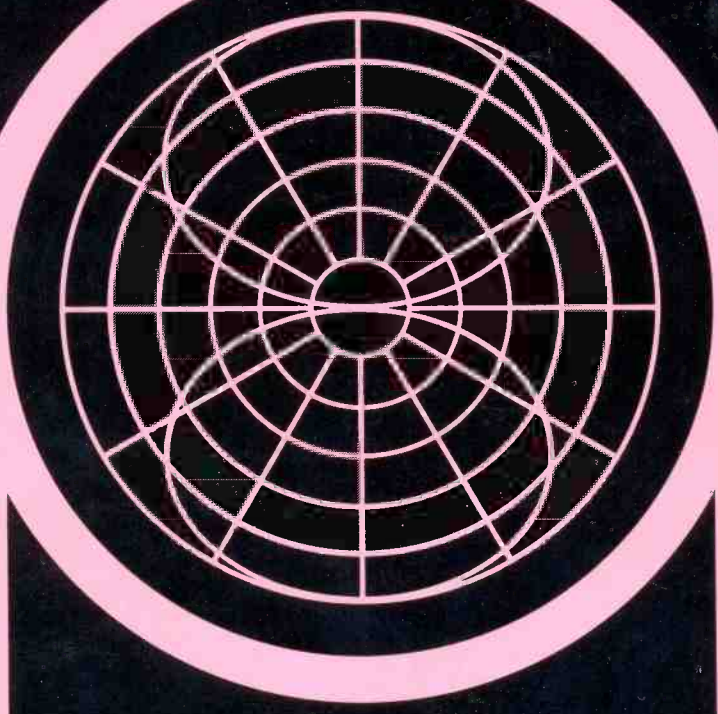
January 1975 25p

studio sound

AND BROADCAST ENGINEERING



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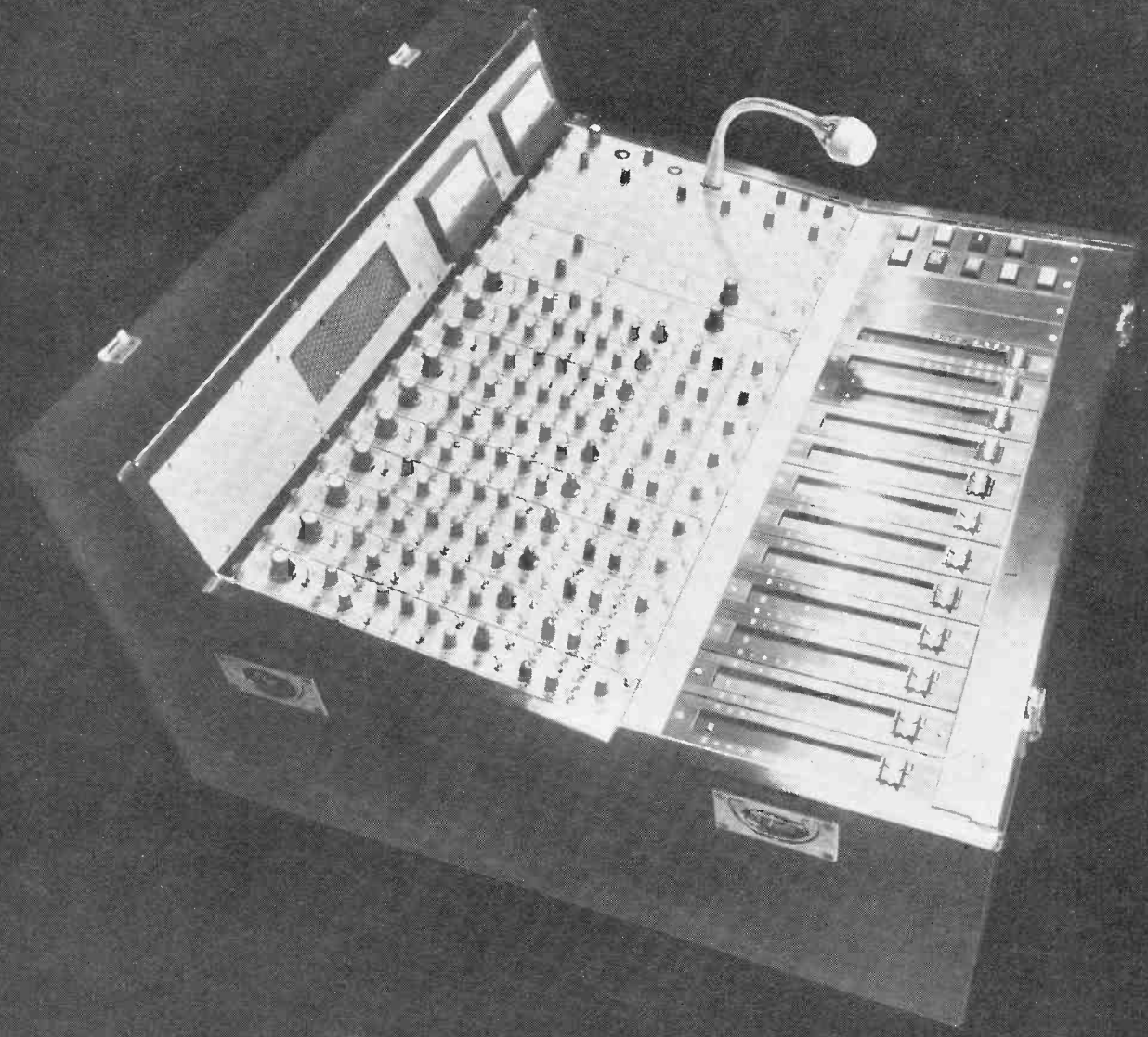

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SUBSCRIPTIONS
STUDIO SOUND, *published monthly, enables engineers and studio management to keep abreast of new technical and commercial developments in electronic communication. The journal is available without charge to all persons actively engaged in the sound recording, broadcasting and cinematographic industries. It is also circulated by paid subscription to manufacturing companies and individuals interested in these industries. Annual subscription rates are £3 (UK) or £3·30 overseas.*

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

BINDERS
Loose-leaf binders for annual volumes of STUDIO SOUND *are available from Modern Bookbinders, Chadwick Street, Blackburn, Lancashire. Price is £1·25 (UK and overseas). Please quote the volume number or date when ordering.*

JANUARY 1975 VOLUME 17 NUMBER 1

POSSIBLY THE MOST useful equipment reviews are those of power amplifiers. Since the requirements are fairly well-defined, something vague about a straight wire with gain and a little self-inductance, it's a relatively simple matter to see how far a brushed aluminium black box goes towards realising such a goal. And then to pass judgement.

Again, small-signal modules have quite specific aims, within some overall scheme. Again, argument centres on the relative weight of mutually opposed parameters, such as noise and distortion, and which compromise is more satisfactory. Nevertheless, different methods of achieving an end do not concern the practical balance engineer; he is simply concerned that a required performance is maintained.

Difficulties creep in when more than two black boxes are involved, because they can be arranged in different ways. Disagreement follows. Some people always want to do things differently, which is unfortunate since it prevents attitudes sitting comfortably still. Since all possibilities could only be catered for by some sort of permutation-review, it's necessary to generalise. Too bad if anyone objects to the application to him.

Microphones are a problem. Like music and other irrelevant things, subjective effects remain uncodified and any discussion can only be sustained by a good vocabulary and a certain familiarity. And, in common with arts criticism, a pungent, eloquent smoke screen is often more effective than careful, sincere comment.

The most tiresome comments on mics and their use come from the purists. But we must distinguish between the theoretician (who, contrary to popular belief, stands or falls by the success of his propositions and cannot be confounded by 'the practical man' if he has done his sums right) and the witless plagiarist (who either has only two mics anyway or has trouble in hearing all he is supposed to through less than 18, even with pfl). Naturally, a little arrogance goes a long way.

Crossed pair taking issue with multimic, and vice versa, is an ultimately unrewarding spectacle; and the extreme polarisation that used to characterise such arguments seems to have softened. But the virtue of such debate was in providing points of reference in the fog of practical technique, which acknowledges no basic principles unless they lead to good results in a specific situation. It isn't helped by some record critics who ought to know better churning on about the 'natural' balances and 'coincident' technique. Fortunately, such misprint is contradicted by anything non-classical (music, not technique) rather more easily than the also obvious confrontation with a mixer containing more than two parallel lines of tone controls, balance controls, loudness filters and other confusing little coloured buttons. But the bland assumptions of true and false which underline such comments are far-reaching. And if the artistic goal is open to facile dispute, what chance the medium of doing its practical work right?

Next month, survey and reviews of straight wires.

STUDIO SOUND *is published on the 14th of the preceding month unless that date falls on a Sunday, when it appears on the Saturday.*

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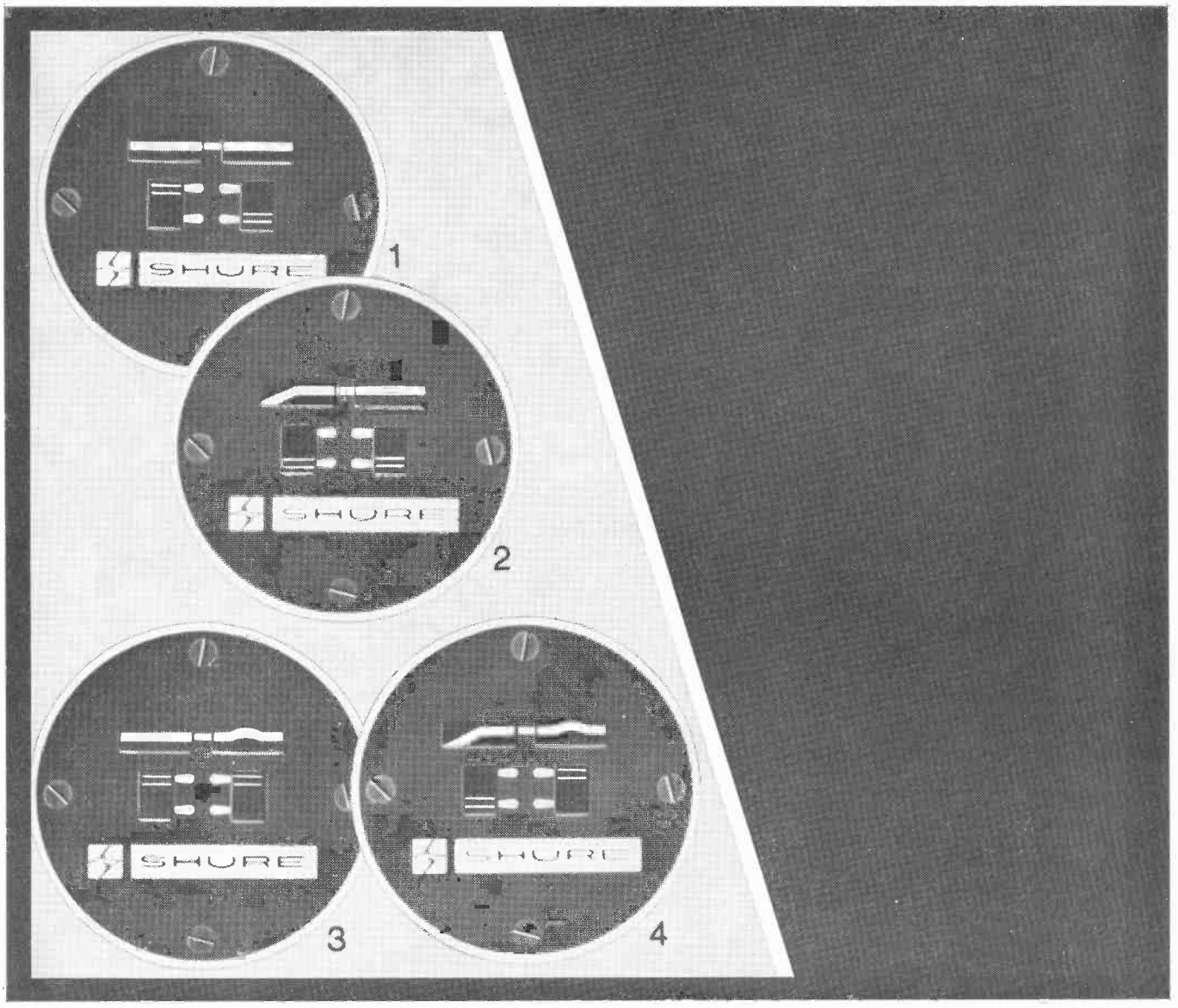

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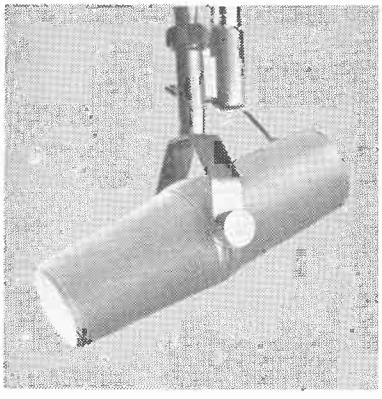

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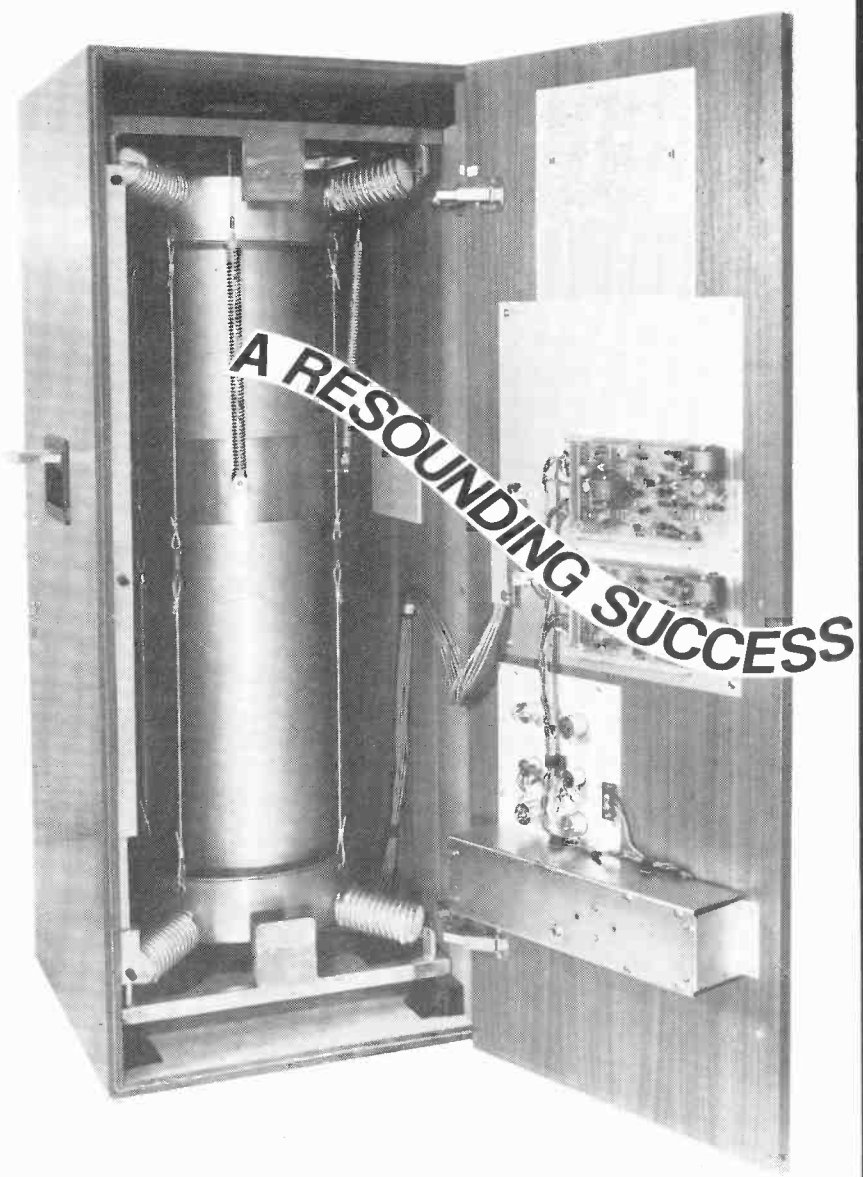

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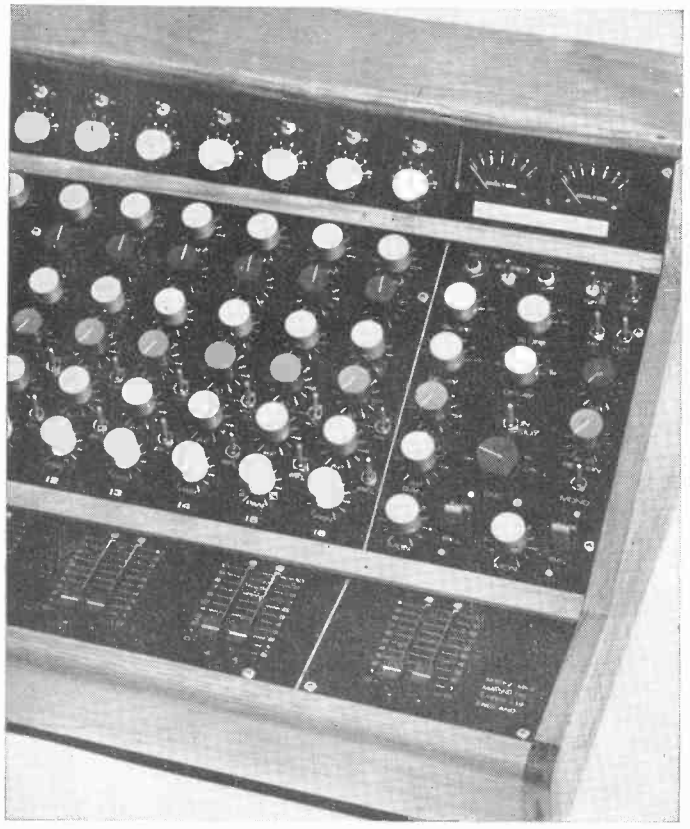

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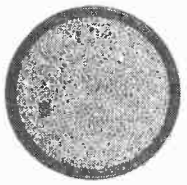

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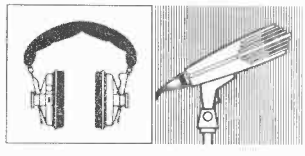

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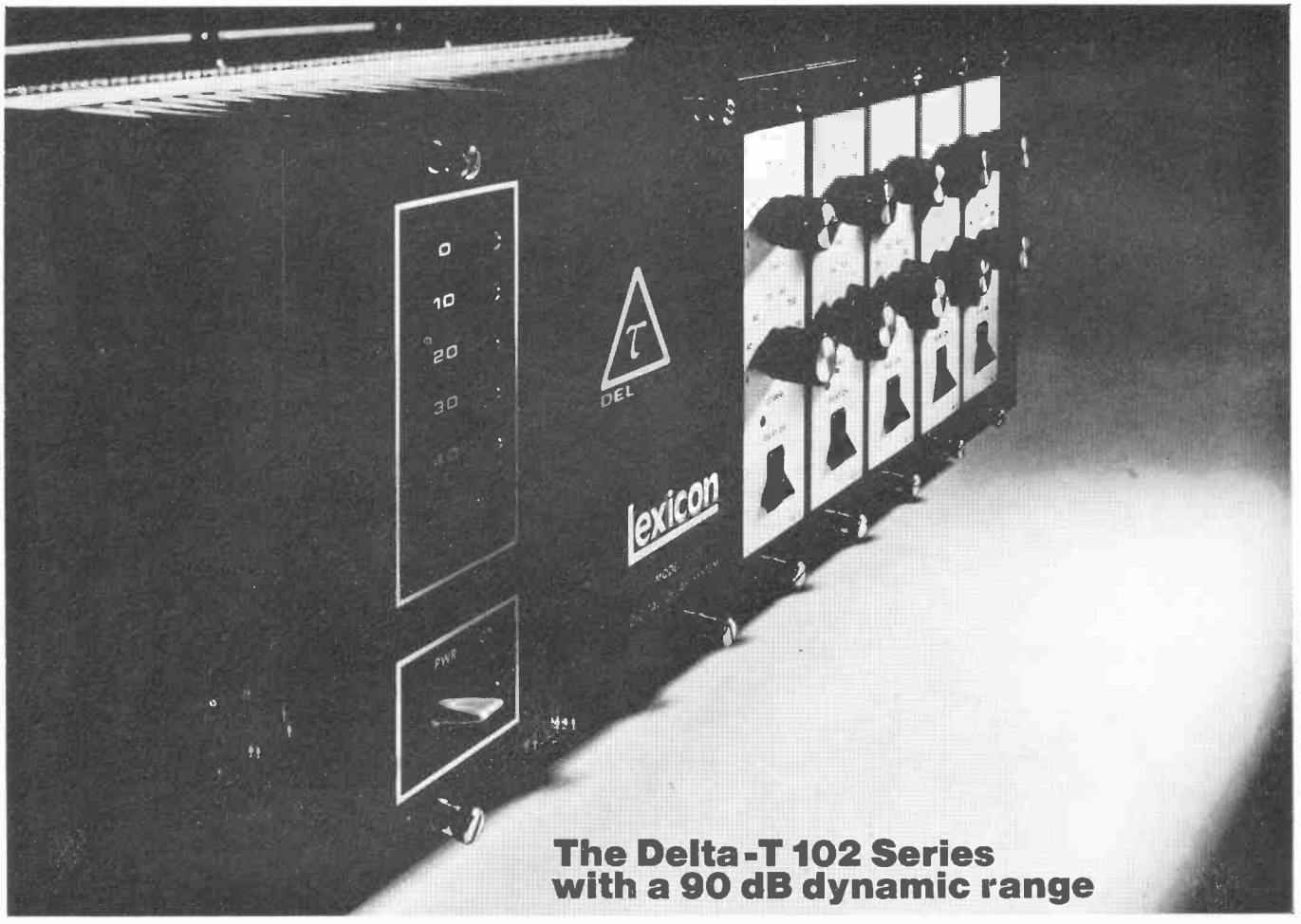

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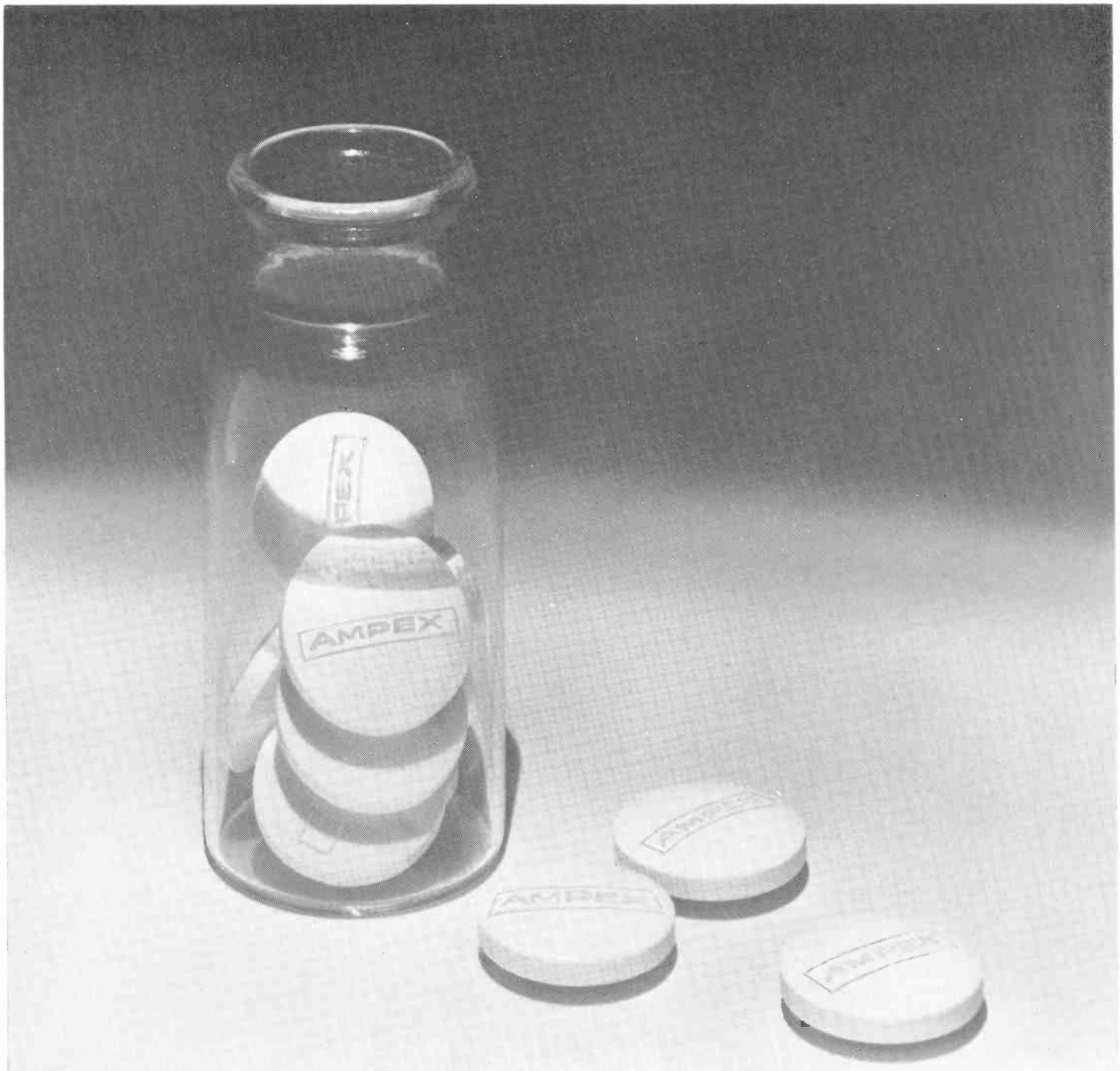

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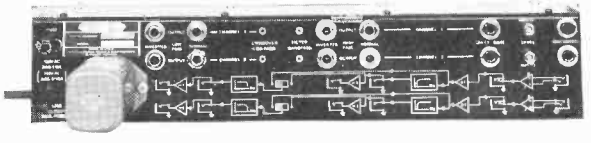

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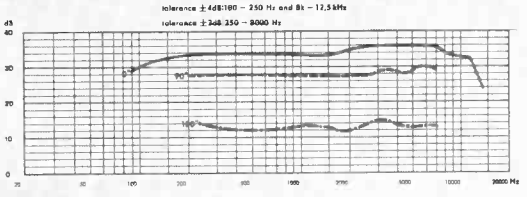

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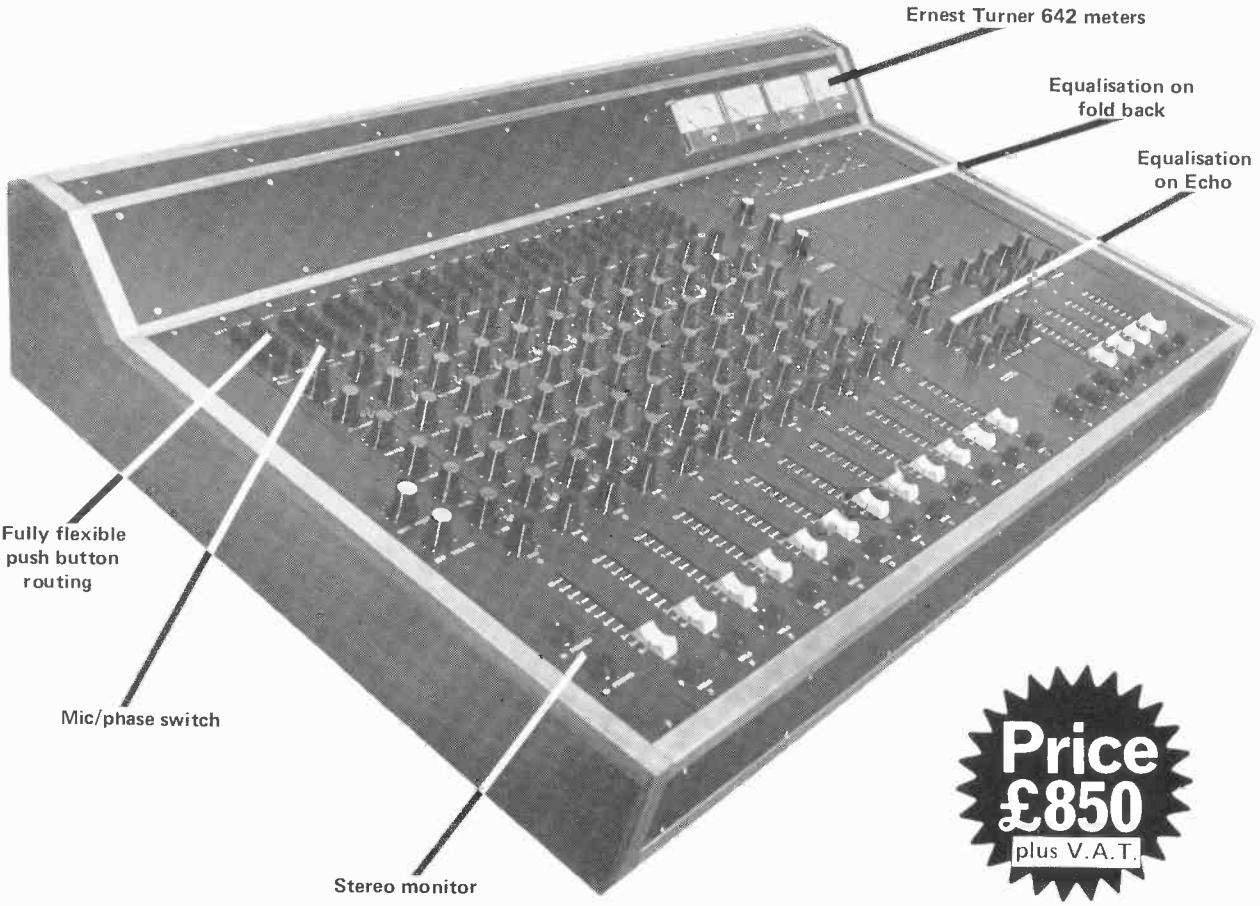

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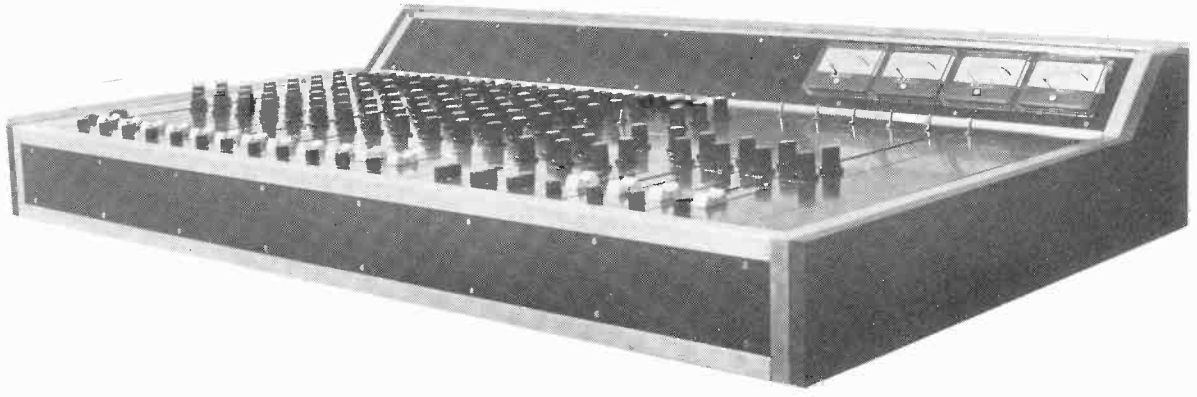

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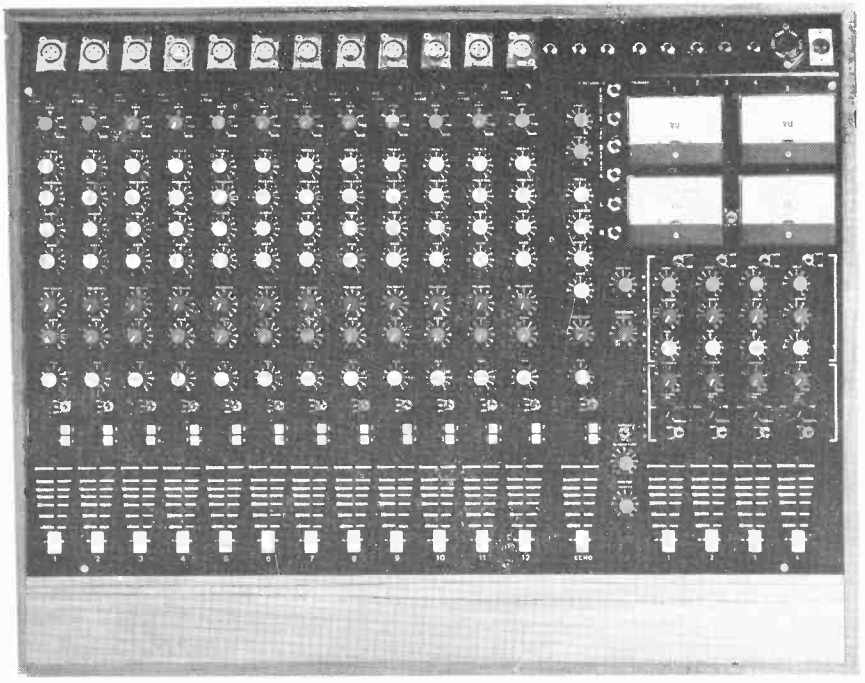

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So often when a recording engineer wishes to choose a microphone for a particular purpose, it is more a question of what is made available to him than what is the best mic for the job. In many cases studio managers have chosen microphone types with only limited applications for use by engineers. For example, one London studio originally had available only two types of microphone, moving coil and capacitor, both being fixed cardioid. Several dozen of these were bought from a single manufacturer, and engineers soon grumbled at the limited choice.

