EQF-1

Number of channels: one.
Band centre frequencies: three section parametric 22 to 500 Hz, 220 to 5k Hz, 1k to 20k Hz. Hi and lo pass filters parametric 15 to 500 Hz, 1k to 20k Hz.
Control range: ±12 dB.
Distortion: less than 0.1% thd.
Power requirements: max 18V bipolar at 75 mA.
Signal interface: 0 dBm.
Dimensions: for console mounting 13.3 x 3.8 x 15.1 cm.
Price: $400. £249.

CATHEDRAL SOUND

Cathedral Sound, Fourways, Morris Lane, Halsall, Ormskirk, Lancashire L39 85X.
Phone: Halsall 328.

CATHEDRAL GRAPHIC EQUALISER

Number of channels: one.
Band centre frequencies: 50, 100, 200, 400, 800, 1.6k, 3.2k, 6.4k, 12.8k Hz.
Control response: ±12 dB at band centre frequency.
Input level: 0 dB. Output level 0 dB.
Input overload point: 2.8V clipping level.
Signal-to-noise ratio: better than 90 dB.
Distortion: 0.05% at rated output.
Power requirements: 240V, 50 to 60 Hz.
Dimensions: 267 x 165 x 165 mm.
Price: £125. $240.

EAGLE

Eagle International, Precision Centre, Heather Park Drive, Wembley HA0 1SU.
Phone: 01-903 0144.

FF11

Number of channels: two.
Band centre frequencies: 40, 200, 1.2k, 6k, and 15k Hz.
Control response: ±10 dB.
Input level: mag phono 3 mV at 47 kΩ. Auxiliary 200 mV at 100 kΩ. Tape 200 mV at 100 kΩ.
Input overload point: 200 mV at 50 kΩ.
Signal-to-noise ratio: 50 dB.
Power requirements: two 9V batteries.
Dimensions: 250 x 180 x 46 mm sloping to 28 mm.
Price: £39.

ESE

E. S. Electronics, 2 Upper Fant Road, Maidstone, Kent.
Phone: 0522-673355/6/7.

EQUALISER

Number of channels: one.
Band centre frequencies: 60, 180, 450, 1k, 2.4k, 5k, 10k Hz.
Control response: ±14 dB.
Input level: —20 dBm, 0 dBm.
Signal-to-noise ratio: 85 dB.
Power requirements: 18V (2 x 9V batteries).
Price: battery model £35, mains powered £40.

MULTITRACK

Multitrack, PO Box 3187, Hollywood, Ca 90028, USA.
Phone: (213) 462 1351.

VARIBAND PARAMETRIC EQUALISER

Number of channels: one.
Band centre frequencies: five independent sections; 20 to 100 Hz, 100 to 600 Hz, 600 to 3k Hz, 3 to 6 kHz, 6 to 20 kHz.
Control range: ±15 dB.
Bandwidth: variable from 2 dB/8 ve to 16 dB/8 ve.
Other: individual parametric sections can be switched in or out independently.
Signal interface: 0 dBm unbalanced.
Signal to noise ratio: 92 dB.
Distortion: less than 0.03% thd 20 to 20 k Hz at +10 dBm.
Power requirements: ±15V at 210 mA.
Dimensions: 48.3 x 25.4 cm.
Weight: 1.9 kg.

NEVE

Rupert Neve & Company Ltd, Cambridge House, Melbourn, Royston, Herts SG8 6AU.
Phone: 0763-60776.
USA: Rupert Neve Incorporated, Berkshire Industrial Park, Bethel, Connecticut 06801.
Phone: (312) 252 8144.

Neve manufactures a range of channel amplifiers for incorporation within mixing consoles that also pro-

44 ▶

Multitrack Vari-band Parametric Equaliser.

AUTOMIX

a completely programmable* mixdown console

*** Featuring Automated Processes' own programmer.**

Automix as a manual mixdown console is incomparable. As a programmable console, it permits new standards of perfection and artistry.

You may capture every detail and nuance of a mix from up to 32 inputs and 4 echo channels. When programmed, your mix may be precisely repeated as often as desired, or each element of sound on any track may be improved individually or in combination.

The audio paths are entirely separated from the DC control circuits. Voltage control amplifiers and state variable devices in the audio paths provide for all functions: level, localization, reverberation, and equalization. Multiple audio paths handled by a single control (grouping) is possible for all functions. An optional video screen displays the quad sound field, identifying each input, as a numeral, in its respective aural position.

The new Automated Processes Programmer differs from previous console automation memory systems. Data is recalled without accumulation of delay at each pass since timing is included in the data. Many mixes may be stored for later recall. Only one tape track is required, and crosstalk is below normal program audio.

Extraordinary performance is achieved at a very modest price.

AUTOMATED PROCESSES, INC.

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SURVEY: EQUALISERS

vide full equalisation facilities. The format can vary from a simple lf and hf shelf with switchable hi pass filter, to lf and hf shelves switchable to bell characteristic, two mid range bells and fully variable lo and hi pass filters. The associated channel preamplifiers offer typical input ranges between —80 to —20 dB (mic) and ±20 dB line. Additional controls provide adjustment of the mid range bandwidth.

ORBAN/PARASOUND

Orban/Parasound, 680 Beach Street, San Francisco, Ca 94109, USA.
Phone: (415) 776 2808.
UK: Scenic Sounds (see APSI).

621 PARAMETRIC EQUALISER
Number of channels: one or two.
Band centre frequencies: four sections 30 to 600, 90 to 1.8k, 250 to 5k, 750 to 15k Hz.
Control range: +16 dB to —infinity. Q adjustable for each section from 0.29 to 3.2.
Distortion: less than 0.03%.
Noise: —96 dB below rated output.
Power requirements: ±28V dc maximum.
Dimensions: fits a 8.9 x 48.3 cm panel rack.
Price: $739. £477.

PULTEC

Pulse Tecniques Inc, 1411 Palisade Avenue, Teaneck, New Jersey 07666, USA.
Phone: (201) 837 2575.

EQP-1A3
Number of channels: one.
Band centre frequencies: three sections provide: shelving from +13 to —17.5 dB at 20, 30, 60, 100 Hz; broad/narrow bandwidth boost at 3, 4, 5, 8, 10, 12, 16 kHz to +18 dB; high frequency shelf to —16 dB at 5, 10, 20 kHz.
Distortion: 0.15% at +10 dBm.
Noise: below 80 dB at rated output.
Signal interface: 0 dBm, maximum output +21 dBm, balanced.
Power requirements: 120/240V ac.
Dimensions: 8.9 x 48.3 x 19 cm.
Weight: 4.1 kg.
Price: $584.

EQH-2
As above regarding *modus operandi* and general specification details. Differences relate to frequency centres: Provides boost (bell) at 3, 5, 8, 10, 12 kHz to +16 dB. Shelf attenuates at 10 kHz to —16 dB. Shelves to +13.5 from —17.5 dB at 20, 30, 60, 100 Hz.
Price: $456.

MEQ-5 MID RANGE EQUALISER
General specification as *EQP-13* and *EQH-2*. Three separate sections provide boost and attenuation at 200, 300, 500, 700, 1k, 1.5, 2, 3, 4, 5, 7 kHz to ±10 dB. Two sections provide boost with the third for attenuation.
Price: $560.

Pultec manufactures a wide range of filters for film and studio work with a variety of switchable cutoff frequencies.

QUAD/EIGHT

Quad/Eight Electronics, 11929 Vose Street, North Hollywood, Ca 91605, USA.
Phone: (213) 764 1516.
UK: Cinesound International Ltd, Imperial Studios, Borehamwood, Herts.
Phone: 01-953 5545.

EQ-712
Number of channels: one.
Band centre frequencies: 65, 160, 400, 1k, 2.2, 4.5, 8.2k Hz.
Voltage gain: unity.
Frequency response, flat: ±0.5 dB from 20 to 20k Hz.
Control range: ±12 dB.
Signal interface: 0 dBm.
Distortion: less than 0.25% at full output.
Output noise: —106 dBm.
Power requirements: ±28V dc at 20 mA.
Dimensions: 22.3 x 12 x 7 cm.
Weight: 0.51 kg.

EQ-312A
Number of channels: one.
Band centre frequencies: 10 centres between 50 and 10k Hz. The console mounting unit uses three dual concentric knobs and provides either bell or shelf response.
Frequency response: ±0.5 dB between 20 and 20k Hz when set flat.
Distortion: less than 0.25% thd to rated output.
Max throughput level: +24 dBm.
Control range: 2 dB steps to ±10 dB.
Power requirements: ±28V dc at 13 mA.
Dimensions: 3.8 x 17.8 x 15.9 cm.

LHF-20
Number of channels: one.
Band centre frequencies: combined hi and lo pass filter with variable roll off at each end of the spectrum. Hi pass 40, 55, 70, 85, 100, 150, 200, 250, 350, 500 Hz. Lo pass 2, 3, 4, 5, 6, 7, 8.5, 10, 12.5, 15k Hz.
Roll off: 18 dB/8 ve.
Gain: unity.
Dimensions: 8.9 x 48.3 x 15.3 cm.

RECORDING STUDIO DESIGN

Recording Studio Design, 87 Hammond Street Road, Cheshunt, Herts.
Phone: Waltham Cross 25682.

VISUAL DISPLAY GRAPHIC EQUALISER
Number of channels: one.
Band centre frequencies: 27 on $\frac{1}{3}$ octave ISO centres from 40 Hz to 16k Hz inclusive.
Control range: up to 30 dB attenuation at any of the centre frequencies.
Signal interface: 0 dBm line level nominal.
Distortion: less than 0.05% thd at +20 dBm output at 1 kHz.
Signal-to-noise ratio: 70 dBm unweighted.
Other: the unit is designed for incorporation into stage monitoring systems as anti feedback device. Each attenuation band has a corresponding led which illuminates at that specific howlround frequency offering visual as well as audible indication.

SOUNDCRAFTSMEN

Soundcraftsmen, 1721 Newport Circle, Santa Ana, Ca 92705, USA.
UK: Gale Electronics and Design Ltd, 39 Upper Brook Street, London W1Y 1PE.
Phone: 01-499 9966.

General specification for all models
Number of channels: two.
Band centre frequencies: 30, 60, 120, 240, 480, 960 Hz, 1.92k, 3.84, 7.68, 15.36k Hz.
Control response: ±12 dB.
Signal to noise ratio: 90 dB below 1V.
Distortion: less than 0.05% thd.

PE2217
with consumer style audio preamp with phono and tape switching. Internal power supplies. $589. £390.

RP2122
source line switching for use pre and post tape recording. Internal power supplies. $369. £195.

20-12
basic unit with internal power supplies.

SPECTRA SONICS

Spectra Sonics, 770 Wall Avenue, Ogden, Utah 84404, USA.
Phone: (801) 392 7531.

500 MIC/PROGRAMME EQUALISER
Number of channels: one.
Band centre frequencies: two section; lo range 50, 100, 200, 300 Hz selected by switch. Hi range 2.5, 5, 10, 15k Hz selected by switch.
Control range: ±12 dB in 2 dB steps.
Distortion: claimed to be unmeasurable; the passive circuit is for use as a feedback element with the Spectra Sonics *101* or *110* audio amplifier.
Dimensions: 3.8 x 9.2 x 7.3 cm.
Price: $220.

501 MIC/PROGRAMME EQUALISER
Operates in much the same way as the above but provides hi and lo frequency bells at 7k Hz and 100 Hz only.
Price: $84.

502 MIC/PROGRAMME EQUALISER
This is a passive network for use as a feedback element with the Spectra Sonics *101* or *110* amplifier. It provides hi, mid and lo eq; the hi and lo sections can be switched from shelf to bell response. Available frequency centres are 50, 100, 200, 300, 400, 500, 800, 1.2k, 1.6, 2, 2.5, 3.5, 5, 7.5, 10k Hz. Control range ±12 dB.
Dimensions: 3.8 x 18.5 x 7.3 cm.
Price: $296.

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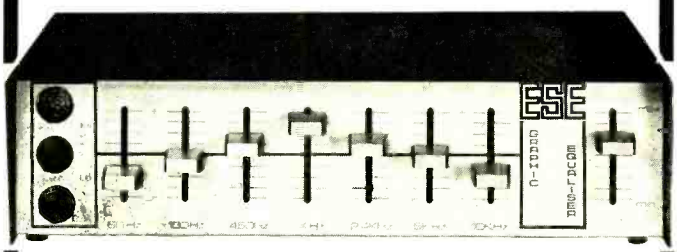

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SPHERE

Sphere Electronics, 20201A Prairie Avenue, Chatsworth, Ca 91311, USA.
Phone: (213) 349 4747.

800 EQUALISER
Number of channels: one.
Band centre frequencies: this is a two section equaliser providing both shelf and peak selection. Lo 60, 120, 250, 500 Hz. Hi 1.5, 3, 5k Hz.
Control range: ±12 dB.
Distortion: less than 0.1% thd at +24 dBm output.
Noise: 86 dB below rated output.
Power requirements: —24V dc unipolar or bipolar.
Price: $290.

900 GRAPHIC EQUALISER
This is nine octave spaced unit for incorporation within the mixing desk.
Band centre frequencies: nine based on octave centres between 50 and 12.8k Hz, switched by bi-directional switch with numerical readout.
Control range: ±12 dB in 11 steps.
Signal interface: 0 dBm, +24 dBm output max.
Noise: 90 dB below rated output.
Distortion: less than 0.1% thd.
Dimensions: 16.5 x 3.8 x 12.7 cm.
Price: $370.

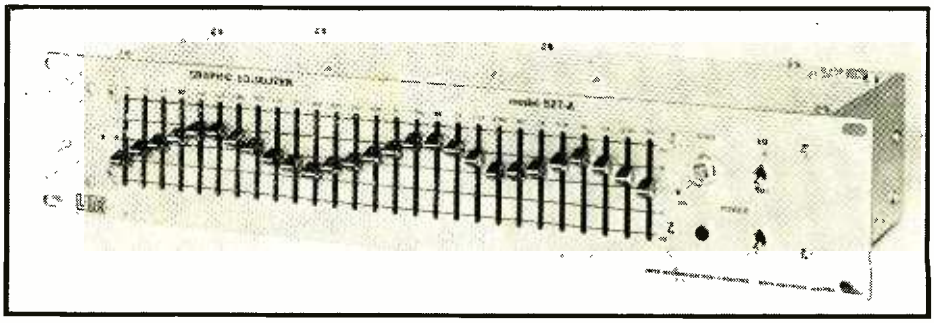
TEKNIK

Klark-Teknik Research Ltd, MOS Industrial Site, Summerfield, Kidderminster, Worcs DY11 7RE.
Phone: 0562-64027.
USA: Sold direct from the UK.
Rest of world: agents in Australia, Holland, France, Norway, West Germany, Singapore, Greece, Belgium, Denmark, Italy, Sweden, South Africa, Spain South Korea.

DN27
Number of channels: one.
Band centre frequencies: 27 bands on ISO centres from 40 Hz to 16 kHz inclusive.
Control range: ±12 dB.
Distortion: less than 0.01% at 1 kHz at +4 dBm output.
Noise: less than —90 dB from 20 to 20k Hz.
Centre frequency accuracy: within 2%.
Signal interface: 0 dBm nominal, to +22 dBm output unbalanced. Balanced signal terminations available.
Power requirements: 120/240V ac.
Dimensions: 48.3 x 13.4 x 21.6 cm.
Price: £405.

DN22
Number of channels: two.
Band centre frequencies: 50, 90, 160, 300, 500, 900, 1.6k, 3, 5, 9, 16k Hz.
This is a two channel equaliser with the above centre frequencies. The general performance specification is as for the *DN27*.
Price: £405.

DN15
This is a stereo 11 band equaliser with a graphic section generally similar to the *DN22*. However, it incorporates a pre-amplifier for use with domestic, consumer audio equipment.
Price: £405.



Universal Audio 527A

UNIVERSAL AUDIO

United Electronics Recording Industries, 11922 Valerio Street, North Hollywood, Ca 91605, USA.
Phone: (213) 764 1500.
UK: F. W. O. Bauch Ltd, 49 Theobald Street, Borehamwood, Herts.
Phone: 01-953 0091.
Rest of World: Gotham Export Corporation, 741 Washington Street, New York, NY 10014, USA.

527A
Number of channels: one.
Band centre frequencies: 27 on ⅓ octave ISO centres.
Control range: ±10 dB.
Signal interface: 0 dBm variable.
Distortion: 0.5% thd at +24 dBm output.
Noise: less than —90 dB below rated output.
Dimensions: 8.9 x 48.3 cm, front panel.
Weight: 5.9 kg.
Price: $660.

529
Number of channels: one.
Band centre frequencies: 27 on ⅓ octave ISO centres.
Control range: up to —15 dB of attenuation at each frequency.
Filter range: hi pass 30 to 240 Hz, lo pass 3.5 to 20k Hz.
Other details as *527*.
Price: $730.

530
Number of channels: two.
Band centre frequencies: 9 octaves between 50 and 12.5k Hz.
Other details as *527*.
Price: $424.

532
A single channel version of model *530*.
Dimensions: 8.9 x 21.6 x 20.3 cm.
Price: $316.

560
Number of channels: one.
Centre frequencies: four parametric sections to provide attenuation notches for howlround suppression in pa systems. Each identical section offers a tunable range between 60 Hz and 6k Hz.
Control range: 0 to —20 dB variable, bandwidth 1/6 octave.
Dimensions: 6.4 x 21.6 x 25.4 cm.
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dbx 157 is a two-channel simultaneous tape noise elimination system which permits monitoring off tape while recording. It is fully compatible with all dbx professional studio systems and costs £414 from professional audio dealers. Switchable (record or play) 150 series noise elimination systems start as low as £130 per channel.

For complete product information contact: **Scenic Sounds Equipment, 27-31 Bryanston Street, London, England W1H 7AB, 01-935-0141.**

dbx inc.

work

Essex

Essex Music have been in business for over 20 years, and for three of those years the company have had a studio beneath their headquarters at 19-20 Poland Street in Soho. The studio was originally built for the benefit of their own writers but in the autumn of 1974 they decided to develop the studio commercially and invite business from outside clients. Since then there have been a number of engineers but the studio manager and chief engineer is now John Burns, who until recently was at Decca. His assistant is Reno Ruocco.

Originally the idea was that the in-house work would subsidise the outside sessions, keeping the studio rates low. Usually it's the other way round. The rates have been the same for about two years—since they opened, in fact—but Essex say the studio now pays for itself. About 40 per cent of the work, they say, comes from outside as an average over the year.

Although Essex don't go out of their way to make trade-paper headlines the way that, say Chrysalis Music seem to do, Essex are one of the biggest music publishers in the country. Essex managing director David Platz started the company, which is now the umbrella for between 40 and 50 different music publishing outfits. In the late sixties they started the Fly label which met with immense success largely because of the popular rise of Tyrannosaurus Rex, later T Rex, under Tony Visconti's direction. The ascent of Fly could almost be charted from *Ride a White Swan* in November 1970. The climax was the *Electric Warrior* album, which was number one in the album chart for eight weeks, interrupted by one week for the *Concert for Bangladesh* lp, and which spent altogether six and a half months in the chart. At the same time there was some successful John Kongos material, including the *Tokoloshe Man* single, but the Fly buzzed its last about the time they re-released *Whiter Shade of Pale* from the Procol Harum back-catalogue.

Olav Wyper, formerly of RCA, EMI, CBS and Phonogram and also a theatrical producer, arrived as managing director of the record company in 1971. He phased out Fly and all the product then went out on Cube. Unlike the former label, Cube had little success apart from a Jimmy Helms single at the beginning. Wyper left at the end of May last year and was replaced by Barrie Bethell as label manager.

The new Electric Record Company label is an effort to retrieve the situation. It was started last February and the first release, on March 12, was Marsha Hunt's *C'est La Vie* single. A new band called Quantum Jump were next with *Lone Ranger*. Essex intend the new label to be 'a leading contender' among the record companies. They want to record contemporary artists and to be as adventurous as possible, they say. They'll release a single every three weeks. At the moment, the label is based round four acts which they say are album oriented. Four albums are planned at the moment but that may increase. Cube still has some back-catalogue from Cocker, the Move, Procol, T Rex and John Williams. A Williams instrumental was released in March and *Get It On/Hot Love* by T Rex.

The studio doesn't specialise in any particular kind of work. Apart from Marsha Hunt they have recorded Cleo Laine, John Dankworth, Sammy Cahn, Wally Whyton, Lonnie Donegan, and kiddie's pin-up Mister Men. The Sweet have been in to produce a band called Angel. 'I think of it,' said John Burns, 'as a good rhythm track studio . . . In two or three months it will be really good.'

The studio measures 6.5m by 5m and is a fully air conditioned floating structure. There isn't a vocal or drum booth since this would reduce the versatility of a small studio but plenty of screens are available. A rehearsal room is available with mic lines connecting it with the control room and Essex have, on occasion, put a brass section in there, but there isn't cctv yet and the arrangement couldn't be said to be ideal. The acoustic in the main studio is fairly bright, and Essex can make adjustments with carpets as well as the screens.

John Burns was eight years at Decca and values the experience. 'The work was very varied. I did everything from spoken voice to orchestral string sections and so on.' Even the middle of the road work, he said, which most engineers tended not to think very much of, needed a particular approach and a different kind of skill. 'They didn't take people on from outside; they trained their own people, and that way they knew what they were getting. I think it was a good basic training and I'm glad of it.'

He is very keen to keep the studio competitive. If my guess is correct he's bombarding Essex boss David Platz with memos about this, that and the other, but if you bear in mind the limited size of the main studio, the facilities it has make any additions a matter of taste rather than necessity. The desk is a basic Triad with 24 inputs and 16 groups. Burns admits that it has limitations but he's quite happy with it. There's little he would be able to do on a more elaborate desk that he can't do on the Triad with a bit of patching in. He plans to make one or two alterations such as taking the pre-fade listen off the click stop at the end of the fader travel and putting it on a $2\frac{1}{2}$ position switch: pfl, off, and pfl spring-biased to off. He also wants to get a couple of ppms and a scope.

The 16 track machine is an *A80* Studer with Dolby *M16* noise reduction. There are two stereo Studer machines, an *A80* and a *B62*, as well as a couple of high speed Revox they use for tape delay. All the machines are fitted with varispeed and there are some remote control facilities although the machines aren't all that far away and, in any case, Essex have a tape jockey.

The monitoring is on Tannoy Lockwoods driven by Amcron *300A* amps. The foldback speakers are also Lockwoods. 'When I came here I was glad not to see JBLs, but that they had Tannoys instead. The Tannoy I find a little harsh at the top but when you're doing a vocal and you hear a voice coming through on the Tannoy it sounds as a voice should sound. The JBL is—I don't know—a bit honky. A lot of engineers like them, though, and I suppose it's just a matter of taste.'

He has had the acoustics checked by Eddie Veale's Acoustic Consultants. 'We were pleasantly surprised by the readings. We had been afraid they might be worse. When we've made the changes they

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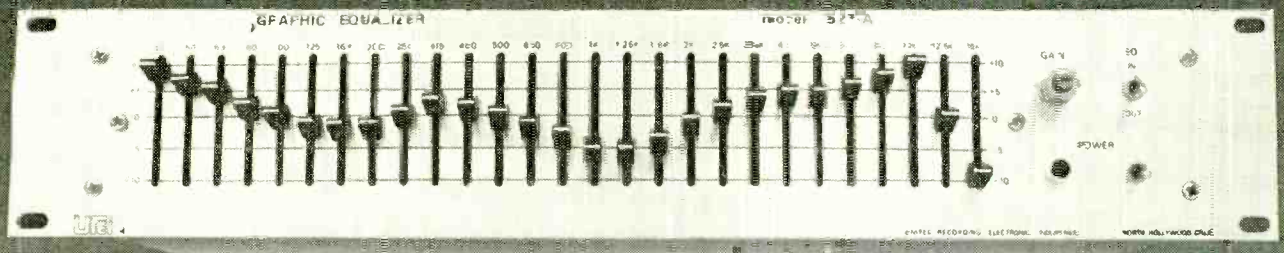
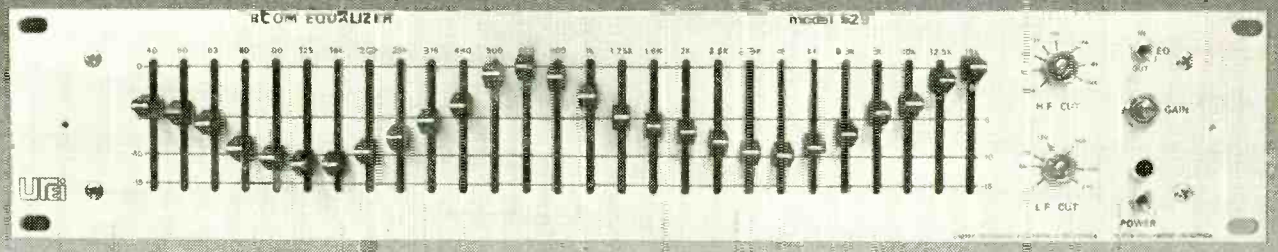
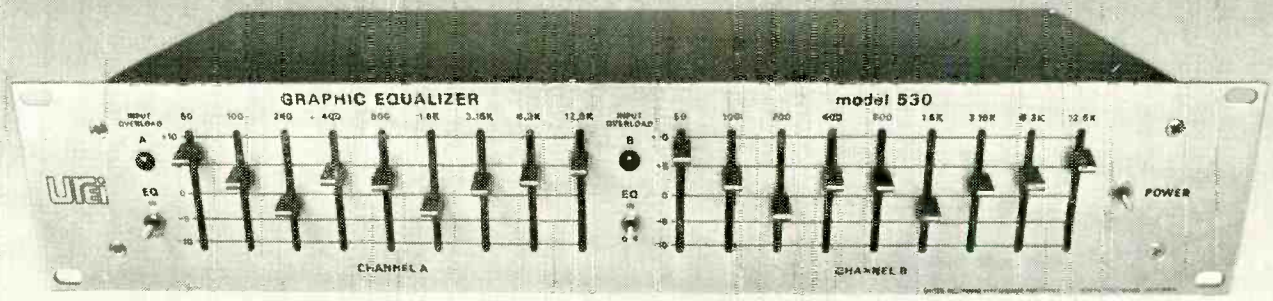
Graphic in Audio







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Model 527 features
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Model 529 offers from
40Hz to 16kHz in 27 steps with up to 15dB of attenuation; with additional high-pass and low-pass filters.

Model 530
a two- channel octave equaliser allowing independent selection in 9 steps from 50Hz to 12.5kHz for stereo application, 10dB boost and attenuation.

Model 532 – the mono version of the 530.

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suggested it should be flat in here to about 1½ dB.' The consultants had only concerned themselves with the control room and not the studio. The equipment was installed when the studio was built by Stuart Johnson, who brought Eddie Veale in to do the acoustics.

One of the first things Essex did when they were upgrading the studio's remix facilities was to get more *Kepexes*. They now have four. John Burns is used to working on Neve equipment and so they have two Neve limiter compressors as well as two Teletronix and one Universal Audio limiter. As well as the desk equalisation, there are three graphic equalisers: a pair of nine band Astronic equalisers and an 11 band, one-third octave switchable Audix. 'I don't believe in using too much equalisation,' Burns told me. 'Some engineers use it to get them out of trouble but it's much better to get it right at the time. People seem to think a mixer is a magic machine, a cure-all, but a mixer is not meant to right all wrongs.' Essex have also equipped themselves with most of the usual ancillaries, including various phasing devices, automatic double tracking, an EMT plate and a Master-Room unit.

Estate Agent's jargon applies as much to studios as to anything else, and if the man tells you that a studio is 'convenient for Wardour Street, Oxford Circus tube station and the West End,' it means there's nowhere to park. Happily that isn't quite the case with Essex Music since there's one of those concrete filing cabinets just around the corner. Poland Street is a bit narrow so you have to unload fast and drive off, but there's a lift straight down to the studio just inside the front door. The rates are £21 an hour basic and go up to £27.50 for overtime. Essex say they are busy, booked up for weeks ahead. Reports about what's happening elsewhere vary, but the determination of the record companies to rehash old products can't be doing bigger studios than Essex much good.

If Essex stay cheap, they'll stay, and, in fact, expansion is underway.

John Dwyer

Freeloader goes to Knebworth

Arriving backstage, it was just as I'd feared. The music world were playing the T-shirt game. I counted three Stevie Wonder's *It's Almost Ready*, a brace of Wings' *It's A Load of Balls*, one *Nils Lofgren*—good taste that man from NME—one Cliff Richard *I'm Nearly Famous* and several *Beach Boys 20 Golden Greats*. Totting up the various labels represented, EMI/Tamla were clear winners. I, myself, plumped for a natty little Wurzels number. Well, they did give me a most enjoyable free trip to the West Country the other week.

The bar was already in full swing when I arrived at 10.40 am. The Fullers bitter and an unknown brand of lager were the most popular items. For my first ice-cold tube, I was joined by photographer Mike Putland. But Knebworth was witness to a very disillusioned Mike. 'Photographers are strange characters,' he told me. 'Loners, mostly. I know a lot of people here, but I don't see the point in talking to them if I'm not going to enhance their lives.' Heavy stuff considering it was barely past breakfast. I wish the lensman the best of luck when he goes to work in the United States in a month or two's time.

He might find a few lives to enhance there.

Most colourful character in the press enclosure was a shaggy spaniel who, it would seem, had been for a swim in a nearby cess pit. His appearance added some light relief to the *Hot Tuna* set.

Lunch (with the combined compliments of WEA, Phonogram, Grunt and MCA) was pleasant enough . . . Greek style fish pate laced with a generous splash of garlic, kebabs and, to finish, strawberry-flavoured ice cream. Only trouble was that the tented restaurant was placed on a slope. Several times I was in danger of falling off my seat. The mobile gents' loo was perched at an even more precarious angle and was to prove a hazard for one or two imbibers later in the day.

Name-dropping time . . . Paul McCartney and wife arrived in a pink Mini. Jonathan King came in his Rolls Royce and looked bored—when doesn't he? Jack Nicholson (what he's got to do with the music business I'm not quite sure. Perhaps he's going to do a follow-up musical based on *Cuckoo's Nest*) refused to discuss his private life, and Paul Getty III was turned away by a burly representative of 'Artistes Services' because he didn't have a pass. Belle of the backstage ball was the late Brian Jones's one-time girl friend, blonde and beautiful . . . No, Donovan was nowhere to be seen.

Up for grabs were Don Harrison Band shirts and stickers, Hot Tuna kites (mine won't fly) and Lynyrd Skynyrd badges. Not exactly rich pickings, but all in all no complaints.

On the weekend previous to the Knebworth Spectacular, my travels took me to a flower show in a remote Sussex village where I was amused to see the locals playing 'Throw the Wellington Boot'. Naturally, it was in aid of charity and, as such, the prizes weren't up to much—a handful of recent EMI releases curiously marked 'Not for resale'. I was surprised to learn that first prize was no less than an lp by Moira Anderson with Rolf Harris and Cliff Richard providing second and third respectively.

At the end of the day, it appeared that the winners were rather less than happy with their prizes, having been promised a more progressive choice such as the new work by the Wurzels . . . In the event, the erstwhile competitors arranged a little diversion of their own.

'Throw the Moira Anderson lp' raised no less than £1.25 with the Rolf Harris number coming second with 95p.

I'm Nearly Famous was an also-ran since some uncharitable person destroyed it with a hammer before others could frisbee it in aid of the Chailey Heritage.

Kingsway Recorders

Over the years the studio, situated a stone's throw from Holborn tube station in London, has been quite a few things to even more people. Like the advertising agency who founded it 14 years ago when the recording industry had barely discovered identity, through a period when it was owned by De Lane Lea who tried to base two larger complexes on the small studio's undoubted success, to the present where former employees bought out the facility from the series of holocausts surrounding De Lane Lea's early attempts at expansion. And of course there were the clients who supported it through the various metamorphoses; names from the golden era of the late sixties, numbering among them Herman's Hermits, Jeff Beck, the Stones and Hendrix. Mickie Most would seldom record his acts anywhere else—a framed bill exists for recording time for the *House of the Rising Sun* by the Animals amounting to 30 shillings. That was 15 minutes for the run through followed by a similar time for the take. And all in mono. However, when the studio opened as a 24 track, a competitor offered time at £3 an hour less—roughly, one imagines, the real cost of brand loyalty.

Because, and perhaps in spite of, Kingsway's long history, it is now a fully equipped studio with all the equipment and peripherals concurrent with a first line 24 track facility. There are larger studios, but this one doesn't usually hit anything much heavier than rock, and besides, the LSO would probably prefer to record in the Conway Hall. Equally, the expression 'good for overdubs' doesn't mean that the drummer induces severe groin injury on the bass guitarist just because the producer decided to lay the rhythm section in its entirety. From the acoustic point of view, the studio proper is rather more live than most, but this was a deliberate policy decision. In the days of Dave Siddle, the man who engineered and managed the studio before the advent of the Music Centre, Wembley, the solid concrete floor was covered with a heavy carpet which naturally produced a much deader feeling in the place. This has since been changed to a parquet wood covering which, according to Terry Yeadon, managing director, manager, maintenance engineer and joke source and sink, has resulted in a much increased roundness to the bottom end: 'Before there was a deader feel but it goes deeper than that . . . when you miked up bass instruments

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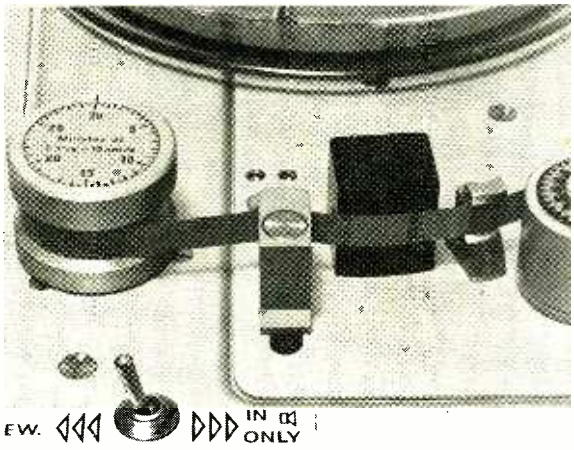
NAGRA TAPE RECORDERS

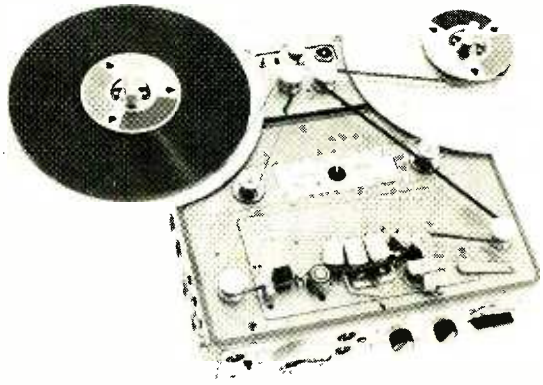
Some New Accessories

QTIM



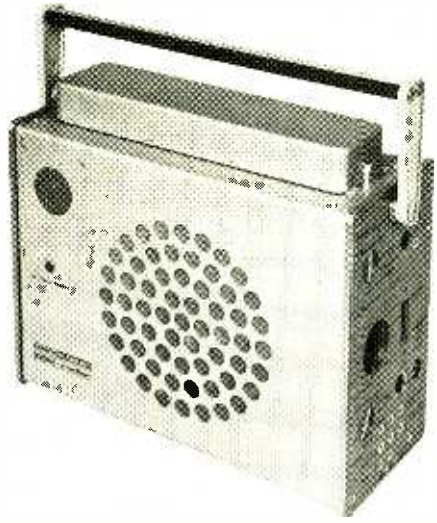
Timer, tape driven and graduated in minutes, to be fixed instead of a tension arm roller.