The right mic for the job

ANGUS MCKENZIE

IDEALLY MICROPHONES SHOULD be chosen purely on a performance basis but frequently, for prestige reasons, a studio will buy, for example, Neumann, for some application where an AKG microphone might be a better alternative. Some types of microphone seem to be associated only with particular sections of the recording world. For example, Sennheiser rifle microphones are used almost exclusively by film and TV studios, although in the last year or so the BBC and IBA have been introducing them for news coverage. Only recently has BBC sound radio started using them at Glyndebourne, for instance, to obtain more presence in special conditions. Often it will need just one well-known engineer to start using a new microphone for that model to become widely accepted and used.

There has been much said about actual microphone techniques, and although I personally prefer to use the minimum number of microphones possible, ideally only two, nevertheless for a particular recording because of acoustic conditions in some locations one may have to use a very large number, even for classical music. A hall having too much short-term reverberation can produce a sound quality, with a single stereo pair, which can only be described as boring and wishy washy, while on the other hand to use more than a single pair in the Royal Albert Hall, or even Ely cathedral, is only necessary if the forces being recorded are not appropriately balanced internally, or if one is working with a producer who wants to create an effect for a gramophone record, rather than attempting to reproduce reality. Often such an effect is more exciting, even if it offends the purist, but nevertheless many engineers will not give simple techniques a try. On the other hand, I have heard 'semi-professional' engineers with modest equipment, perhaps consisting of one stereo microphone and one professional tape recorder, becoming arrogant, and claiming that anyone using more than a single pair for stereo is always wrong. My reply would be: let him try to make a recording of a large orchestra in the new Hove Town Hall, or the De Monteforte Hall in Leicester, with its serious flutter problems.

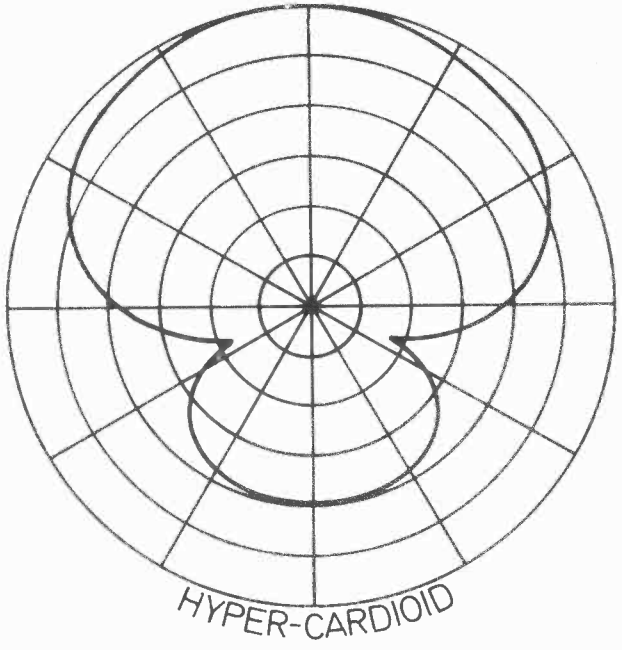
Choosing the right microphone must become an art and not a science, a personal opinion and not a text book matter, and should become an engineer's personal choice, and not company policy. In spite of this, there are clearly some basic rules in choosing microphones, which are all important, and failure to observe them may well create problems so severe that no amount of knob twiddling can repair the damage done by making a wrong decision.

Although capacitor microphones have now become a mainstay in most studios, the moving coil cardioids remain very popular. Ribbon mics are still being made, but in decreasing quantities, though this doesn't mean they are unsuitable for use today. The polar diagram of an STC *4038* ribbon is almost perfectly bi-directional at all frequencies. Many engineers like to use this polar diagram to allow a ribbon mic to pick up brass instruments on the main axis while excluding loud percussion instruments on the side. Because these microphones have a very flat response up to 10 kHz or so and then fall off rapidly they are often liked by engineers for use with woodwind when a close capacitor type might over-emphasise breathiness. Although such breathiness can be reduced by equalisation, I have always felt that there is something about the sound of a ribbon mic which is very 'musical'. Often, I have been asked by a professional violinist to use a ribbon rather than a capacitor for a solo pick-up. Beware, though: the ribbon microphone's enormous magnet can damage master tapes and even unrecorded tapes, by introducing a dc magnetisation which cannot easily be erased.

Almost all ribbon mics are purely bi-directional, although the RCA Varacoustic had a shutter at the rear allowing a choice of effective polar diagrams to be obtained acoustically. Bi-directional ribbons will give a very noticeable bass lift to close speech. I have always noticed a tendency to high frequency coloration sounding almost like a peaky resonance, and have associated this with acoustic resonances around the magnets and between the front and back meshes covering the microphones. In any case, good omni-directional microphones give a far better speech quality than any other types, for they usually avoid p-blasting and other air exhalation effects. They do not in general require wind shields, which can cause hf loss, and sound more natural without the low frequency boost created by velocity and cardioid polar diagrams of all types. However, omnis are the most difficult to mix in with a general multimic balance, for they introduce serious phasing problems at low frequencies, and are also prone to rumble pick-up.

Ribbon and moving coil microphones have a very low output, and therefore require extremely well screened microphone cable and microphone preamplifiers in the control desk having a low inherent noise. They give an output some 20 dB lower than the average capacitor type, and some control desks will not have sufficient gain for them when they are used for recording very quiet speech sounds. However, they can give high output levels without distortion, and moving coil cardioids in particular are useful for close miking pop groups. Since these obtain the cardioid polar diagram acoustically, they are often prone to handling noises, and in any case the polar diagram can change if the shank of the microphone behind the front is obscured by a hand, or by a clamp covering the air holes. I have found some types rather prone to shock damage; in particular the AKG *D202* used to have very fine wires connecting the treble and bass diaphragms to the cross-over unit (this has since been improved). These wires broke very easily, and so in general use often required maintenance. Nevertheless, the AKG *D224* seems more robust in this respect, although the internal wiring is similar. Interwoven screened cables are particularly suitable for moving coil and ribbon mics, but they should not be run close to any mains wiring. Some microphones are available with either Cannon-type connectors or DIN ones. In practice the DIN plugs are much more difficult to wire up, and are less reliable, so I would advise sticking to Cannon terminals. Many of the mics are available with either socket.

Capacitor mics must be handled with care and stored if possible in a reasonably warm environment where the humidity can be kept low. If stored for any length of time they should be switched on some hours before use



in a warm place to remove any moisture from the diaphragm. In this way noise and rumble can be kept to a minimum. Capacitor microphones fall into three groups—those having single polar diagrams, those having switchable polar diagrams on the microphone, and those having the polar diagram controllable remotely. The first type includes the well-known Neumann *KM84*, the AKG *451/452* series, the Calrec *1050* series, and various models made by Schoeps, Sennheiser, STC, Pearl etc. Of these, the Neumann *KM84* has a very low inherent noise and a wide frequency response without peaks and a good cardioid. When bought in small quantities, however, it is an expensive microphone. The AKG range has two types of amplifier body, one for 9.5V phantom powering, and the other for the more conventional 48V. There seems to be virtually no difference in the performance of the amplifiers, but the first type is suitable for use with the AKG battery power box using a *PP3* battery, which also contains a 1:1 isolating transformer. A number of different heads are available to suit most purposes.

The *CK1* capsule is an acoustic cardioid and is rather more noisy than many other types, although it sounds very smooth. It is particularly useful for close miking, and the cardioid pattern is fairly well maintained at different frequencies. The *CK2* capsule, an omni one, is my personal favourite for speech recording. It has an exceptionally fine pattern at all frequencies and a very flat and uncoloured response. The *CK5* capsule has a built-on wind shield incorporating bass cut, and is particularly useful for pa work, whereas the *CK8* is a hyper-cardioid capsule having a 20 cm plug-on stem. The *CK9* is a rifle-type microphone head having high directivity at higher frequencies. AKG can also supply a swivel adaptor type *A51* which allows the capsule to be pointed in any direction relative to the amplifier body. This allows two capsules to be mounted at a 110° included angle with their amplifiers running parallel and strapped to each other for stereo. Short and long extension tubes *VR1* and *2* are available so that the capsule can be several feet above a vertical amplifier body, perhaps on stage, so that the mic itself becomes almost unnoticeable from a distance.

The AKG *414* capacitor mic is normally supplied to work off 9.5 to 12V phantom powering, but can be driven from a 48V phantom supply, provided that resistors of approximately 5.6k ohms are used to feed the supply to each leg in the microphone input of the mixer. The resistors should be of 1W rating and the phantom supply should be well capable of giving the extra current required without any extra ac ripple. The *414* has four switchable polar diagrams, omnidirectional, bi-directional, normal cardioid and hyper cardioid. The last position is most unusual on a mic not remotely controllable, but is nevertheless used probably more often than omni or bi-directional by most people used to the mic. The position was added at the request of the BBC and other professional users when its predecessor, the *412*, first appeared.

The Neumann *U87* has three polar diagrams (missing out hyper-cardioid), is larger than the AKG, but also has provision for internal battery operation which is most convenient. A comparison between these two mics is included in this issue. Remotely controllable polar diagram mics seem temporarily to be a little out of fashion, although I cannot understand why. I have found it a great convenience to be able to change a polar diagram in a control room as an audience perhaps fills a concert hall more than expected. By remotely altering polar diagrams and using stereo widening and narrowing in a control desk, an equivalent to physically altering the angle between the capsules can almost be obtained, which probably could not be done during a live performance.

The Neumann *SM69* and other stereo coincident capsule microphones all have remotely controllable diagrams, and their capsules can be set at any angle relative to each other. AKG will be introducing an updated fet *C24*, and Pearl and Sennheiser are also making stereo models. Although the convenience of having one stereo mic cannot be underestimated, it is probably better, because of flexibility, to use two separate mics in close proximity, provided that remote control facilities are not of great importance. Remote control unfortunately adds quite a considerable amount to the cost, although an advantage is the availability of switchable polar diagrams in steps between the more usual ones.

Although most bi-directional patterns are

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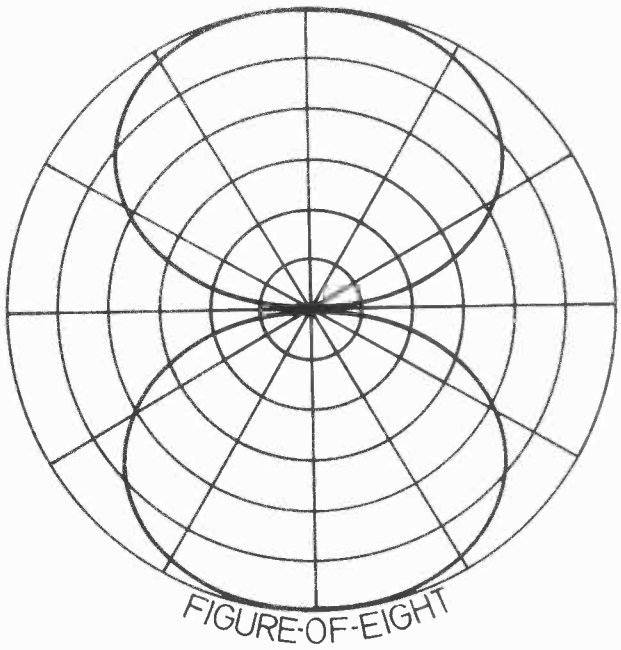
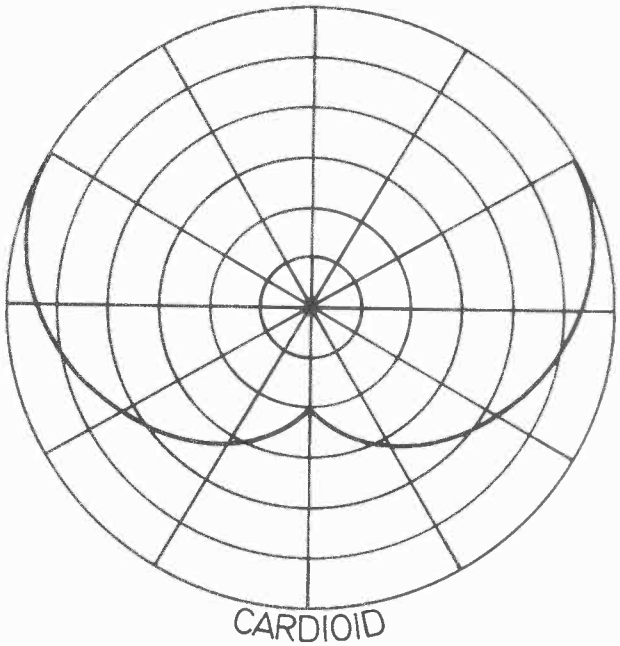


held over a wide frequency range by various microphones, some mics exhibit slight bass loss. At very high frequencies the diagram falls inwards slightly. Cardioid microphones vary greatly in their pattern performance at different frequencies, and I have noted that the AKG *D202* seems to be particularly good in the middle, pretty good in the bass, but gets rather narrow at the extreme top end. Cheaper moving coil cardioids normally tend to lose their pattern at lower frequencies, although they become highly directional at high frequencies; this can often be useful. A number of users have found that the *U87* bass cardioid is not too good, and have preferred the AKG *414*. A good low frequency cardioid is important when it is required to cut rumble out of the microphone pick-up, particularly in tv studios or large concert halls.

A good high frequency cardioid performance is particularly important when cardioid microphones are to be used in pairs for stereo, since a narrowing of hf polar diagrams tends to exaggerate width at high frequencies, thus giving incorrect positioning to sounds slightly left and right of centre. Whereas sounds at the edges will appear very lifelike, a tendency to dullness in the centre will also be noticeable. This effect is exaggerated as the angle between the mics is increased, and frequently reaches an absurdity when the microphone capsules are back to back. This technique is nevertheless used sometimes when considerably more ambience is required in the general sound, when good mono compatibility is important, and when degradation of stereo image is acceptable. I prefer to use small capsule capacitor mics for stereo pairs if the accuracy of image is very important, and well remember the excellent positioning obtained from the Neumann *SM2* stereo microphone, which is unfortunately no longer available. This microphone, though, seemed to have rather an apparent bass loss when used in bi-directional polar diagram.

Bearing in mind the excellent sounds that can be obtained from two cardioids in close proximity, with an included angle of 110° or so, some enterprising manufacturer might make a simple stereo cardioid model having one rotatable capsule. Although it would be preferable for it to be a capacitor type, a moving coil could give good results, although it might have rather an odd shape in order to preserve the polar diagrams at all frequencies (which incidentally would have to be achieved by acoustic means). While discussing polar diagrams, I would like to disagree with the practice of some recording organisations in using a multitude of omnidirectional microphones to obtain a stereo balance. The path difference at low frequencies can give very strange cancellations and additions, and accurate positioning at high frequencies can only be achieved by the use of further mics. Recordings made with this type of technique seem to reproduce with a very 'woofy' bass and lack real positional definition; such positional clarity as exists is forced by multi miking. For those concerned in comparisons I would like to suggest comparing the stereo sound obtained by the BBC at St. John's, Smith Square, London, in which they normally use coincident mics, with that achieved by the commercial companies in the same venue. Omni mics also pick up more rumble than directional ones, and this can become very wearing when listening to records on good quality equipment.



The choice of capacitor microphone powering

Originally, when capacitor microphones were valve powered, separate mains power supplies were needed, and multicore cable connected the mic to the power supply. Now that virtually all capacitor mics have fet preamplifiers in them and include, in the mic head, means of converting lower voltages to the necessary high ones, for polarisation purposes, it becomes possible to power directly from the control desk. Although the most popular system, known as phantom powering, supplies positive dc to the microphone head on both live audio leads with a dc return via the screen, a few other systems are in use.

Sennheiser, among others, send positive dc on one audio leg and negative on the other, and the screen purely prevents hum, rf and static pick-up. The disadvantage is of course the possibility of a disaster occurring on accidental phase reversal coupled with failure of protection components, but nevertheless the system offers some important advantages. Since in a normal phantom power microphone the dc returns along the screen of the mic cable, any slight oxidation in connectors or screening can produce rectification of any rf in the vicinity, and thus cause quite serious interference. Although this can sometimes be eradicated by using 1:1 transformers near the microphone, with centre taps shorted together, and decoupled from screen, there is always a danger. In addition, a complete break in the screening will render the microphone inoperative, and this unfortunately happens rather frequently with some types of connector. I have had, for example, a lot of trouble with the AKG *412* and *414* connectors, and I cannot see why these cannot be changed to Cannons. The a/b powering system is usually 12V, and even if the screen becomes disconnected the mic will still work, although hum might be noticeable. The screen, if connected well to the microphone chassis, seems to give an improved rf screening, which is quite important when working near transmitters. Since there are tens of thousands of these around—both professional and amateur—the danger should not be underestimated. For example, Decca at their West Hampstead studios had continual trouble with local radio amateurs before a mutual understanding was reached. With trepidation, I must add that I am also a radio amateur, but I hope I have never caused such interference.

The choice between 48V and 9.5V phantom powering is difficult, but basically rests on the ease with which 48V power supplies can be made ripple-free, and the fact that 48V microphones draw only a minimal current, as against the advantages of 9.5V mics being operated in an emergency by battery power supplies run from easily available *PP3s*. Future Films, however, distribute a useful Pearl 48V power supply at a very reasonable cost, which uses two 24V batteries in series. We usually take these out on mobiles in case of any phantom supply fault on the desk. Most 9.5V capacitor mics obtain their internal ht from an rf oscillator driven from the 9.5V input, the oscillator transformer secondary supplying adequate voltage at low current to a rectifier smoothing circuit. Such mics can therefore have quite a high polarising voltage available, whereas some 48V mics are limited to that voltage for polarisation. The practice of using negative 12V phantom power supplies as used by one or two Continental firms is unfortunate; I can see no purpose in it, and any confusion can be serious.

Frequency response

Whereas moving coil microphones tend to

be rather peaky towards the higher end of their response, and often have a bass response tailing off somewhat sharply, ribbon mics are much smoother but lack extreme top. Capacitor mics are almost always much smoother throughout, but seem to have very definite shelf boosts from 1 kHz or so up to 10 kHz. In general, the Neumann range seems to have such presence boost, whereas AKG mics are much flatter. Nevertheless, the Neumann *KM84* cardioid is one of the flattest mics available. A shelf boost can sometimes be useful to achieve a special effect, and was originally designed to offset high frequency losses in air when mics were used at greater distances. Over the years, however, engineers have used mics closer and closer to the sound source, and such boosts are no longer necessary since they can be introduced in a different form in a control desk.

Unfortunately it is much more difficult to take away a shelf boost than to give presence lift, since removal of the boost means a fairly precise and opposite shelf which may be difficult to set by ear. This phenomenon is so important that it is worth quoting an example which actually happened on a recording session. A very beautiful harpsichord had to be recorded, a reproduction of an original instrument, in a central London church. Both a Neumann *SM69* stereo mic and a pair of AKG *414s* were put out approximately 3m from the instrument; subjectively both musicians and my recording team agreed that the AKG reproduced the sound more accurately. In that situation the *414s* reproduced the delightful tang of the instrument with a natural sweetness, whereas the Neumann sounded twangy and hard. The latter also seemed to bring up action noise; even introducing various hf shelves did not help, the main problem being that when any shelf cut was introduced it became very difficult to bring up the 15 kHz end of the response adequately and steeply enough. Although clearly a far more comprehensive equaliser would have done the trick, it seems hardly reasonable to be forced to take graphics along to live recording sessions.

The very latest mics to be designed by all good manufacturers seem to be reasonably quiet, but I can remember 15 years ago having a good AKG *C12* which, although flatter in response, was some 8 dB noisier than my Neumann *U47s*. Some capacitor mics seem to have a seriously coloured extreme top, but as this seems to be a matter of opinion, potential users should try various types, especially on massed strings. For such an assessment a loudspeaker with very low coloration must be used, and probably the best known examples are the Quad electrostatics and Spendor *BC1s*. A fair indication, however, can be gained from a good pair of electrostatic headphones, such as the better models made by Stax and Koss. On low frequencies many capsules obtaining their polar diagram acoustically seem to exhibit a loss, and a comparison between capsules on the rhythm section will soon show up any differences. Remember too that multi-polar diagram mics usually exhibit bass loss in their bi-directional positions. Unfortunately this loss has a tendency to be rather more than 6 dB per octave below 80 Hz or so. Don't forget, however, that an extended bass response below 30 Hz can cause problems in disc cutting, and cassette tape duplication.

Microphone sensitivity

Up to 34 dB difference in output has been measured between the very highest sensitivity capacitor microphones and some moving coil and ribbon types. Remember that a microphone having a very high output may well clip internally at high sound pressure levels. The control desk to which the microphone is connected must be capable of accepting very high levels. At least 15 dB should be held in hand on the control desk between the maximum level registered from the mic and the clipping level of the amplifier, since many sounds have what is termed an extremely high crest factor, this representing in dB the spikiness of the wave form. Muted brass instruments sound very much quieter than they actually peak, and one example of a capacitor mic that can easily distort internally on peaky wave forms is the STC *4136* which has an output level of approximately –50 dBm for a sound pressure level of only 74 dB. Singers closer than a metre to this microphone can cause distortion, and a trumpet 30 cm away from the microphone sounded extremely seriously clipped when I tried it during some tests for this magazine a few years ago. Clearly, this microphone had too much gain in the pre-amp. Some mics have switchable attenuator pads which act before the fet and allow them to be used close to very loud instruments. Most Neumann mics have such pads, and now most other manufacturers are introducing them.

Some capacitor mics have a rather low output, such as the earlier models of Calrec *1050*, only being 10 dB or so higher than dynamic types. Noisy microphone amplifier input stages will not have their input noise overcome by microphone noise, and therefore low output microphones should not be used with them. Great care should be taken in choosing capacitor mics for use with any 'domestic' recording equipment as almost certainly such equipment has been designed for use with dynamics, and capacitors will be likely to cause overloading. Note that for almost all capacitor mics having a nominal output impedance of 200 ohms the attenuator pad should have approximately 1000 ohms input impedance bridging the mic, and an output impedance of not higher than around 200 ohms.

Output impedance

As a rule in British studios, 200 ohm impedance mics should be selected for use with input stages having an input impedance of 1000 ohms. Most microphones will work satisfactorily into 600 ohms, but some models having their output impedance increasing at low frequencies, or having a variable impedance, may show response irregularities. 60 ohm mics should be used for mixers having an input impedance of 200-300 ohms. Make sure, however, that the impedance stated for the mixer is not the impedance of the microphone for which it has been designed.

There seems to be little point in having microphone preamplifiers with an input impedance higher than 1.5k ohms, although it is arguable that some mics might possibly give slightly less output distortion at very high levels when more lightly loaded. Some tape recorders, such as the new Revox *700* and the Nagra *4S* have high input impedances on the mic sockets, and this virtually discourages the use of dynamic microphones with the Revox because of noise problems, and of low output capacitor microphones with the Nagra because of insufficient mic gain. However, the Nagra may be simply modified (details from Hayden Laboratories).

Noise levels

Whereas moving coil and ribbon microphones require the quietest microphone preamplifiers into the control desk, capacitor types all have an inherent noise produced by their head preamplifiers. Capacitor mics in current use vary widely in equivalent noise, the quietest being most of the Neumanns, the Calrec series, the Schoeps and the Sennheiser range, while the noisiest appear to be the Neumann *KM86*, the AKG *451* and *C12A*, and some Pearl models. The very quietest mics are only needed, however, when they are to be used at a considerable distance from the sound source, or when amplifying quieter sounds such as speech, clavichords, church organs and distant musical instruments. Although I have experienced occasional noise problems with the AKG *C24* and the *451*, I have never had any trouble with the *414* or microphones in the Neumann range. Some Schoeps microphones have just come to hand (see Reviews), and these have proved to be most promising. The larger Sennheiser rifle mics, like all other mics in the range, are rf frequency modulation types having a very low noise, and are extremely useful for spotting distant instruments to give presence. My colleagues have used them on cathedral organs accompanying carols etc to add some weight to the treble pipe work, which would otherwise need close mics on an incredibly tall stand. If rifle mics are to be considered, I recommend that severe bass cut is introduced with great care in stereo placement since at lower frequencies rifle mics lose directionality and mixing them in flat could cause phase problems at low frequencies.

Price considerations

The most expensive mics are frequently not the best for a particular job, but as a rule it is probably more useful to buy microphones with three or more switchable polar diagrams, rather than those which are not switchable. If a number of microphones is to be bought, I suggest including at least one stereo one in addition to some pure cardioids. Inexpensive moving coil types are always useful as a standby, and many balancers like microphones such as the Beyer *M160* hyper-cardioid ribbon and STC *4038* pure ribbon. It also seems unwise to stick to only one manufacturer, since each maker has his own forte. Ruggedness and appearance are also important. Finally, but certainly not least important, is the recording engineer's own personal preference for a particular type.

Footnote: just before sending in this article I have heard that AKG are shortly producing a new 414 head connector coming out on an XLR socket rather than a multi pin. This will be a great blessing, and is a result of many complaints by users about the unreliability of the present connector. The D202 has very recently been modified to include a more reliable internal choke, and some of the fine wiring has been made more reliable.

Survey: microphones

KEY

TRANSDUCER TYPE. MC—Moving coil. R—Ribbon. C—Capacitor. El—Electret. RC—Varactor (tuned circuit fm system). DR—Double ribbon.

POLAR RESPONSE. O—Omnidirectional. C—Cardioid. HC—Hypercardioid. SC—Supercardioid. B—Figure of eight. S—Special. V—Various. VS—Various switchable.

ADASTRA

Adastra Electronics Ltd, Unit N22, Cricklewood Trading Estate, Claremont Rd, London NW2 1TU. Phone: 01-452 6288/9

Model No	Transducer type		Impedance	Output	Price	Remarks
EX220	C	C	600	70 dB	£20.25	Windshield.
B7105	C	C	600	70 dB	£24.30	Windshield.
B7107	C	C	600	70 dB	£15.70	

AKG

AKG Akustische Und Kino-Gerate GmbH, A-1150 Vienna, Brunhildengasse 1, Austria.
UK agents: AKG Equipment Ltd, 182/184 Campden Hill Rd, Kensington, London W8. Phone 01-229 3695/6.

Model No	Transducer type		Impedance	Output	Price	Remarks
D202	MC	C	300	.16 mV/μB	£54	Two way system.
D200	MC	C	250	.14 mV/μB	£40	Two way system.
D224	MC	C	250	.13 mV/μB	£72.40	Two way system.
CK1	C	C	N/A	.95 mV/μB		Condenser capsule.
CK2	C	O	N/A	.8 mV/μB		Condenser capsule.
CK5	C	C	N/A	.95 mV/μB		Internally suspended.
CK8	C	HC	N/A	1.5 mV/μB		Interference tube.
CK9	C	HC	N/A	1.1 mV/μB		Interference tube.
C451/2	FET preamps for use with above condenser mic capsules.					
C414E	C	V		.6 mV/μB	£173	Polar response switchable—inc. fig. of 8.
D58	MC	HC		.072 mV/μB	£20	Head only.
D190	MC	C		.23 mV/μB	£28	General purpose.
D590	MC	C		.13 mV/μB	£28	Head only.
D21	MC	C		.22 mV/μB	£43	Extended bass.
D160	MC	O		.13 mV/μB	£31	Windshield.
D1200	MC	C			£39	Variable bass.
D2000	MC	C		.23 mV/μB	£40	Designed for PA.
C510E	El	C			£52.70	Interchangeable cartridge.
C510E	El	O			£73.70	Studio Lavalier-tie pin.