QGB



10½in. reel adapter, equipped with two electronically controlled motors. Power supplied through the rechargeable cells of the NAGRA or through external source (ATN, etc.) Weight: 6lb. 6oz.

DSM



Field monitor and amplifier. Internal power supply, A.C. mains 110/220V, 48-440 Hz, or IACC rechargeable battery compartment. Battery charger included. Two loudspeakers, treble and bass-medium, power output 20W on mains, 8W on batteries. Frequency response 60-16,000 Hz ±3 dB. External speaker output. Suitable for **all** NAGRA recorders. Two Floating line inputs, 1 unbalanced line input, 1 dynamic microphone input. Low speed correction for NAGRA SNS and SNG, 3-position filter.
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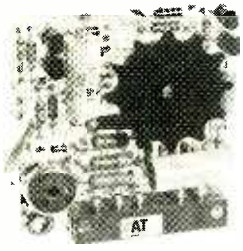

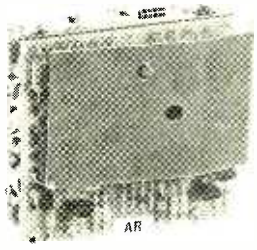

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such as bass guitar or drums, there would be plenty of bass but it tended to cut off, losing that sense of depth . . .'

Surprisingly, there isn't an actual drum or vocal booth, which, one imagines, could lead to leakage problems, but apparently this is not so. The use of tall integrated screens where and when necessary enables the studio to cope with the worst cases such as drums and piano with an adequate level of separation. Microphones are the usual Beyer, Neumann and AKG mostly scattered over the 114m² of floor area. The only obvious criticism which can be levelled at the studio is a very low-level rumble coming from the air conditioning ducts which normally gives no problems on session. If absolute silence is required, and for most overdubs it's not, then the air conditioning is turned off for the duration.

The control room is small but certainly not Mickey Mouse. Perhaps it appears smaller than one would expect because of the not very small JBL *4350* speakers sitting at the front ready to give a suntan to anybody heavy handed with the bass eq. The Raindirk console helps the situation by providing a large quantity of desk into just over two metres of frontage. The format is basically 30 inputs, 16 outputs with 24 track monitoring. Of course, it provides much more than this; the engineer can subgroup a number of machine tracks and reinsert on an output buss before the group fader. This facility is no longer uncommon and is certainly helpful when remixing an involved track setup as might occur with drums, but back in '72 when the desk was manufactured, it was mostly unheard of. Once again, for remix ergonomics, there are an additional four output faders mounted right in the centre of the desk for operational ease. There are four because this represents a nominal nod and wink towards quadraphonic operation although Terry Yeadon says that there is little call for quad facilities. By his own admission, it's a chicken and egg situation. The monitoring arrangements aren't really oriented towards four channel mixdown: 'We've never had a call for it . . . when we do, we might get it set up.' The channel eq facilities on the Raindirk were probably ahead of their time by offering hi and lo pass, hi and lo shelve with multi-step transition frequencies, and most important of all, two switchable up and down midrange bells with interwoven frequency centres between the two controls. This system gives much more control over bell shape than is possible with conventional midrange frequency centres, due to the possibilities of control interaction.

The rest of the control room fits in well—the 24, 4 and 2 track Studer *A80* machines, battery of A & D compressors plus a dbx *160* and a few empty beer cans—Kingsway is known for being a very sociable place. Then there's the *Biofrean Emission Stabiliser* with *Hyper Neuron Energy Readout*. Er? And the *Parabolic Concept Device*. Ya what? All it takes to equip a studio with these recording aids is a felt tip pen and a bit of skilful grafitti on an empty panel above the compressor bank: 'Oh yeah, that. It's an empty panel that the guys don't like 'cause it looks like we can't afford to put anything in it . . . Look it's even got an on/off switch. It's unusual for them to remember that.' Anyway, the man said that they were mad round there and in any case, it probably helps.

Kingsway opened in October '73 built with money supplied mostly by Ian Gillan, lead singer with Deep Purple, and staffed at that time by ex Music Centre engineers Martin Birch and Louie Austin—Terry Yeadon was also gainfully employed by De Lane Lea along with the others. Since then, Martin has left to produce his own bands and Louie seems to be heading in a similar direction. That's life. Skilful and competent engineers see production as a natural progression. These days, Paul 'Chas' Watkins—Chas was a soubriquet dropped on the slightly-built assistant engineer by Adam Faith 'because he looks like Charles Hawtrey'—helps Louie Austin out on many of the sessions taking some of the work load off the latter; something that is aggravated by the evening working hours enforced on Kingsway Recorders by the unsympathetic attitude of the Civil Aviation Authority which rents the building directly above the studio.

It's the old, old problem of studios working in close proximity to others who may not be so appreciative of their endeavours. For Kingsway, the problem has been aggravated by circumstances out of their control. A couple of years ago, the CAA decided that they required a suite of three conference rooms; moreover, they reckoned the ideal place was diametrically above the studio with a reception area situated above the control room. When the original studio was built 14 years ago, little attention was paid at that time to acoustic isolation designed into the fabric of the building—it was mono with uses scarcely more demanding than voice overs. Time went on and things got louder. It didn't matter all the time there were sympathetic occupants above, the whole building being originally owned by the founders of the recording studio. However, when they sold out to Rothchilds, who promptly let the building out to the CAA, the regime changed. The CAA slapped an injunction on Kingsway which forced them into a very one-sided compromise — Kingsway must create no noise during the working day, which, in practice, means that they can't start working until 6 o'clock in the evening.

Terry Yeadon tried to reach a compromise with the CAA by offering to move the conference rooms at his expense to the other end of the building but the inevitable answer was 'Why should we? We're quite happy with them where they are; it's you who are causing the problem.' In spite of this strangling restriction on working hours which, on Yeadon's own estimates cuts income by 50 per cent, the studio still manages to make a profit which is good—but wrong. The reason it makes a profit at all is far more than a simple reflection of the high standard of workmanship offered by Terry, Louie et al, it's really down to the knockout sociability: in the morning, everyone sleeps, but that still leaves an awful lot of afternoon for entertaining anyone who should drop in. Plus, of course, the facilities which the place has to offer. For instance, there is a useful echo room which goes largely unseen—perhaps just as well since the interior is painted a very nasty shade of green (however, it is pleasing to report that this colour is slowly changing since Louie Austin uses the place to spray bits and pieces off his car).

There could be a longer-term answer to the noise problem. Some time ago, Kingsway Recorders bought the freehold of a large two-storey building in Macklin Street, just round the corner from the present studio. The idea is, of course, to build a new facility in the massive empty shell of a building that used to be a theatrical/film set painting shop. Either floor could house a complete studio and control room; with both there is room enough for a complex of several studios. Tom Hidley, of Eastlake Audio, has had a look at the building with a view to the conversion. His amazed reaction at seeing the top floor was the same as everyone else's at seeing the enormous, empty expanse of building with a 12m-high ceiling. He commented that the upper storey on its own could house the acoustically finest facility that he has ever constructed, simply because of the height and space available. However, the reality, like everything else, depends on whether everyone concerned can come up with the cash—and not a little of it either. If they can, they will probably build the most successful facility in London, in spite of the body blows that the crippling British tax laws inflict on people who record in British studios.

Yeadon is not, by nature, a bitter individual, but he came close to looking that way when describing how the tax laws work against studios. He quoted an example of how Ian Gillan, part-owner and British tax exile, can't work in his own studio because, if he did, he would lose about 98 per cent of everything he stands to make from the resulting record. Stupid and short-sighted it most certainly is.

But when the evening comes around, everyone works like demons despite the heavily-stacked odds, and no matter what happens, they will always make enough to keep the fridge full of beer . . .

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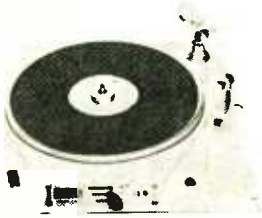

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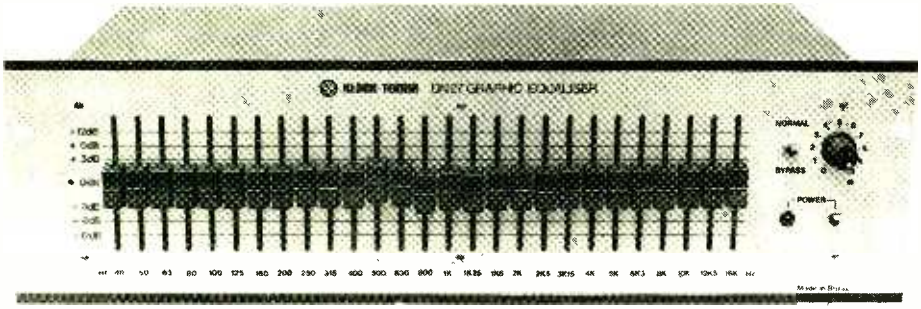
reviews

Klark Teknik DN27 graphic equaliser

Hugh Ford



MANUFACTURER'S SPECIFICATION:
Input impedance: unbalanced 10k ohms nominal.
Output impedance: unbalanced less than 10 ohms —short circuit protected.
Operating level:—20 dBm to +24 dBm.
Centre frequency accuracy: ±2%.
Frequency response (controls flat): ±0.5 dB : 20 Hz to 20 kHz.
Output clipping point: +20 dBm into 600 ohm load.
Distortion: less than 0.01% at 1 kHz at +4 dBm into a 600 ohm load. Less than 0.05% from 20 Hz to 20 kHz at +4 dBm into a 600 ohm load.
Equivalent input noise: 20 Hz to 20 kHz unweighted, less than —90 dBm.
Price: £450 retail; $800.
Manufacturer: Klark Teknik Research Limited, MOS Industrial Site, Summerfield, Kidderminster, Worcs.
US: Lamb Laboratories, 155 Michael Drive, Syosset NY 11791.

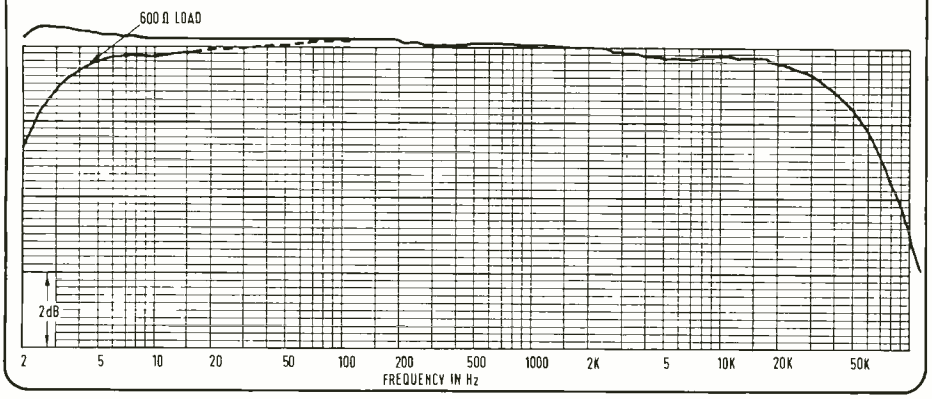
THE Klark Teknik *DN27* is a 27-way graphic equaliser with the controls covering the range 40 Hz to 16 kHz on the ISO standard third octave centre frequencies. The equalisation controls are in the usual form of slider potentiometers arranged for a 'graphic' display which has rulings at ±12 dB, ±6 dB, ±3 dB and zero equalisation.

Further controls on the anodised front panel include a rotary gain control, a normal/bypass toggle switch and the power on/off switch with its associated led indicator. To the rear of the unit is the IEC power connector with its associated metric power fuse and *XLR* connectors for the unbalanced signal input and output. All panel features are clearly identified and the complete unit is designed for standard 483 mm rack mounting taking 133 mm rack height and requiring a behind panel depth of 216 mm.

The overall standard of construction is very good with solid mechanics and all the equaliser itself mounted on a single large printed circuit board which is readily accessible for maintenance. The power supplies occupy a small separate board on to which is mounted the toroidal mains transformer and the stabilised power supplies, with an input voltage selector for either 240V or 110V operation.

Although the individual components are not identified on the printed boards, the schematic supplied includes the full circuit together with a detailed layout diagram.

FIG. 1 KLARK TEKNIK DN 27 GRAPHIC EQUALISER



Frequency response and noise

The overall frequency response with the individual equalisation controls in their flat position is shown in **fig. 1,** which demonstrates that the response is unusually flat. While the equalisers do not have a mechanical 'notch' in the flat position, it is understood that this is a feature to be shortly introduced, and it will certainly assist operation. Fig. 1 also shows the effect of loading the output which is capacitively coupled, but clearly the change in low frequency response is negligible.

Fig. 2 shows the boost characteristic for each equaliser and demonstrates that the individual equalisers have accurate centre frequencies and that their gains have been accurately aligned. As is to be expected the practice of setting all equalisers to full cut or boost gives a relatively severe ripple in the frequency response and a gain or cut in excess of the nominal ±12 dB range. However, this condition should not be encountered in practice, and **fig. 3** shows that a smooth equalisation is attained even when extreme degrees of frequency response correction are applied.

With all the equalisation controls in their 'flat' position the noise at the output when referred to the input was found to be –86 dBm rms over the band 20 Hz to 20 kHz or –89 dBm 'A' weighted. These figures are slightly short of the manufacturer's specification of –90 dBm, but it is suspected that this figure was obtained using an average law meter as opposed to a genuine rms meter, the difference being a noise improvement of 2.5 dB.

At maximum gain the input clipping level was found to be +13 dBm, so this may be added to the above noise figures to obtain the available dynamic range which is in the order of 100 dB irrespective of the gain in use.

Distortion

Measurement of total harmonic distortion and noise with the Sound Technology *1700A* Distortion Measurement System gave the following results when driving into 600 ohms:

Output level	100 Hz	1 kHz	10 kHz	20 kHz
+10 dBm	<0·01%	0·005%	0·017%	0·056%
+18 dBm	<0·005%	0·006%	0·04%	0·1%

Examination of the residual distortion waveform showed that a large part of the above measurements consisted of noise rather than harmonic distortion, and at lower output levels there was an apparent increase in total harmonic distortion due to the influence of noise.

This first-class performance was further confirmed by attempts to measure individual harmonics and intermodulation products. So good is the Klark Teknik equaliser that no significant results could be obtained using the latest Bruel & Kjaer swept measurement equipment!

Input and output

It has been mentioned that the input clipping level at maximum gain was found to be +13 dBm, but the practical permitted input level is unrestricted as the unbalanced input feeds directly to a potentiometer which is the front panel gain control. While the input is protected

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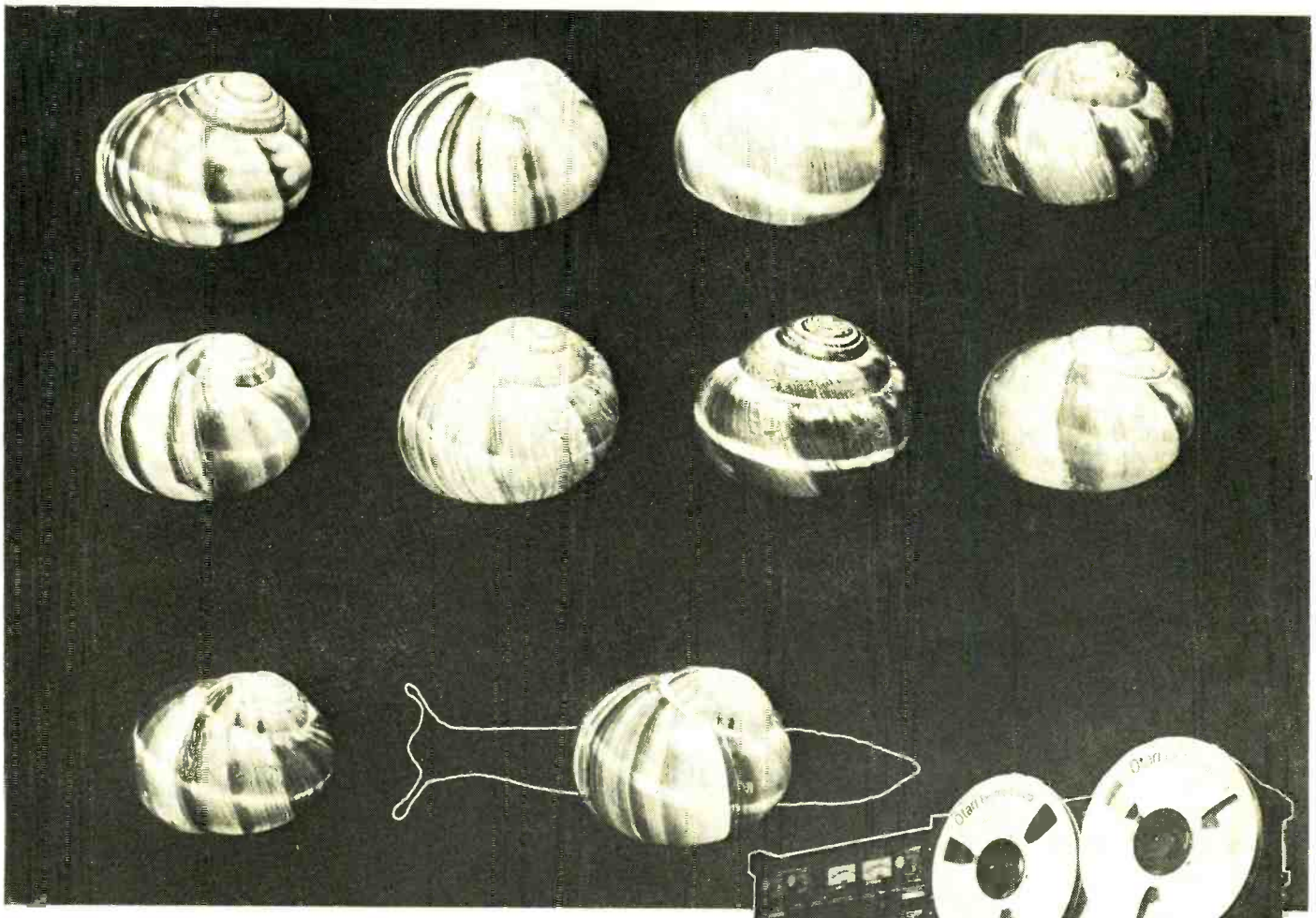
once is enough!



The snail moves slowly and steadily. But think! The weight of the shell that the snail carries is two to three times the weight of its own body; this is equivalent to a 175 pound man walking steadily forward with a 400 pound weight on his shoulders.

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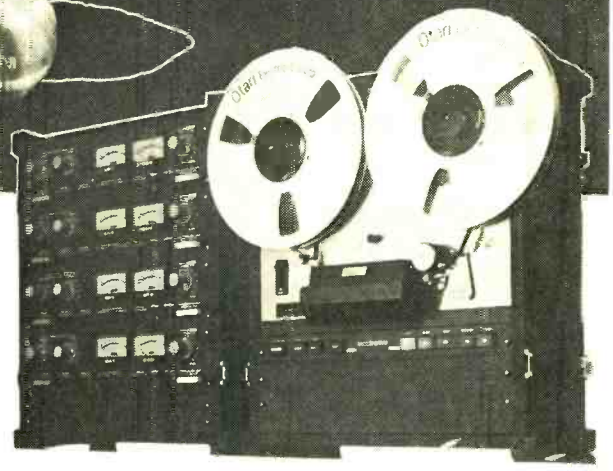

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KLARK TEKNIK DN27

by two back-to-back zener diodes, unfortunately it is direct coupled, with the result that even small dc offsets will play havoc with the input clipping level. The manufacturer informs me that this feature will be modified in future production.

The actual input impedance was found to be constant with input gain control setting at 10 800 ohms with an available gain of 9 dB from input to output at maximum gain setting. On the output end the maximum output at clipping was found to be + 20.5 dBm (loaded into 600 ohms) with an associated output impedance of only 0.5 ohms in series with 200 μF. Clearly these levels and impedances are virtually ideal so far as general compatibility is concerned.

Operation of the 'normal/bypass' switch was sensible in that it left all the electronics in circuit and merely removed the equalisation which is in the form of feedback.

Thus operation of the switch leaves the overall gain constant and permits easy with/without equalisation switching.

Other matters

The power supply voltage was far from critical with the internal power supplies being well stabilised such that the incoming mains voltage could be dropped to as low as 210V from the nominal 240V without any effect upon the signal path.

Summary

The Klark Teknik 27-way graphic equaliser is a well built unit which is easy to maintain. Furthermore its performance is excellent, offering equalisation with virtually no added distortion and an adequate dynamic range.

Clearly the range of available equalisation is quite sufficient for any normal application in either the studio or for such applications as room equalisation where a one-third octave equaliser is highly desirable. ■

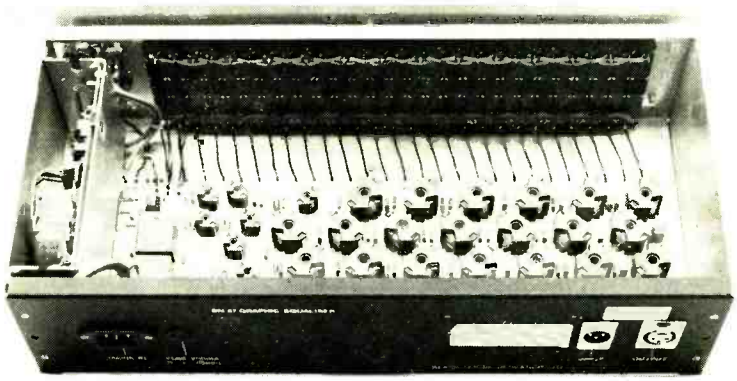


FIG. 2
KLARK TEKNIK INDIVIDUAL EQUALISER RESPONSE AND 'FLAT OUT' RESPONSE

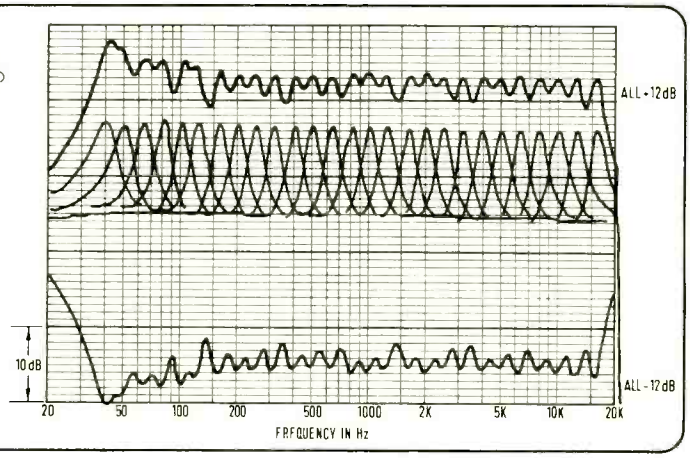
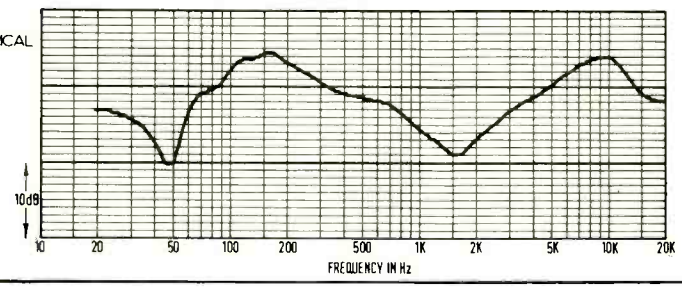


FIG. 3
KLARK TEKNIK TYPICAL AVAILABLE CURVE SHOWING LACK OF 'BUMPS'



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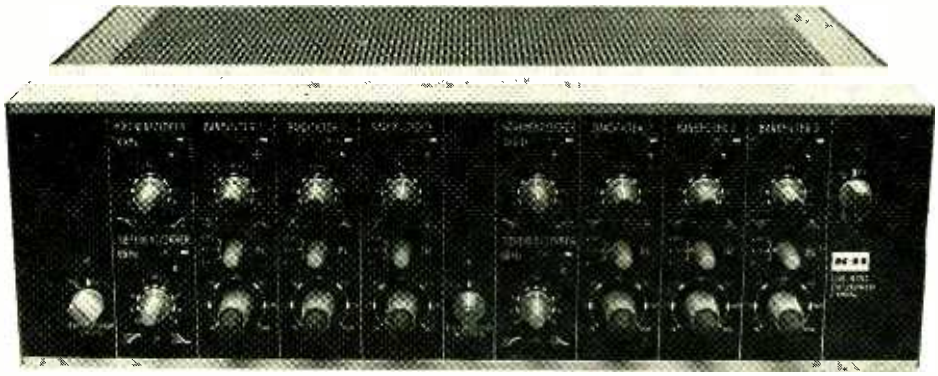


Hugh Ford

MANUFACTURER'S SPECIFICATION

Functional arrangement of the filter groups

2 x Bass: boost and roll-off. Stepless (continuous) adjustment. Range 15 dB (60 Hz).

2 x Treble: boost and roll-off. Stepless (continuous) adjustment. Range 15 dB (10 kHz).

2 x 3 Band filters: each frequency between 15 Hz and 30 kHz can be steplessly selected. Bandpass and band reject slope steplessly variable between 5 dB/octave and 23dB/octave. Six simultaneous band filters are built-in. The frequency response can therefore be steplessly influenced simultaneously at six points. Due to the steplessly variable slope, there is variable bandwidth for all six band filters. All active electronic band filters operate independently and are therefore non-interacting even when neighbouring frequencies are selected.

Technical Data on the active electronic filters

Frequency response: +0 dB —0.5 dB (20 Hz to 20 kHz).

Input impedance: 100k ohm asymmetrical. (Optional 5k ohm symmetrical.)

Output impedance: 30 ohm asymmetrical (source). (Optional 30 ohm symmetrical.)

Input level: +6 dBm (1.55V) +22 dBm max (10V).

Output level: +6 dBm (1.55V) +22 dBm max (10V).

Distortion: into a 300 ohm load from 40 Hz to 15 kHz.
0.08% at +6 dBm output level
0.16% at +12 dBm output level
0.26% at +22 dBm output level

Intermodulation distortion: (to SMPTE or DIN 45 500 into a 300 ohm load).
0.09% at +6 dBm output level
0.16% at +12 dBm output level
0.7% at +22 dBm output level

Noise: unweighted 35 μV to DIN 45 500. Noise voltage 35 μV weighted to CCIR.

Gain: Unity, corresponding to 0 dB in linear setting.

Isolation resistance: 20 Megohm to case.

Stray field: 10 milligauss.

Crosstalk: 70 dB (20 Hz to 20 kHz).

Manufacturer: Klein & Hummel, 7301 Kemnat, Postfach 3102, West Germany.

UK: FWO Bauch Limited, 49 Theobald Street, Boreham Wood, Herts.

US: Gotham Export Ccrporation, 741 Washington Street, 10014.

THE Klein & Hummel *UE-400* equaliser is a twin channel device having two identical channels. Each channel consists of three band-filters which are adjustable for frequency, level and slope: in addition there is a high-pass and a low-pass filter associated with each channel.

Physically the complete unit is of standard width for mounting in a 483 mm rack, occupying a height of 132 mm and a depth of about 300 mm behind the front panel, exclusive of rear panel connectors which comprise a standard IEC power plug with its separate 20 mm fuse, and in the review sample *XLR* type audio connectors.

The chassis itself is a semi-modular type of substantial construction with a black anodised front panel and white legends. Internally there are five printed boards screwed to the chassis, but with edge connectors in two instances. The remaining electronics, which are the filters themselves, are secured to the front panel by their control shafts and have edge connectors for power and audio feeds. All components are properly identified on the printed boards with the exception of a fuse on the power supply boards which is not accompanied by its value.

Turning to the front panel layout one channel occupies each end of it, with the power on/off switch and its indicator led at the extreme right. Considering an individual channel there is an overall 'on/bypass' switch at the left followed by five vertical white rulings which give the appearance of about 40 mm wide modules. The first 'module' is the high-pass and low-pass filters each of which has an 'in/out' switch and a slope control. The remaining three 'modules' are the three band-filters which are identical and have the following controls: at the top there is an 'in/out' switch followed by a calibrated level control which has a range of ±12 dB and below which there is a three-position rotary frequency range switch which is calibrated X1, X10 and X100.

The frequency range switch operates in conjunction with a rotary frequency control. This is calibrated from 15 to 200 Hz and is concentric with a slope control which is calibrated from 5 to 22 dB per octave. All the front panel controls have a good clear layout with easy access and the calibrations and legends (albeit in German on the review sample—but I am told that an English version will be available) are very clear, with a liberal use of coloured knobs.

Frequency response and noise

The overall frequency response of the equaliser system with the individual equalisers switched out, and with them switched in and the controls 'flat', is shown in **fig. 1**, which shows that the response is extremely flat in the audio band in both conditions. However there is a small, but undesirable, rise above the audio frequency band—more about this later, since I don't like audio equipment which has an excessive bandwidth.

Response of the high-pass and the low-pass filters is shown in **figs 2** and **3**, which show that both filters have their specified performance at 60 Hz and 10 kHz respectively. Clearly the curves represent a useful equalisation function, but it is a shame that there is no roll-off outside the audio band at either extreme.

Examination of the function of the band filters confirmed that the characteristics remained constant with the tuned frequency, which was reasonably accurately indicated by the frequency control knob. The filter characteristic with respect to the 'selectivity' control is shown in **fig. 4** for a single filter at maximum boost and maximum cut. At other boost and cut conditions the overall shape remained constant, with only the maximum amplitude difference changing.

Clearly the availability of three such filters in each equaliser channel, in addition to the high-pass and low-pass filters, makes the unit a very versatile equaliser for general program

FIG.1 KLEIN+HUMMEL

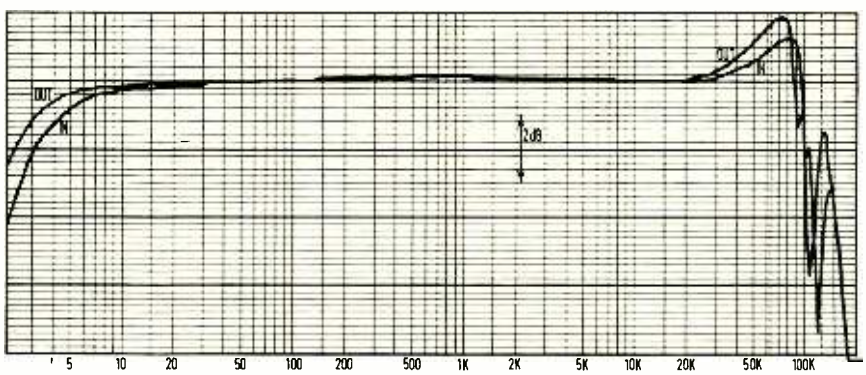


FIG. 2 KLEIN AND HUMMEL HIGH PASS FILTER

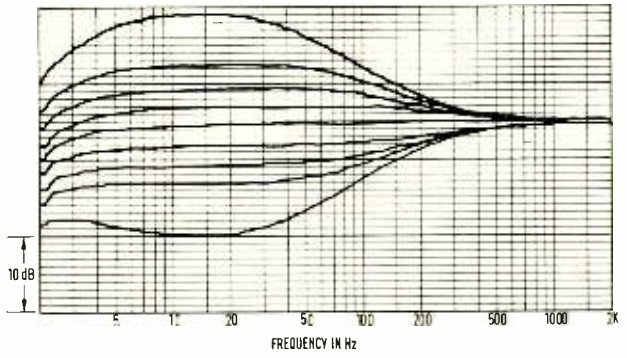
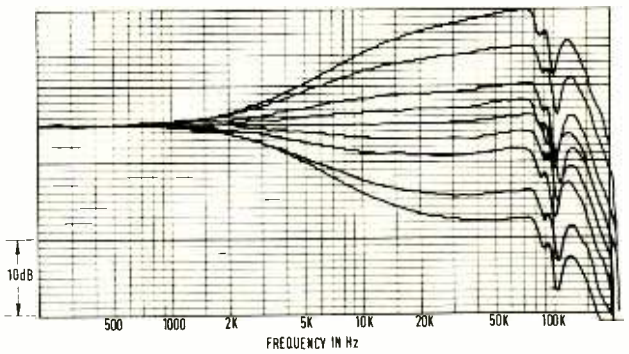


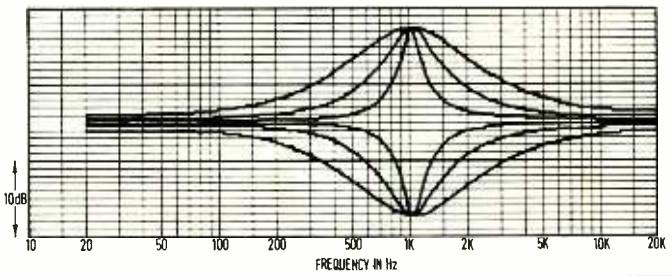
FIG. 3 KLEIN AND HUMMEL LOW PASS FILTER



equalisation. However, the characteristics of the filters are such that this equaliser is not suitable as a 'clean-up' device for removing such things as power supply hum or camera noise.

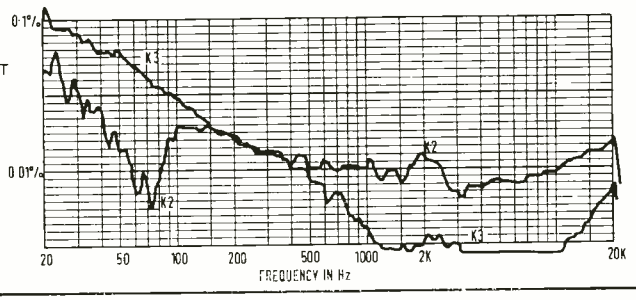
The internal noise generated in the equaliser was found to be very low under all conditions, the following figures being obtained with all equalisers switched in with their controls 'flat':

FIG. 4
KLEIN+HUMMEL BAND FILTERS 1kHz



Measurement condition	Noise
rms 20 Hz to 20 kHz	—77.5 dBm
rms 'A' weighted	—93.6 dBm
DIN peak 20 Hz to 20 kHz	—82.5 dBm
weighted to DIN, peak	—83.5 dBm

FIG. 5
KLEIN AND HUMMEL DISTORTION AT 0dBm OUTPUT



Power supply hum or other discrete tones were to all intents and purposes absent in the output.