BEYER

Eugen Beyer, Electrotechnische Fabrik, D71 Heilbron, Thereseinstrasse 8, PO Box 170, Germany. Phone 07131 82348.
UK agents: Beyer Dynamic (GB) Ltd, 1 Clair Rd, Haywards Heath, Sussex. Phone 0444 51003.

Model No	Transducer type		Impedance	Output	Price	Remarks
M160N	DR	HC	200	—152 dBm	£96.07	
M206NC	R	HC	200	—153 dBm	£46.99	
M500NC	R	HC	200	—153 dBm	£56.80	High front/back ratio.
M101NC	MC	O	200	—150 dBm	£48.24	Clamp and windshield.
M111N	MC	O	200	—153 dBm	£53.89	Studio Lavalier.
M67NC	MC	C	200	—148 dBm	£48.24	Speech/music switch.
M69NC	MC	C	200	—144 dBm	£36.15	
M201NC	MC	HC	200	—149 dBm	£49.10	Clamp/windshield.
X1NC	MC	C	200	—146 dBm	£31.84	General purpose Hum buck.

CALREC

Calrec Audio Ltd, Hangingroyd Lane, Hebden Bridge, Yorkshire HX7 7DD. Phone: 0422 84-2159.

Model No	Transducer type		Impedance	Output	Price	Remarks
CM901C	C	O	N/A	.4 mV/μB	POA	Integral windshield.
CM903C	C	O	N/A	.4 mV/μB	POA	Extended response.
CM950C	C	C	N/A	.4 mV/μB	POA	Extended response.
CM951C	C	C	N/A	.4 mV/μB	POA	Reduced bass.
CM956C	C	C	N/A	.4 mV/μB	POA	Reduced bass, windshield.
CB 9C	Self powered preamp, cannon fitting for above series.					
CM1003C	C	O	500	.8 mV/μB	£54.70	Extended response.
CM1001C	C	O	500	.8 mV/μB	£54.70	Windshield.
CM1050C	C	C	500	.8 mV/μB	£54.70	Studio cardioid.
CM1051C	C	C	500	.8 mV/μB	£54.70	Reduced bass.
CM2001C	C	O	500	.8 mV/μB	£54.70	Windshield, phantom.
CM2003C	C	O	500	.8 mV/μB	£54.70	Phantom powering.
CM2050C	C	C	500	.8 mV/μB	£54.70	Phantom powering.
CM2051C	C	C	500	.8 mV/μB	£54.70	Reduced bass, phantom.
CM2056C	C	C	500	.8 mV/μB	£54.70	Bass, phantom, windshield.
CM2101C	C	O	1k	.6 mV/μB	£54.70	Windshield, phantom power.
CM2103C	C	O	1k	.6 mV/μB	£54.70	Phantom power.
CM2150C	C	C	1k	.6 mV/μB	£54.70	Phantom power.
CM2151C	C	C	1k	.6 mV/μB	£54.70	Reduced bass, phantom.
CM2156C	C	C	1k	.6 mV/μB	£54.70	Bass, phantom. windshield.

CONDOR

Condor Electronics Ltd, 100 Coombe Lane, London SW20 0AY. Phone: 01-946 0033.

Model No	Transducer type		Impedance	Output	Price	Remarks
EM82	El	O	600	—65 dB	£12	Internal battery.
EM82H	El	O	50k	—46 dB	£12	Internal battery.
EM83	El	C	1k	—68 dB	£13.80	Internal battery.
EM83H	El	C	50k	—51 dB	£13.80	Internal battery.
EM84	El	O	1k	—65 dB	£12	Lavalier.

EAGLE

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

Model No	Transducer type		Impedance	Output	Price	Remarks
PRO M20	C	C	600	—60 dB	£32	Complete with clamp.
PRO M10	C	O	600	—70 dB	£35	Complete with clamp.
PRO M25	C	C	600	—70 dBV	£37.40	60 cm boom arm.

ELECTROVOICE

Electrovoice Inc, 600 Cecil St, Buchanan, Michigan 49107.
UK agents: Special Products Division, Gulton Europe Ltd, Brighton BN2 4JU. Phone: 0273-66271.

Model No	Transducer type		Impedance	Output	Price	Remarks
635A	MC	O	150	—149 dB		Broadcast, report.
660	MC	HC	150	—150 dB	£40	Low cost bass effect.
671	MC	C	150	—154 dB		
DS35	MC	C	150	—148 dB		High close bass effect.
RE15	MC	C	150	—150 dB	£99.50	Hum cancellation.
RE16	MC	C	150	—150 dB	£103.50	Hum cancel, anti-pop.
RE20	MC	C	150	—150 dB		Low cost bass effect.
RE55	MC	O	150	—149 dB		General purpose.

NEUMANN

Georg Neumann & Co, 71 Heilbronn/Neckar, Fleinerstrasse 29, Postfach 2120, Germany.
UK agents: FWO Bauch Ltd, 49 Theobald St, Boreham Wood, Herts WD6 4RZ. Phone: 01-953 0091.

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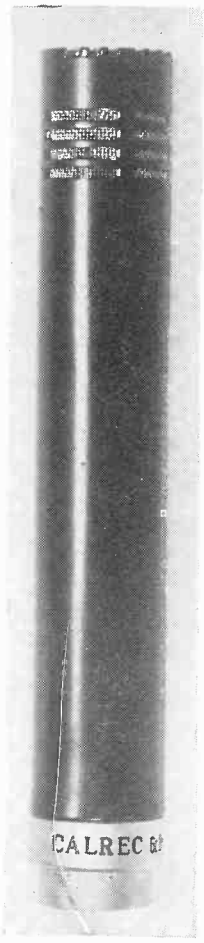
WHO'S WHO IN SOUND

AIR STUDIOS

Who's Who in sound know what's what when it comes to a sound recording system. Only the best is good enough for AIR Studios. Which is why they chose Neve. This 32 input, 24 track quadrophonic music recording console was specially designed to fit AIR's most advanced studio at Oxford Circus. It looks magnificent. The results speak for themselves.

Neve internationally sound people

Rupert Neve, Cambridge House, Melbourn, Royston, Herts. Telephone: Royston (0763) 60776. Or Cambridge (0223) 53454. Telex 81381. Cables Neve Cambridge.
2719 Rena Road, Malton, Ontario L4T 3K1, Canada. Telephone: 416 677 6611. 06968753
Berkshire Industrial Park, Bethel, Connecticut 06801, U.S.A. Telephone: (203) 7446230. Telex 969638. Hollywood Office: Telephone: (213) 465 4822.



Above: *STC 4038*

Right: *Calrec CM 1050C*

SURVEY

KM83	C	O	200	1.0 mV/μB	£91.72	Pressure unit.
KM84	C	C	200	1.0 mV/μB	£98.83	Pressure gradient.
KM85	C	C	200	1.0 mV/μB	£98.83	Rolloff 12 dB@ 50Hz.
KM86	C	VS	200	.8 mV/μB	£149.74	—10 dB atten. switch
KM88	C	VS	200	.8 mV/μB	£149.23	—10 dB atten. switch
KMS85	C	C	150	.6 mV/μB	£138.65	High sound levels.
U87	C	VS	200	.8 mV/μB	£150.73	Rolloff 200/30 Hz,
*U47*fet	C	C	150	.8 mV/μB	£140.78	—10 dB switch, 50 Hz rolloff switch.
*SM69*fet	C	VS	150	1.8 mV/μB	£332 75	Tandem transducers for coincident stereo
KMA	C	S	800		£87.45	Studio Lavalier.

All the above are for use with phantom powering from 48V dc.

PEARL

AB Pearl Mikrofonlaboratorium, Knutsgatan 6, S265 00 Astorp, Sweden. Phone: 042-515 20.
UK agents: Allotrope Ltd, 90 Wardour St, London W1V 3LE. Phone: 01-437 1892/3.

D441LS	MC	HC	200	—51 dB	POA	Windshield, anti-pop.
LD18	MC	O	200	—74 dB	POA	
RD16	MC	C	200	—70 dB	POA	Small size.
RD34	MC	C	200	—74 dB	POA	
F69	MC	C	200	—70 dB	POA	High output.
HM47	MC	O	200	—76 dB	POA	Studio Lavalier.
HM49	MC	O	200	—74 dB	POA	High performance.
CL3	El	O	200		POA	Tie clip studio mic.
DC20	C	O	200	—46 dB/Pa	POA	
DC21	C	C	200	—44 dB/Pa	POA	
DC63	C	V	200	—60 dB	POA	Variable polar pattern, inc. fig. of 8.
DC73/12	C	C	200	—40 dB/Pa	POA	10-50V powering.
DC73	C	C	200	—46 dB/Pa	POA	
DC96	C	C	200	—61 dB	POA	Low noise, 130 dB dynamic.
EC71	C	C	200	—58 dB	POA	Miniature high performance.
EK71	C	O	200	—58 dB	POA	Miniature high performance.
FP92C	El	C	200	—66 dB	POA	Self contained battery.
FP92CO	C	C	200	—38 dB/Pa	POA	Internal 15V battery.
FP92KO	C	O	200	—42 dB/Pa	POA	Internal 15V battery.
SP84	C	O	200	—42 dB/Pa	POA	Variable rolloff. 15V.
SP85	C	C	200	—42 dB/Pa	POA	Variable rolloff. 15V.
ST8	C	V	200	—46 dB/Pa	POA	120V. Dual unit for coincident stereo.
TC4	C	C	200	—52 dB	POA	120V. Very high performance.
VM40	C	O	200	—48 dB/Pa	POA	Speech/music/ —10 dB switch.
VM41	C	C	200	—48 dB/Pa	POA	Speech/music/ —10 dB switch.

Interference tubes supplied for *SP85, VM41* only as complete unit.
Unless otherwise stated, mic power supplies are 48+6—8V phantom.

PHILIPS

Pye Business Communications Ltd, Cromwell Rd, Cambridge CB1 3HE. Phone: 0223-45191.

EL6042	MC	O	200	.12 mV/μB	£47.50	QD adaptor.
LBB9005	MC	C	200		£28.	Hum compensation.
LBB9050	MC	C	200	.14 mV/μB	£33	Two way system.
LBB9101	MC	O	200	.16 mV/μB	£36	

ROSS ELECTRONICS

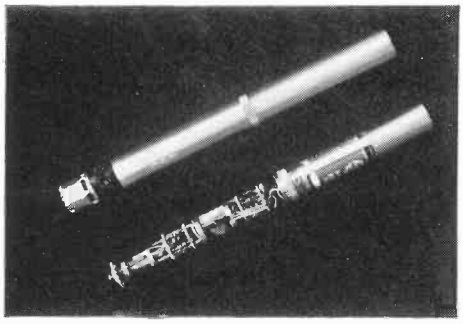
Ross Marks Ltd 32 Rathbone Place, London W1P 1AD. Phone: 01-580 7112/3.

RE325	MC	C	600	—54 dB	£9.66	Dual impedance.
RE330	MC	C	600	—55 dB	£11.06	Dual impedance.
RE335	MC	O	600	—57 dB	£11.06	Dual impedance.
RE345	MC	C	600	—72 dB	£12.75	Anti-pop.
RE360	El	O	600	—62 dB	£13.59	FET preamp/HP7 cell.
RE365	El	C	600	—68 dB	£14.91	FET preamp/HP7 cell.

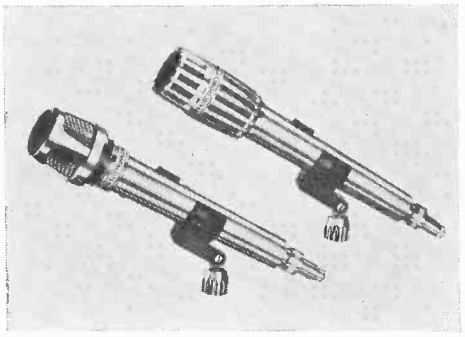
SCHOEPS

Feldon Audio Ltd 126 Great Portland St, London W1N 5PH. Phone: 01-580 4314.

CMT540U	C	C	1k	1.3 mV	£113	lf filter.
CMT441U	C	HC	1k	1.3 mV	£115	
CMT55U	C	O/C	1k	1.2 mV or 1.5 mV	£133	polar response sw.
CMT56U	C	V	1k	1.0 mV	£146	
CMTS501U	C	V	1k		£306	stereo coincident.
32U	C	O	1k	2.0 mV	£119	
34U	Cardioid version of *32U*				£119·50	
340U	As *34U* with lf filter				£122	
331U	Hyper-cardioid version				£123	
CMTS301U	C	V	1k		£112	stereo coincident.
CMT42	C	O	1k	1.5 mV	£112	
CMT44	C	C	1k	1.5 mV	£112	
CMT440	As *CMT44* with lf filter				£114	
CMT441	Hyper-cardioid version				£115	
35U	C	O/C	1k	1.9/2.3 mV	£135	polar response sw.
36U	C	V	1k		£153	
CMT45	C	O/C	1k	1.4/1.7 mV	£128	polar response sw.
CMT46	C	V	1k	1.0 mV	£150	polar response sw.
CMT52U	C	O	1k	1.3 mV	£108	
CMT54U	Cardioid version of *CMT52U*				£108	
CM62T	C	O	1k	1.4 mV	£155	
CM64T	C	C	1k	1.4 mV	£156	
CM640T	C	C	1k	1.4 mV	£156	
CM641T	C	HC	1k	1.4 mV	£156	
MK2	C	O	600	1.2 mV	POA	Capsule.
MK3	C	O	600	1.0 mV	POA	Capsule.
MK4	C	C	600	1.2 mV	POA	Capsule.
MK40	C	C	600	1.6 mV	POA	Capsule for speech.



Above: *Pearl reed switches*



Above: *Philips LBB 9005/06*

Above: *Millbank 2255*

Left L to R: *Ross RE 345 & RE 350*

MK41	C	HC	600	1.3 mV	POA	Capsule.
MK5	C	O/C	600	1/1.2 mV	POA	polar response sw.
MK6	C	V	600	V	POA	various polar responses.

SENNHEISER

Sennheiser Electronic, 3002 Bissendorf/Hann, Germany. Phone: 05130-8011.
UK agents: Hayden Laboratories Ltd, Hayden House, 17 Chesham Rd, Amersham, Bucks HP6 5AG. Phone: 02403-5511.

MD441U	MC	HC	200	—52 dBm	£69	Treble/bass switch.
MD421U4	MC	C	200	—52 dBm	£49.50	Bass atten. switch.
MD413U	MC	C	200	—56 dBm	£39	Anti-boom.
MD21N	MC	O	200	—52 dBm	£29.80	Robust.
MD214U3	MC	O	200	—58 dBm	£50.85	Lavalier studio mic.
MD211U	MC	O	200	—56 dBm	£53.80	40-20 kHz ±2.5 dB.
MKE201	El	O	1.5k	—32 dBm	£32.05	5.6V internal battery.
MKE401	El	SC	1.5k	—27 dBm	£37.40	5.6V internal battery.
MKH415T	RC	SC	200	—32 dBm	£130	12V phantom, interference.
MKH815T	RC	L	200	—26 dBm	£130	12V phantom, interference.
MKH125T	RC	O	150	—32 dBm	£153	Lavalier 12V.
MKH105T	RC	O	200	—32 dBm	£108	20-20 kHz ±2.5 dB. 12V.
MKH110	RC	O	2k	—32 dBm	£133	8V phantom power.

The *MKH110* is intended for instrumentation in the range from 0.1 Hz to 20 kHz. As such, a three volt dc offset exists on the output.

SHURE

Shure Electronics Ltd, Eccleston Rd, Maidstone, Kent ME15 6AU. Phone: 0622-59881.

SM5B	MC	C	150	—79.5 dB	£165	Boom mounting.
SM5C	MC	C	50	—84 dB	£173.40	100 Hz Hi-pass.
SM7	MC	C	150	—79.5 dB	£148.80	Boom mounting.
SM53	MC	C	150	—81 dB	£99	Hum buck, anti-pop.
SM56	MC	C	200	—76 dB	£159.99	Stand, extended bass.
SM57	Hand held *SM56.*				£48·60	
SM58	MC	C	200	—76 dB	£62.40	Shock proofed.
SM33	R	SC	150	—81 dB	£97.20	Stand.
SM51	MC	O	Low	—82 dB	£46.20	Studio Lavalier.
SM60	MC	O	Low	—81.5 dB	£31.80	Anti-pop.
SM76	MC	O	150	—87.5 dB	£78	Extended response.
SM50	MC	O	150	—78.5 dB	£50.40	Robust.

Most of the above are dual impedance.

Unidyne IV series					
	MC	C	H/L	.13 mV/μB	From about £39.
Unidyne III series					
	MC	C	H/L	.12 mV/μB	From about £34.
Unidyne II series					
	MC	C	V	.12 mV/μB	From about £34.
Unisphere I					
	MC	C	150	.14 mV/μB	From about £38 to £75.
Unisphere B series					
315	R	B	H/L		£40.80
300	R	B	H/L		£66.60
579SB	MC	O	Low	.1 mV/μB	£29.40
578	As *579SB*				
576	MC	O	150	.094 mV/μB	Extended response.

SONY

Sony Showroom, 134 Regent St, London W1. Phone: 01-439 3874.

ECM22P	El	C	250	1.5 mV	£59.95	600 ohm alternative.

STC

Hampstead High Fidelity, 91 Heath St, Hampstead, London NW3. Phone: 01-435 6377.

4038	R	B	300	—85 dB	For levels to 125dB spl.
4021	MC	O	300	—80 dB	Studio and acoustic ref.
4104	R	C	300	—80 dB	Noise cancel, lip guard.
4115	R	C	300	—85 dB	Broadcast.

TURNER

Millbank Electronics Group, Uckfield, Sussex TN22 1PS. Phone: 0825-4166.

2203	MC	O	150	—57 dB
2203	MC	C	150	—57 dB

NEWS

ORTF Strike

AT THE TIME of writing ORTF is being hit by a series of strikes by journalists. The first two day strike was held on October 8 and continued the next day. The journalists have given notice that they will hold another two-day strike on October 29 and 30. The strikes are expected to continue until the journalists are guaranteed employment when the act which approved the splitting of ORTF into seven separate companies comes into effect on January 1, 1975.

The journalists have learned, according to one source, that between 250 and 300 freelance journalists—one third of the freelances who work for ORTF—and about 200 of the 1050 contract journalists will be made redundant. The journalists say that ORTF is not overstaffed, that the company has fewer journalists working for it than the BBC and the number is about the same as countries such as Italy, Poland and Yugoslavia. 'It has become very smart, very chic to say that we are overstaffed,' said one, 'but what people forget is that we have 23 provincial centres in France and a number of regional centres overseas, which account for about 400 journalists. We have about 150 working in external broadcasting. Another thing is that in France, cameramen are counted as journalists, but they are not in England. There are three channels as well as all the regional centres, which means more than 200 cameramen.'

The external broadcasting service will disappear entirely when the new *régime* begins on January 1. Journalists were not reassured when, on October 24, the director general of the French commercial radio station Europe One, M Maurice Siegal, was sacked and strike leaders announced that their action would continue 'for as long as necessary' beginning on the following Tuesday.

The splitting of ORTF into separate competing sections was announced by Jacques Chirac, the French Prime Minister, as part of the new President M Giscard d'Estaing's clean sweep, six weeks after he came to office. There would be three television stations and three radio stations plus an audiovisual research institute. As we reported in September ORTF has lost £15.1 million in the last two years. A colour version of 'The Sleeping Beauty', for example, was shown in black and white after the budget for the production had been overspent by £85,000. D'Estaing had promised before the election that, if elected, he would give the problems of ORTF top priority. He was as good as his word. Indeed he acted so swiftly that opposition to the move was in disarray. This opposition includes the trade unions, the press and the left.

They have opposed the plan on the basis that the government wish to destroy the state monopoly and set up a third channel dependent on advertising which would, they say, 'be the death of French culture, not to say deprive the press of advertising'. When the bill to authorise the dismemberment of ORTF was introduced more than 100 amendments were tabled. Speaking in the debate M Chirac said the government wanted a free and democratic radio and television which were the property of no-one, subject to no private interest, but at the service of the nation as a whole: 'We think that the state monopoly is the best guarantor of the independence of a public service, but it must not be a sort of comfortable protection against competition.'

Four state companies would be set up, he said, run by boards of six members. Two of the board would be representatives of the state, one a member of parliament, and there would be one each from the press, the staff and the arts and literature. Three of these companies would each control one of the television channels and the fourth would be responsible for the radio. Each company would be responsible for its budget and programmes. A fifth company would 'administer the actual technical means of broadcasting' and a sixth would be responsible for 'heavy' cultural production, for which it would be financed from public funds, for supplying programmes to the three television and the radio channels in competition with commercial programme makers.

The bill was approved on July 25 by 290 votes to 183 after some heated exchanges when the left tried to block the bill, which was then sent to the senate for approval.

According to reports, workers in ORTF do not think the new system will be financially successful. As far as advertising revenue goes the old organisation was limited to 25 per cent of its revenue, the rest having to be made up by the licence.

It seems, however, that the ORTF had a great deal of difficulty in bringing the amount of advertising up to the 25 per cent limit.

The unrest should be seen against the background of a general feeling of insecurity in France, traditionally a country which reacts strongly to low levels of unemployment that would be considered unfortunate but unavoidavble in other countries. An agreement was signed on October 15 between the French employers' federation, the CNPF, and all the trade union organisations stating that any Frenchman made redundant for economic reasons would receive a year's pay, an agreement which one report described as the first of its kind that any working class movement has obtained anywhere. That has not assuaged the fears of the ORTF journalists, however, for they say that the payments will be made monthly and that attendance will be required at a redundancy office, where the unemployed man will be offered any job available. If he doesn't want the job his redundancy payment will be cancelled, said one.

The coming reorganisation of ORTF is the ninth in three years. One journalist, asked if there might be a tenth, said he didn't know. The government is prepared for it. In announcing the proposed changes early in July M Chirac said 'The hypothesis of transfer to private ownership (of one television channel) had its defenders and its advantages. We considered, however, that the traditional mission of the ORTF should not be brought into question. It is a fundamental option, but should it appear that we had been mistaken, we would go back on this option'.

Giscard d'Estaing is no less determined. In his first presidential press conference he said: 'A country which has the cultural tradition of France must have a radio and television which are among the best in the world.'

Mr Len Young

THE DEATH HAS been announced of Mr Len Young, the well known and respected chairman of Vitavox, at the age of 71.

Mr Young, who founded his company in 1931, was considered one of the great pioneers of the sound manufacturing industry; his avowed aim was always to produce the best sound equipment available. Since it was founded, his firm has gone from strength to strength and now exports to 34 countries.

Mr Young was a founder-member of the APAE.

Low cost level meter

PARTRIDGE ELECTRONICS, the sound mixing equipment company, have introduced a new level meter to their range of products. Described as a 'peak reading vu meter', this instrument operates as a vu meter with a faster than normal rise time. This unit, which uses a Bach-Simpson movement, produces a 0 dB reading with 0 dBm line level. Power requirements are 24V at 4 mA. This meter claims to fill the gap between the conventional vu and the expensive ppm system of metering. Price is £8.32 from Partridge Electronics Ltd, 21/25 Hart Road, Benfleet, Essex SS7 3PB. Phone: 03745-3256.

Compact broadcast console

NEVE HAVE ANNOUNCED a new 20 channel broadcast console arranged into four groups with two outputs. This desk, designated type *5301*, was first shown at the London IBC and is claimed to be one of the most compact units of its type in the world. Taking up a mere 1.2m of space, the desk is available with a rack mounted patch bay for use with ob vehicles; the other model has integral patch bay and furniture surround for tv studios etc. Rupert Neve & Co Ltd, Cambridge House, Melbourn, Royston, Herts. Phone: 0763-60776.

Electronic music mag with a difference

A NEW ORGAN, under the editorship of Jacob Meyerowitz, intends to put music back into the expression 'electronic music'. To be called 'Analog Sounds', his magazine

will concern itself as much with the creation of music by electronics as opposed to the creation of electronics for its own sake.

The quarterly issues will comprise four distinct parts: method, procedure, medium and process. The first two parts concern themselves with the parameters of music, its theory and practice. The last two sections will show and detail the applications of electronics to obtain the required effects. The magazine is intended to be sequential; the four sections may be split up and bound to make four reference volumes. Published in the USA, the annual subscription (four issues) is $15. 145 West 55th Street (Apt. 6F), New York, NY 10019, USA.

Three level sequencer

ELECTRONIC MUSIC LABORATORIES of Vernon, Connecticut have added a new three level by 16 step sequencer, the *EML 400*, to their range of synthesiser products. Of modular construction, this unit will enable functions such as vc envelope generators, vco, vca and vc filters with three programmed voltages for every note in a 16 note sequence. To create longer sequences, further memory boards (type *EML416*) may be added; alternatively, they can operate in parallel to provide more functions per step.

To create a stepped synthesiser within a synthesiser, an *EML401* module may be added to the basic *400*. This contains two vcos with phase lock facility, a vc filter, a vc envelope generator, a modulator and vca. A separate power supply is available. This couplet would operate within the framework of an existing synthesiser. Electronic Music Laboratories Inc, P.O. Box H-4, Vernon, Connecticut 06066.

Radio Idi

CEC, A DIVISION of the Cetec Corporation of America, has recently announced the signing of a contract to supply broadcasting equipment to the Republic of Uganda. Valued at £175,000, the shopping basket includes broadcast studio mixers, disc consoles, tape recorders and a UK developed solid state matrix switching system. The Sparta Electronic Corporation, another subsidiary of Cetec, is to supply much of the equipment which will form the basis of the Ugandan external broadcast service controlled by General Idi Amin VC (self awarded). Cetec Inc, 13035 Saticoy Street, North Hollywood, California, USA. Phone: 213-875 1900. For the UK: Computer Equipment Company Ltd, Shaftesbury Street, High Wycombe, Bucks HP11 2NA. Phone: 0494-37529.

Bigger Theatre Projects Group

STAGESOUND LTD, the sound company founded by the late Bill Walton, has become part of the Theatre Projects Group. TPG say that the facilities of Stagesound are entirely complementary to their own interests, and it is hoped that the addition will provide a more efficient dubbing and editing service to the educational and industrial training sector. Theatre Projects Group, 10 Long Acre, London WC2E 9LN. Phone: 01-240 5411.

Mixing with the knobs

SIFAM, TRADITIONAL PURVEYORS of meters to the electronics industry, have announced their entry into a new market with a range of collet fixing knobs. The company spent two years researching the range resulting in a series of collet knobs available in diameters of 11, 15, 21 and 29 mm. The series has been designed so that a smaller knob will fit within the fixing recess of the next size up enabling use as a concentric pair. Manufactured in several colours, most of the range is available ex stock. Sifam Ltd, Woodland Road, Torquay, Devon TQ2 7AY. Phone: 0803 63822.

l/r Hallam

RADIO HALLAM, the group awarded the franchise to operate the local radio service for the Sheffield and Rotherham area, started broadcasting on October 1. In keeping with the IBA charter, the investors in the new radio company represent a wide range of local interests including Sheffield Newspapers, Trident Television, several trade unions, employers such as Delta Enfield Cables and a host of other people. Of passing interest is the board of directors; the youngest member, managing director and station manager Bill MacDonald, is 46; the others, all local dignatories, are very much more advanced in years. If a crime is committed in the Sheffield district, the miscreant stands a good chance of being brought before the board of Radio Hallam; three out of eight of the directors are magistrates.

This fact aside, Radio Hallam promises to be successful under Bill MacDonald's affable direction. The average age of the operating staff is about 28, rather less than that of the board of directors. The personality of the station embodies the form of Keith Skues, programme director, general factotum—and by his own definition —'dogsbody'. Keith, who has an impressive track record from the halcyon days of pirate radio, is responsible for defining much of the musical attitude of Radio Hallam as well as presenting some of the programme output in person. In the latter task, he is helped by ex BFN, Lux, Beeb and Pinky & Perky man Roger Moffat.

In common with other independent local radio stations, Hallam spreads its interests over a wide range. The station uses most of the daily nine hours of needle time but still provides coverage for local events. According to Bill MacDonald, much local interest revolves around sport; there are six football clubs in the service area which may help to focus local interest on Radio Hallam by providing extended ob cover of the matches. To give a sense of community spirit to those people who don't like football, Bill intends to present local talent spotting programmes (please call Bill, not us).

In common with the ilr network, the station transmits on medium wave, and in vhf using circular polarisation; this type improves the standard of reception on fm portable radios that use a vertical rod aerial. The station transmits from Tapton Hill on 95.2 MHz, and from Skew Hill on 1546 kHz. When supplemented by a vhf relay situated at Rotherham, the expected coverage of Radio Hallam will be about 660,000 people.

Counting pennies

SOME GOOD NEWS for users of impulse counters; Kynmore, who manufacture a large range of impulse counters, have lowered their oem prices by 25% for six models in their range. This has been brought about by rationalisation of the product line leading to cheaper production costs. Kynmore Engineering Co Ltd, 19 Buckingham Street, London WC2. Phone: 01-839 2371.

Costly Classic

A CASSETTE TAPE which promises 'performances that are indistinguishable from disc or open reel' must be very expensive. The new Classic Cassette range from 3M is. The cassettes, which obtain their claimed performance by Fe_3O_4/C_rO_2 dual coating technology, cost £2.16 rrp for the *C90* size. At the launching reception for the Classic range, 3M stated that they would ensure that their product went on to the retail market at the full recommended price. Recording Materials Division, 3M United Kingdom Ltd, 3M House, Wigmore Street, London W1A 1ET. Phone: 01-486 5522.

AES Convention

WITH AROUND FIVE months until the AES convention at the Cunard Hotel, London all the stands for the exhibition have been taken and nearly half the number of papers needed have been accepted. If unofficial reports prove correct the convention in London will prove interesting from a number of points of view. The first is that the number of papers has been restricted so that no more than two will be read at any one time. The second is that there has been a rejection rate of around 60 per cent of those submitted. The rejected papers were considered either not technical enough, not sufficiently novel in content, or merely public descriptions of commercial ventures.

Some lectures will be an hour long and some half an hour, to allow a proper time for each paper according to the needs of each. This move has, apparently, upset the American AES, which has proved very conservative in its approach to this convention, as to others. But they were even more upset when the London organisers told them that all the papers would have to be presented with a preprint for distribution to delegates, that the preprints would be available in a single bound volume and, worst of all, that this volume would be presented to all delegates to the convention. It looks as if London's first convention may, after all, give the parent organisation something to think about.

Swann song

SIR MICHAEL SWANN, chairman of the BBC Board of Governors, has made two important speeches since the general election expressing concern about the future of the BBC. The first was delivered at a luncheon given by the Broadcasting Press Guild in London on October 15. He said that the BBC had said a long time ago that the present licence fee would only keep the corporation going until the spring of 1975 'when we are likely to be around about the limit of our borrowing powers'.