Distortion

At +22 dBm output (600 ohm load) the second and third harmonic distortion was found to be just over 0.1% between 100 Hz and 20 kHz, reaching 0.3% at 40 Hz and then rising rapidly at lower frequencies. While this is a creditable performance, the excellent performance at 0 dBm output is shown in **fig. 5.** Intermodulation distortion to either the SMPTE method or the difference-tone method was found to be below 0.03% at 0 dBm output, with the SMPTE intermodulation distortion rising to 0.05% at +10 dBm output.

At this level the difference tone distortion is given in **fig. 6** which shows a good performance within the audio band, but a very sharp rise in distortion to as much as 20% at 60 kHz.

60 ▶

FIG. 6 KLEIN+HUMMEL DISTORTION AT +12dBm

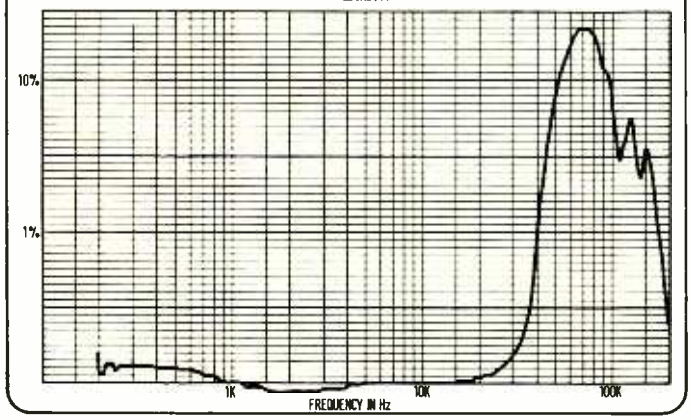
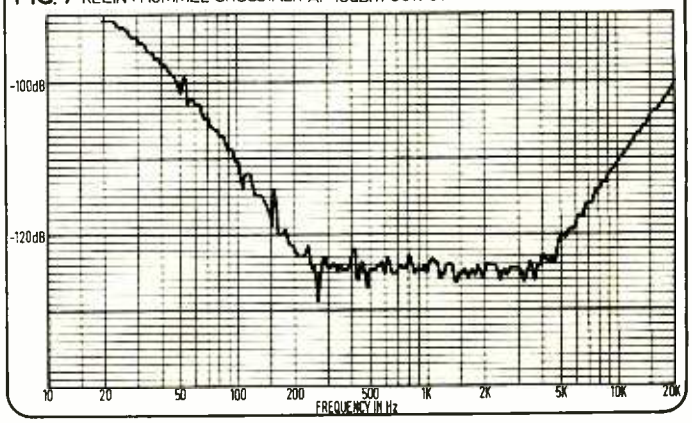


FIG. 7 KLEIN+HUMMEL CROSSTALK AT +10dBm OUTPUT



KLEIN & HUMMEL STEREO EQUALISER UE 400

Not only is this characteristic indicative of transient intermodulation distortion, but it also means that intermodulation products of out-of-band signals (including noise) will be transferred into the audio band—if only the bandwidth had been limited to the audio band this problem probably wouldn't exist!

Inputs and outputs

In the review sample both the input and output connections were transformer coupled and floating, the system gain between the inputs and outputs being 0 dB in the 'flat' condition.

Input or output clipping points were found to be identical at +23.5 dBm or better from 100 Hz to 20 kHz and falling to +21 dBm at 20 Hz due to the transformer coupling.

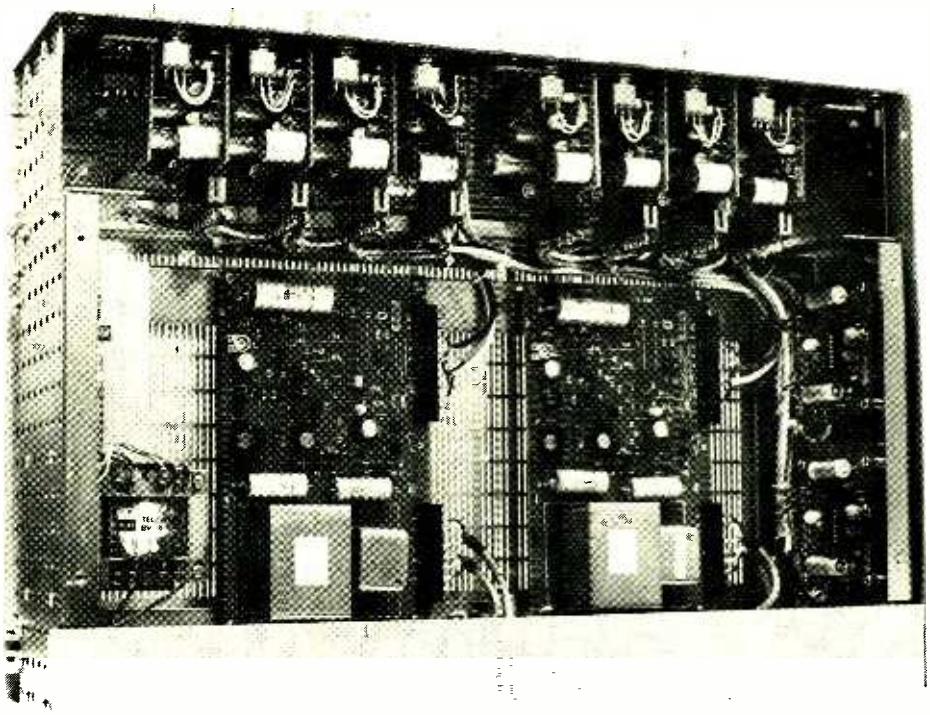
The input impedance was found to be a constant 22 300 ohms over the audio frequency band which is somewhat higher than the manufacturer's specification states—in my opinion, however, this is an improvement. On the output end the output impedance was found to be 31.5 ohms which is completely satisfactory. Neither the input impedance nor the output impedance was affected by any control settings.

Other matters

Crosstalk performance was as shown in **fig. 7** which is far better than specification, and no control interactions were noted during the review measurements.

Investigations using squarewaves showed that there was a certain amount of ringing with any control settings, and with the equalisers in or out of circuit. The extent of this ringing is shown in **fig. 8** which represents a 1 kHz squarewave passed through the system into a 600 ohm load which itself had no effect upon the amount of ringing.

Mains power line variations down to 210V on the nominal 220V tapping had no effect upon performance with either or both channels driving full power into 600 ohm loads.

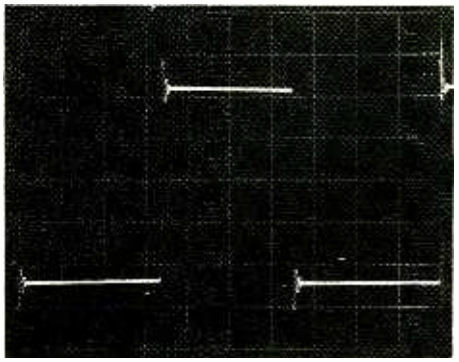


Summary

This Klein & Hummel equaliser certainly did all that the manufacturer's data suggested, and in many respects was far better than specification. However, the bandwidth was in my opinion excessive giving an uncontrolled frequency response well above the audio band, with accompanying intermodulation distortion.

As a practical studio equaliser this is a versatile piece of equipment for general sound equalisation but it is not suitable for cleaning-up badly recorded material. However, an unusual feature is that each channel has three identical equalisers which can overlap in frequency if required, but even then the shape is far from that of a notch filter. ■

FIG. 8 1 kHz squarewave



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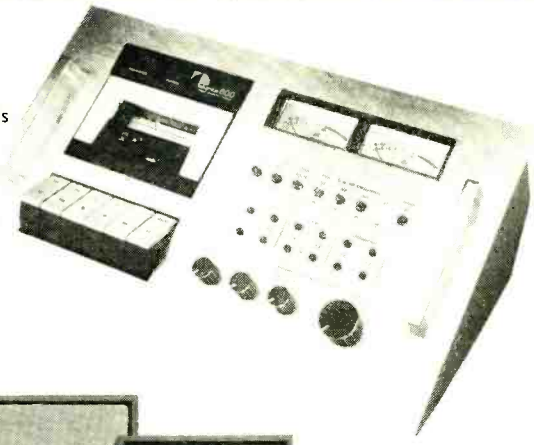

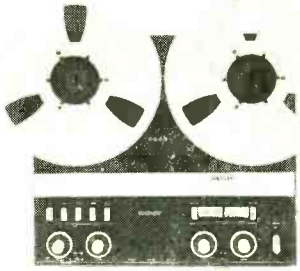

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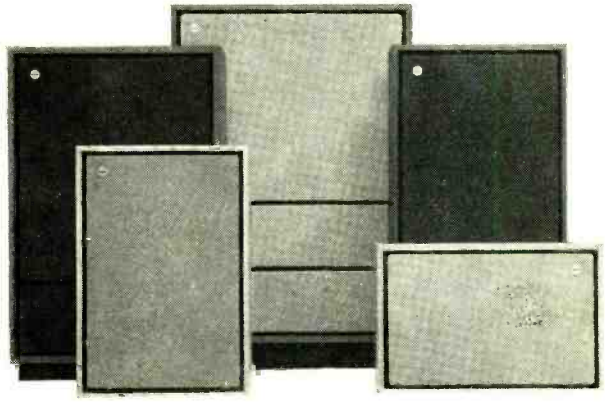

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Durability Problem — All units feature welded steel chassis for maximum strength and rigidity. Other features include 19" rack-notched heavy guage front panels. A rear panel switch converts the two channel amplifier to a higher power bridge connected single channel amplifier.

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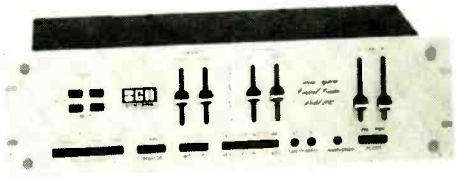

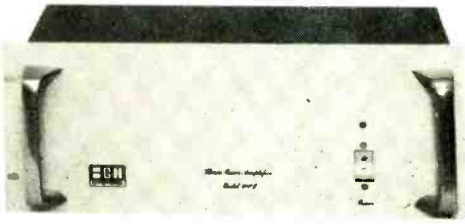

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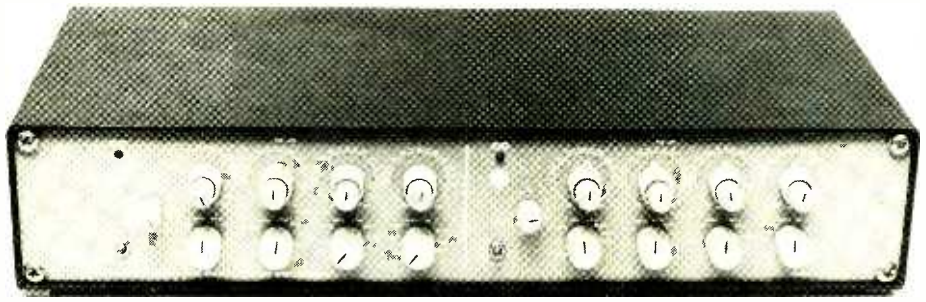
Orban Parasound parametric equaliser 621B

Hugh Ford

MANUFACTURER'S SPECIFICATION

Operating controls: equalisation, bandwidth and tuning for each of four sections. Equalisation in/out for entire equaliser. Gain.
Frequency response (eq controls set mechanically flat): ±0.25 dB 20 Hz to 20 kHz.
Available gain (eq controls flat): +11.5 dB max, adjustable by front panel level control.
Input: 10 000 ohms unbalanced bridging.
Output: less than one ohm unbalanced. Will drive +20 dBm into 500 ohms or higher 20 Hz to 20 kHz. Unconditionally stable with any capacitive load. Will not ring with any capacitance below 0.03 µf.
Slew rate: 2.0 V/µs. Squarewave rise time less than 15 µs at +19 dBm equivalent peak output. Squareness exhibits no ringing when eq controls are flat. Squarewave exhibits no spurious ringing (other than that associated with ideal equalisation curves) with any degree of equalisation.
Circuitry: active rc. No inductors are used.
Harmonic distortion: as per curve supplied.
Noise: eq controls flat —86 dBm in 26 kHz noise bandwidth. Eq controls at —∞, —84 dBm in 26 kHz noise bandwidth.
Noise output of single active bandpass section: less than —87 dBm in 26 kHz noise bandwidth, for any combination of settings of tuning and bandwidth controls.
Phase shift: input to output, eq controls flat 7° at 20 Hz, less than 0.5° at 1 kHz, 20° at 20 kHz.
Equalisation characteristics: curves corresponding to minimum and maximum bandwidth for a single section are shown. dB equalisations of single sections add without interaction. Bandwidth and equalisation controls infinitely adjustable with resolution limited by characteristics of conventional carbon pots.
Range of adjustment of 'Q': 0.29 to 3.2.
Range of adjustment of equalisation: +16 to —∞ dB. Typical notch depth greater than —35 dB.
Tuning range per band: 30-600 Hz, 90-1800 Hz, 250-5000 Hz, 750-15 000 Hz. Tuning dials are calibrated at ISO standard third-octave frequencies.
Power requirements: ±18 to 28V, unregulated, or ±15V regulated. Accessory bolt-on type *85A* power supply permits operation from 115-230V ±10% ac, 50-60 Hz.
Overload lamp: will light for approximately 200 ms if the instantaneous positive or negative peak level at the output of the input buffer or any of the four equalisation sections exceeds +20 dBm.
Price: £477 basic equaliser. Power Module £28. Cabinet with inbuilt power supply £52.
Manufacturer: Orban Associates Division, Kurt Orban Company Inc, San Francisco, California.
UK: Scenic Sounds Equipment, 27-31 Bryanston Street, London W1.



THE Orban Parasound type *621B* parametric equaliser offers two channels mounted in a standard 483 mm rack mount chassis occupying 88.9 mm of rack space, with the alternative of a free standing cabinet as per the review sample. The basic equaliser requires dc power supplies, but a small bolt-on power supply is available; the free-standing cabinet model contains a power supply.

Each channel of the equaliser is identical with four filters which overlap in their tuning range, a continuously variable input level control, an equaliser in/out switch and an overload lamp. The latter is arranged to be illuminated when either the input stage or any one of the four filters approaches overload—this is a very valuable feature not often found in equalisers which are of course always prone to unexpected overload due to their high potential gain at selected frequencies.

The equaliser in/out toggle switch is arranged to connect the output stage to either the equalisation section output or to the output of the input buffer stage while leaving the equalisation stages in circuit. Thus in the 'equaliser out' condition the filters remain connected to the input drive and the overload indicator remains operative on all stages of the equaliser. This results in an indication of overload in the filter stages even when they are out of the signal path.

Input level control is affected by a potentiometer actually connected to the input line, thus there is no effective restriction on the usable input level. Furthermore, there is an available gain of 11.5 dB from input to output in the bypass condition.

With the exception of the frequency range, each filter section is identical in function and includes three controls. To start with there is a control for each which tunes the filter peak over the range of each band 30 Hz to 600 Hz, 90 Hz to 1.8 kHz, 250 Hz to 5 kHz and 750 Hz to 15 kHz. While the overlap between bands may at first sight appear to be excessive, it is in practice a great advantage as the filters do not interact and one can, for instance, use the two lower bands to filter out power line frequency and one of its harmonics.

Each tuning control has rough calibrations at the standard ISO centre frequencies, but these are purely intended as reference points and not for measurement purposes. The remaining two filter controls take the form of a pair of coaxial potentiometers, one of which controls the filter shape and the second of which controls the maximum boost or cut. The latter is infinitely variable between +16 dB boost and virtually infinite cut with the potentiometer characteristics carefully arranged so that the ±10 dB range about zero is expanded and easily adjusted to fine limits.

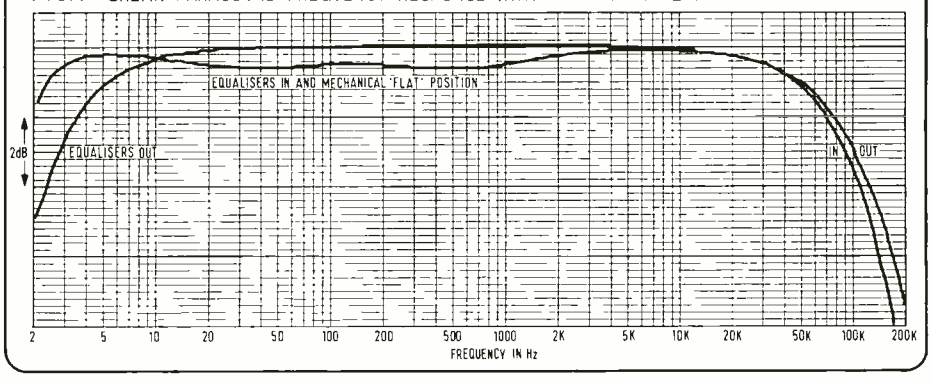
As will be seen, the filter shape control also gives a wide range which is easily controlled to fine limits.