The licence fee would have to be increased, he said, and his personal view was that it would be just to have a colour fee twice that for black and white. Two pounds

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on each of the fees would make a significant difference, he said, but he thought it better that the colour licence should be increased more. He quoted Denmark's licence fee as £42.57 and Holland's as £17, which he said was one of the lowest in Europe.

He said that the corporation had been making economies, 'though you can fiddle around with minor economies the only way you can make major ones is by cutting programmes. The sort of thing we could develop is that we do not fill vacant posts, make cuts in hours —that sort of thing'. That would be the situation if the fee were not increased.

He said that direct financing might be a great deal less troublesome for a government but it would be a great deal more trouble for the BBC: 'As long as you have a licence fee you preserve a degree of independence not so easy to preserve if you are financed directly. One way or another you are much more potentially subject to government intervention.' He was in favour of index-linking of the licence fee to the cost of living.

His remarks were made off the cuff, the BBC say, and a copy of them is not available. However, for a speech made to the Royal Television Society in Birmingham, copies were made available to the press beforehand. In it he expressed anxiety that the independence of the BBC might be eroded. Its independence rested on freedom from government control, which ensured that listeners trusted what you broadcast, and kept internal editorial freedom, avoiding an attachment to right or left or to any pressure group.

Speaking of accusations of bias he said that they were not equally balanced between right and left: 'Instead, when there is a Conservative government the complaints are mainly of left wing bias, and when there is a Labour government of right wing bias.'

'If we are being, as we try to be,' he continued, 'scrupulously impartial, it inevitably follows that we are likely to annoy the party in power more than the party in opposition . . . It has been suggested to me once or twice by civil servants . . . that the process of government has now become so difficult that the media in general and the BBC in particular while reporting impartially, should lean, if only slightly, towards Government . . . But I am clear that this is an impossible request.'

The licence fee was a guarantee of the BBC's independence, he said, although many objections were raised to it. He thought it was good value for money, and that politicians had talked themselves into thinking that rises in the licence fee were unpopular. 'In times of high inflation it is likely to need raising rather frequently. . . the fee has in fact remained static for nearly four years and must be the only thing in Britain that has.'

Speaking of alternative means of financing he said there were many objections to pay-as-you-view, though he did not say what these were. Advertising too had objections, one of which that there was not enough to go round. 'Our fear is quite simply that direct government finance would slowly, perhaps almost imperceptibly, but very surely erode our independence.' One has to be a 'very saintly payer of the piper not to wish to call the tune, and there are very few saints around. The plain fact is that government is responsible for what is done with government money.'

A week later Sir Michael made a widely publicised lunchtime speech to BBC staff. He said that the responsibility for programmes must rest with the people who make them. Although the governors were the custodians of the public interest in broadcasting they could not possibly see and evaluate all the 100,000 hours of programmes the BBC put out nationally every year. 'Who, I wonder, would indoctrinate the censors and what would this do to the confidence and self respect of the programme makers? I shudder to think.'

The week of the first speech ended with a question about the future of broadcasting being asked on 'Any Questions?' but, mercifully and by the sheerest coincidence, Marghanita Lasky, who is on the Annan Committee, was on the panel to answer it. She exhorted listeners to write to the committee telling them what they thought on the subject. Lord Windlesham has also said his piece on the independence of the BBC. This spontaneous burst of loyalty to the corporation may be not unconnected with the fact that the Annan committee takes its last evidence at the end of the year, only a few weeks away. More of the kind may be expected.

New premises for expansion

HELIOS ELECTRONICS, the mixing console manufacturers, have moved to larger premises situated at Browells Lane, Feltham, Middlesex TW13 7ER. The new phone number is 01-890 0087/8/9. By way of a welcome, Helios recently received an order for three broadcast consoles to be delivered to Mainos tv, part of the Finnish broadcasting network.

Solid state 250W fm transmitter

AVAILABLE IN TABLE TOP format, the *DFM-250-SS* fm power amplifier from Sintronic develops a claimed 250W from completely solid state circuitry. The unit is said to meet the relevant CCIR and FFC standards for broadcast transmitters when used with a low power exciter/driver. The manufacturers recommend their own *DFM-10* unit for use with the amplifier. Intended for fm use only, amplifier operates under class C conditions at a constant power level and duty cycle. Broadcast/Communications Division, Singer Products Company Inc, One World Trade Center, Suite 2365, New York, NY 10048, USA.

Windlesham

LORD WINDLESHAM, 42, leader of the Conservative opposition in the House of Lords, has joined ATV as a full time joint managing director. The other joint managing director is Mr Bruce Gyngell, formerly deputy managing director of ATV Network Ltd, and now also deputy chairman of ATV.

Lord Windlesham, who joined ATV in November after announcing his decision following the Conservative defeat during the election, made a speech just after his announcement praising the BBC for having established an independent system of broadcasting in this country: 'All broadcasters should be concerned about the principle of independence, and any new arrangements for financing the BBC should be made only after a period of very thorough scrutiny by an all party independent committee.'

Lord Windlesham joined Associated Rediffusion in 1957 where he was an executive producer on documentaries. He was made a director in 1965. In 1967 he joined Grampian where he was managing director and controller of programmes until 1970, when he joined the Heath government as Minister of State at the Home Office. In 1972 he moved to the Northern Ireland office. He became leader of the Conservative peers in June 1973, having served on Westminster City Council from 1958 to 1962. He delivered a Granada Guildhall lecture in 1974 on politics and broadcasting.

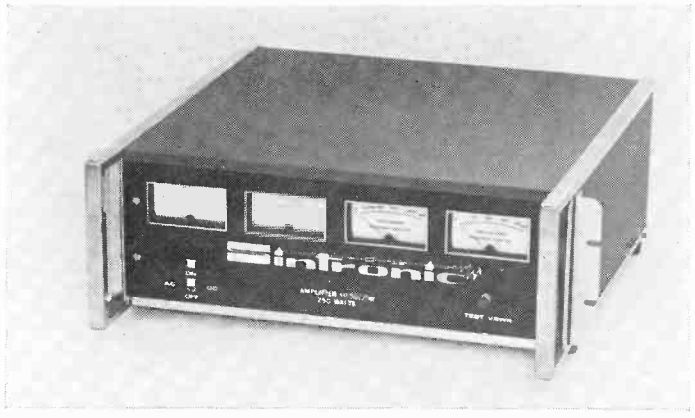
Low cost open headphones

BEYER DYNAMIC HAVE recently introduced a low cost open headphone onto the British market. Although the phones look very flimsy (which also implies that they are very light), they are claimed to be very tough and capable or taking much abuse. A very brief listening test indicated that the sound quality was much higher than the £7.83 price tag would suggest. On the subject of microphone stands, Beyer said that they intended to import the Konig and Meyer range from West Germany. Beyer Dynamic (UK) Ltd, 1 Clair Road, Haywards Heath, Sussex. Phone: 0444-51003.

Direct drive turntable unit

POWERED BY A 20 pole direct drive dc servomotor, the *SR717* turntable from Sansui is claimed to provide 'state-of-the-art' performance. The quoted short term speed stability is 0.035% with a rumble figure better than –60 dB. The tone arm is also new; it is fitted integrally with the turntable and is said to do all the things that a good tone arm is supposed to do. Other

Sintronic DFM-250-SS



features include a built-in strobe with fine speed adjuster, a direct reading stylus pressure gauge and a plinth which was specially designed to damp out resonances. The price is £222.44. Sansui Audio Europe SA, 39/41 Maple Street, London W1P 5FU. Phone: 01-580 5352.

AIR

JUST OVER FOUR MONTHS after Chrysalis announced they had taken over Wessex recording studios comes the news that they have purchased AIR studios and all its associated companies for a total purchase price of around £1 million. Chrysalis have obtained a majority shareholding in AIR with an option to buy the rest of the shares within five years, though it may not take that long.

At the beginning of August AIR nearly completed a deal with DJM but a last minute hitch developed and prevented the deal going through. It was widely supposed in the industry that George Martin would continue to try to find a buyer for AIR and that he was interested in setting up a floating studio on a yacht.

Chrysalis say their pre-tax profits this year will be £1,500,000. They now own six multi-track recording studios and they say this makes them one of the biggest studio groups in the world.

Cassette tape

CLAIMED TO POSSESS a performance equal to chromium dioxide formulations, the new ferric oxide *X1000* cassette from EMI costs only 99p (*C60*). EMI state that the frequency response extends from 25 Hz to 15 kHz without giving the recording level at which this figure was obtained. EMI, Blyth Road, Hayes, Middlesex. Phone: 01-573 3888.

Tandberg instrumentation recorder

THE AGENCY DIVISION of Farnell Instruments has announced the availability of Tandberg's new four channel fm carrier tape recorder model *TIR 115*. This is a lightweight portable recorder using 6.25 mm tape at speeds of 2.37, 9.5 and 38 cm/s. The frequency response is from dc to 5 kHz at the highest speed. A crt monitor displays the carrier deviation of all four channels simultaneously; in addition, one channel may be used for vocal comments. Farnell Instruments Ltd, Sandbeck Way, Wetherby, Yorkshire LS22 4DH. Phone: 0937-3541/6.

Independent Local Radio

TWO MORE INDEPENDENT local radio stations have taken to the air: Swansea Sound, who started regular broadcasting on September 30, and Radio City who likewise commenced on October 21. Swansea Sound (managing director Charles Braham) fields a board of directors whose makeup is best described as obscure; this may well reflect the local nature and integrity of the station.

Radio City, which broadcasts to the Liverpool area, is made up of enterprising scouses such as Ken Dodd and Carla Lane under the managing directorship of Terence Smith, a well-known journalist.

US standard for amplifiers

AS A RESULT of a recent ruling by the US Federal Trade Commission, power output ratings claimed for amplifiers used in domestic and in-car entertainment products must now conform to a fixed format. The new regulation, effective November 4, requires the output rating to be given in rms watts per channel, both channels driven, together with the corresponding frequency response, load impedance and total harmonic distortion specified at that rating.

RAI

THE HEAD OF Italian Radio and Television, Signor Ettore Bernabei, has resigned. The news that he would do so was leaked by the company he is to join, Italstat, a construction firm, only days before journalists, politicians, writers and civil rights campaigners were to march on RAI Headquarters on September 20. We understand from RAI's office in London that he would continue in office as general manager until the organisation's charter expires on November 30, 1974.

The London office of RAI would make no comment on the reasons for Bernabei's unpopularity and would make no statement on reports that he used autocratic and unorthodox methods, or that he used the state radio and television service as a source of political patronage and nepotism, or that he ran up huge deficits. He was said to have encouraged political control of the RAI's output, controlling news and documentary programmes so that social problems would be glossed over but politicians' activities would be covered in full. Little coverage would be given to political scandals, riots or the soaring cost of living.

The close of November marked the end of a troubled period for RAI. In July Italy's constitutional court ruled that RAI's monopoly of radio and television was illegal. The state had no right to ban cable television and private relay stations beaming foreign television services into Italy. Such a state monopoly could be constitutional only if it guaranteed free, impartial and representative information. 'These are now lacking,' they said. The Italian government had banned cable television in 1973 and the decision contributed to the downfall of the coalition government led by the Christian Democrats under Signor Andreotti. In June this year the dismantling of private relay stations beaming programmes from Switzerland and Austria was ordered but Telebiella, a Turin cable television company, appealed against the decision, and others followed suit. During the recent campaign for a referendum on divorce the RAI service was accused of bias.

RIAA equaliser

DESIGNED FOR BROADCASTING, the Stereo Disc Amplifier from Surrey Electronics provides amplification, equalisation and filtering of signals from magnetic pickup cartridges. The unit is claimed to meet the full IBA specification for disc preamp equipment; the quoted noise figures are -58 dB referenced to 6 mV input to produce an output level of 0 dBm. The 18 dB/octave filters corner at 24 Hz and 10 kHz; the low pass circuit is switchable on the front panel for surface noise reduction. The unit is self powered from standard ac lines through an XM connector with the whole assembly mounted in a rigid diecast box. Signal lines connect via lockable DIN sockets.

Already in service with several ilr stations, the Stereo Disc Amplifier is available ex-stock from Surrey Electronics, The Forge, Lucks Green, Cranleigh, Surrey GU6 7BG. Phone: 04866 5997.

Console for radio and tv

INTENDED MAINLY for tv broadcast use, the new 16 input Robins/Fairchild mixing console claims to be suitable for radio applications. Construction is modular — ic op amps are used throughout—providing the possibility of further system expansion at a later date. Standard features of the model *1632* are two output channels for separate studio and control room monitoring, c/w muting relays, a headphone output from the control room monitor, a cue channel with built-in speaker, talkback facilities for two studios etc, wire-wound faders and illuminated push button switching. There is a range of processing modules (compressors, equalisers etc) available for use with the desk. The basic unit costs $9,995. Robins/Fairchild, 75 Austin Blvd, Commack, Long Island, NY 11725 USA. Phone: 516-543 5200.

PCB mounting frames

OF SPECIAL INTEREST to manufacturers of modular pcb systems, the Scanbe mounting assemblies offer a complete card stacking file for standard or wire wrap cards. Standard card guides are 15 cm long, arranged in 43 cm rows at 1.2 cm spacings holding up to 34 cards per file. Sold as a complete unit, connector mounting bars, end plates and full assembly instructions are included. Tekdata (Trading) Ltd, Westport Lake, Canal Lane, Tunstall, Stoke on Trent, Staffs ST6 4PA. Phone: 0732-811711.

Indian horns

VITAVOX, WELL KNOWN manufacturers of cinema sound and pa equipment, has received an order for 300 *S3* pressure units to be delivered to a major Indian sound reinforcement company. This is the largest Indian order ever received by Vitavox; the company claims that this represents a major breakthrough for loudspeaker marketing in India. Vitavox Ltd, Westmoreland Road, London NW9 9RJ. Phone: 01-204 4234.

Dekko

DEKKO FILMS AND Dekko Sound services of Boston, Mass, have moved to a new studio designed by the acoustical engineering firm of Bolt, Beranek and Newman situated at 295 Huntington Ave. In the finest traditions of our colonial cousins, the new studio is described as 'floating, soundproof, acoustically correct and perfectly isolated'. Dekko equipped the studio with a Magnatech sound system offering full editing facilities, and with audio visual dubbing equipment capable of working directly with magnetic film soundtracks. Small run cassette duplication is also offered. Dekko Films Inc, 295 Huntington Ave, Boston, MA. 02115. USA. Phone: 617-536 6160.

New QS decoder

USING CUSTOM IC chips, the *QSD 1 QS* Variomatrix decoder from Sansui is said to offer a similar standard of performance to the professional *QSD 4* model at a much reduced cost. The new decoder claims a wide dynamic range, a high degree of interchannel

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separation and a creditable 0.05% distortion. In addition, the unit provides 'hall' and 'surround' synthesised effects.

Heart of the unit is a series of integrated circuits developed for Sansui by the Hitachi Corporation. The first of the series (*HA1327*) constitutes the phase discriminator; the second (*HA1328*) is the matrix with the third (*HD3103P*) being an fet array providing control. At the present, the chips are available in sample quantities to original equipment manufacturers from the following Hitachi offices: Hitachi America Ltd, Chicago Office, 111 East Wacker Drive, Chicago, Illinois 60601, USA. Phone: 312-644 6565. Europe: Hitachi Ltd, 4 Dusseldorf, Immermann Strasse 15, West Germany. Phone: 0211-351185.

Chipping Norton Studios

STEPPING OUT OF the railway carriage at Kingham station, the first sounds heard emanated from chickens pecking about on the platform; the rural ride to the village of Chipping Norton, deep in the heart of Oxfordshire, was nearly over. A four mile taxi ride in a mud splattered motorcar completed the journey. One glance at the exterior of Chipping Norton Studios indicates that the building was once the village school complete with bell to exhort its pupils to lessons.

The iconoclasts that built the studio from the former seat of parochial learning are Mike and Richard Vernon, record producer and finance man respectively. Mike, who created one of the first progressive record companies in the 'Blue Horizon' record label, doesn't take part in the day to day running of the studio; although he produces most of his records at Chipping Norton, he leaves it to Dave Grinstead et al to keep the tape spools turning. Dave, who started his chosen career as a tape operator with Decca, looks after the technical aspects of studio life, sharing the session balancing work with Barry Hammond.

Chipping Norton Studio is 16 track; the MCI recorder is fed from a 18 input Trident 'B' series desk which, according to Dave, will soon be changed for a quad-wired 24 input 'A' series console. A pair of Quad powered JBLs provide monitoring in the compact control room which appears to give very acceptable acoustic properties with regard to unwanted resonances etc. The rectangular studio has length to breadth ratio about two to one, slightly unusual but entirely satisfactory from an operating point of view.

The longest wall runs parallel to the control room having a large window let into the same wall to enable a wide view of the floor. When asked about traffic noise from lorries grinding up the steep hill outside the building, Dave Grinstead pointed out that they don't make schools like this one anymore. Indeed, the walls are reminiscent of a medieval keep in their thickness; mineral fibre blocks exclude any residual noise; walls and ceiling are lined with this dense, fireproof material. As expected, the floor is of solid concrete construction. At one end of the room resides a Yamaha grand piano, at the other a large drum booth with the greater part of a spare drum kit stowed on the roof.

Mastering arrangements are handled by two Scully quarter-inch tape machines; the MCI multitrack master operates from the control desk through 16 Dolby *A361* noise reduction units leaving an extra four in reserve for mastering. Other control room fixtures include an AKG floor standing reverb unit, an EMT stereo echo plate and Universal Audio compressor/limiters. The layout of the control console seems well thought out with the most frequently used controls within easy reach of the operator, this was borne out by watching the techniques during a recording session. Richard Vernon's young offspring, present in the control room at this time, proved that the acoustic isolation between this room and the studio left nothing to be desired.

One of the best and most imaginative features in this rustic setting is the relaxation and accommodation facilities afforded to visiting clients. The upstairs classrooms have been converted into a self-contained flat of spacious proportions. The studio provides a communal lounge and cooking areas together with separate bedrooms housing up to 14 bodies in very comfortable surroundings. Dave Grinstead, appropriately, lives in the erstwhile headmaster's house next door to the studio. The village of Chipping Norton offers all the benefits of rural life; this includes a first rate public house serving genuine bitter straight from the wood. The village seems the perfect backdrop to a very happy recording studio.

Portable Dolby

DESIGNED FOR USE with the Nagra *IV*, the DNR series of portable noise reduction units from Future Film Developments can be adapted to operate with other machines. The Dolby processor is based on 'A' type noise reduction modules cat. no. 22 which are activated

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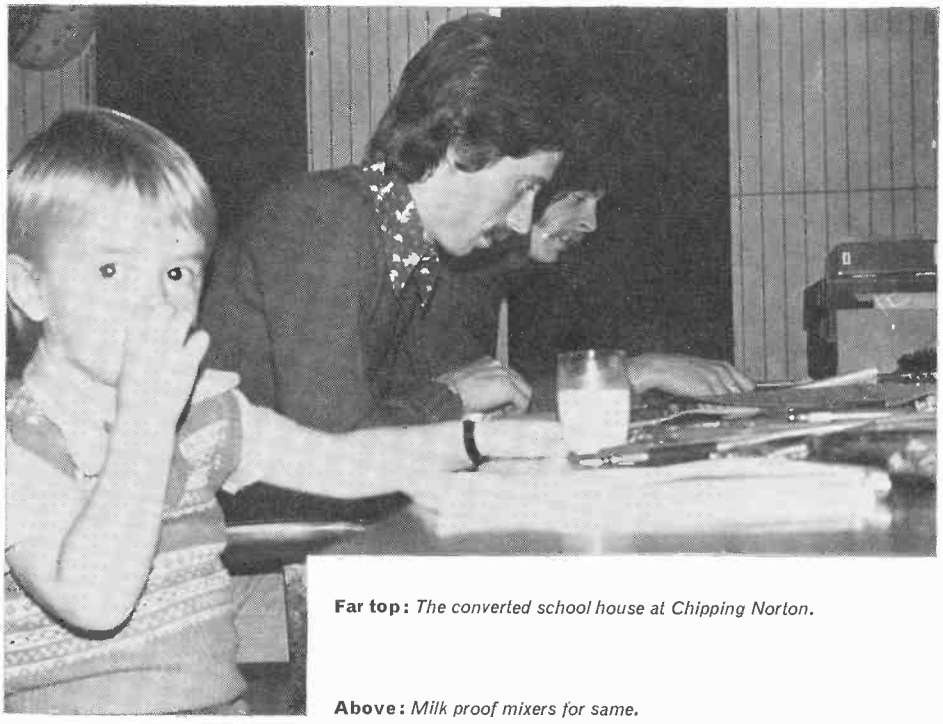

Far top: *The converted school house at Chipping Norton.*

Above: *Milk proof mixers for same.*

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PATENTS

THE FOLLOWING list of Complete Specifications Accepted is quoted from the weekly *Official Journal* (*Patents*). Copies of specifications may be purchased (50p) from the Patent Office, Orpington, Kent BR5 3RD.

October 2

1374179 Sony Corporation.
Magnetic tape recording and/or reproducing apparatus.
1374224 Eastman Kodak Co.
Cartridges for strip material.
1374234 Olympus Optical Co Ltd.
Electrical attachment devices.
1374293 Sony Corporation.
Video signal reproducing systems.
1374309 Pioneer Electronic Corporation.
Protective circuit.
1374456 Hitachi Ltd.
Post deflection focusing type colour cathode ray tube.
1374502 RCA Corporation.
Method of radio frequency splutter etching.
1374521 Crosfield Electronics Ltd.
Image reproducing methods and apparatus.
1374539 Nippon Gakki Seizo KK.
Tone-source device.
1374540 Philips Electronic & Associated Industries Ltd.
Automatic gain control.
1374560 Tokyo Keiki, KK.
Slot array antenna with flare.
1374567 Telefonaktiebolaget L. M. Ericsson.
Double reflector antenna arrangement.
1374571 Ricoh, KK.
Testing of recording and reproducing equipment.
1374580 Smiths Industries Ltd.
Electrically-operated display devices.
1374624 Agence Nationale De Valorisation de la Recherche.
Electrical filters enabling independent control of resonance or transition frequency and of band-pass especially for speech synthesisers.
1374674 Sony Corporation.
White balance control system.
1374731 Pioneer Electronic Corporation.
Tape player.
1374735 ITT Creed Ltd.
Telegraph transmission apparatus.
1374741 Saint-Gobain Industries.
Window pane having a radio antenna.
1374974 Agfa-Gevaert.
Device for recording images.

October 9

1375060 Coulter Electronics Ltd.
System for displaying a data distribution curve on a 100% scale irrespective of the quantity of data sampled.
1375176 Defence, Secretary of State for.
Semiconductor devices.
1375223 Rockwell International Corporation.
System for composition of symbols.
1375240 Eastman Kodak Co.
Motion picture cartridges.
1375353 Nippon Gakki Seizo KK.
Musical instruments.
1375388 General Electric Co.
Projection systems.
1375526 Felten & Guilleaume Kablewerke Ag.
Capacitor equalising box for balanced low-frequency communication cables.
1375604 Decca Ltd.
Correction of instability in film projection.
1375618 Burroughs Corporation.
Line Generator for CRT display system.
1375638 Western Electric Co Inc.
Electromagnetic wave frequency conversion devices.
1375645 Rank Organisation Ltd.
Television picture correction.
1375664 International Business Machines Corporation.
Transversal filter equaliser.
1375680 International Standard Electric Corporation.
Antenna array arrangements.
1375782 Sansui Electric Co Ltd.
Signal transmission system.

October 16

1375906 Sumitomo Electric Industries Ltd.
Radomes.
1375919 Viennatone Horgerate Produktions GMBH.
Telephones.
1375925 Bosch Fernsehanlagen GMBH.
Television apparatus.
1376006 Arvin Industries Inc.
Magnetic disc-type recording mechanisms.
1376046 Siemens AG.
Radio receiving antenna systems.
1376059 Philips Electronic & Associated Industries Ltd.
Amplifier circuit.
1376072 Knight, B. E.
Instruments of the guitar family.
1376083 Hofmann, U.
Circuit arrangement for recording binary signals on magnetisable storage media.
1376093 Matsushita Electric Industrial Co Ltd.
Sampling modulation system for an electronic musical instrument.
1376100 International Business Machines Corporation.
Magnetic recording heads.
1376125 Southern Communications Ltd.
Tape recording and/or replaying apparatus.
1376128 Plessey Co Ltd.
Systems for monitoring mains electrical power supplies.
1376158 Hitachi Ltd.
Pattern generating device and method of recording a generated pattern.
1376189 Xerox Corporation.
Mask for facsimile scanning apparatus.
1376220 Matsushita Electric Industrial Co Ltd.
Cathode ray tube having index strip electrode.
1376260 Omron Tateishi Electronics Co.
Magnetic memory unit.
1376296 RCA Corporation.
Secam decoder.
1376335 Agence Nationale De Valorisation De La Recherche.
Electrostatic transducers for converting electrical signals into ultrasonic signals and vice versa.
1376357 Thomson-CSF.
Method of telecommunication via satellite and systems using this method.
1376358 Wagner Electric Corporation.
Induction-keyed control circuit with keying network having variable resonant frequency.
1376371 Eastman Kodak Co.
Apparatus for directing strip material from a roll.
1376414 Standard Telephones & Cables Ltd.
Electro acoustic-transducers.
1376433 Absalom, R. R.
Electric sound-producing device.
1376441 Kodak Ltd.
Cinematographic film.
1376455 Brown, S. G., Communications Ltd.
Telecommunications headsets.
1376465 Matsushita Electric Industrial Co Ltd.
Colour image pick-up system using strip filter.
1376517 Price, E. E.
Electro-optical display system.
1376548 Bosch Fernsehanlagen GmbH, Robert.
Voltage reduction circuit.

October 23

1376611 Tricoire, J.
Thermographic sheet.
1376616 Seneca Plastics Ltd.
Optical display system.
1376651 Mullard Ltd.
Device for generating sound waves.
1376652 International Computers Ltd.
Magnetic transducers and to methods of manufacture thereof.
1376670 Luxor Industri AB.
Driving mechanism for the turntable of record players.
1376707 Matsushita Electric Industrial Co Ltd.
Record apparatus.
1376757 General Electric Co.
Stereophonic decoder circuit arrangements.
1376799 Philips Electronic & Associated Industries Ltd.
Image display cell.
1376832 Philips Electronic & Associated Industries Ltd.
Electro-acoustic transducer.
1376907 Western Electric Co Inc.
Single tube colour cameras.
1376954 Philips Electronic & Associated Industries Ltd.
Line amplifier.
1376984 International Computers Ltd.
Magnetic circuits.
1377021 Philips Electronic & Associated Industries Ltd.
Signal receiver for receiving signals of different frequency.

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AKG have a new electronic Time Delay Unit TDU 7202. These units will be demonstrated throughout the country, early 1975. Ring AKG for details and in the meantime a booklet is available on request.
We don't know too much about all this gear really, but, we do give you all the literature at Exhibitions and we are such a success ..... I wonder why*?
See you at the AKG stand; AES Convention, APAE Exhibition, and APRS Exhibition.
*Because they are wise and sweet and have such..... such big ears. Peter Eardley.
Their versatile C451 is a winner and ever so popular on Television.
AKG now have a range of ELECTRET Microphones including the NEW CE.10 miniature Lavalier.
AKG EQUIPMENT LTD
182 CAMPDEN HILL ROAD
LONDON W8 7AS. 01-229-3695.
AKG

PATENTS

1377033 Polaroid Corporation.
Motion-picture film cassettes.
1377080 Matsushita Electric Industrial Co Ltd.
Stereophonic reproducing system.
1377108 Pioneer Electronic Corporation.
Endless tape cartridges.
1377138 Matsushita Electric Industrial Co Ltd.
Four channel arrangements.
1377178 Hanlon, T. F.
Apparatus for reproducing a colour image from colour image information coded on black and white film.
1377237 Standard Telephones & Cables Ltd.
Telephone headset.
1377262 Sperry Rand Corporation.
Communication systems.
1377263 Sperry Rand Corporation.
Pulse receivers.
1377334 Bendix Corporation.
Communication system with at least one repeater station using the same carrier frequency.
1377351 Victor Co of Japan Ltd.
Miniature tape cartridges.
1377374 Plessey Co Ltd.
Apparatus for processing electrical pulses in TDM systems.
1377378 Pioneer Electronic Corporation.
Record-changer spindle.

October 30
1377426 Messerschmitt Bolkow Blohm GmbH.
Method of and apparatus for photographing a subject by line scanning.
1377447 RCA Corporation.
Apparatus for replicating magnetic recordings.
1377531 Varian Associates.
Network for pulling a microwave generator to the frequency of its resonant load.
1377543 Sony Corporation.
Decoding systems for colour television receivers.
1377583 British Aircraft Corporation Ltd.
Communication systems.
1377670 Compagnie Honeywell Bull.
Disc memory units.
1377684 Telecommunications Radioelectriques Et Telephoniques.
Data-transmission filter.
1377770 Sato, S.
Apparatus for visual projection and sound reproduction.
1377792 International Computers Ltd.
Cathodochromic information display.
1377796 Singer Co.
Synchronised film transport electronics for telecine systems.
1377814 Bachmann, M. E.
Transcription control for cassette tape player or the like.
1377858 Telemation Inc.
Colour television encoder modulator.
1377870 Matsushita Electric Industrial Co Ltd.
Rotary head type magnetic recording and reproducing apparatus.
1377871 Ricoh, KK.
Magnetic recording and reproducing arrangements.
1377884 Ricoh, KK.
Magnetic recording and reproducing arrangements.
1378019 Singer Co.
Display for video information.
1378035 Siemens AG and Telefonbau und Normalzeit GmbH.
Transmission of asynchronous information in a synchronous serial time division multiplex.
1378036 Peak Technologies Ltd.
Microwave radiation monitor.
1378114 Nippon Electric Co Ltd.
Antenna system.

Video recording of still pictures

I READ BP1,349,665 from Matsushita Electric Industrial Company Ltd of Osaka as directed particularly towards the use of tv systems to communicate photographs, data read-outs and perhaps newspaper pages in permanent form. According to the inventors, attempts to take a permanent record of a video image are complicated by the fact that the image is produced by a flying spot.

The invention takes the form of a normal tv set with conventional circuitry, display tube and controls; but a secondary, slave tube, with a fibre optics face plate is also used, the inner surface of the face plate being coated with a phosphor. This slave tube is housed out of sight within the set but is under the influence of all the normal set controls. Thus the picture on the slave tube should match the picture on the main display tube.

As shown in **fig. 2** the slave tube 25 directs an electron beam on to the inner surface of face plate 26 and a recording medium 21 (such as film) is pressed by pressure pad 46 against the plate 26. Thus the film is exposed to radiation emitted from the video image to record a desired single frame. The film 21 is fed to the slave tube for exposure from a store roll 31, and after exposure is passed through a processor 36. The film with the processed image is turned through 90° at 44 and fed out through a letter-box slot in the front of the set. Synchronisation between the feed rate of the film 21 and the sweep rate of the flying spot on the face plate 26 is unnecessary because the film is fixed by the pressure pad during the recording operation. **Fig. 1** shows the set as seen by an operator, with the main display tube at 13 and the developed film 21 emerging from the slot 19.

FIG. 1

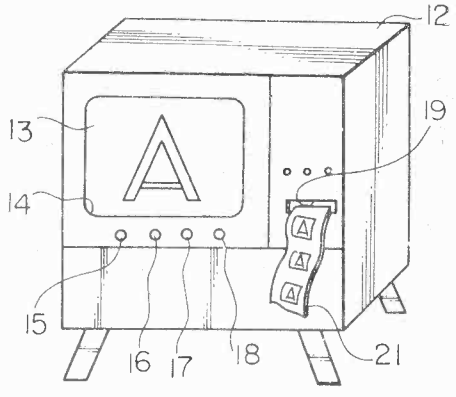
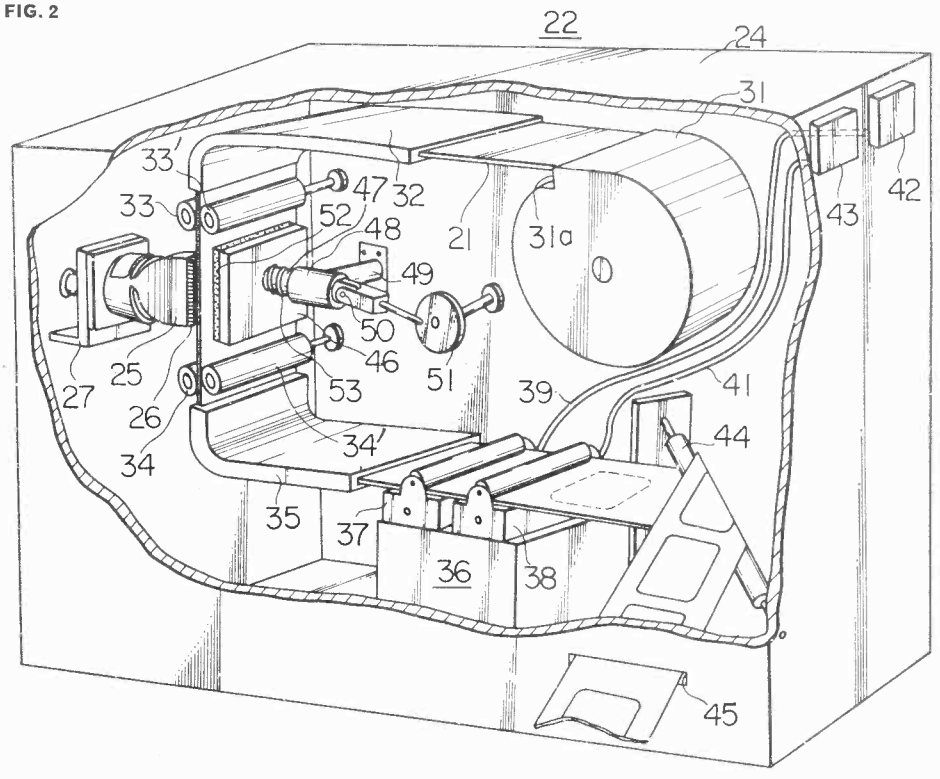


FIG. 2



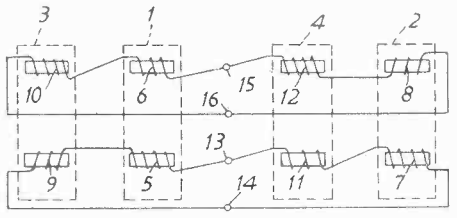
Quadraphonic loudspeakers

SO FAR EMI Ltd have been issuing quadraphonic records made in the CBS SQ system, and there has been no sign of any independent EMI activity on the surround sound front. BP1,348,643 from EMI still doesn't show whether the company have any home-grown matrix system up their sleeve, but discloses their interest in a quite new approach to providing sum and difference pseudo-quadraphonic surround sound.

An ordinary stereo amplifier is used to reproduce two-channel recordings. As is now well known, conventional stereo recordings, and matrix recordings in particular, contain additional information which is there for the taking. Such additional information is usually extracted by phase shift or resistance networks at the amplifier, but the EMI proposal is that the loudspeakers themselves be used to decode the information. This they achieve by providing each loudspeaker with two drive coils each operating on the same diaphragm but having different numbers of turns.

In **fig. 1** the lefthand channel output terminals 15, 16 feed series connected coils 10, 6, 12 and 8 of loudspeakers three, one, four and two (arranged as shown in **fig. 1**) and the righthand channel output terminals 13, 14 feed series connected coils 9, 5, 11 and 7 of the same loudspeakers. The two coils of each speaker are wound in different senses and/or have different numbers of turns. Thus, the front right loudspeaker one has its coils 5 and 6 acting on the diaphragm in additive sense, as do coils 11 and 12 of front left loudspeaker four. Rear right loudspeaker two has coil 8 in subtractive sense with respect to its coil 7 and rear left loudspeaker three has coil 9 in subtractive sense with respect to coil 10.

FIG. 1



EMI suggest that the output signal voltage from the right channel should be distributed between coils 5 and 9 in the proportions .707 and .293 and in similar proportion between the coils 7 and 11. Likewise the output from the left channel is distributed between coils 10 and 6 and between coils 12 and 8, also in the proportions of .707 and .293. These proportions are best attained by using coil turns in the ratio 2.4 to 1. This arrangement means that the signals applied to the loudspeakers are as follows:

Loudspeaker one (right front) .707R+.293L =R+0.41L

Loudspeaker two (right rear) .707R—.293L =R—.41L

Loudspeaker three (left rear) .707L—.293R =L—.41R

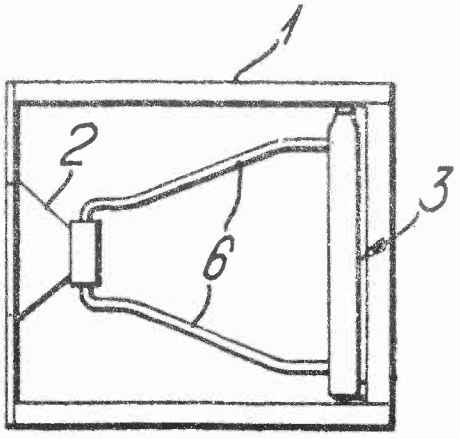
Loudspeaker four (left front) .707L+.293R =L+.41R

Although the signal addition and subtraction is usually achieved by winding the coils of different turns in different directions, the same effect can of course be achieved by winding the coils in similar directions and connecting them in opposite senses.

Aquatic loudspeakers

THE RANK Organisation in BP1,348,535 proposes some extremely interesting ideas on loudspeaker cabinet damping. As is well known, a light cabinet suffers from panel resonances which may colour the loudspeaker tone; brick or concrete cabinets are free from such resonance but are often impractical. The Rank patent claims that loudspeaker cabinets of which the walls are formed from liquid-filled containers offer the best of both worlds.

A loudspeaker cabinet is built as a skeleton frame rather like a fish tank without glass. The side, rear, top and bottom panels are all liquid-filled double-walled containers which can be slotted into the skeleton. While the panels are empty the cabinet is relatively light and portable. When the panels are filled it is very heavy. The filling liquid can be water (with anti-freeze to prevent rupture in the winter) or any other liquid that proves suitable.



It is maintained that liquid-filled panels have a very high sound-damping factor and thus in many ways behave acoustically as concrete or brick structures. The presence of water inside a loudspeaker cabinet also provides a convenient on-the-spot means of cooling the voice coil jacket. In **fig. 1** loudspeaker two is connected by conduits 6 to a water-filled rear wall 3 of the cabinet 1.

All this prompts me to wonder what results would be obtained from an infinite baffle-type loudspeaker virtually filled with liquid as an acoustically damping medium (with of course some insulation to protect the diaphragm and speech coil).

Adrian Hope

AGONY COLUMN

The American record producer would insist on having his little joke at the expense of his protégés. Of note was one occasion where he persuaded a well-known Anglo-Saxon drummer that his Yank counterparts got 'a nice bass drum sound' by overdubbing a separate track of the bass drum played by kneeling down and hitting it with boxing-gloved hands. Dutifully, at the next session the enlightened drummer turned up sporting a pair of boxing gloves. Polite laughter was heard in the control room as he spent the next three takes grovelling on the floor smashing the bass drum before realising that he had been had.

A well-known fuhrer of studios and record companies is alleged to exhibit legendary meanness towards his underlings. It is also said that he seems to be badly informed about matters musical and electronic. Driven to desperate measures, an impoverished engineer offered the latter-day Scrooge a tape recorder for sale that was his only worldly possession, saying that the purchase of the instrument would do wonders for the fuhrer's turnover. Of course, the machine went back home with the engineer the moment that the cheque was received. In due course, the engineer became impecunious once more. This time, our friend went to the great man and suggested that if he had two machines, the studio could do great things in stereo . . . 'another' machine was purchased.

The session was going quite well, despite the big line up. There was a fairly aimiable atmosphere anyway, but the bar helped, and lunchtime had taken its toll. Due to the arrangement of the studio, the percussionist was forced to play his gong over his shoulder, so that he could watch the conductor's waving and hit it at the appropriate moment. Unfortunately, he missed the conductor's relatively subtle indications to play more quietly, and didn't look like responding in the immediate future, so the fixer crept discreetly round behind him to tell him. In the meantime, the musician had swayed rather more than was good for his playing; consequently, when the next stroke was played, it was just as loud as before except that it was the fixer's face that made the sound.

CLEAN FEED

by Cross Patch

Going solo: There must be a strong motivation for a man to forsake the comforts of PAYE, pension contributions, sick pay, entitlement to Unemployment Benefit, paid holidays and all the little luxuries a good employer should provide, to go on his tod as an independent contractor. But there is a growing trend for recording engineers to do just that, to go 'free-lance'. What personal advantages can there be in adopting such a course? It is said that to be self-employed can offer a modicum of relief from the burden of income Tax. Acceptable claims can be made for items of expenditure which would not be allowed to someone in regular employment. An eminent record producer once boasted that his friendly local Tax Inspector passed a claim for the cost of exotic deodorants made on the grounds of essential use in the hot, stuffy atmosphere of control rooms. Be that as it may, it doesn't seem really credible that intelligent, sober, level-headed fellows like recording engineers would jack in good jobs for the sake of a bottle of tax-deductible after-shave. Surely there must be something more to it than that. After all, that 'Tax advantage' thing is a bit insubstantial. Admittedly it can be proved that, by not having to pay tax on the earnings of Year 1 until some time in Year 2, or later if the pace of the exchange of query letters can be kept up, then advantage is taken both of the depreciation of the value of the currency during the period and the interest on the money remaining in the bank during that time, that interest itself being subject to tax but at a still more remote time. There are those who make a hobby of that sort of thing and jolly good luck to them, but unless one is earning an enormous amount of money it hardly seems worth all the bother. Recording engineers do not, on the whole, earn enormous amounts of money. If they really are in full command of all the skills they should have, then their contribution to a successful recording is often grossly under-priced. Can that be the reason for engineers going free-lance? Whatever the reason, it is an interesting trend of some significance when taken in context with a parallel development in the success of the ACTT's recent recruiting drive among recording studio staff, until now traditionally non-Union. When a gap appears between management and worker, the Union is always there to fill it with, perhaps, some of the workers who have gone free-lance.

Stands and speakers: Very good to hear in all the gloom depressing the audio market that Tannoy and Keith Monks Audio have come back from the Tokyo Trade Fair clutching some really juicy orders won against heavy competition. If the goods/quality/time/price ratio is right and a high level of customer service is offered, then business can still be done by those making the effort.

Revelation: Remember the shock sensation story of the bugging of Transport House around last election time? There was this van bristling with 'aerials' parked in Smith Square, see, and this guy, nosier than most, creeps up to the back and presses his face against the window to glimpse another guy, inside the van, crouched over some apparatus and wearing a pair of cans. Inside guy spots nosey outside, appears to panic, and the van takes off in a cloud of dust and old manifestos. Instant conclusion jumped at with the speed of an Olympic hurdler—guy with the cans has been listening in on secret 'phone calls subtly coded like 'Keep it warm, luv. I shall be home late' or 'Is that you, Solly? What are the odds?' to be relayed to SMERSH. Nonsense, nothing of the kind. The simple truth is that the guys in the van had been doing a bit of crafty pirate-ing on a recording being made at St. John's, Smith Square, and thought the face at the window belonged to BPI's special investigator who has become the terror of the bootleggers over the past 12 months. Anyway, that's the story, brothers, and every bit as believable as the original. Seriously though, the BPI has been having considerable success in reducing the incidence of pirate-ing and bootlegging, and a number of people have found themselves on the wrong end of an expensive prosecution. It is not the sort of thing an honest, hard working studio should get itself involved with.

What are the wild waves saying?: Bother in the air again! The frequencies are getting overcrowded. And now, horror of horrors, listeners in Tirana are being denied Tony Blackburn's jokes (they should be so lucky!) because BBC Radio One is on 247 metres which is precisely the same wavelength as Albania's capital city. 1948 saw the last handout of wavelengths with the UK and France getting the best choice. Germany was left with that new VHF system rather on a 'let 'em have it, it won't last' philosophy. Since then radio has grown both in numbers of stations and in radiated power. A number of 'emergent' nations use radio for propaganda (so what's new?) and if they find a station already on their self-chosen wavelength causing interference, then the policy seems to be to push up the power by a few Kw's. If everyone would be content with VHF and with AM at reasonable power which didn't annoy the neighbours all would be well, but when national prestige is at stake, patient reasonableness becomes a scarce commodity. Attempts to sort out the confusion are being made by the members of the European Broadcasting Area meeting in Geneva. One fairly certain outcome seems to be that the UK will have to surrender some medium wave AM channels. Trouble is that our VHF channels are already rather crowded with public services, like the police, ambulance, fire, refuse collectors, and all sorts of unidentifiable people. Never mind, the changeover, if and when it comes, could give a much-needed boost to VHF radio sales.

Wearing heads: A studio buys a new tape machine. The purchase price is entered in the books under capital expenditure and the sum is depreciated over a certain number of years until, at the end of the last financial year, the book value of the machine is nil. A new machine is purchased with the money that has been allowed for by the process of depreciation on the old machine and the pattern is repeated. That is the theory but the practice is complicated by the increase in price of the replacement machine over the original depreciation period. Thus, the original machine was bought for £x and the new one will cost £4x. At the same time the money itself has depreciated at an annual rate currently standing at more than 17 per cent. So many financial men are strongly advocating the general adoption of 'inflation accounting' and have a most persuasive argument. This is where things are apt to get a mite complicated and should be discussed with a good accountant. But a point arose the other day in discussion with a very good accountant indeed, which ringed round the importance of a client giving his professional advisers complete and precise instructions. A tape machine can be treated as a homogeneous unit for accounting purposes, depreciated as a unit and finally written off as a unit. This presupposes that all parts of the unit wear out at the same rate but they don't. Replacement of the odd component during the lifetime of the unit is unimportant because it can be allowed for in the maintenance budget. But suppose some part of the unit has to be renewed which will cost as much as 30 per cent, not of the current book value of the unit but of the whole replacement cost of the unit, what then? The part in question was a multi-track headblock costing a tidy sum particularly to a studio already hard pressed for cash, and no separate provision had been made for such expenditure. The accountant didn't know that headblocks wear out more quickly than tape machines and why should he if no one had thought to tell him. So the problem arose of having to find some hundreds of pounds in a hurry and unexpectedly because the performance of the headblock in question had not even been properly logged. It only goes to show what can happen in studios where the management hasn't got it together.

Footnote: If recording engineers do go free-lance in any numbers then, presumably, studios would treat them as casual labour, employ them on an ad hoc basis and be able to cut overheads to the bone in consequence.

IN COMMON WITH all recording studios, we have our own preconceived ideas about the relative merits of different microphone types. Some of these ideas will clearly be based on experience, but naturally some of them are open to question as new developments arise. Consequently this survey of the AKG *C414*, Schoeps *CMT36* and *CMT56*, and the ubiquitous Neumann *U87* variable polar diagram mics was of great interest to us.

To avoid preconceived ideas interfering with impressions, various tests were carried out recording the same material with the three microphones as close as possible to each other on to separate tracks of a 38 cm/s Dolby A tape. Subsequently we listened back to the tapes on our Spendor *BC3* monitor loudspeakers, switching from one microphone to another—without any of us knowing which mic was which, and noting various remarks. Some of the results came as something of a surprise, since on more than one occasion we all preferred microphones which previous opinions might have ruled out of court.

The choice of which microphone to use for which material is, we feel, too often left to preconceived ideas and we hope our comments in this comparison will at least provide scope for experimentation by adventurous engineers. All of the microphones offer more or less the same facilities, and are in the same price bracket as each other—indeed all are very fine microphones well worthy of their reputations.

AM/TF

NEUMANN U87i CAPACITOR MICROPHONE

By Angus McKenzie and Tony Faulkner

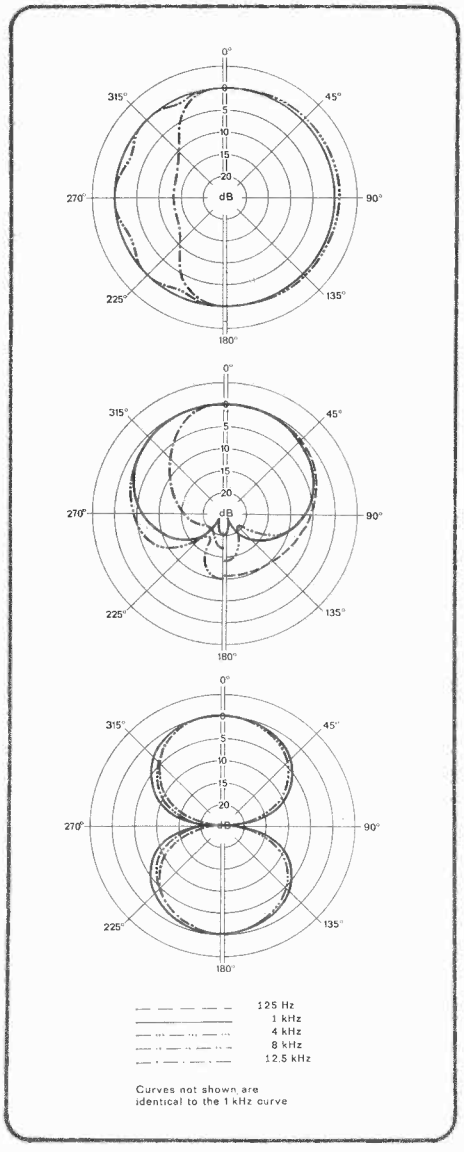
MANUFACTURERS' SPECIFICATION
Acoustic operation: pressure gradient transducer
Output into 1 kΩ: omni, 0.8 mV/μbar; cardioid, 0.9 mV/μbar; figure-of-eight, 1 mV/μbar.
Recommended load: 1 kΩ or greater (250 Ω or greater).
Nominal impedance: 200Ω (50Ω).
Capsule capacitance: 2 x approx 53 pF.
Self-noise: approx 26 dB to DIN 45 405.
Sound pressure to 0.5% harmonic distortion at 40 Hz, 1 kHz and 5 kHz: without pad greater than 200 μbar=120 dB; with pad greater than 650 μbar=130 dB.
Phantom power requirement: 44V to 54V.
Current: 400 μA.
Price: £150
Manufacturers: Georg Neumann & Co, 71 Heilbron/Neckar Fleinerstr 29, Postfach 2120, Germany.
UK distributors: FWO Bauch, 49 Theobald Street, Boreham Wood, Herts.

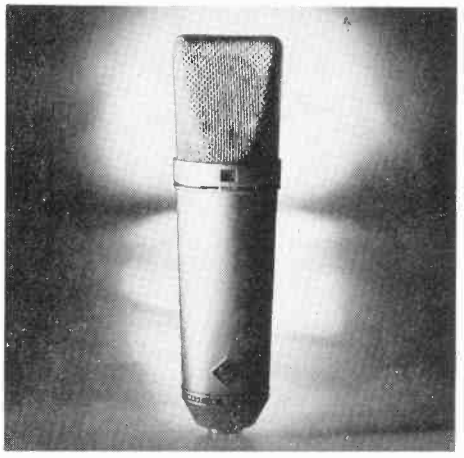
The Neumann *U87* is very well established in many of the London studios, as well as around the world. It was described as 'the most reliable mic we have come across' by one studio we telephoned to compare notes before completing this survey.

The microphone is the largest of those under test (200 mm long and 56 mm in diameter) and also the heaviest (over 400g). Although this makes life difficult for light-fingered visitors to the studio, it also provides a potential source of inconvenience with boom-stands on full-reach (particularly the smaller variety).

The *U87i* is the fet version of the *U67* (which is still widely used) and has switching for figure-of-eight, cardioid and omni-directional polar patterns — no hypercardioid (cottage-loaf). The mic can be internally powered with two batteries, which could be of great convenience, and a battery state meter is incorporated in the body. The batteries are automatically switched on as soon as the *U87* stand-adaptor/head cable is connected, by means of a micro-switch depressed by the connecting plug which is a Cannon connector with an extended shank.

The microphone can also be externally powered by the customary 48V xy phantom system, when a readily accessible switch on the circuit board inside the mic case is set to 'external'. The connector is three-pin Cannon and either a standard *U87* head-cable can be used or else a suspension mount (*Z48*) can be





bought and simply use any normal *XLR* to *XLR* microphone connecting cable. A wind-shield is available at a modest price (*WS67*) which is a sponge sleeve and seemed to function quite adequately with fairly close speech, although it may not be completely satisfactory for the uncommon application of outdoor recording.

Apparently the *U87* circuit has recently been modified to improve overload margins—but inspection of the current circuit indicated no current feedback around the single fet since the source was decoupled by means of a 20 μF capacitor to earth, which might contribute to intermodulation distortion.

The circuit design incorporates a –10 dB switch for sensitivity, which is effected by means of a 560 pF capacitor connected in parallel with the microphone capsule itself; this reduces the input to the gate of the fet. There is also a bass roll-off switch on the body of the microphone which cuts the response at 100 Hz by four to five dB and at 50 Hz by around eight dB according to the published specification. As mentioned earlier, the basic

circuit consists of a single fet, with the feed to the primary of the output transformer coming from the drain via an electrolytic decoupling capacitor. A further fet is incorporated in the circuit as a voltage regulator.

The microphone is very sturdily built, and seems very unlikely to fail mechanically unless mistreated unforgivably or else most unlucky.

As far as actual sound quality is concerned, we found it most acceptable for most applications, with a few exceptions. The noise level was, subjectively, very low indeed, and would be unlikely to cause any problems. The polar diagrams, particularly at high and low frequencies, were not altogether exemplary, but at least the high frequency end can partly be put down to the large capsule diaphragm (2.5 cm) which is equally responsible for its characteristic sound quality. The front-to-back ratio in the cardioid position was rather poor at low frequencies, and we feel that this would benefit from some attention by the manufacturers since it could prove a problem in some circumstances, particularly in small studios already suffering from isolation problems. It could also prove annoying in a situation where one is using a number of spaced microphones in a classical music balance—any rumble present in the recording location would be rather exaggerated by the almost omnidirectional polar response at low bass frequencies.

In the figure-of-eight polar diagram, the *U87* has significant bass roll-off (4 dB at 50 Hz), but in this pattern it is very good in terms of 'p' popping on voice. Ninety degrees off axis, the *U87* is down in top in both cardioid and omni functions, and this could prove disappointing if one is relying upon a coincident pair for the main balance of, say, an orchestra—where the centre of the stereo image would lack treble definition.

As far as applications are concerned, the *U87* seems well suited to most applications, particularly percussion and brass. We were not all that happy with the tone on strings, where the quality seemed somewhat hard and brittle. In general we preferred other microphones for strings, such as the Neumann *KM84* or AKG *C414*, but this is very much a matter of taste—with particular reference to one's choice of monitor loudspeaker. There seemed to be something of a 'nasal' presence boost, which might sometimes be desirable, particularly with some makes of monitor speaker—but we did not altogether like it.

The quality on brass was most vivid, and very clear without being clinical. There was again something of a nasal coloration, but in this case it flattered the sound to advantage. We would put this down to a combination of the resonant frequency of the large capsule, and to the shape of the mic case. Our reservations regarding the string quality can be extended to the use of the Neumann *U87* for harpsichord and piano recordings, where we would again prefer one or two other microphone types, unless one likes a nasal quality for some specific reason of production. The coloration seemed by no means easy to equalize out; it was much easier to make another mic sound like the *U87* than it was to make the Neumann sound flat.

On voice, the *U87* showed very high clarity—sibilants were exaggerated a little, but the overall quality was very good. Although the sound from the mic did not sound as faithful to speech as some other mics, the effect of enhanced clarity and presence could be of some advantage. Extending the idea of using the *U87* for voice, we used the mic for a recording session in a church in Surrey where we were recording a small madrigal group. The *U87* again showed very good clarity, but this time the coloration, which aided intelligibility in speech, did not enhance the vocal quality of the choir and gave it rather a hard tone.

All in all, we are impressed by the microphone, whose performance in our studio makes it clear why it is so widely employed in recording studios. However its characteristic sound does not flatter everything it meets. On speech, percussion and brass it can be recommended to most potential users—but for strings, choirs, piano etc, we found it rather 'hard' and as such not universally applicable. The microphone was most reliable and robust all the time we had it in our recording set-up, and remarks from other London studios would do much to confirm the *U87*'s reputation as a consistent, sturdy microphone which always works. Obviously there are sometimes minor problems as with other mics, but the usual problems of rf breakthrough and noise-chattering seemed totally lacking.

AKG C414 CAPACITOR MICROPHONE

By Angus McKenzie and Tony Faulkner

MANUFACTURERS' SPECIFICATION

Type: pressure gradient receiver (twin diaphragm condenser microphone capsule with fet preamplifier).
Frequency range: 20 to 20 kHz.
Directional characteristic: switchable pattern selection of cardioid, omni-directional, figure-of-eight and hypercardioid.
Sensitivity at 1 kHz: 0.6 mV/μbar.
Capsule capacity: 2 x 100 pF.
Impedance (20 to 20k): less than 200 ohms.
Load impedance: greater than 500 ohms.
Operating voltage: 9V.
Universal phantom powering: 9-25V (within the range 7.5V to 9V dc with proportionately decreased sensitivity).
Current consumption: less than 5.5 mA (DIN 45 596).
Unweighted noise level: 3 μV eff.
Equivalent noise level: 21 dB spl (0.6 mV/μbar CCITT-C DIN 45 405).
Price: £160
Manufacturers: Akustiches U. Kino Gerate G mbH, A-1150 Vienna 15, Brunhildengasse 1, Austria.
UK distributors: AKG Equipment Ltd, Eardley House, 182-184 Campden Hill Road, London W8 7AS.

The AKG *C414* microphone is the fet transistor version of the *C12A* nuvistor microphone which is well known, particularly in broadcasting circles. We have two *C12*'s, two *C412*'s and two *C414*'s in our own mobile recording unit, and we have always been most satisfied by their performance. The *C414* has not the same following as the Neumann *U87* in London studios, and we feel that this is not obviously explicable—since it has several extra points in its favour, as well as a good overall performance.

The microphone itself is considerably smaller than the *U87* (about 11 mm long) and is also considerably lighter (200g). The casing does not appear as robust as that of the Neumann. In common with the *U87*, the *C414* requires a special head-cable with its own stand-adaptor—which in the case of the AKG employs a Cannon six-way connector (like the *C12A*) that, regrettably, in our experience is occasionally unreliable, particularly with metal fracturing. We understand from AKG in London that there is a modification available to make the *C414* into a standard three-way *XLR* connection which will be of great advantage. Nonetheless, even with the six-way Cannon mic connector, the cable can be supplied terminated in a standard *XLR* connector.

The *C414* has switching for four polar diagrams—cardioid, omnidirectional, figure-of-eight and hypercardioid (cottage-loaf, ie halfway between cardioid and figure-of-eight). The inclusion of hypercardioid is most useful, offering more flexibility in applications (such as particularly encountered in broadcasting) where one employs just a very few microphones for an overall balance of, say, an orchestra and the overall pickup of hall ambience has to be controlled in the main balance. The mic is xy phantom-powered from any voltage between 7.5V and 52V, with the provision of suitable feed resistors in the power supply for different voltages as recommended by AKG; used on 48V the *C414* draws a fairly high current.

This range means that the microphone is compatible with most xy phantom systems normally encountered, and can be used with the 9V battery units also supplied by AKG for use with the *C451* series. One problem with the use of the battery power supply has been the increase in microphone self-noise as the voltage from the battery nears the 'knee' of the zener diode incorporated in the power circuit of the *C414*. With a new battery, the microphone is quiet; as the battery volts drop, the noise increases a little, and then it returns to its low level after the battery voltage has dropped further. A sturdy windshield (*W11*) is available from AKG and seems to perform quite satisfactorily.

AKG in London say that there are plans to introduce a modified circuit to improve overload margins further—with more feedback, and incorporating a bass-roll-off provision in due course. Early models of the *C414* did have problems with rf breakthrough in unfavourable situations, but we understand this has received prompt attention and that the performance is now markedly better and will be improved further on the introduction of the new *XLR*

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AKG C414

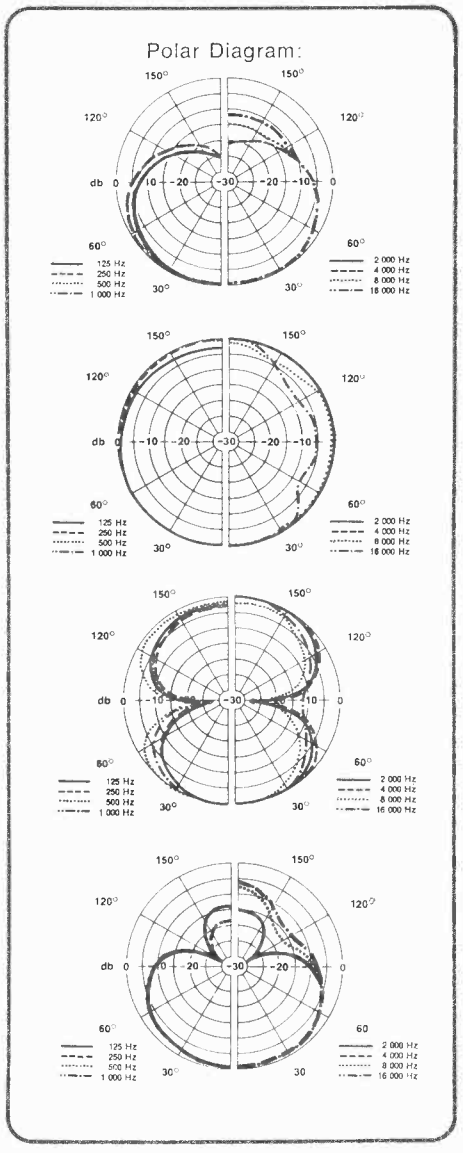
type stand adaptor; this will incorporate rf suppression.