Turning now to the construction of the equaliser, the basis of the unit is a very solid front panel finished in light blue with red and white calibration marks. While these are not particularly important for normal usage, they are not easy to read and this would hamper re-setting known conditions. Because external power supplies are used there is no power on/off switch or power 'on' indicator.

The actual chassis is mounted behind the front panel and it was pleasing to note that all the front panel potentiometers had their knobs properly fixed with two allen screws each, and that the apertures in the potentiometers had been taped (albeit untidily) to prevent the ingress of dust. Within the chassis there is one printed circuit board for each channel, and to the rear, completely independent barrier strip connectors for the audio and power connections belonging to each channel; this is a slightly peculiar idea, as the power input has to be wired separately for each channel!

Layout and the standard of wiring is not to the highest of standards. Further, the instruc-

FIG.1 ORBAN PARASOUND FREQUENCY RESPONSE WITH EQUALISERS 'FLAT'



tion book provides a circuit but no component layout diagram; components are not identified. Preset controls on each board consist of two trimmers per filter stage and an overall gain trimmer: all these are skeleton-type controls, where I would have preferred to have seen better quality components.

When, as in the review sample, the free-standing cabinet and power supply is used, this is fitted with properly identified fuses for the two dc lines and the incoming power. In addition, it has a pair of XLR type input and output connectors for each channel, and a standard IEC power connector.

Performance

To deal with first things first, the whole purpose of an equaliser is to modify frequency response without introducing other forms of distortion. **Fig. 1** shows the overall frequency response with the equaliser switched out and also with the equaliser switched in and the individual cut and boost controls at their mechanical centre positions. Other than a modification to the response below 5 Hz there is remarkable accuracy of the controls.

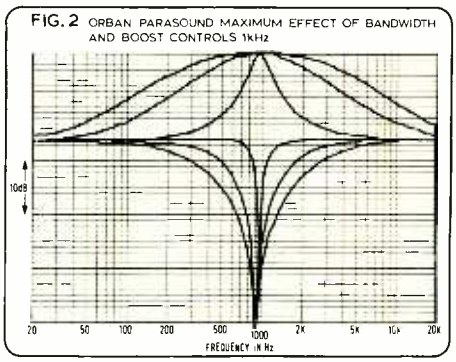
While the four filter sections have similar characteristics, it is not feasible to include the multitude of equalisation plots for each section, thus **fig. 2** is included to illustrate the cut/boost control at maximum, minimum and 'half way' bandwidths with the filter tuned to 1 kHz. This plot shows the extreme conditions which are possible while **fig. 3** shows more likely conditions with the boost control set to ±6 dB and the bandwidth control varied over the central part of its range. Taking into account the four filters with their non-interactive properties and overlapping centre frequency ranges, the equaliser is an extremely versatile device for studio use. A typical specialised application might be cleaning-up a tape made on location with mains hum and loss of high frequencies and too much mid-frequency: the Orban Parasound equaliser is just the job for this, as is shown in **fig. 4.**

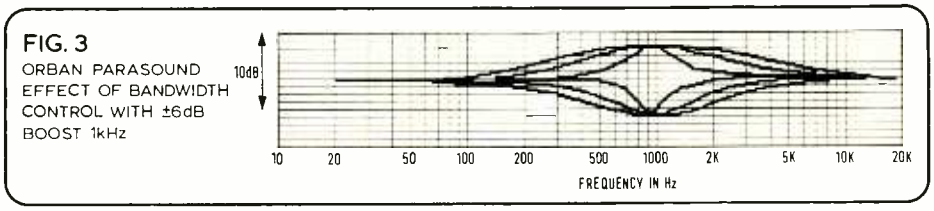
The available output from the equaliser was found to be +18 dBm with the overload lamp just lit, and +20 dBm with clipping from a source impedance of 1Ω in series with 40 μF. Measurement of harmonic distortion showed that it was extremely low at all output levels. The second and third harmonic distortion at an output level of +10 dBm are shown in **fig. 5.** Here, the distortion below 500 Hz is residual from the testgear. Similarly, difference frequency distortion using two tones with 200 Hz separation was at a very low level as is shown in **fig. 6** with SMPTE-type intermodulation distortion being almost unmeasurable.

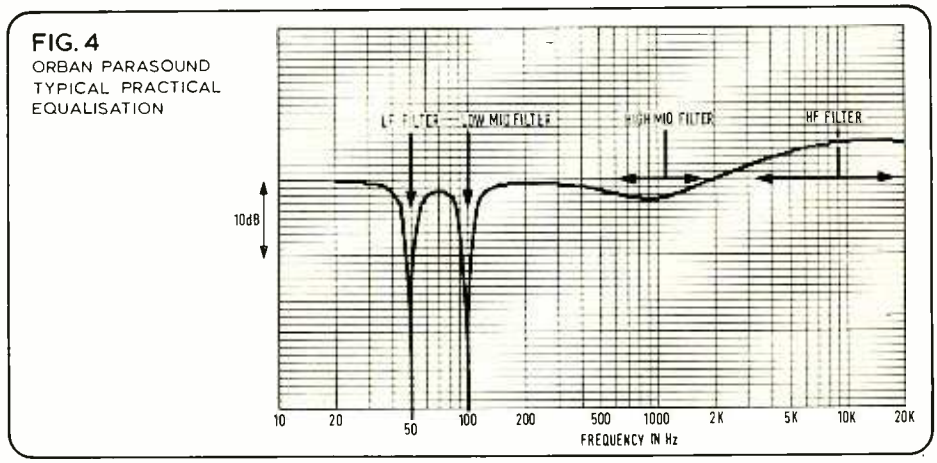
Testing with squarewaves also gave the most impressive results with absolutely no spurious ringing and such good performance in the 'flat' condition that it was impossible to tell with an oscilloscope if one were looking at the input or the output. As specified by the manufacturer, the slew rate was found to be 2V/μs with the phase shift close to specification with +4° at 20 Hz, 0° at 1 kHz and −17° at 20 kHz.

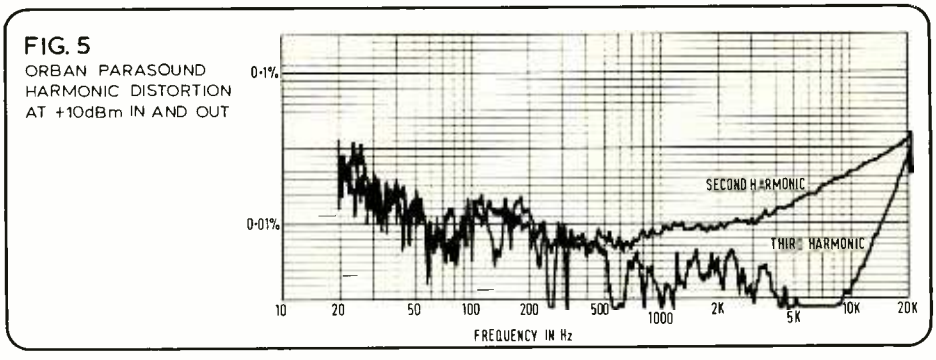
The overall system noise with the equalisers 'flat' was found to be −96 dBm rms over the band 20 Hz to 20 kHz, falling to −90.5 dBm rms 'A' weighted at the maximum equaliser gain of 11.5 dB from input to output, which was constant with the filters in or out of circuit. However, contrary to the specification, the filter in/out switch was not click-free in operation. Crosstalk between the channels was purely of academic interest at −86 dB at 20 kHz falling to better than −100 dB below at 1 kHz and no problems were found with mains hum.

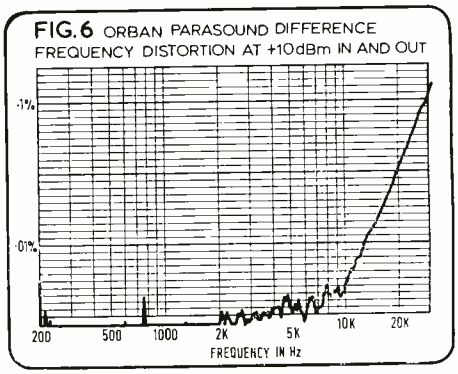
On the input end the input impedance was constant with frequency at 8.47k ohms for one channel and 8.85k ohms for the other, the setting of the input gain control not affecting the input impedance. However, one potential snag is that the input is dc coupled, and thus, not only does any dc offset on the input upset the input amplifier's clipping point of +10 dBm input at maximum gain, but also the input amplifier is unprotected. Operation of the overload lamp was extremely fast: an overload of only one cycle at 20 kHz was clearly visible.











Summary

Not only is there a good dynamic range available, but the harmonic and the intermodulation distortion are outstandingly low.

The standard of construction is far from the best, but the unit is an excellent performer at a reasonable price; furthermore, other than the power requirements, it meets its specification which has itself been thought out with great care.

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THE NEW MX 5050 8SD HALF INCH / EIGHT CHANNEL RECORDER FROM OTARI

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The MX 5050 8SD Features

- Selective reproduce on all eight channels.
- Motion sensing to prevent tape damage.
- Front panel edit and adjustable cue.
- Fixed (standard reference level) or variable output.
- 600 ohm outputs with XLR connectors.
- Punch-in/punch-out record capability without clicks or pops.
- Front adjustable bias, record EQ, reference level, rear adjustable reproduce EQ, selective reproduce level.
- Bias adjustable for new high energy tapes.
- Variable speed (+ or — 10%) dc capstan servo standard.
- Plug-in PC boards for ease of maintenance and adjustment.
- Optional portable, rack or console mounting.

Preliminary Specifications

Tape speeds $7\frac{1}{2}$ and 15 ips (19 and 38cm/s).
Reel size $\frac{1}{4}$ x $10\frac{1}{2}$ inch NAB.
Frequency response for 15 ips is 30Hz to 18,000Hz + or — 2dB, and for $7\frac{1}{2}$ ips it is 30Hz to 16,000Hz + or — 2dB.
The signal to noise ratio for tape speed 15 ips is NAB weighted 58dB and for $7\frac{1}{2}$ ips is NAB weighted 58dB.
The wow and flutter (measured per NAB weighted). Tape speed 15 ips is less than 0.06%, and $7\frac{1}{2}$ ips is less than 0.08%.
Distortion is less than 1% at 1000Hz at 200nWb/m.

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OTARI

A limited number of Franchised Distributorships are available in certain areas. Please contact Reg Sharpe.

* Subject to foreign exchange variances.

Telefunken M15A recorder

Hugh Ford

MANUFACTURER'S SPECIFICATION

Tape Transport

Motors: 1 brushless dc servo motor with quart oscillator reference. 2 special reel motors.
Tape speeds: 38 cm/s and 19 cm/s.
Deviation of average speed from nominal speed: ≦ ±0.1%.
Wow and flutter: measured with *EMT 420*, weighted to DIN 45 507; at 38 cm/s ≦ ±0.4%, at 19 cm/s ≦ ±0.06%.
Tape slip: ≦ 0.1%.
Tape width: 6.35 mm.
Tape length: 1000m standard tape.
Tape coating: alternative inside (A wind) or outside (B wind).
Hubs and spools: European-type hub to DIN 45 515, 100 mm diameter (with turntable for self-supporting tape packs) or Cine type spool to DIN 45 514, 60 mm core diameter or NAB type spool, 114 mm core diameter (with adaptor and turntable).
Starting time: for nominal speed ≦0.2s. For ±0.1% wow and flutter ≦1s.
Fast wind time: ≦150s with 1000m tape.
Stopping time (out of fast wind with full reel): stop ≦3s, tape end ≦2s.
Spooling tape tension: 1N.
Electronic tape timer: 4-digit display indicating minutes and seconds for both tape speeds, in reverse motion beyond zero indicating ascending time with negative sign.
Timer error: ≦0.2%.

Amplifiers

Equalisation: available (option switchable) to usual NAB, CCIR standards.
Input: balanced, floating.
Input level: +6 dBm (max +15 dBm) or by changing connections +15 dBm (max +24 dBm).
Input impedance: 5000 ohm between 30 Hz and 16 kHz.
Output: balanced, floating.
Output level: +6 dBm nominal, adjustable to +12 dBm (at 2000 pWb tape flux). Max output level +24 dBm or by changing connections +15 dBm (nominal) adjustable to +21 dBm (at 2000 pWb tape flux) max output level +24 dBm.
Output impedance (+6 dBm and +15 dBm versions): ≦40 ohm between 30 Hz and 16 kHz. Min load impedance 150 ohm up to +18 dBm, 200 ohm up to +24 dBm.
Erase/bias frequency: 131 kHz.

Overall Characteristics

These data refer to NAB equalisation and to modern tapes, eg 3M 206 or equivalent.

Frequency response:

38 cm/s 30 Hz to 16 kHz ±1.5 dB
60 Hz to 16 kHz ±1 dB
19 cm/s 30 Hz to 15 kHz ±1.5 dB
60 Hz to 10 kHz ±1 dB

Signal-to-noise ratio: 'A' weighted, rms, referring to 400 pWb/mm (6 dB above operating level).

	38 cm/s	19 cm/s
full-track	≦69 dB	≦69 dB
stereo	≦65 dB	≦65 dB
two-track	≦64 dB	≦64 dB

Total harmonic distortion: referring to 400 pWb/mm (6 dB above operating level): full-track, two-track ≦1%, stereo ≦1%, pilottone model ≦1%.
Crosstalk rejection: measured with 1 kHz according to DIN 45 521; stereo version ≧38 dB (with ferrite heads), two-track version ≧54 dB (with Vacodur heads).
Erasure: 76 dB at 1 kHz.
Mains: 110, 120, 220 or 240V (+5/—10%), 50 or 60 Hz.
Dimensions:

	height mm	width mm	depth mm	weight kg
Chassis	308	645	525	53
Carrying Case	420	760	615	28
Console	800	720	595	28
Console on castors	903	720	595	30

Price: Stereo version as reviewed £3451.
Metal Case £378.
Console on castors £173.
Auto Locator AL 15 A £1165.
Remote Control Unit FS 15 A £195.
Vari-speed module SZ 15 A £296.

Manufacturer: AEG Telefunken, D-7750 Konstanz, Bucklestrasse 1-5, West Germany.
UK: Hayden Laboratories Ltd, Churchfield Road, Chalfont St. Peter, Bucks.
US: Gotham Audio, 741 Washington Street, New York, NY 10014, USA.

THE Telefunken *M15A* is a basic line in, line out machine which is available in either a console version or a so-called portable version. I say 'so-called', because it is a massive machine weighing over 80 kg in the portable version, but clearly the weight of the machine indicates that it is substantially built.

Construction of the basic tape transport is what one might call traditional, with the basis of the entire machine being a very large flanged alloy casting which is machined with the necessary reference faces for the tape guides, headblock and motors. It is my opinion that there is much to be said for this form of construction, as the basis of any decent recorder must be a stable reference face which will not distort with the inevitable knocks and bangs to which a machine is subjected.

The two very large reel motors bolt on to the casting and effect a direct drive to the spool turntables which accept by means of adaptors either European hubs, cine spools or up to 267 mm NAB spools. In spite of the direct drive, the turntables always ran cold, as did the complete machine. Tensions are controlled by band type brakes on the reel motor shafts, the brakes being controlled by sprung and damped tension arms via a fairly complex mechanical linkage which is provided with adjustment for tape tension. Clearly Telefunken have paid great attention to this part of the machine, as the tape handling was to a very high standard without the usual tape snatching which is associated with this type of tension control.

From the pay-off tension arm, the tape passes to a large diameter roller guide which drives an optical pickup which is used by the tape timer, and thence to a further large diameter roller guide and to the removable headblock. This is a small casting which is secured to the main casting by two thumbscrews pressing the headblock on to three spot reference faces. While, in itself, this is a very sound arrangement, two of the reference faces on the transport are surrounded by a metal plate with holes for the reference faces. The result is that dirt is very likely to accumulate on the reference faces and to be difficult to remove.

In other respects, the headblock is very well made with a fixed erase head and good solid azimuth adjustment of the record and the replay heads between which there is a small flutter roller. Tape guidance over the heads is unusual, in that five fixed edge guides guide the lower edge of the tape only. The heads and guides are angled to lead the tape slightly downwards. A further feature of the headblock is an inbuilt pair of editing scissors. These are arranged such that pushing a button at the rear of the headblock lifts the tape from the replay head and then proceeds to cut the tape at the correct point at the normal 45° angle.

The exit guide of the headblock is followed by a large diameter capstan the shaft of which has a long housing assisting in support of a heavy flywheel. This also acts as a drive pulley for the flat belt drive from a small Hall effect capstan motor. Speed changing works by altering the motor speed which is referenced to a crystal oscillator. To reduce wear, the capstan motor automatically stops when the machine is in the idle mode.

From the capstan, the tape passes to a large diameter roller guide, and thence to the take-up spool via the tension sensing arm. Reverting to the capstan, the pinch roller is solenoid-operated and will fall out if the capstan motor speed goes out of tolerance.

Tape transport control is by means of the usual four pushbuttons 'fast', 'stop', 'play' and 'record', all of which are illuminated in the conventional arrangement. These are electronically interlocked such that the machine cannot get up to any untoward antics. However, there was no interlock on tape tension, and if the machine was accidentally started with a loop in the tape path, it took up with a tremendous snatch.

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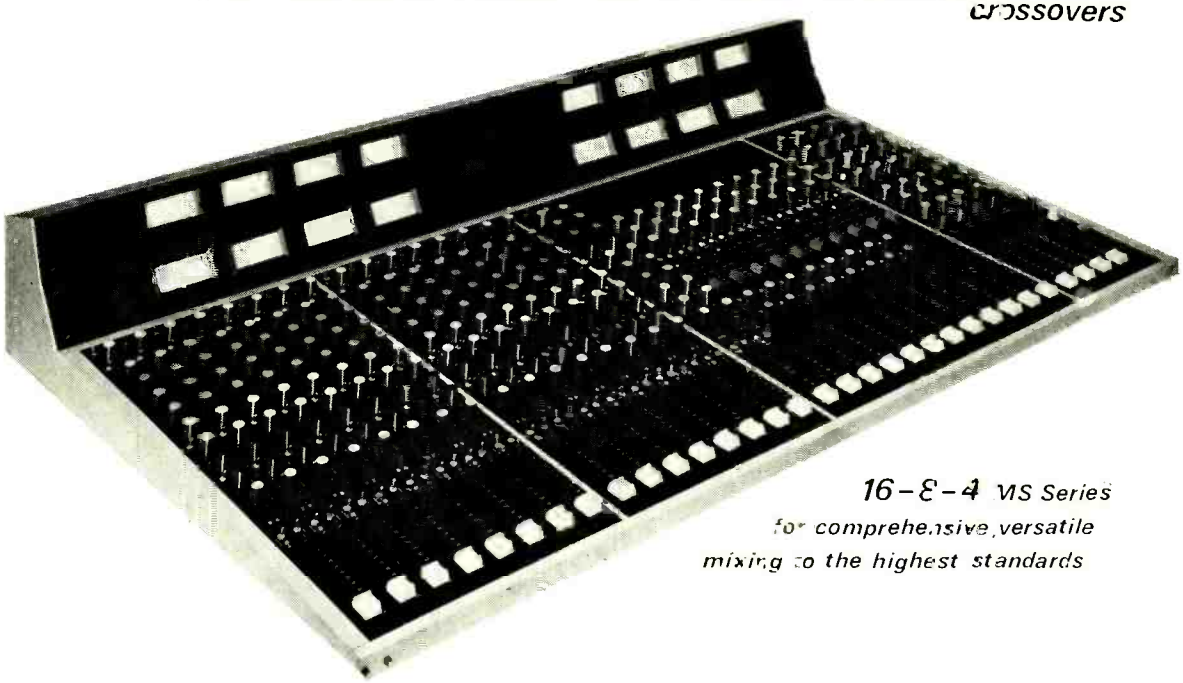

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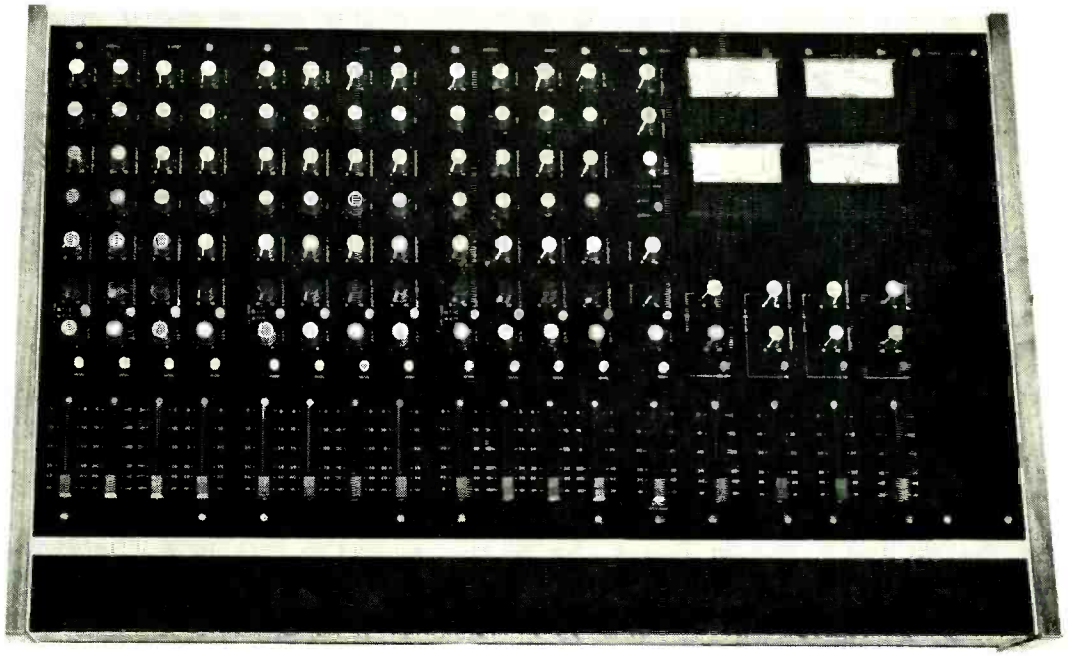

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TELEFUNKEN M15A

Fast spooling is controlled by the 'fast' button working in conjunction with a small lever which controls tape direction and tape speed. However, spooling was not at constant speed, and albeit that the maximum speed was not excessive, it was not possible to spool continuously at a low speed holding the controls.

A further illuminated pushbutton serves to reset the tape timer to zero. This is a seven-segment display of four digits in minutes and seconds. Not only does the timer automatically correct for the current tape speed but also, when zero is reached, it gives a negative display in real time as opposed to reverting to some awkward display.

The current selected tape speed is indicated in an illuminated window; the speed is selected by a locking type pushbutton similar to the power on/off switch and a remote/local control switch, all of which are secreted under a hinged panel. This panel forms a tape cutter and a splicing block in addition to the automatic scissors and a further metal splicing block on the head cover, which of course is designed to give excellent access to the heads for cleaning and editing since there is no front headscreen. In spite of this, the replay head was not prone to hum pickup in reasonable surroundings.

Two further editing facilities complete the user controls on the transport. Firstly the automatic tape lifter, a roller located between the erase and the record heads, can be manually operated by a small lever behind the headblock, such that the tape can be dropped on to the record and erase heads. This requires care if wow and flutter is to be avoided. Secondly, there is the edit control in the form of a round knob. This control brings the pinch roller near the capstan such that the tape is in contact with the replay head in all tape movement modes; also it de-mutes the replay amplifiers which are normally muted in the standby and fast modes. Furthermore, when this control is operated, the machine enters a dump edit mode if the take-up spool is stopped.

Beneath the transport the audio electronics are contained in a hinged card cage which, in the stereo machine, is remarkably empty since all the electronics are contained on five plug-in printed circuit boards. As can be imagined, the boards are densely packed with components, most of which are not legibly identified and, at the time of writing, no servicing data was available. It is hoped that proper servicing data will be prepared with clear board layouts! Another point is that the three types of board use identical pin-type connectors without mechanical interlocks—therefore, it is possible to insert a board in the wrong hole.

The three types of board have 270° type preset properly identified controls readily accessible at the front. On the oscillator board there are three controls, two for setting bias symmetry and one for setting ht voltage. On the replay amplifier board, there is the usual Telefunken versatile equalisation arrangement comprising for each tape speed an output level control, a mid frequency and a high frequency equalisation control, and a high frequency peaking control—this combination provides very exact adjustment of the replay equalisation.

The record amplifier board has similar controls with the exception of the high frequency peaking controls, and of course has, in addition, a bias control for each tape speed. Both the record and the replay boards had some link facilities, which are used for changing equalisation between CCIR and NAB. To the rear of the transport there is a further card cage containing seven printed circuit boards which are associated with the logic control of the transport.

Replay performance

Using instrumentation connected to the large type Tuchel connectors at the balanced outputs, the replay frequency response as received was found to be incredibly flat using BASF *DIN38* and *DIN19S* full track calibration tapes. At 38 cm/s the response was within +1, -0 dB over the full range of the tape from 31.5 Hz to 18 kHz with respect to 1 kHz, the results of 19 cm/s tape speed being +0.9, -0.3 dB from 40 Hz to 18 kHz with respect to 1 kHz and -1.2 dB at 31.5 Hz. So flat is the replay response at both tape speeds that the tolerance on the calibration tapes is far wider than the deviations found on the machine.

The signal handling capabilities of the replay chain were also excellent, with a greater than 20 dB margin on a recorded tape flux of 320 nWb/m before clipping at 1 kHz. There is not, therefore, any likely problem in handling any tape which may come available in the foreseeable future.

In spite of the fact that no front shield is used to screen the replay head, induced hum levels from adjacent instrumentation did not cause any problems. The following reference level (320 nWb/m) to replay noise figures were obtained without tape.

Taking into account that this is a CCIR equalised stereo machine, the noise performance is really excellent and gives a substantial margin of the noise from any current low noise tapes.

Other than bias breakthrough in the record mode which was more than 60 dB below 320 nWb/m, no spurious tones were found in the replay output in the frequency band up to 200 kHz.

Record/replay performance

As the machine was supplied ready aligned

tape speed	condition	reference level to machine noise	
		channel 1	*channel 2*
38 cm/s	20 Hz to 20 kHz rms	—67.9 dB	—70.9 dB
	'A' weighted	—78.5 dB	—78.7 dB
	CCIR weighted rms	—71.8 dB	—72.0 dB
	CCIR weighted peak	—67.8 dB	—68.0 dB
19 cm/s	20 Hz to 20 kHz rms	—59.2 dB	—60.3 dB
	'A' weighted	—66.2 dB	—55.8 dB
	CCIR weighted rms	—66.2 dB	—66.0 dB
	CCIR weighted peak	—60.0 dB	—59.3 dB

FIG. 1
TELEFUNKEN M15A
OVERALL RESPONSE

38 cm/s
BASF SPR50LH
-20dB REF. 320 nWb/m

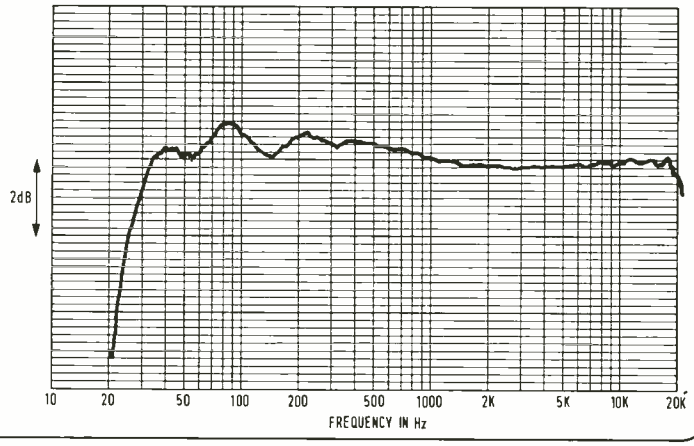


FIG. 2
TELEFUNKEN M15A
OVERALL RESPONSE
'AS FOUND'

19 cm/s
BASF SPR50LH
ZERO LEVEL -20dB REF. 320 nWb/m

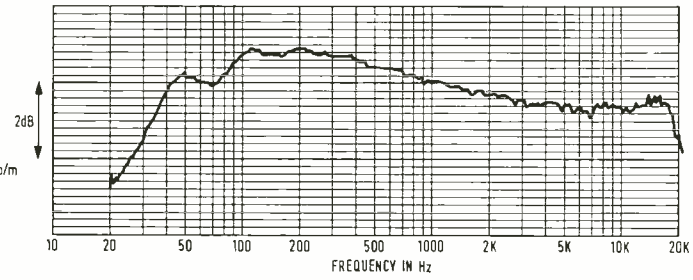
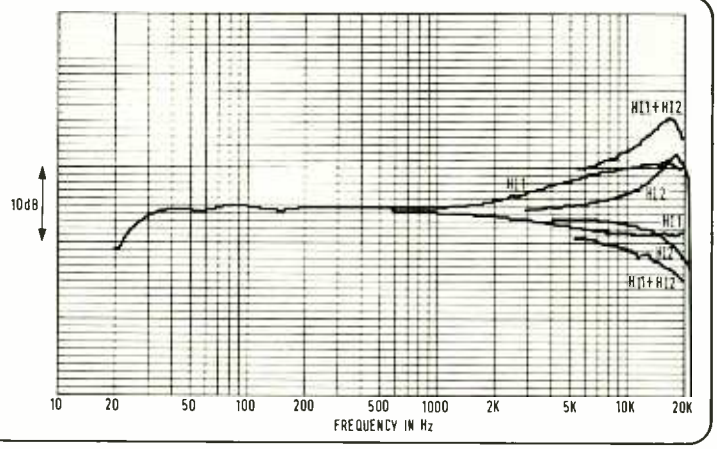


FIG. 3
TELEFUNKEN M15A
RANGE OF RECORD
EQUALISATION

38 cm/s
BASF SPR50LH



for BASF *SPR50LH* tape, most of the record/replay parameters were measured using this tape, which is popular in Europe because of its low print through and its matt backing which improves winding.

The record/replay frequency response was virtually identical on both channels as received, the responses at 38 cm/s and 19 cm/s being shown in **figs. 1 and 2** respectively. The comprehensive adjustments on the amplifiers leads to the remarkable performance of +1, -0.2 dB from 31.5 Hz to 20 kHz shown in **fig. 1**, where the only bumps in the overall response are due to the minimal secondary gap effects of the replay head at low frequencies.

An idea of the available record compensation is shown in **fig. 3** which shows the range of the record equalisers using *SPR50LH* tape at 3.5 dB over bias at 10 kHz at a tape speed of 38 cm/s. Certainly a wide degree of compensation is available and it is hard to imagine a tape in the foreseeable future which could not be handled by the Telefunken.

The maximum output level for 3% third harmonic distortion at 1 kHz was found to be 8 dB above 320 nWb/m at 38 cm/s—precisely the tape manufacturers specification, with 7.5 dB above 320 nWb/m being available at 19 cm/s. So far as other tapes are concerned, the record amplifier could drive to a level 16 dB above that required to record 320 nWb/m on *SPR50LH* tape before the onset of clipping, thus giving a reasonable margin on current tape types.

Fig. 4 shows the second and third harmonic distortion when recording at the reference level of 320 nWb/m at 38 cm/s. It was apparent that

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the third harmonic content is that to be expected from the tape type and that the second harmonic is astoundingly low such that above 2 kHz, the figure shows noise—this is a clear indication that no head magnetisation is present and that the even harmonic distortion of the bias oscillator is very small.

SMPTE type intermodulation distortion when recording a signal with the same rms value as reference level showed that the predominant intermodulation product was the 7 kHz tone ± twice the 50 Hz low frequency, and that these products were each at 0.3%.

The measurement of difference tone distortion by sweeping two frequencies which were separated by 200 Hz using the B & K type *1902* distortion analyser produced **fig. 5** from which it is to be seen that the BASF *SPR50LH* tape gave rather alarmingly poor results when compared with Ampex *456;* however, there is no indication that the machine itself makes any significant contribution to the distortion.

As is shown in **fig. 6,** the crosstalk between the stereo tracks when recording signal on one channel and only bias on the other is unusually flat above 1 kHz where the crosstalk is –38.5 dB. As is normal, the low frequency crosstalk has a cyclic pattern due to secondary gap effects and fringing at the replay head. Erasing capability at 1 kHz and a tape speed of 38 cm/s was unusually good at 90 dB using *SPR50LH* tape.

The final test done on the record/replay chain was to look at the squarewave performance. The results of recording and replaying a 1 kHz squarewave are shown in **fig. 7.** It is to be seen that, as is common, there is overshoot due to phase characteristics of the equalisation, but also a small degree of ringing is present at a high audio frequency.

Wow, flutter and speed

Telefunken have done it again—consistent DIN weighted wow and flutter of under 0.012% at 38 cm/s throughout a NAB reel puts the *M15A* at the top of the league. Even at 19 cm/s, the wow and flutter was less than 0.02%, and this could probably be improved by lowering the tape tension from its high 100 or so grams which are required for European spools to about the normal 70/80 grams.

In addition to praising the DIN weighted wow and flutter, the longitudinal flutter and scrape flutter is, I think, the lowest I have ever measured on a conventional tape transport. **Fig. 8** shows a narrow band spectrum analysis of a recorded 10 050 Hz tone. It can be seen that sideband noise is not only contained in a narrow spectrum but also that the level of the sideband noise is satisfactorily low.

The tape timer was found to be accurate to better than 1s in 20 min, and tape slip was also less than one part in 10^3 even in the fast wind mode, making it very easy to locate any required section on tape.