The microphone circuit incorporates a 2 MHz oscillator for obtaining the 60V dc polarizing voltage for the capsule from the incoming phantom volts. The 2 MHz oscillation is half-wave rectified and stabilized for the low current required. The microphone head amplifier circuit is basically an fet source follower driving an emitter-follower, which in turn drives the output transformer via an electrolytic decoupling capacitor. In the case of the *C414* the source of the fet is not bypassed by a capacitor (contrary to the *U87*) and we feel this could help reduce intermodulation distortion.

The self-noise of the *C414* did not seem quite as low as that of the *U87*, but we can see few occasions where it might cause difficulty since it was still in the 20 phons region and was very good (in fact the quietest in the AKG range).

The overall frequency response was, subjectively, very wide, with an extended bass response which could be either an advantage or a disadvantage depending on application. A suspension mount would get rid of most potential problems, as would a high-pass filter setting such as may be found on professional microphone amplifiers. This extended bass was most suitable for organ recordings and also for large orchestras—although it would bring out rumble in some locations, which could easily be cut out with a suitable filter as previously mentioned. This low end presented rather a problem for speech application, where it gave the voice a strange detached sound—the low end did not seem to 'belong' to the top end. Nonetheless, the quality was good and a little equalization helped.

The polar diagrams seemed excellent, as discovered last year when we carried out some experimental recordings in an anechoic chamber. Although the *C414* has a large



capsule (2.5 cm) in common with the *U87*, it does not appear to exhibit such a significant loss of treble off-axis, and a coincident pair gives a very convincing stereo image. The microphone incorporates a useful –10 dB sensitivity switch.

As far as the accuracy of reproduction, and 'sweetness' of sound is concerned, the AKG *C414* was very good. The string tone was very pleasing and flattering, as was the quality on piano and harpsichord. String tone seems the forte of the *C414*, and we would have no shame in recommending it, if only for this application.

The rumble pick-up was clearly evident when we came to play back our madrigal singers test recording made in a Surrey church, which suffers a little from distant lf rumble from Heathrow Airport. However, the vocal quality had a pleasing warmth which was lacking on the *U87*.

On orchestral recordings, the *C414* microphones always seem to give a clean top, which is subjectively very pleasant—and the string tone makes it a most apt choice for this application. The brass quality lacks the vividness and presence of the *U87*, but was by no means failing, and for any recording engineer who wants to try a different 'sound' the AKG *C414*'s are well worthy of investigation. The treble response greatly enhanced the quality of guitars and harpsichords, although it gave speech quality rather exaggerated sibilance.

Concluding

Generally speaking, we are very happy with the AKG *C414*, and we have, as stated earlier, several in our recording set-up which are used a great deal. We have used four in a coincident cardioid 'cluster' for quadraphony with great success—our only reservations are mainly concerned with mechanical robustness, particularly of the six-pin Cannon stand-adaptor/connector, and with the speech quality which was a little boomy and 'tizzy' before equalizing.

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SCHOEPS CMT 36 AND CMT 56 CAPACITOR MICROPHONES

By Angus McKenzie and Tony Faulkner

MANUFACTURERS' SPECIFICATION
Frequency range: 40 to 16 kHz.
Directional characteristics: (mechanical adjustment): cardioid, figure-of-eight, omni.
Output level (1 kHz in cardioid): —38 dBV/10 dynes/cm².
Sensitivity (1 kHz in cardioid): 1.2. mV/dyne/cm².
Spl at 0.5% thd (into 1 kΩ audio range) cardioid: 128 dB spl for CMT36; 126 dB spl for CMT56.
Equivalent noise loudness level (CCITT): 26 dB spl approx CMT36; 23 dB spl approx CMT56.
Noise voltage (CCITT): —106 dBV approx CMT36; —110 dBV approx CMT56.
Source impedance: approx 20 ohms symmetrical CMT36; approx 200 ohms symmetrical CMT56.
Load impedance: greater than 600 ohms.
Phantom power: 12 (9)V CMT36; 44-52V CMT56.
Current: approx 8.5 mA CMT36; approx 650 μA CMT56.
Price: £195, £187.
Manufacturers: Schalltechnik Dr-Ing. Karl Schoeps, 75 Karlsruhe 41, Spitalstrabe 20, Postf 410970, Germany.
UK distributors: Feldon Audio, 126 Great Portland Street, London W1N 5PH.

The Schoeps range of capacitor microphones has not apparently received the interest and acclaim in the UK it has had elsewhere in the world (partly in the USA and parts of Europe) and our tests would indicate a certain injustice.

Both microphones are similar in appearance and facilities offered, with some internal electronic differences. The Schoeps is a pencil microphone similar in size to a Calrec *CM 1050* or AKG *C452*, only it is a side-shot mic (ie it picks up from the sides, rather than from the top).

It employs standard *XLR* three-pin connection, and offers cardioid, omni-directional and figure-of-eight polar patterns. These are not obtained by means of changing the polarization of a double-diaphragm (the technique employed by the Neumann *U87* and AKG *C414*); they are achieved mechanically by the twist of the mic cap, which has click-positions for each pattern.

The first difference between the *CMT36* and *CMT56* is the powering. Both employ xy phantom powering, the *CMT36* operating nominally on 9-12V (although we are advised it will function on 48V with suitable feed resistors), and the *CMT56* operating on 48V.

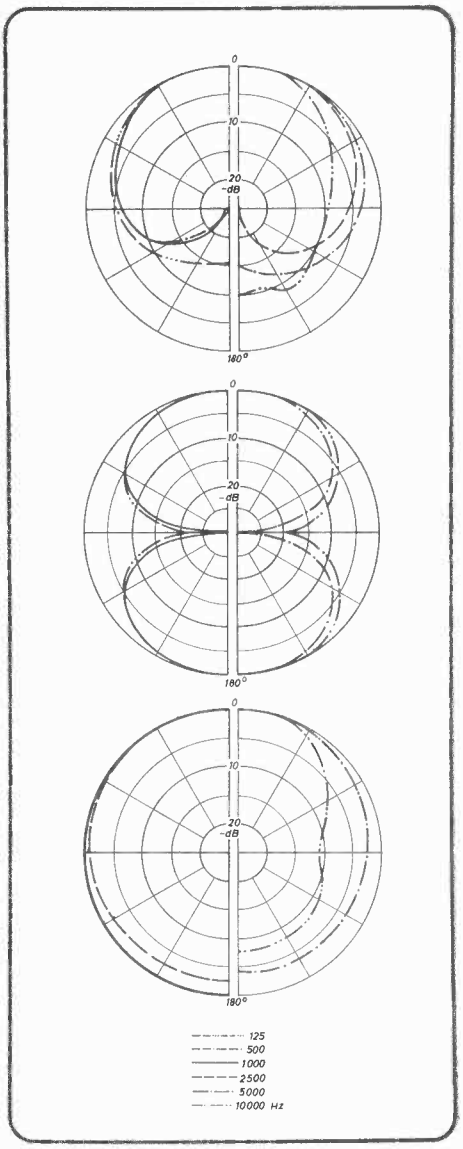
The basic difference between the two models is that of amplifier design. The *CMT36* has no output transformer at all (offering, we imagine, some reduced distortion and improved transient performance) and the *CMT56* has a single fet with the drain feeding the primary of an output transformer via an electrolytic decoupling capacitor. In place of a transformer in the *CMT36*, the fet drives two p-n-p transistors. The drain of the fet feeds one base via a capacitor, and the source of the fet feeds the other base. One leg of the audio output comes from one emitter direct, and the other leg from the other emitter. The dc volts are extracted from the midpoint of the two collectors (which are joined one to the other) and two resistors connecting base to base. The source load of the fet is not capacitatively decoupled (different from the Neumann *U87*) and this current feedback should reduce intermodulation distortion in the amplifier. The sound quality of the *CMT36* and *CMT56* did not appear to differ particularly in any of our tests; indeed we were most enthusiastic about both in all of them.

The general impression gained from all the comparisons was one of extreme flatness without any particular coloration. The polar diagrams were audibly good, particularly that of the figure-of-eight; on one recording session we used just a pair of these microphones in coincident figure-of-eight configuration (90° à la Blumlein) and the reproduction was most impressive. Listening on headphones provoked turning around on several occasions, convinced that someone was talking—but it was the microphones!

When we replayed the recording made of the madrigals, the sound was very smooth and all of the words were very clear, without excessive rumble from London Airport, and with a very good extreme top. A distinct lack of intermodulation distortion was evident, and was most refreshing.

The stereo definition with a single pair of these microphones put many a multi-microphone balance to shame, and the placement was most convincing in terms of front and back of sound-stage. It seems to us that the Schoeps is very widely applicable since it does not seem to have any particular sound of its own other than a great sense of clarity. This feature means that the sound it gives can be 'curve-bent' to requirement. The string tone was very clear and true although it lacked the 'flattering' *C414* sound, and the brass was also very clear, although it lacked the vividness of the *U87*—but we feel that mic channel equalization could change this situation.

As must now be clear, we are very enthusiastic about the Schoeps microphones—their flatness gives a great deal of scope to the creative engineer. As they have not established themselves firmly in the UK it is not easy to make comments regarding long-term reliability —but our brief experience does not indicate any likely problems. One UK user, Bob Woolford, told us of only one difficulty he had with them—a while ago he was recording out-of-doors on an island off Spain with them, and a late night session broke off at 4 am for a break. When he returned, the microphones were behaving far from healthily—this turned out to be rather large volumes of dew! When the dew was wiped off carefully, all was well again.



The choice of which microphone to use is a most interesting one, and this survey has made us very keen to try different microphones in

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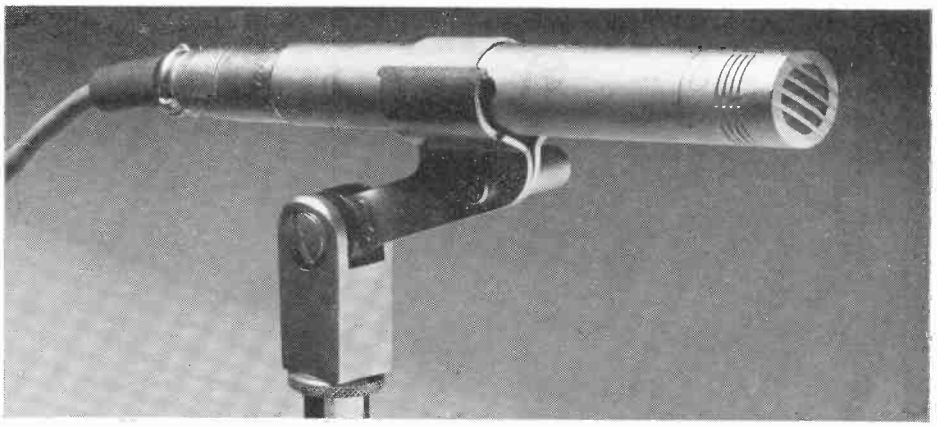
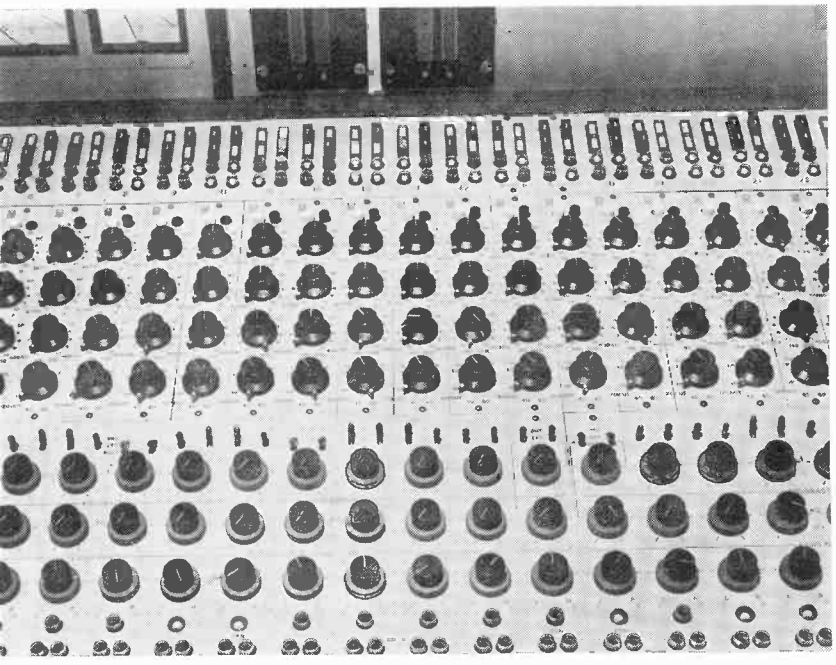


ALL RIGHT
FOR 7 or 8
plus a couple
of
echo returns...



...but how
about when you
get to 16 or 24
or even 32?....
is your memory
infallable?
no one's is....

.... except
compumix

it memorises everything
and gives it back to you
faithfully... every time.

quad/eight by

FELDON

helps you through the night

On Easter Sunday 1964 the medium airwaves suddenly and illegitimately carried the voice of Simon Dee saying 'Good morning ladies and gentlemen' this is radio Caroline broadcasting on 199, your all-day music station'. Ten Years later, almost to the day, Piccadilly Radio started legitimately broadcasting in Manchester. It was an eventful decade for British radio.

The continuing story of ILR—Radio Manchester

ADRIAN HOPE

RADIO CAROLINE WAS the first of the score of pirate stations that were doomed to eventual extinction under the axe of the 1967 Marine Offences Laws. Piccadilly Radio was the fifth of the projected three-score legal independent local radio stations made possible by the Sound Broadcasting Act of 1972 and the Independent Broadcasting Act of 1973. Without the good ship *Caroline* and all who sailed on her, there would have been no Radio Piccadilly, no Capital, no LBC, no Radio Clyde, no Birmingham—no nothing but the BBC. So it is fitting that a fair number of the engineers, disc jockeys and entrepreneurs who received a leaden handshake under the 1967 Act are now employed by or running Britain's legal commercial radio stations.

They are giving the BBC national and local stations a hard run for their money; although Broadcasting House gleefully published audience rating figures that seemed favourable to them, it had to ask Capital's Kenny Everett to call off his listeners after Kenny invited them to phone into the BBC with their comments on these ratings. To put it another way, it is just not possible that a station like Capital —with the Everett and Cash morning shows, plenty of good music and a bottomless pit of new ideas for programmes and promotions— will not make considerable inroads into BBC Radios One and Two and Radio London listening figures. If and when the great British Public becomes used to the idea of an all news station, it is not probable that they will wait patiently for a BBC bulletin when LBC is offering continuous news. Radio Clyde has not only brought stereo radio to Glasgow for the first time ever (neither BBC national nor local radios had a pilot tone to offer up there) but it has brought truly local news reports. As James Gordon, managing director of Radio Clyde, told the IPA Society recently, Glaswegians are not particularly concerned about hearing what traffic conditions are like in London. Don't laugh, he said, as we laughed. That is what BBC radio has been offering us.

After the awful hiccough when I tried to write up Capital Radio soon after it went on the air (and failed through what turned out to be some missing links in the PR chain) I have been back to Euston Tower several times and been made to feel very welcome each time. Most of the teething troubles, both off and on air, seem to have disappeared and I would think that the one lesson to be learned from the launch of LBC and Capital is that starting a radio station from scratch in four months may be physically possible (both LBC and Capital made their deadlines) but it is as pointless an exercise as climbing Everest with one leg strapped behind your back.

On arrival at the railway station, the first thing I saw were vast posters on the platforms advertising Piccadilly on 261. I was directed without problems to the radio station building, which is in the Piazza of the à la mode Piccadilly Plaza shopping and hotel complex in the centre of Manchester. The lack of problems wasn't surprising because the Piccadilly Radio offices are not exactly hidden. Along the edge of the Piazza stretches what must surely be the largest advertising poster in the UK, if not the world. 24m high and 600m long, it runs round the entire south-west corner of the building. It may not be modest but I'll bet it gets people tuning in.

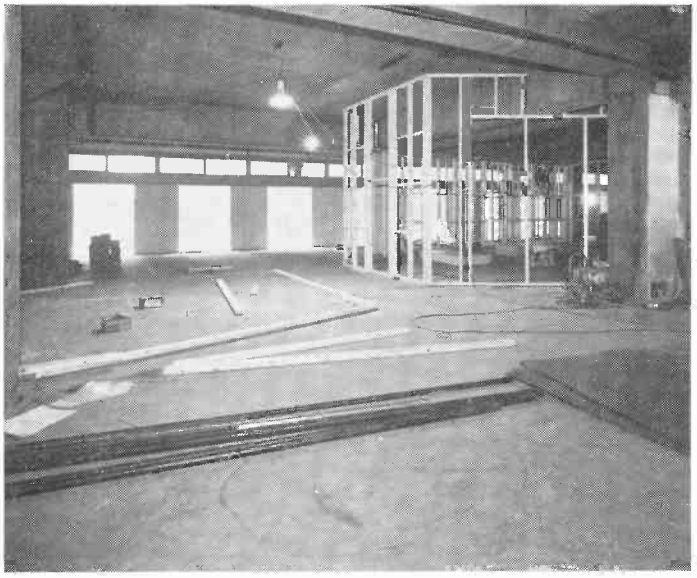
Upstairs in the studios I met Geoffrey White, the chief engineer, along with his assistant Philip Thompson and two engineers from the IBA northern area who just happened to be there on a routine visit. This was particularly fortunate because it enabled me to talk (and thus now write) not only about the Piccadilly station itself, but also about more general matters of reception on medium wave and vhf in the north of England.

As emerged from the Capital article and subsequent correspondence and research, there is no consistent policy of co-sitting BBC and ILR transmitters. This should present no real problem on the medium-wave bands, but on the vhf bands (and especially in stereo, where a good signal strength is necessary for hiss-free reception) problems can and will arise if a listener has a directional aerial sited on a BBC transmitter and thus off-beam and excluding the ILR transmitter. A tangled web of good and not-so-good reasons explain why co-siting is not possible and, in a nutshell, the problem can be summed up as follows:

Because local radio is local rather than national (as are BBC One, Two, Three and Four) separate services must be transmitted to cover separate small city areas all over the country. Because there are just not enough medium wave and vhf wavelengths to go round, some different stations must share the same wavelengths. In order that the transmissions from one local station shall not break through into the transmissions from another station using the same wavelength, the aerial systems used must be directional (ie transmit the power just where it is needed and nowhere else) and of sufficiently low power to fall short of the area covered by a station with a shared wavelength. For instance Glasgow Radio Clyde has been allocated the same vhf frequency as Swansea (95.1 MHz). The Manchester vhf frequency 97.0 MHz is shared by Tyneside-Wearside, with both these stations sharing 261 on the medium wave with LBC (permanent frequency), Glasgow, Birmingham and Plymouth. The extent to which stations share the same wavelength gives some idea of the fine balance which must be drawn between sufficient strength to cover the intended area satisfactorily and insufficient strength to crash in on another station. Whereas the BBC uses both horizontal and vertical polarisation techniques to enhance separation between sharing vhf stations, the IBA has adopted circular polarisation for vhf on all independent stations (this gives improved results for portables and car sets operating with simple whip aerials). Thus there can be no isolation of ILR stations by polarisation characteristics. So far the directionality of the IBA aerials, the transmission powers used and the physical spacing of the transmitters on shared wavelengths has produced no real co-channel interference problems. But of course, the number of ILR stations in operation is still in single figures and it is anyone's guess how successfully the system will work in practice, if and when the eventual target of 60 separate stations is reached.

The best thing we can all do is keep our fingers crossed and hope that the IBA theory works out in practice.

Whereas commercial television and BBC



Left: *How they started out.*
Above: *How they've ended up.*

television now transmit on vhf from shared aerials, there is no such rationalised scheme of sharing between BBC national and local radio and the ILR transmitters. The result, as we have seen, can be exclusion of the ILR signal by a directional aerial lined up on the BBC mast. When the BBC started to realise its plans for 40 local BBC radio stations, the laws to set up commercial radio had not been passed and thus there were no firm plans for any ILR stations. Of course any farsighted planner or politician worth his salt would have known that commercial radio would eventually come to this country, but in the absence of any such foresight, the BBC was left to its own devices and naturally started to transmit local radio from the national or regional BBC vhf transmitters (Wrotham in Kent for London, and Holme Moss for Manchester). Because the regional transmitters were intended to saturate large areas of the country rather than just city centres, they were usually miles away from the service area and thus the local radio stations needed to put out a fair amount of power to reach their intended city audiences (Radio London uses 16.5 kW erp for mono vhf transmissions from Wrotham). Listeners sited their receiver aerials on the BBC transmitters and as often as not used directional multi-element arrays to exclude interference and unwanted reflections. When the IBA engineers started to look round for suitable sites for their transmitters (which, remember must transmit with low power to cover just a selected city area with no interference to other city stations on shared wavelengths) there were very few locations where aerial-sharing between the IBA and BBC would have worked for local transmissions. As a result we have the IBA transmitters popping up all over the country, usually miles from the nearest BBC transmitter, thus by virtue of parallax inevitably out of line with many receiver roof aerials carefully aimed at the Beeb's stalks. In such cases 'a wet piece of string' would serve better as an aerial to receive IBA radio than an extensive multi-element directional array.

So far, many people listen to local radio on portable sets fitted with a simple whip aerial so that the different location of the transmitters is of little consequence. The problems in practice will only make themselves fully felt when more listeners start to listen to local radio in vhf stereo via directional roof aerials sited on the BBC transmitter. Then the relatively low signal strength will manifest itself as a thoroughly unpleasant hiss. It may well be years before sufficient people start listening in stereo to realise that they can't do so without rethinking and reorganising their aerial system. When that time comes listeners may be excused some resentment over the inability of the BBC, the ITA (as it was then) and the Ministry of Posts and Telecommunications of several years ago who could not then muster sufficient foresight, forethought and cooperation to plan for a future of local BBC and commercial radio. They may also wonder why the Government and local planning authorities have made it possible for developers to build skyscraper blocks in our cities (thereby making transmission and reception in those cities even more difficult) but still have the right to refuse space on their roofs for aerials to transmit local city radio and similar services.

I raised some of these points at Manchester and gather that, as yet, there have been no problems encountered with regard to reception. The fm transmissions radiate from Saddleworth with 2 kW erp (the medium wave transmissions are from Ashton Moss, ten or 12 miles out of the city centre, also at 2 kW erp). Tests made by Geoffrey White suggest that the planned and intended 60 dB (1 mV per meter) contours are being met. Both the fm and medium wave transmitter aerial systems are highly directional, the latter having four out of line masts to produce the necessary nulls.

The medium wave signals are piped to Ashton Moss via Post Office land lines but, in the special case of Manchester, the signals to the fm transmitter at Saddleworth are carried by a pair of uhf links operating from aerials on the Piccadilly Radio building roof. The signals are sent up as a stereo pair (on 934 and 938 MHz) with encoding at the transmitter. This facilitates circuit tests—one leg can be fed and the other checked, even during transmission. The Marconi transmitters, which operate unattended, remain permanently on except when servicing is necessary. The transmitters have some power in reserve but it is unlikely that this can ever be used because the Manchester signals would then interfere with Manx radio on the Isle of Man.

There seems to be some tacit back-scratching between the IBA and the Manx station, which has so far avoided what could be an awkward source of mutual interference.

Piccadilly Radio went on the air on the predicted date (April 2) after a year's planning. Geoffrey White and Philip Birch first started working out the station details in April 1973, having been given a clean slate to build it from scratch. The premises which they were able to obtain are almost too good to be true. Around 10 000 square feet of empty space was available in the Piccadilly Plaza; while at his previous job as technical consultant with the Granada Group, he worked full-time to shape the station. Geoffrey White seems almost obsessively tidy, with an abhorrence for trailing cables and untidy wiring. The result is that the station (although not yet quite finished) is remarkably free of clutter. It is clear that this is no happy accident. For instance, before the channels for the cables were let into the floors, full-scale plywood mock-ups of the control desks were built and positioned exactly in their intended positions to place the channels just where they are needed. The use of mock-ups also enabled the designers to be sure that operators would be able to reach what they wanted to reach when they finally sat down and went on the air. As opening day approached, the three-day week hit the station, but all concerned are very proud that they finally met the deadline.

Piccadilly is staffed by about 75 people, of which eight are engineers, some from the BBC and some ex-IBA. In keeping with the philosophy behind local radio, many of the station shares are owned by local newspapers, including the *Bolton Evening News* and the *Rochdale Observer*. Other shares are owned by Granada. The idea behind offering local

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RADIO MANCHESTER

radio shares to local newspapers is, of course, to compensate those newspapers for the likely loss in advertising revenue. The Piccadilly Radio rates seem reasonable. A 30s spot, for instance, costs £4 between 1 am and 6 am, £10 between 7 pm and 1 am, £22 between 2 pm and 7 pm and £34 between 6 am and 2 pm. The station put together its own ID jingle package under the production of Bob Snyder with the music of John Cameron (of CCS fame). Some of the adverts on the air are produced outside, but a fair number are produced by Piccadilly Radio.

Costs vary between a minimum of £10 for a simple announcement on cartridge to £200 or more for a special production with original music. Piccadilly currently has plans to build a special jingle studio to handle the fair amount of work which is coming in from local advertisers; some of the home-grown adverts that I heard, both at the studio and on my portable radio in Manchester over the following weekend, are very reasonable indeed. There seems to be more effort to inject humour into adverts in Manchester than in London, which if it works can be highly successful and if it does not work can be excrutiatingly embarrassing. I didn't hear anything in the latter category possibly due to the station policy of refusing to broadcast anything really bad; on the whole listening to the station is a fairly pleasant experience. True a few of the news broadcasts jarred a bit, and this is one area where any amateurism shows. Over the years we have grown used to hearing the BBC news readers pronounce everything correctly and never fluff a line. When the commercial stations have matched the BBC (the Broken Biscuit Company as they like to call it), then commercial radio will have really arrived. Capital and LBC, incidentally, have greatly improved their newsreading recently.

Piccadilly Radio is adamant that it wants a station image, not an image of individuals. Thus although their two top disc jockeys, Roger (Twiggy) Day and Steve Merike, are both pretty flamboyant personalities, the name of the game is to make Piccadilly instantly recognisable as Piccadilly within a few minutes of tuning in. They have nine hours a day of needle time, but usually do not use it all, probably largely due to the three-hour shutdown. But the station may eventually go 24-hour. There seems to be rather less phone-in than on the London stations; Piccadilly policy here is to use an expert in a studio and encourage listeners to phone in with questions rather than opinions. If the anchor-man in the studio senses that the caller has something worth saying, he then draws the caller out. This way, in theory at least, listeners are spared opinionated lectures from boring callers.

There are ten phone lines into the studios (with the possibility of hitching-up another seven if necessary), these being fed straight through to the consoles, each caller being given and told his line number. The broadcaster has a series of numbered buttons corresponding to numbered lights which show up where calls are available. By pressing button No. 1, he can punch straight through to the caller on line No. 1 etc. There is also facility for conference calls if necessary. So far Piccadilly is not routinely using the 7s tape delay which the IBA insists they must have to hand for use when necessary. General policy seems to be to attempt the programme live, for with delay there is always the risk of confusion due to the delay of the received programme on the caller's radio. But the broadcaster can always switch to delay when trouble is brewing. The switch-over is usually handled by the use of 7s jingles to inject the necessary blocks of time. Perhaps just as effective as the tape delay system (which I am assured was the invention of a certain Mr Goebbels in Germany way back in the Thirties) is the rather simpler 'black list'. The switchboard operators soon learn to recognise the names, and even the voices, of callers who have already proved themselves better left hanging on an empty line than allowed on to the air to bore or abuse listeners. I am reliably assured that one whole vast family is already on the radio station black list, but no one will tell me what it was that they did in the first place to get there.

Most of Piccadilly's output is in stereo with only the telephone calls, sports broadcasts and emergencies switched over to mono. In an effort to check quality, Geoffrey White and his team sat in shifts for 24 hours and recorded everything the station put out in stereo, monitoring the levels on the ppm meters of a Neve desk. One thing they found out bothered them, and I've been asking around and find that they are not the only ones who have noticed the phasing problem with cartridge machines. The problem is that the cartridges themselves are essentially fairly cheap plastic items which carry a stereo recording and cue tones on a continuous loop of tape. All is well with the cartridge system until the two stereo channels are summed to provide a mono signal (either at the transmitter or in a receiver). When summing takes place any differences in phase between the two stereo channels will cause unpleasant audible phasing effects and this means that the azimuth alignment of the heads on all the machines used for recording and playback must be accurately compatible. Unfortunately it is emerging that in practice this is very hard to achieve. The problem is eased if so-called 'Stereo Phase' cartridges (which are precision made and cost around twice as much as ordinary cartridges) are used, but there is still no guarantee that the man who recorded the cartridge (eg in an ad agency) has used a machine with correctly aligned heads. Geoffrey White was even able to show me with Lissajous figures on an oscilloscope how the phasing of a cartridge will change as it is physically touched. Listeners with portable radio sets are unlikely to be bothered by phasing effects on the commercials, but as serious listening to the commercial stations increases, so will the chances of people wondering why the commercials occasionally sound odd. And as commercials are what commercial radio is all about, this is something that can certainly not be swept under the carpet.

Piccadilly has a total of four stations and two control rooms arranged in square format and surrounded by a perimeter of offices and corridors (in many respects very similar to Capital in London). The two control rooms double also as studios for broadcasters who run and ride their own programmes; the equipment shows no signs of compromise. Spendor BC *IIIA* speakers are used in the music studio and KEF monitors in all the control rooms. The speakers are mounted in a rather clever way. Steel rods run up through the ceiling to fibreglass hangers on the floor of the storey above. The speakers are bolted to these rods and thereby are isolated from the studio floor and walls leaving the floor free from cumbersome stands and preventing feed-through from room to room. The desks used are Neve with AKG *D202* and *C451* and Shure mikes. Characteristic of Geoffrey White's meticulous planning is the provision of a phantom power source for a condenser mike at all mike positions. The turntables used are EMT *928s* in the studios and Garrard *301s* with Ortofon arms and Shure cartridges in the listening rooms. The tape machines are Bias for editing and Leevers-Rich throughout in the studios. A touch of Neve limiting is used on fm transmission with off-air monitoring by McMartin receivers for fm and a Trio on medium wave. All programmes are logged on Chilton loggers running at 2.375 cm/s and churning out two tapes a day. The tapes are then kept for three months before re-use.