Inputs and outputs

Physical input and output connectors were of the large Tuchel type as opposed to the *XLR*

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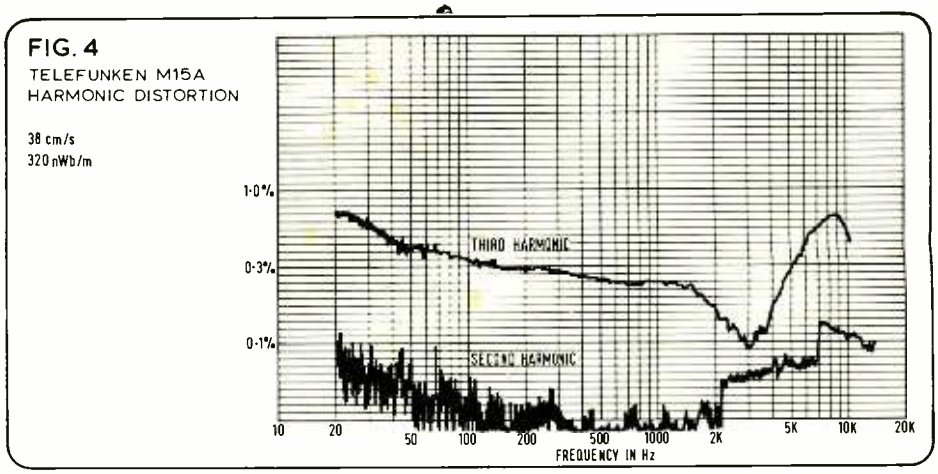


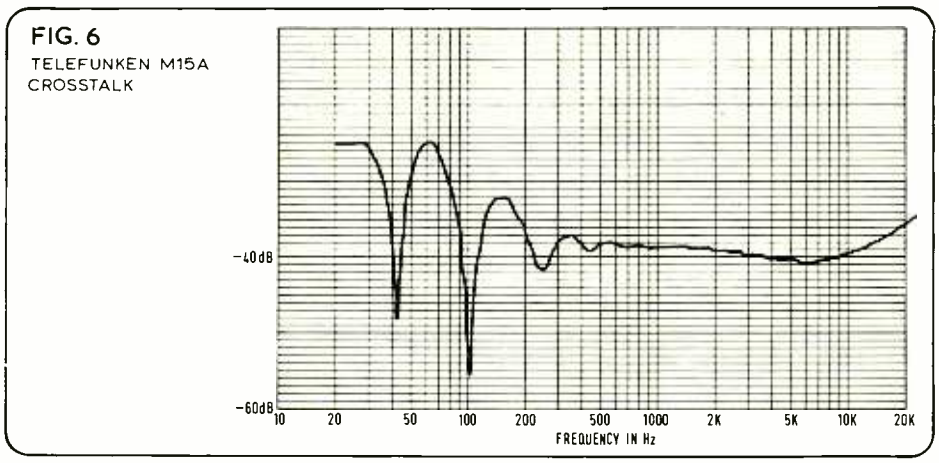
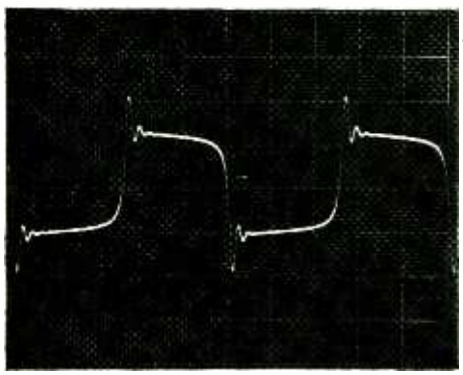
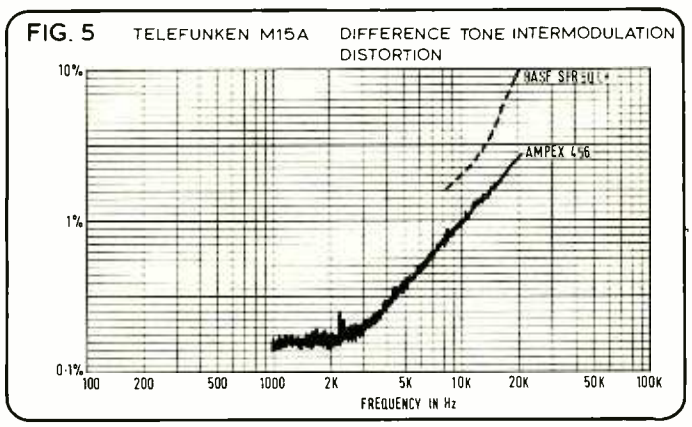
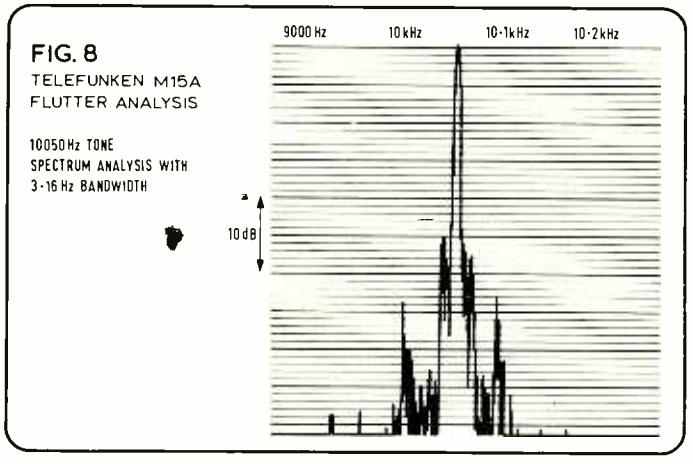


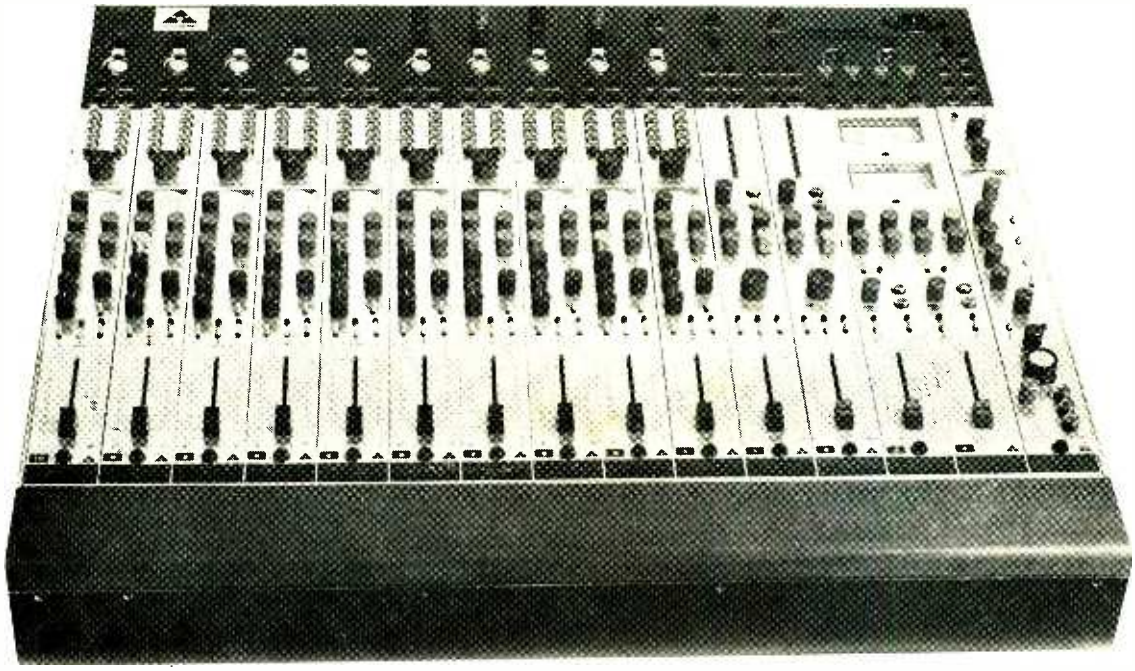
FIG. 7







The mixer which carries on



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type which I would like to see as an option. The inputs and the outputs were floating and isolated from ground, in addition to which there was a link on the machine for isolating the signal ground from the chassis ground—a very sensible addition.

The input impedance was most satisfactory at a constant 16 900 ohms in the audio band, requiring from −12 to +10 dBm to record 320 nWb/m on *SPR50LH* tape, according to the pre-set adjustment on the record amplifier.

Likewise the output impedance was satisfactorily low at 30 ohms, with a drive capability of +25 dBm into 600 ohms with an adjustment range between +4.5 dBm and −45 dBm for a recording at 320 nW/bm.

Remote control unit FS 15A

This unit is essentially a small switch box which duplicates the illuminated transport control switches on the tape transport and has a few other functions. Further facilities include two toggle type switches, one of which is a speed selector and the other of which in suitably equipped machines changes between CCIR or NAB equalisation. Associated with the speed switch there are three lights, two for indicating the nominal speed in use, and the third being a 'ready' lamp illuminated when the capstan is in phase lock.

Vari-speed unit SZ 15A

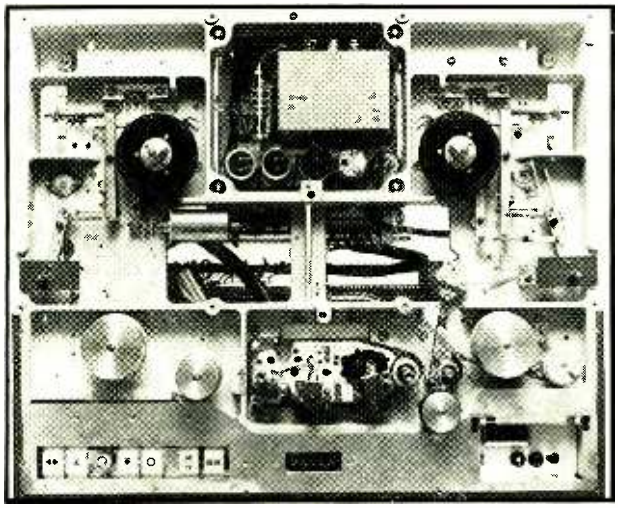
The unit offers continuously variable speed over the range ±50% of nominal speed. Controls on the unit consist of a two-position toggle-type switch for switching between 'quartz' servo lock and 'variable', the latter condition being indicated by a red light. In addition there is a green light which is only illuminated when the capstan is in servo lock with the crystal control in both the fixed speed 'quartz' mode and in the variable mode. The variable speed is set by an edge-on multi-turn potentiometer which has a flywheel action, the percentage speed variation being shown by a three-digit seven-segment type display at the top of the unit. As a convenience the front panel bears a printed chart of halftones in terms of percentage variation in terms of the musical scale.

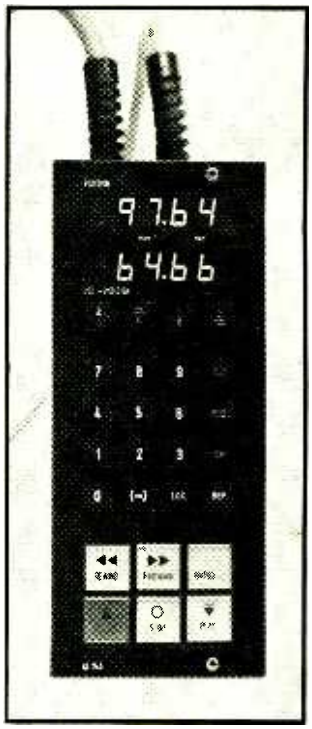
Checking the accuracy of the actual tape speed in relation to the indicated percentage change indeed confirmed that the maximum error was never more than half a digit, and furthermore, in practice the speed range was from 41% of nominal to 172% of nominal with correct phase lock.

Auto locator unit AL 15A

The unit has the normal search and repeat functions, but it also can be used for relative timing. Furthermore, it contains stores for up to nine locations.

The auto locator is small, with a front panel area only 190 mm high by 80 mm wide (twice the width of the remote control unit or the vari-speed unit). At the bottom of the panel there are six illuminated pushbutton controls which are identical to the tape transport controls. The remainder of the unit is concerned with auto location, the key to which is two numerical displays at the top of the unit; both indicate time in minutes and seconds up to ±99 min and 59s with automatic sign changing about zero time indication.





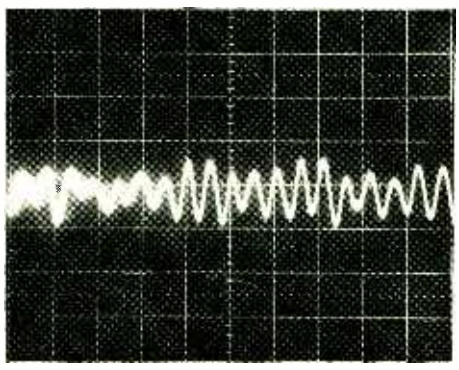
The upper display normally indicates current tape position with respect to the original set zero point; however, pressing a button on the unit reverts this timer to a current zero for timing individual sections on tape—repressing the button changes back to normal time from set zero. This upper display may be individually reset or may be transferred to the second display which is the 'locate-position' display which can be individually reset, can be set manually to any required time, or can be transferred to or from the upper display.

Beneath the displays there are nine push-buttons numbered zero to nine, a minus button, a locate button and a repeat button, in addition to a reset and a 'position' button. The buttons numbered zero to nine serve two functions: they can be used to load a required time into the locate display, or to display the contents of the nine time stores.

Part of the beauty of this arrangement is that pressing a single button stores the current tape location in one of the nine stores, and that repeated use of the button automatically advances to the next of the nine stores and remembers the current location. Alternatively the stores may be loaded with times manually, and a further facility is to subtract a time increment from all stores simultaneously—this feature can for instance be used to correct for starting time. The locate and the repeat functions may use stored times, or may use times which have been manually inserted in the two displays or a combination of the two.

When using the auto locator the tape movement was very well controlled with the machine proceeding into the fast winding mode and automatically slowing down as the required position was reached, finally stopping at the required position with no overshoot at all.

FIG. 9



Other matters

M15A features the switching of the erase head; the bias and the replay muting are automatically timed to avoid clicks or gaps on tape, with the timing compensated for the selected tape speed. In practice, I was unable to record any clicks, but a pretty nasty bump could be produced in the output if the tape speed selector was altered in either the run mode or when the tape was static and the edit mode was selected.

The phase jitter between tracks was found to be very small as is shown in **fig. 9** which is an oscillogram of the phase in relation to time, the peak to peak value at 38 cm/s, 10 kHz, being about 7°.

In operation the machine was a very quiet runner, but in some circumstances the healthy thump of the pinch roller going into contact could be a nuisance, but it is understood that this noise can be reduced.

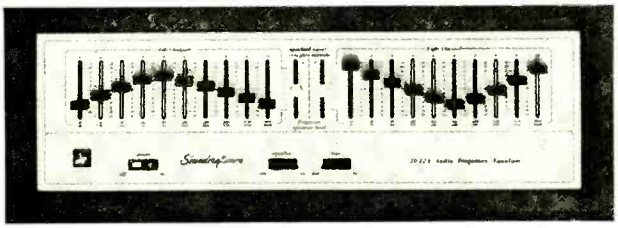
Summary

The machine is built in the best traditions of recorder design; its performance must be described as outstanding from both the mechanical and electromagnetic viewpoints. The machine is excellent both as a studio master recorder and also as an editing workhorse, but is really rather heavy and bulky as a portable machine.

Optional auxiliaries in the form of the auto locator, the vari-speed and the remote control units are also well designed and, in particular, the small size and the extreme versatility of the auto-locator makes it a very attractive proposition; however, I must admit that, while the price of the machine is very reasonable, I don't like the price tag on the auto locator.

The Soundcraftsmen 20-12A Graphic Equalizer

Exclusive to REW



REW are proud to present the Soundcraftsmen Graphic Equalizer—undoubtedly the finest unit of its kind for both Hi-Fi and professional use. Each of the stereo channels is divided into 10 frequency bands, from 20 Hz to 20,480 Hz. Boost and cut of 12 dB is provided on each band and a gain control adjusts the output to match any amplifier. The unit has a champagne gold anodised front panel, enclosed in an attractive wood-grained cabinet. The Soundcraftsmen can be used as a sophisticated tone control enabling you to highlight individual instruments. Alternatively it can be used to produce a near-perfect flat frequency response in any domestic conditions by compensating for either poor room acoustics or various deficiencies in Loudspeakers. Also perfect for equalizing tape recordings. Send for full literature.

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- 146 Charing Cross Road, London WC2. Tel.: 01-240 3064/5.
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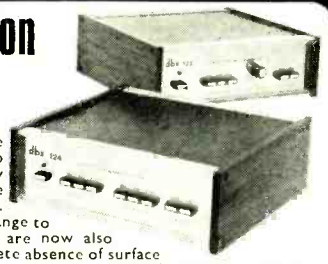
dbx noise reduction units



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*Console Deck with eye level electronics. *Highest quality 4-track recorder on ¼" tape. *Automatic sync facility makes over-dubbing easier. *Full motion sensing logic provides smooth tape handling. *Auto repeat to play/stop facility enables previously recorded track to be repeated continuously. *Variable bias controls on front panel. *Built-in pink noise generator. *Peak reading led indicators in addition to expanded scale vu meters. *Plug-in lead block. *Flat response sync output. *Cue control for fast editing. *Remote control facility. *Flying start drop-in record.

SPECIFICATIONS

Tape Transport—Three motor (Hysteresis synchronous capstan and eddy current—induction reel), electronic speed change. Solenoid operated.
Tape Speeds—15 ips and 7½ ips.
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Professional REW Audio

REW Professional Audio

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

Replies to Box Nos. should be addressed to the Advertisement Manager, Studio Sound, Link House, Dingwall Avenue, Croydon CR9 2TA, and the Box No. quoted on the outside of the envelope. The district after Box No. indicates its locality. **SEX DISCRIMINATION ACT 1975:** No job advertisement which indicates or can reasonably be understood as indicating an intention to discriminate on grounds of sex (e.g. by inviting applications only from males or only from females) may be accepted, unless (1) the job is for the purpose of a private householder or (2) it is in a business employing less than six persons or (3) it is otherwise excepted from the requirements of the Sex Discrimination Act. A statement must be made at the time the advertisement is placed saying which of the exceptions in the Act is considered to apply.

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★**Fanfare Records.** Tape - disc pressings, demo's, masters, any quantity. Studio/mobile Neumann disc cutter. S.A.E. brochure. 1 Broomfield Close, Rydes Hill, Guildford. Tel. 0483 61684. X

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Full Information on Request
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★**Sound News Productions.** Britain's oldest full-time tape/disc cassette transfer service. Direct transfers, pressings for private and for the trade. Fund-raising advisory service for Societies, Choirs, Bands, Ferrograph, Grundig, Philips, Revox equipment promptly serviced. 18 Blenheim Road, London W.4. Tel. 995 1661. M

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