Isolating the studios from outside sound proved something of a problem for two reasons. Firstly, the physical construction of the building was not suitable to allow the provision of internal brick walls. Secondly, a busy main road runs alongside the building outer wall. The fairly complicated answer was to use a suspended lattice ceiling with lead sheets hanging as curtains down the inside of the studio walls, in cavities bounded by plaster. A series of listening rooms was built along the length of the cavity wall and these open on to a corridor. The corridor then opens on to

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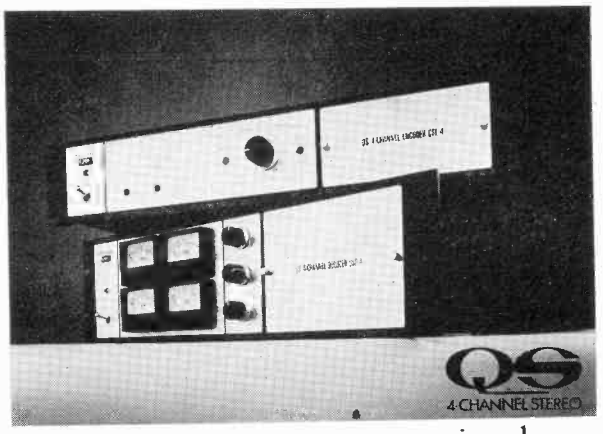

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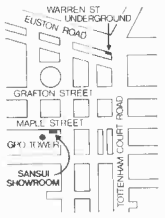

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LETTERS

Dear Sir, Your 'Silly Question' (Cleanfeed, October '74 issue) about 'A' hiring out an acoustically rotten control room at top rates to 'B', whose subsequent discomfiture and fiscal disadvantages appear to be in need of repair, deserves a less than silly answer—but not, I counsel, in the form of a High Court writ.

A large number of studios charge top rates without having competent acoustic design applied to the areas involved or to the air-conditioning system. My partnership spends a surprising amount of time trying to retrieve these situations which should never have arisen in the first place. Some are irretrievable. Not infrequently the advice we have given to eager 'A's is not to build the studio complex at all, or to do it somewhere else. This earns us very little thanks and no fees from 'A' but does save prospective 'B's from predictable disasters.

But you asked what action 'B' should take. He ought to check out 'A's studio facilities first. Of course he did this in the case you cited, but chose an expensive and unrewarding way of doing it, ending up with a useless master tape. A better method would be to ask 'A' for a report of the acoustics and sound insulation of his studio including the relevant data: reverberation curves, measured background noise levels, and so on. If 'A' can't provide that 'B' should go elsewhere, thereby saving time and money. I sympathise with all the disconsolate 'B's everywhere. Now that I've written this, however, 'B's should recognise in future that they could hardly claim 'damage to their reputation as record producers'. If they can't be bothered to read this and act upon it what kind of reputation do they have that could suffer damage? Consider this little parable: a friend of mine owns a decaying 80-year-old house in grave danger of collapse. Within can be found, by looking hard through the gloom, a few musky threadbare rugs and an occasional rotting stick of 'furniture'. He proposes to hire it out as a luxury furnished house at extortionate rates that would enable one to live at the Hyatt Regency Hotel in San Francisco instead. I asked him what qualifications this ruin had to earn the title 'luxury'. 'The rent,' he said.

Yours faithfully, Sandy Brown, Sandy Brown Associates, Architects and Acousticians, 12 Conway Street, London W1P 5HP.

Dear Sir, The review published in the November STUDIO SOUND of our Yamaha *NS 690* raises some interesting points. Since the speaker was submitted for review, the price of the *NS 690s* has been reduced to £219.95 a pair, and I am sure that had the reviewer been aware of this (we forgot to tell him in time) his criticisms on a cost-performance basis would have been less severe.

To some extent this situation is due to geography and I am certain that if the reviewer had been based in Tokyo, where Spendor *BC1s*, KEF *104s* and others cost in excess of £300 a pair, and Yamaha *NS 690s* are only £180 a pair, a different picture would have emerged. Possibly a review on neutral ground would be the answer. Possibly Calcutta.

Thank you for letting me air this view in your column.

Yours faithfully, Malcolm Kays, Natural Sound Systems Ltd, Strathcona Road, North Wembley, Middlesex.

Dear Sir, In your introduction to the October issue of STUDIO SOUND under the heading 'Glossary of Terms' you refer to the need for definitions of technical terms.

We agree. In fact the APRS issued such a glossary to its members in 1967 and are in the process of updating it for inclusion in the new APRS Handbook, due for publication in 12 to 15 months time.

Those who have points of view they wish to have considered should write to the Co-ordinating Editor, John Borwick, B.Sc., Ridge Cottage, Hill Road, Haslemere, Surrey.

Yours faithfully, E. L. Masek, Secretary of the APRS, 23 Chestnut Avenue, Chorleywood, Hertfordshire WD3 4HA.

Dear Sir, We at Neve were very pleased to read your article in the November STUDIO SOUND giving details of a visit by John Dwyer to the Decca Studios in Paris — Société Française du Son.

So that the record is straight we would like to correct one or two small inaccuracies in the article. The channel equalisation units referred to are not of course *108* but the well-known Neve *1081*, which has been acclaimed throughout the world as one of the most sophisticated high performance channel amplifiers available.

The reference to transformers below the photo on page 38 is a little misleading since some of the information is missing. The hum actually arose in the foldback circuits external to the console and not within it as the article suggests.

Finally, good luck to STUDIO SOUND, a very interesting and well-produced magazine.

Yours faithfully, Peter Moody, Rupert Neve & Co Ltd, Cambridge House, Melbourn, Royston, Hertfordshire.

Sorry, and thank you—**Ed**

NEWS

automatically from the encode to the decode mode by the tape recorder r/p switch. Internal rechargeable batteries supply 28V at 200 mA (mono); their capacity is sufficient for 10 hours continuous use in the record mode. The stereo unit consumes 100 mA more. To save battery power, logic ignals derived from the capstan motor control circuits set the unit in the stand-by mode in the absence of capstan rotation. Physical size is about the same as the Nagra *IV*; the whole unit weighs 4.5 kg. Future Film Developments Ltd, 90 Wardour Street, London W1V 3LE. Phone: 01-437 1892/3.

Greek tv troubles

THE GREEK ELECTION campaign is (November) causing problems for Greek television services. Greece has two television stations one of which is run by the Greek armed forces. For the first time, television is being used for election campaigning and the Prime Minister, Mr Karamanlis, has allowed the parties equal time, on the state radio and television stations, but the army station will not be used for campaigning. The right wingers maintain that it would be intolerable for communists to sully the screens of armed forces television by appearing on them. The opposition have said that the government has bowed to pressure from the military establishment and that the armed forces station is answerable to no-one.

Audio show

THIS YEAR'S AUDIO Festival and Fair, organised by Industrial and Trade Fairs Ltd, was held from October 28 to November 3 in the Grand Hall, Olympia. The show, sponsored by the *Sunday Mirror*, attracted 83 000 fee-paying audiophiles a claimed increase of ten per cent on the previous year. The show, the first audio to be organised by ITF, suffered some loss of patronage by the big firms of consumer audio. A spokesman for Thorn, one of this year's non-runners, said that they could 'spend the money better elsewhere'. His comments were echoed verbatim by a press officer for the massive Rank Radio International Group, another retractor; he further stated that the group would look to the provincial fairs for future promotional venues. Another reason given by manufacturers for their reticence to exhibit, stemmed from the 'fiasco of last year's show' alluding to the sight of carpenters and electricians completing stands a day after the show had been declared officially open. Generally, exhibitors stated that they were favourably impressed with the organisation of this year's fair but wished that the show had been better supported by other manufacturers; the gallery above the main floor remained but half full.

AKG CK9 GUN MICROPHONE

By John Fisher

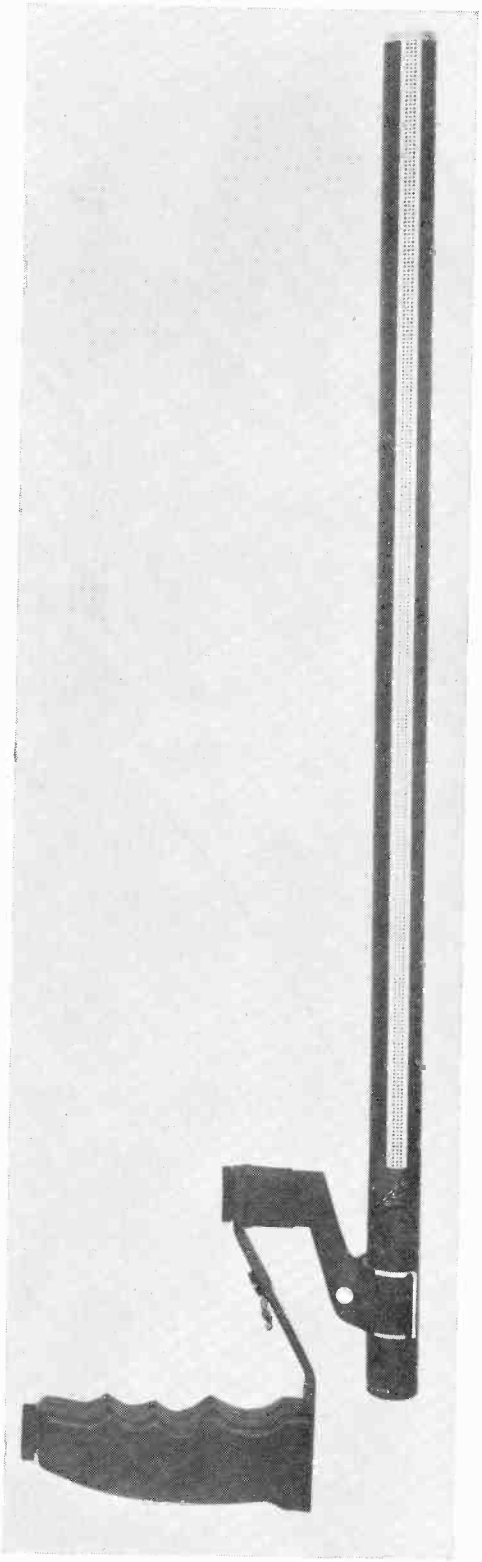

Fig. 1 shows the frequency response of the preamplifier alone, when fed via a source impedance of 600 ohms in series with 27 pF, which is the nominal capacitance of the condenser capsules. It is to be seen that the response in the 'flat' position is sufficiently flat over the audio frequency spectrum, but in the two bass cut positions there is a little boost just above the cut-off frequency. Whilst the manufacturer does not mention this in the specification, it is probably a desirable characteristic; however, it is noted that in the maximum cut position the attenuation is less than that specified.

Because the preamplifier is only intended to operate with the AKG series of condenser capsules, it was not felt appropriate to measure other aspects of its performance on its own for the purposes of this review, and consequently measurements of noise and gain were done for the complete microphone.

Noise of the complete system was determined as an equivalent sound pressure level of 22 dB(A), with the preamplifier set for a flat response. Such a performance is remarkably good and well within the manufacturer's figures.

Sensitivity at 1 kHz was found to be 0.95 mV for 74 dB spl (equivalent to 1 microbar) which is close to the related sensitivity.

The frequency response performance, which is shown for four different angles of incidence in **fig. 2**, must be regarded with some caution, as the plots were obtained under conditions that were not perfectly anechoic. However, the characteristics shown reflect the general pattern of the microphone's performance where at zero degrees incidence the frequency response is largely flat to greater than 16 kHz and a rapid but smooth fall-off in treble occurs as the angle of incidence is increased. The front to back performance was found to be very good over the complete audio spectrum.

The output impedance of the assembly was measured at under 300 ohms at frequencies up to 5 kHz, from where it rose to 500 ohms at 16 kHz. Whilst this characteristic is quite acceptable for normal purposes, the impedance at high frequencies is somewhat higher than the specification suggests and could be troublesome in exceptional circumstances.

Finally, the current drawn by the system at 9V dc was measured as 1.7 mA quiescent, which means that between 200 and 300 hours' life can be expected from a PP3 size battery driving the system, as is the case with the optional type *B46E* power unit.

Hugh Ford

MANUFACTURER'S SPECIFICATION
CK9 Gun
Frequency range: 30 to 18 kHz.
Directional characteristic: lobe.
Sensitivity at 1 000 Hz: 1.1 mV/μbar (—59 dBV).
Equivalent noise level: 24 dB with filter CCITT-C/DIN 45 405.
Weight net: 480g.
Dimensions: 610 mm long x 23 mm diameter.

MANUFACTURER'S SPECIFICATION
C 451EB preamplifier
No-load amplification: 0.47 ±0.5 dB (feeding via 27 pF condenser and laod of studio amplifier ⩾3 000 ohms).
Impedance, 20 to 20 kHz: ⩽200 ohms.
Operating voltage: 9V dc.
Universal phantom powering: 9-52V dc.
Current consumption: ⩽5.5 mA to DIN 45 596.
Frequency range: 5 to 30 kHz.
Bass attenuator built in: Flat or —7 dB at 50 Hz or —20 dB at 50 Hz switchable.
Unweighted noise level: 3.6 μV eff in flat response setting.
Equivalent noise level: 21 dB weighted to CCITT-C/DIN 45 450 in flat response setting.
Price: £38.90 for gun; £72.00 for preamplifier.
Manufacturers: Akustiche U. Kino Gerate G mbH, A-1150 Vienna 15, Brunhildengasse 1, Austria.
UK agents: AKG Equipment Ltd, Eardley House, 182/184 Campden Hill Road, London W8.

Introduction

THERE HAVE BEEN many attempts to produce the perfect ultra-directional microphone, otherwise known as gun, shotgun or rifle microphone. Very few have been entirely successful, though many have proved useful in particular applications.

The gun microphone has become familiar over the years in film work, where the microphone must be kept out of camera shot, in television, in news reporting, sound effects recording/broadcasting and more recently in sound reinforcement. The majority of gun microphones have been dynamic types, though a number of capacitor gun microphones and

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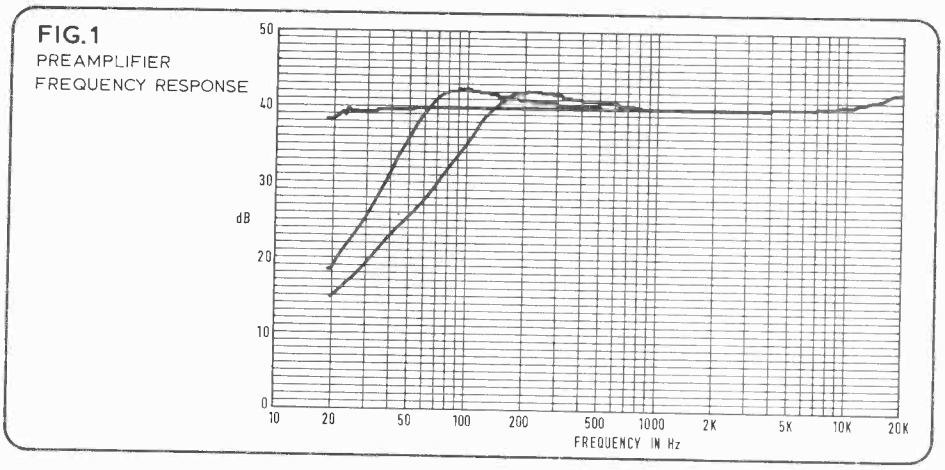
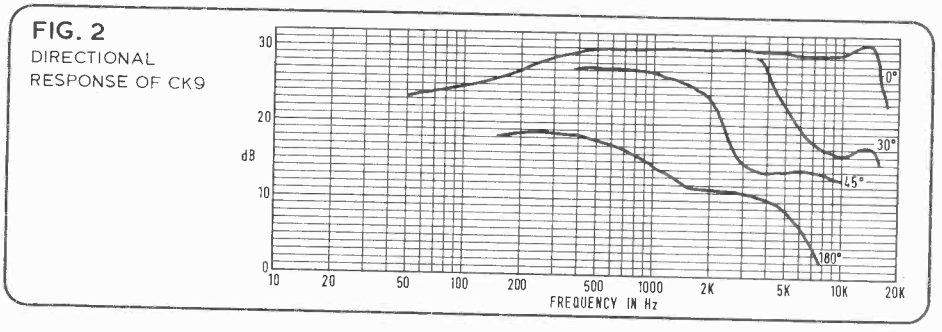
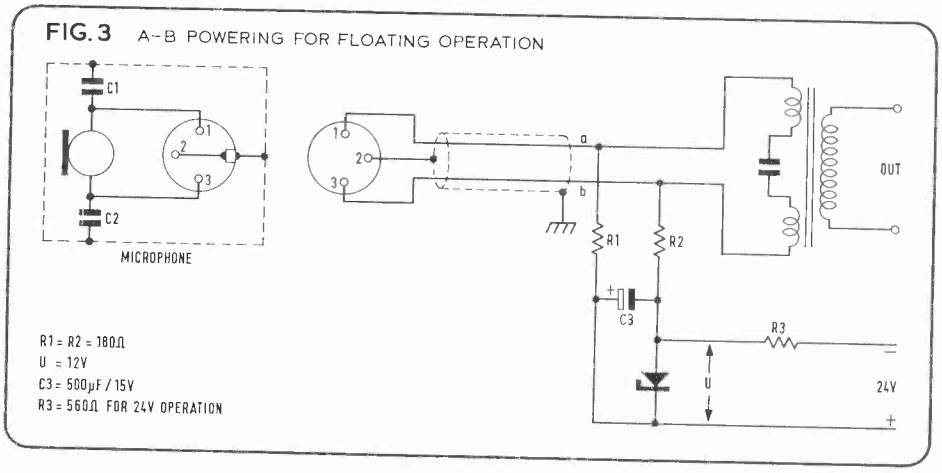
other highly directional devices have been produced.

There have been several main approaches to the ultra-directional microphone, including the use of bundles of tubes of various lengths ahead of the transducer, use of slotted tubes, multiple apertures etc, to produce interference and/or phase-shifts for sound coming from off axis without effect, hopefully, on sound coming along the axis of the microphone (see Robertson, 'Microphones' (Iliffe) Ch.11, and Burroughs, 'Microphones: Design and Application' (Sagamore) p73 et seq). There have also been a number of horn/lens arrangements, and the parabolic reflector.

The AKG *CK9* capsule, part of the CMS modular range, is a capacitor type fitted with a slotted interference tube, and has been developed from a familiar professional cardioid microphone capsule.







Operating principles

The *CK9* capacitor capsule, developed from the more familiar *CK1* capsule used in the *C451* and *C452* microphones, was designed for high directivity, independent of frequency, in the smallest dimensions possible. It uses a combination of interference and pressure gradient principles. At high frequencies, directivity is achieved mainly by interference between sound waves entering laterally through holes along the length of the tube. At low frequencies, directivity is obtained by a large pressure gradient and phase shift; low frequencies have access to the rear of the microphone diaphragm via three small apertures, a loading cavity and the backplate of the capsule proper. In fact, to simplify things a great deal, the *CK9* appears very similar in construction to the standard *CK1* capsule with the addition of the front tube and with three of the four sets of apertures behind the diaphragm blanked off. The result is an increase in directivity from three for a cardioid to approximately ten mid-band for the *CK9*—in other words, while a cardioid would pick up about a third of the random sound or reverberation that an omni-directional microphone of the same axial sensitivity would, the *CK9* picks up only about one-tenth *at mid frequencies*. The effect is to enable the microphone to be used about three times as far away from the sound source as would be possible with a cardioid microphone to maintain the same ratio of direct to indirect sound, or that at the same distance the reverberation or indirect sound will be reduced by a factor of approximately 10 dB mid-band.

In fact, according to the manufacturer's curve, the directivity (γ) drops to about five at 150 Hz and rises to about 17 by 10 kHz. This inevitably affects the quality or spectral balance of the reverberation, and probably for this reason the axial response has been tailored somewhat so that the nominal response at 50 Hz is some 6 dB down on that at 1 kHz, with the output rising gently to a maximum of about 4 dB around 12 kHz, which not only tailors the response nicely for intelligibility over the speech band in unfavourable conditions but also balances to some degree the reduction in discrimination at lf and increase in discrimination at hf. How much is deliberate and how much fortuitous only the designer knows, but the result is undeniably satisfactory in practice for most purposes!

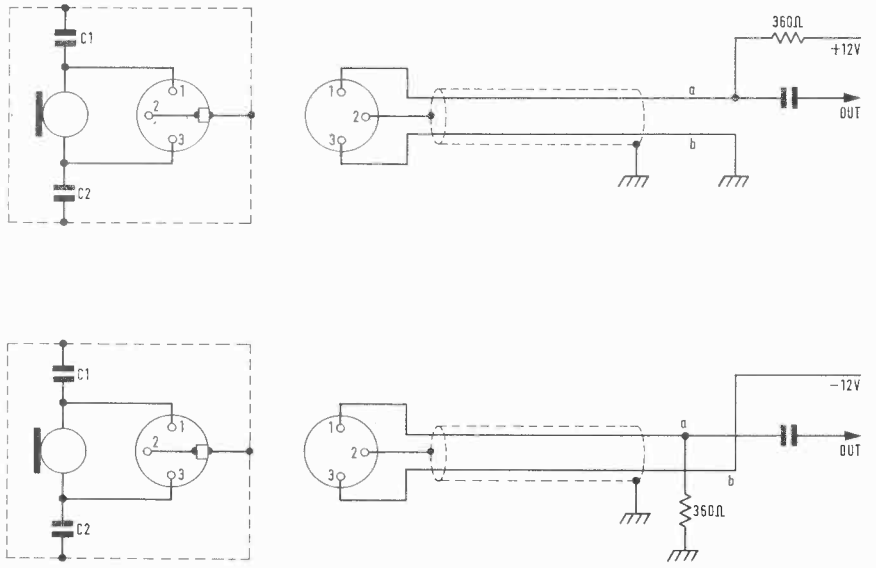
It should be noted, however, that at 180° the output from the *CK9* at low frequencies is actually *greater* than the 180° output from the *CK1* cardioid, owing to the introduction of a small rear lobe in the characteristic (AKG describe the characteristic as club-shaped); on the other hand the mid/low frequency output is some 6 dB down (nominal) at 45° to the axis of the *CK9*, while this reduction in output is not heard until about 90° with the *CK1* cardioid.

It is normally assumed that the damping materials and acoustic design of a highly directional microphone of this kind will result in a sensitivity on axis somewhat lower than that of a cardioid of similar basic construction. In fact the quoted sensitivity of the *CK9* is 1.1 mV/μbar compared with 0.95 mV/μbar for the *CK1*, and the effective noise level is only degraded from 22 to 24 dB (weighted).

Additional items

The amplifier supplied with the *CK9* was the *C451EB* preamplifier, which is marginally quieter than the *C452* amplifier, is phantom powered from a supply of 9 to 52V and incorporates a three-position switch with two

FIG. 4 A-B POWERING FOR UNBALANCED OPERATION



bass-cut positions and one flat position. The bass roll-off frequencies are 75 and 150 Hz, and the positions give respective attenuations of zero, seven and 20 dB at 50 Hz (manufacturer's figures). The equivalent noise level of the amplifier is degraded nominally by 1 dB in the bass-cut positions. The 'E' version is *XLR* compatible; a similar ('C') version is DIN compatible. The battery unit has a 9V battery and transformer to provide powering independent of the mains; a standard *PP3* battery gives a nominal operating life of 40 hours, and while the consumption of the microphone amplifier is only some 2 mA at 9V, any significant fall in supply below 9V reduces the sensitivity.

Construction

I must confess here and now that I regard the *CK9*, like the Sennheiser *MKH815*, as one of the most beautiful pieces of audio engineering, visually, that are about. The *CK9* is a long, slender matt-black tube, with a matt-black end enclosed in a matt silver ring, and with a matt silver stripe running almost the full length. Into this fits the even more slender, sand-blasted nickel-plated amplifier unit, about half of which projects from the tail of the *CK9* to accept the connector. It seems a shame to obscure this elegant and yet totally unobtrusive design in a windshield!

Raptures over, down to facts. The *CK9* incorporates a ceramic electrode and embossed metal diaphragm for stability with age, temperature and humidity. The interference tube/capsule assembly is some 610 mm long, 23 mm in diameter. The interference apertures (in the silver stripe) are three rows of square perforations of side 1 mm, over a length of 495 mm. The diaphragm appears to be situated at the end of the rows of perforations, and the three rear apertures, each about 13 mm across by 2 mm, are centred about 10, 14 and 18 mm behind the last of the interference holes. Behind these again are the factory-fixed retaining grubscrews for the capsule, and the remainder of the tube is the sheath for the front part of the *C451EB* amplifier, which screws on to the standard capsule mounting inside the sheath.

This raises two of my few criticisms: when the amplifier is screwed home, it is not possible to alter the setting of the bass attenuator without unscrewing the amplifier from the *CK9*, thus temporarily disabling the microphone, and it is thus not possible to compare instantly the effect of the attenuator in and out. While this may to some extent be a good thing in that it may discourage fiddling and also prevent accidental operation of the switch (though it would be quite a feat to operate it accidentally, it is so small and well recessed), if the switch has to be reset in the field it does mean unscrewing the unit, and consequent extra wear on and risk of damage to the capsule thread. I can't say I am entirely happy about regular screwing and unscrewing of that fine thread, having heard the odd unhappy tale about damage to capsule threads in the past. One is not, however, *obliged* to unscrew the units unless one wants to alter the bass setting, so the two could normally be set up as one unit and left.

A soft carrying case is provided, in addition to a rigid tubular transit housing, but the foam plastic which comes round the *CK9* will scarcely accommodate the extra length of the amplifier, though the case will at a (firm) push. The amplifier comes with its own padded and foam-lined case. The *CK9* also comes with its own axial response curve as measured by AKG.

The *C451EB* amplifier is 18 mm in diameter and 136 mm long overall (10 mm shorter in the C version). The amplifier, built around a printed circuit panel running most of the length of the housing, contains an fet bipolar impedance converter driving a centre-tapped output transformer; this allows phantom powering via the two cores of the screened cable which carry the balanced audio output. The amplifier also

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AKG CK9

contains a small hf oscillator and rectifier unit to provide the necessary polarizing voltage for the capsule; suitable filters to remove supersonic frequencies are incorporated in the output from the amplifier.

Since the *CK9* is part of the AKG CMS range, it can alternatively be used with the *C452C* or *C452E* amplifiers (DIN and XLR respectively), which are designed for phantom powering over a limited range of supply voltage (40-54V) and take both amplifier supply (0.5 mA) and polarizing voltage direct from the phantom supply. This makes the combination less suitable for battery operation and hence for portable or mobile work, however. Also, the equivalent noise level of the amplifier is nominally some 3 dB higher (weighted) than that of the *C451C* or *E*, which may prove troublesome when working well back from a sound source or with quiet sounds. Mechanically the two amplifier versions are similar.

As mentioned earlier, the *C451EB* amplifier supplied incorporates a switched bass attenuator, which is useful in removing rumble and handling noises, and wind noise, in mobile, boom or outdoor applications. The switch is set back in a narrow slot halfway up the body of the amplifier; it must be adjusted by levering with a fine screwdriver or similar implement, and there are three distinct click settings as well as clearly engraved markings. A tight-fitting plastic skirt around the lever minimises the risk of objects entering the amplifier housing.

The inside of the amplifier case is threaded at one end to accept the fine thread used on the capsules of the CMS range; the other end is fitted with the appropriate male *XLR* (or DIN) fitting.

Performance

General

Tests were carried out over a period of several weeks to assess subjectively the performance of the *CK9/C451* combination, with and without windshield, under a variety of conditions. A number of other capacitor microphones were used for comparative purposes, and listening tests were carried out using Spendor *BC1* and other high-quality loudspeakers.

No operating instructions were provided, but it was felt that the extensive information provided by the data sheets accompanying both *CK9* and *C451EB* rendered further instruction largely unnecessary. The battery power unit supplied was used throughout and was found very convenient to use, though it is quite easy to forget to switch off at the power supply if the microphone is not disconnected after use.

Sound quality

Sound quality was assessed both using live/relayed comparisons and live/recorded comparisons on speech tests, and limited music tests. Performance was assessed both indoors and outdoors; outdoor assessments included performance in windy conditions, under moving and hand-held conditions, and with and without windshield.

It came somewhat as a surprise to find just how excellent the sound from on axis was, with no concession to the microphone being a special-purpose unit. Background hum and hiss were always commendably low, and no temperamental troubles were experienced even on quite cold or humid days.

Speech

In all cases the reproduced sound was felt to be exceptionally clean and natural. There was a complete absence of sibilance, even when speaking a few centimetres from the front of the microphone (a condition unlikely to be encountered in practice). Fairly careful positioning and aiming of the microphone is necessary in view of the sharply directional characteristic and the more rapid narrowing of the front lobe at high frequencies than at lower frequencies.

Used outdoors the reproduced sound was very slightly 'light' on both male and female voices, probably a reflection of the slightly rising overall response (according to AKG's own measurements on the review sample the response—with bass attenuator set flat—rose gently by about 6 dB between 50 Hz and 1 kHz, and a further 2 dB between 1 kHz and 10 kHz). This lightness is not obtrusive, only apparent by direct comparison with the live voice and with relayed sound using a microphone without this tilt in response; it adds considerably to intelligibility under noisy conditions and to my ears is much to be preferred to presence bumps and the like, which can always be added if required. Used indoors, or in reverberant surroundings, the overall sound is nicely balanced by this response tilt and the effect is much less apparent.

The combination of a highly directional characteristic and the excellent low-noise properties of the microphone amplifier give a remarkably quiet and clean signal even with natural speech levels some way away from the microphone; it is hardly an eavesdropper's instrument, on the other hand.

Voice and guitar

As part of the limited music tests, recordings and comparisons were made of a singer with own guitar accompaniment in a fairly reverberant acoustic. Excellent results were obtained with the capsule end of the *CK9* about 2.5m away from the performer. The voice was largely uncoloured and the character and attack of the guitar were well maintained, while the resulting recording sounded fairly dry; an omnidirectional microphone used at the same range produced a very live sound that verged on bathroom quality.

With the microphone moved in to about 1.5m from the performer it became possible to introduce substantial amounts of general noise and disturbance in the room, other than on the axis of the microphone, before pickup of these sounds became obtrusive, illustrating the potential of this microphone for reinforcement of performers without their being tied to hand mics or obscured by stand mics.

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VIDEO RECORDER GUIDE

Make & Model	Tape Size	Colour	B & W	Mains	Portable (battery)	Edit	Slow Motion	Time Lapse	General	Compatability code	Price & (At Press)
IVC 705P (P/C)	1″	(o)	o	o					Will play 525 line 60Hz tapes, 2 audio tracks, stop frame, studio quality.	A	1968 mono (2270) colour
IVC 711P (P/C)	1″	(o)	o	o					2 audio channels, stop, frame.	A	1491 mono (1793) colour
IVC 741P (P/C)	1″	(o)	o	o				o	High quality, 2 audio tracks, stop, motion.	A	2547 mono (2849) colour
IVC 761P (P/C)	1″	(o)	o	o		o			Assemble edit, 2 audio tracks, stop, frame.	A	2170 mono (2472) colour
IVC 801PSM	1″	(o)	o	o			o		2 audio tracks, stop, frame.	A	2124 mono (2426) colour
IVC 821P	1″	(o)	o	o					2 audio tracks, stop, frame, off tape monitoring.	A	2763 mono (3065) colour
IVC 871P (P/C)	1″	(o)	o	o		o			Insert edit, 2 audio, stop, frame.	A	4052 mono (4354) colour
IVC 900	1″	(o)	o	o		o			Ultra high quality, broadcast options.	A	7518 to 20760
IVC 100	1″ cartridge	(o)	o	o					2 audio channel high performance cartridge loading.	A	tba
Ikegami 321	½″		o	o					Remote control option.	B	420
Ikegami 321C	½″	o	o	o					Remote control option.	B	595
Ikegami 321L	½″		o	o				o	Remote control option, 12+ 24 hours record.	B	720
JVC KV 350	½″		o	o		(o)			Mechanical edit, built in SPG.	B	368
JVC KV360	½″		o	o		(o)	o		Mechanical edit, built in SPG.	B	432
JVC PV 4500	½″		o	o	o				Includes hand held camera, mic., mains/charger unit.	B	745
JVC CR 5000	¾″ cassette	o	o	o					Remote control option, 2 audio tracks, player only.	C	664
JVC CR 6000	¾″ cassette	o	o	o		(o)			Remote control option, 2 audio tracks.	C	749
National NV 3020E	½″		o	o					High quality, audio dub.	B	350
National NV 3040E	½″		o	o					Remote control option.	B	495
National NV 3030E	½″		o	o		o	o		Insert edit, Audio dub.	B	535
National NV 1070	½″		o	o				o	12 hour record.	B	590
National NV 3082	½″		o	o	o				Includes camera, mic., mains charger unit.	B	750
National NV 5125	½″ cartridge	o	o	o					Cartridge loading, stop, frame, auto repeat.	B	595
National NV 3000	¾″ cassette	o	o	o					Complete with off air tuner, monitor, auto colour lock, RF output.	C	890
Shibaden 610	½″		o	o			o		Audio dub, variable speed playback.	B	380
Shibaden 610 KD	½″		o	o		o	o		Insert & assembly edit.	B	620
Shibaden 620	½″	o	o	o			o		Audio dub, variable speed playback.	B	595
Shibaden 620 KD	½″	o	o	o		o	o		Insert & assembly edit.	B	880
Shibaden 612K	½″		o	o				o	6, 12, 24, 48 hours record.	B	810
Shibaden	½″ cartridge	o	o	o					Cartridge loading.	B	580
Sony CV 2100	½″		o	o		(o)			Mechanical edit.	D	365
Sony AV 3620	½″		o	o					High resolution.	B*	380
Sony AV 3420	½″		o	o	o				High resolution, complete with camera, mic., mains/ battery charger.	B*	810
Sony CV 5600 P	½″	o	o	o		o			Mechanical edit.	D	745
Sony AV 3670	½″		o	o		o			High resolution, insert & assembly edit.	B*	575
Sony EV 320 CE	1″	(o)	o	o		o	o		Studio quality, insert & assembly edit, still frame, colour & remote option.	E	1850
Sony VO 1200	¾″ cassette	o	o	o					PAL/NTSC playback, auto repeat search, 2 audio channels.	C	640
Sony VO 1810	¾″ cassette	o	o	o					PAL record/playback, NTSC playback, 2 audio channels, search, auto repeat.	C	735

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Obviously there are limitations of movement, and the 1.5m is about the closest distance practical for this arrangement in order to preserve the balance between voice and guitar. Used closer on voice alone, the microphone discriminated quite well against the guitar (acoustic) provided the mic was inclined upwards from in front of the performer so that the soundbox of the guitar was towards the least sensitive direction of the microphone at low frequencies. In practice it is a little more difficult to position the microphone for reinforcement of the guitar as it becomes rather hard to avoid changes in balance and sound quality with movement.

Voice

As an extension of the above, tests with close singing were carried out. No problems or vices were encountered provided the singer remained reasonably on axis and did not approach closer than about 8 cm from the end of the microphone. On-axis sound was slightly light but otherwise clean and free from any apparent nasties.

Musical box

In order to examine whether the *CK9*'s complicated arrangement of tube, slots, damping materials etc produced any nasty effects on transient sounds, as from a musical box or the like, comparisons and recordings were made using a small musical box, with great care that the reproduced sound was at the same level as the original, and that in the case of the recordings the A-B test was made with the musical box and speaker in as nearly as possible the same position in the listening room; listening was carried out at various distances. The results were quite remarkably good and very much better than similar tests with another less complex capacitor microphone. The sound was clear, bright and without unnatural tizz or fuzz of any kind. There were no reservations except that it is most important that the sound should originate on axis; at 10° off axis it was surprising how the quality was 'shaded'.

Piano

The piano is possibly not the first instrument that springs to mind when considering applications of the gun microphone, but I felt it would be interesting to see just how well piano could be recorded (in mono) using the *CK9*, in view of its satisfactory performance on other material so far.

Apart from a slight lack of bass at the bottom, quality was remarkably good. A recording made at approximately 5m in a live room sounded quite dry on replay, except right in the bass where the fall in directivity was not entirely balanced by the falling response, and where raising the bass to compensate made matters worse. However the exercise did show just how good the results could be should the need arise.

Birdsong

A number of outdoor recordings of birdsong and other sounds, natural and unnatural, were made. These included, as well as birds, the sounds of active bees, passing helicopters, cars and aircraft, children at play, distant lawnmowers, telephones etc; in fact a fair package of general sound effects. All reproduced convincingly; on a still day there was no need for the windshield and with care handling noise and transmitted rumble were minimal.

This and similar gun microphones are being used for natural history recordings by a number of professionals, particularly those connected with natural history films; this is to be expected in view of the excellent sound quality obtained, the standard of construction and pedigree of the instrument, and the ease with which it is handled, quite apart from its unobtrusive appearance. On the other hand it must be remembered that many sounds in nature are quite quiet, as too are distant sounds such as cricket ball hitting stumps, so signal-to-noise ratios can become a problem. The background noise of the *CK9/C451* system is very low, but nevertheless there comes a point where a distant sound is just too quiet for a satisfactory signal-to-noise ratio to be obtained.

A gun mic can discriminate against ambient noise, but not against its own amplifier noise; unlike the old parabolic reflector arrangement there is virtually unity gain in the direction in which the microphone is pointed, by comparison with the basic cardioid. At frequencies where the diameter of a parabolic reflector is substantially greater than the wavelength of the incident sound, a considerable improvement in the output results through focussing of the sound on to the microphone, which can be an omnidirectional or cardioid type according to the relative importance of signal level and narrow angle of pickup. Against this, there are the disadvantages of poor directivity at low frequencies and variations in frequency and polar response at middle and higher frequencies (Robertson—'Microphones', Ch. 11). Nevertheless, there may be instances where a good, quiet cardioid such as the basic *CK1/C451* combination, in conjunction with a suitable reflector, may be more appropriate where appearances can be traded for signal.

Polar response

Mention has already been made of the apparent rapid fall in output off axis, and the club-shaped design characteristic for the polar response over a wide frequency range. Some speech tests were therefore carried out to supplement the observations under various headings above with regard to the subjective polar response over the speech band. These were in turn supplemented with similar tests using the musical box, which showed up rather more easily the narrowing of the response lobe at high frequencies.

At 15° off axis, the output from the musical box was noticeably dulled; at 30° off axis, speech and musical box were both down in level, particularly in the extreme top. At angles beyond that it was easier to get meaningful results with speech than with the musical box, which is fairly quiet in any case. Minimum output in the speech band seemed to occur at about 120° to the main axis of the microphone, and output was still very well down at 180°.

Next, to investigate the effect of the interference slot on the polar response around the microphone, it was mounted fairly low on a stand, facing upwards from a well-carpeted surface. The speaker then walked sideways in a circle around the microphone, speaking at a constant angle of about 45° to the main axis. Taking the interference slot as reference, the top apparently reached a maximum at about 180° to the slot, ie with the interference slot out of sight behind the microphone. The effect was slight, however, and I would doubt very much that it would ever be of much consequence.

Popping

The popping problems associated with some microphones on close speech or singing are unlikely to be encountered with this one if only because of its likely uses. A possible exception is during radio or television interviews in a crowded area, where the gun mic might be held over the heads of the crowd towards the interviewee and might either accidentally be swung too close or come close to some other speaker (it would be very bad policy to use the microphone within a few centimetres of a person in the majority of sound reinforcement applications). It was found that close speech at about 5-8 cm from the front of the tube would produce some popping, but the problem is completely removed by use of the windshield and is very unlikely to be a serious one.

Wind noise

The microphone was used successfully out of doors on a calm day without the need for windshield or lf filters. A moderate breeze caused some noise, however, and a strong wind a fair amount of blasting, as is to be expected. AKG supply a polyurethane foam windshield (type *W19*) which covers almost the full length of the *CK9* and offers a claimed attenuation of 20 dB to wind noise. They also supply and recommend the Rycote windshield (see below), designed for use with the *CK9* and similar slimline gun microphones; this proved entirely successful in coping with all winds at our test site.

Handling noise

On the whole the microphone proved relatively free from handling noise, though handling was much improved by the compliant mounting in the Rycote windshield. The attenuation of rumble and bumps was helped by the use of the 75 Hz filter, without seriously degrading the response.

The rubber handgrip *H7* may also be used to reduce handling noise in conjunction with the windshield or a fixed stand grip for the microphone.

Bass filters

The *C451EB* amplifier supplied with the *CK9* was the version incorporating switched bass filtering from 75 and 150 Hz, giving 0, 7 and 20 dB attenuation at 50 Hz in addition to the design attenuation of low frequencies.

Most listening tests were carried out with the switch in the flat position. The 75 Hz turnover position was found useful in reducing handling bumps and rumble, without affecting speech quality; it did not cope significantly with wind rumble, for which the 150 Hz setting was better and the windshield very much better still. Obviously the 150 Hz position could be useful under adverse conditions of lf noise and rumble, but where possible the 75 Hz setting would be preferable if the flat setting cannot

be used. If the switch, which is obscured by the end of the *CK9* tube, is to be left set, I would feel inclined to position at the 75 Hz turnover for general use as a compromise, as the 150 Hz setting normally makes speech sound a little thin. Obviously this is a matter for personal experiment, however, and for musical purposes the bass loss would have to be borne in mind; on the other hand for bird-song recording etc the bass loss could be an asset in reducing distant traffic rumble etc from the outset.

An external bass filter type *KF 1E* (–30 dB at 30 Hz ref 100 Hz) is also available.

Residual noise

To those who know the *C451* family of microphones it will come as no surprise that the background noise of this combination is very low and allows considerable flexibility in use. Moreover, regardless of noise measurements and weighted/unweighted figures, the microphone *sounds* quiet—what hiss there is, is smooth and its spectrum makes it unobtrusive. No hum problems were encountered, even when using the output unbalanced. The source impedance is below 200 ohms, and long balanced leads may be connected without problem. It is very unlikely that distortion would ever be a problem.

Summary

The *CK9*/*C451* combination gun microphone is a beautifully made and finished design. It produces sounds of a very high quality, with low background noise levels as well as low ambient noise levels. The axial frequency response is smooth, and the slight rise from extreme bass to the top end, some 8 dB in all, produces the effect of a clear and balanced sound in conditions of high ambient noise or reverberation without making the instrument unusable for music purposes. Its speech performance is particularly good. The microphone offers a high degree of discrimination against off-axis sounds, and though this discrimination is not wholly independent of frequency the polar response is well maintained over a wide range; discrimination is considerably better than on many earlier and present designs of gun microphone and the deficiencies are to some degree mitigated by the slight tilt of the axial frequency response. In conjunction with the other accessories available, the *CK9* is a most useful component in the CMS range from AKG and offers great flexibility in use.

In addition to what one might call the traditional uses of the gun microphone—hand-held outdoors, boom-mounted indoors and out—high quality gun microphones are now being used in high quality sound reinforcement and for stage pick-up in the theatre, where it may be necessary to place a microphone by the edge of footlights or even in the pit while discriminating against nearby (orchestral) sounds. On the strength of my own experience with this microphone, I would expect this to be a growing use of the gun mic where—as in this case—the microphone's performance will enable this to be done satisfactorily. The *CK9* has the bonus of being inconspicuous, and beautiful if you do spot it.

B 46 Battery unit

The *B46E* is a small, solid, matt-nickel finished unit, approximately 35 mm square by 114 mm long (142 mm including *XLR* female termination), with a captive screened-twin lead providing a balanced output via an isolating transformer. The transformer is centre-tapped on the input side to provide 9V phantom powering for the microphone via the balanced signal leads and the microphone output transformer. There is a recessed slide switch in the case, to switch the supply on and off, with an engraved red dot for 'on'. A single large non-captive bolt, which can be turned easily with a ½p piece, enables the inner part of the unit to be slid out to exchange the 9V *PP3*-type battery or equivalent Mallory *TR146X* cell. The battery supply is decoupled. A similar unit designated *B46C* is available with DIN connector for use with the appropriate leads and amplifier. The unit is intended to supply one microphone only.

Rycote windshield

The Rycote windshield intended for use with the *CK9* assembly is a long, white sausage-shaped affair, fitted with a detachable handle. Externally, the windshield is made of a stiff, coarse white plastic mesh, with large spaces between the cross-members of the mesh. The two ends are rounded, and the hemispherical ends are coupled to the long tubular section with grey plastic rings. The ring at the tail end of the shield is split, and a cunning hole-and-pimple plus velcro tape arrangement allows the end to be removed and replaced easily in order to fit the microphone inside; there is a small double slot provided for the microphone cable to emerge through this ring, and the cable is gripped quite well by this arrangement when the microphone is in position. Inside, there is another reinforcing ring at the middle, and the inside of the plastic mesh is lined with thin white brushed nylon or some similar material. A reinforcing strip of plastic along part of the length of the shield carries the bolts for fastening the detachable wooden handle, as well as the compliant rubber mountings for the nylon grips that hold the microphone. Slipping the microphone in and out of these is quite easy once the knack is acquired. The microphone is positioned so that neither the front nor back of the *CK9*/*C451* unit rubs on the fabric at the end of the windshield.

In use the windshield was found to be completely effective in moderate winds and when swinging the microphone unduly rapidly. Unfortunately, there were no gale-force winds during the period of test. The windshield also helped cut down handling noise and rumble considerably, because of the compliant mounting inside. However the varnished wooden handle did give rise to some scuffing noises, which were completely eliminated by using the AKG *H7* pistolgrip, for which the end of the wooden handle carries a threaded insert. The balance of the combination is good for easy handling and rapid pointing and, if anything, is improved by use of the *H7* as well.

Comparative tests were tried with the windshield on and off the microphone, to see whether there was any detectable affect on sensitivity or frequency response. The effect on speech was very subtle, if any, and I would strongly recommend the use of the Rycote windshield with the *CK9* for outdoor or hand-held use.

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■ AKG CK9

Accessories

The use and performance of the various accessories supplied with the *CK9/C451EB* for evaluation have been dealt with in the body of the field trial, and I shall confine myself here to brief descriptions.

H7 Pistol grip

The *H7* pistol grip is intended for use in conjunction with the *CK9* and either the Rycote windshield or the AKG *SA70/3* stand adaptor. The pistol grip is moulded in a semi-flexible rubbery material, which reduces the transmission of rumble and bumps, and produces less finger movement noise than the wooden handle of the Rycote windshield does without the *H7*. The finish is matt black. A useful extra.

SENNHEISER MKH 815T

By John Fisher

THE TESTING OF the microphone was necessarily fairly basic, for as with other electroacoustic transducers there is always some doubt as to what extent the measured results correlate with the subjective performance. The sensitivity was found to be 5 mV using the DIN standard powering arrangement for a sound pressure level of 74 dB spl at 1 kHz (equivalent to 1 microbar) which is within the upper limit of the manufacturer's specification allowing for measurement errors. Because of this high sensitivity the microphone is capable of delivering up to half a volt at high sound pressure levels, so considerable care must be exercised to make certain that the microphone amplifier being used is capable of handling such a high level without overload; if necessary attenuators can be inserted in the microphone line without excessive loss in signal to noise ratio.

As shown in **fig 1**, the microphone's impedance is less than 20 ohms between 500 Hz and 20 kHz, so capacitive loading by very long microphone cables will have negligible effect upon the frequency response, the recommended microphone amplifier input impedance being greater than 200 ohms.

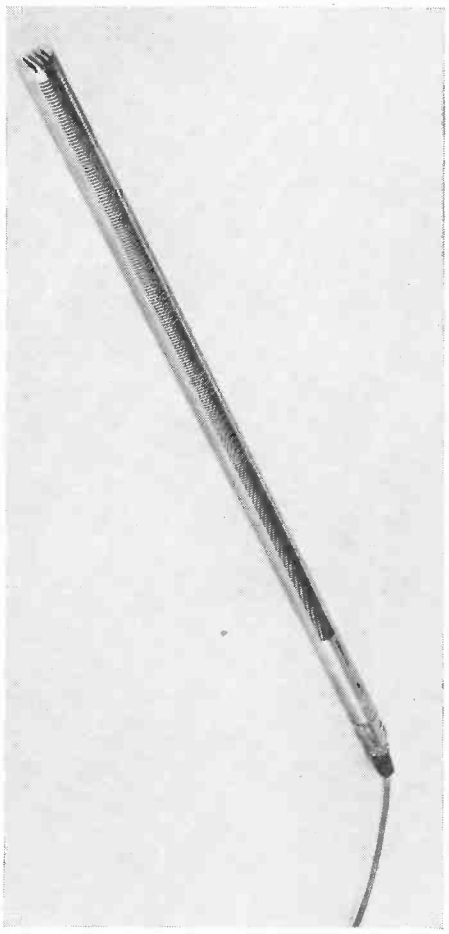
The noise performance of the microphone was found to be extremely good, the equivalent sound pressure level of the internal noise being only 22 dB(A). Taking into account the high sensitivity, this means that very good noise performance can be achieved even if rather poor microphone amplifiers are used!

Instead of plotting a polar diagram of the frequency response, **fig. 2** shows the response on axis, and at three different angles off axis. These curves were obtained under conditions which were not perfectly anechoic and must therefore be treated with some caution; however, they do show the pattern of the microphone characteristics. It is to be seen that on axis the microphone has a rising characteristic at high frequencies which I believe to be a desirable characteristic for a gun microphone, and also a fall off at very low frequencies which was found to make the microphone very tolerant of 'handling noise'.

A very rapid fall-off occurs at middle and high frequencies with mild orientations off axis with a pronounced dip around 6 kHz, but provided that the microphone is aligned within say ±15° this does not present any problem.

Finally, on the powering side, the microphone current drain was found to be 5.7 mA into the DIN standard power arrangement of two 180 ohm resistors being fed by 12V. This requirement is met by such recorders as the Nagra *IV*, and for other applications Sennheiser manufacture a variety of powering devices.

Hugh Ford



MANUFACTURER'S SPECIFICATION

Studio directional microphone
Connector socket: 3 pin standard to DIN 41 524. (Type MKH 815 T-U : 3 pin Cannon XLR3.)
Dimensions: 19 mm dia, 550 mm long.
Weight: approx 370g.
Frequency response: 50 to 20 kHz
Operating principle: interference line.
Directional characteristic: lobe.
Sensitivity at 1 000 Hz: 4 mV/μbar ±1 dB; 40 mV/Pa ±1 dB.
Impedance: approximately 20 ohms symmetrical floating.
Nominal load: + 7200 ohms.
Signal to noise ratio to DIN 45 590 ref 1 N/m²: 74 dB.
Maximum sound pressure level: 150 μbar.
Operating voltage: 12 ±2V.
Current drawn: approx 6 mA.
Temperature range: —10°C to +70°C.
Manufacturer: Sennheiser Electronic, 3002 Bissendorf/Hann, West Germany.
UK distributor: Hayden Laboratories Ltd, Hayden House, 17 Chesham Road, Amersham, Bucks.

Introduction

THIS MICROPHONE CAME for review at the same time as another gun microphone, the AKG *CK9/C451EB* combination from their modular range of capacitor microphones. To avoid unnecessary repetition may I refer the

reader first to my general introductory remarks in the field trial of that microphone.

An earlier Sennheiser gun microphone design is described in some detail, along with others, in A. E. Robertson's standard work 'Microphones'; it was a moving coil type, some 200 cm long. Another design, by Western Electric, was some 150 cm long, and it is interesting to see how a similar or better directivity, coupled with other improvements in performance, has been achieved in much smaller dimensions in the current generation of gun microphones, following the general trend with microphones as a whole.

Operating Principles

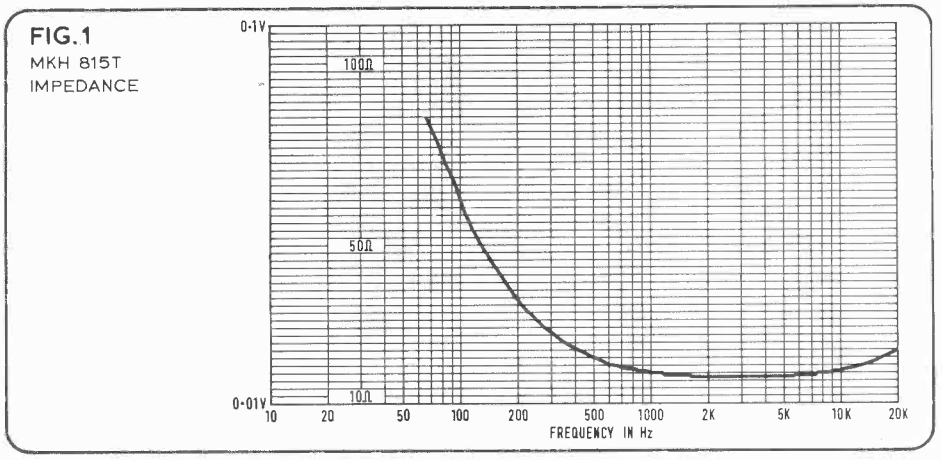
Like the AKG gun microphone, the Sennheiser *MKH815T* uses a capacitor capsule as the transducer, and an interference tube to increase the directivity. In other words, a slotted tube is coupled to the front of the capsule, and while sound entering from straight ahead passes down the tube largely unimpaired, sound striking the microphone from the side enters via the various apertures along the length of the tube and arrives at the capsule out of phase with sound from the same direction which has entered the front of the tube; the result is a cancellation or interference between these out-of-phase waves and a reduced or zero output. The effect is dependent on angle and frequency, and at low frequencies the microphone is increasingly dependent on sound reaching the rear of the diaphragm to provide directivity, as in a conventional cardioid design. The general effect is to produce a single large lobe in the direction in which the tube is pointed; the lobe becomes narrower at high frequencies but pickup from the rear may also increase. The aim is normally to provide high directivity over the speech band at least.

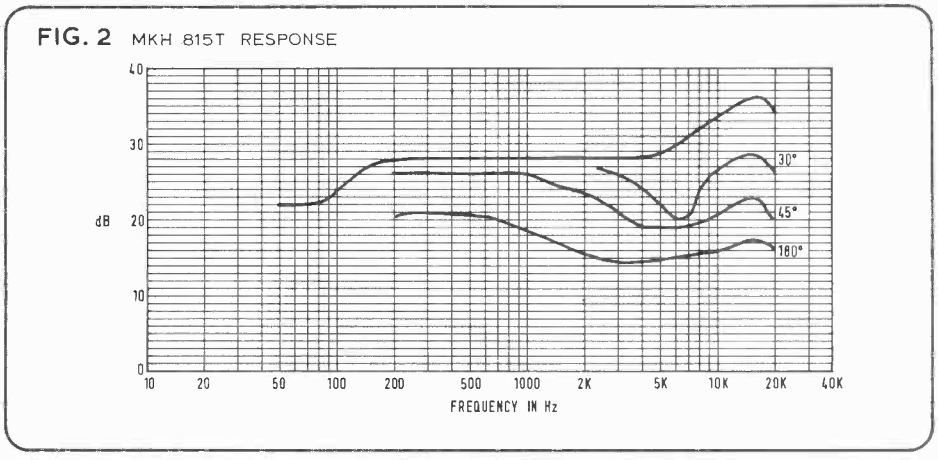
In other respects, however, there are a number of interesting differences between the AKG and Sennheiser designs. The Sennheiser is not modular; designed as a single unit with transducer and amplifier in one housing. Furthermore, unlike the AKG design which uses an fet front end and a dc polarizing voltage, the Sennheiser microphone uses rf techniques to obtain the audio output, allowing the voltage across the capsule to be kept down to some 10V ac, with a number of obvious advantages as regards humidity, etc, as long as the rf technique is as good as the fet amplifier in other respects such as noise level and linearity.

The Sennheiser circuit uses an 8 MHz crystal controlled oscillator, which feeds a discriminator tuned by the capacitance of the capsule. The resultant audio output is amplified, buffered and filtered. The output impedance of the amplifier is low, which makes for non-critical impedance matching, and the output is at a rather higher level than is normal with professional capacitor microphones; it can indeed be used (unbalanced) to feed the auxiliary input of a Revox recorder.

There have been two schools of thought about the use of rf circuits in capacitor microphones. One advocated rf circuits because with careful design and adjustment they offered low noise levels and avoided some of the problems of high-voltage, high-impedance circuitry; the other complained that the stability of the circuits, particularly under tv lights and in hot, humid atmospheres, was not good enough to ensure that satisfactory performance was maintained. Doubtless the inclusion of a crystal oscillator indicates that some care has been taken to provide the necessary stability. It would be very difficult, however, in a field trial of this kind, to simulate accurately and adequately over a sufficient period the adverse conditions under which such a microphone *might* be used; beyond saying that no problems were encountered in the course of testing, no comment can be made or should be implied from this field trial on the long-term performance of the circuitry under extreme conditions; nor should this caveat be taken as implying that the microphone will *not* be satisfactory under those conditions.

The use of rf techniques rather than the conventional high impedance input removes the need for a very-high input impedance amplifier, removes the danger of arcing as the voltage applied to the capsule is low, removes the tension on the diaphragm due to the polarizing voltage on a conventional capsule system, removes the need for special high-value resistors and low-noise fets or nuvistors in the amplifier circuits, and keeps impedances in the amplifier low; the floating supply system removes the need for an output transformer while allowing the dc supply to be carried by the twin audio leads in a similar way to phantom powering, but without a dc flow through the screen (which has been known to cause noise on certain microphones).





It should be noted that the A-B powering technique used by the Sennheiser is not directly compatible with phantom powering; a number of readers may be more familiar with phantom powering than A-B powering to DIN 45 595, and accordingly the method of connection for floating and unbalanced inputs is shown in **figs. 1** and **2** respectively.

Alternatively, a battery adaptor type *MZA 6-2* is available; this takes a stack of nine Mallory *RM 625* mercury cells and screws directly to the output connector of the *MKH815T;* a similar unit is available for connection to the Cannon terminated version of the microphone; other units available are two mains supplies, a matching unit lf filter for connection to Nagra inputs, a rumble filter unit and an adaptor for powering from 12-48V phantom supplies (*MZA 56 P-O* and *MZA 56 P-U* for DIN and Cannon *XLR* versions respectively). None of these units was supplied with the review microphone, but I would expect the battery unit to be a most useful extra for mobile work.

Construction

The *MKH815T* is visually a very beautiful piece of engineering. It is slightly slimmer and shorter than the AKG gun microphone, partly because of its integrated design.

Sound enters the front of the interference

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tube via slots machined into the cylindrical-concave end of a metal plug that closes the interference tube. The interference tube and amplifier housing appear to be in a sand-blasted nickel finish that is elegant without being highly reflective; there should be little or no problem of reflections of studio lights if the microphone appears in-shot, and it should be largely unobtrusive in reinforcement or similar applications. The tube is just under 55 cm long and 19 mm in diameter, and the interference apertures, a series of closely-spaced slots some 11 mm across the chord, run in a line down the length of the microphone for about 45 cm. The slots are backed by a very fine metallic gauze, which is too fine to allow one to see what is inside. The transducer diaphragm appears to be about 6 cm from the rear of this row of apertures, towards the front of the microphone, so sound entering the rear of the microphone capsule does so by a similar but shorter interference tube. The space behind the capsule also appears to contain parts of the amplifier circuitry, though the gauze prevents clear sight of what is there. A single grubscrew retains the internal assembly in the casing, and the male DIN connector is suitable for use with a threaded (not bayonet) locking connector.

The sensitivity may be adjusted by altering the nominal values of a fixed attenuator which precedes the buffer transistor of the head amplifier; values are specified in the instruction booklet (which contains a circuit diagram) for sensitivity adjustment by ±1 and 2 dB.

Performance

General

Tests were carried out over a period of several weeks to assess subjectively the performance of the *MKH815T* as a highly directional microphone, under a variety of conditions. Other capacitor microphones were used for comparative purposes, including the AKG *CK9* unit; listening tests were carried out using Spendor *BC1* and other high-quality loudspeakers.

A small booklet accompanied the microphone in its padded wooden case, and provided all the necessary information with regard to powering and connection; the microphone is supplied with its own axial frequency response curve as measured by Sennheiser. On the review sample the hf response in the 8-15 kHz region, as measured by Sennheiser, appeared to be just outside the manufacturer's specified tolerance for rise in output in this region; similarly at the lf end the bass roll-off started earlier but was better maintained at the extreme than implied by the manufacturer's published nominal curve (though measuring conditions are likely to influence the lf readings in particular). The general sound produced by the microphone suggested that there was indeed a definite rise in output at high frequencies, and while this gave a clear sound it was not always quite as natural as sound obtained with other microphones, among them the *CK9* gun mic.

Sound quality

Quality was assessed using live-replayed comparisons and live-recorded comparisons on speech, and limited music tests. Performance was assessed in both still and windy conditions, stand mounted and hand held.

The general impression was of a slight lack in bass, combined with a noticeable rise in output at high frequencies; the sound produced was very acceptable under adverse conditions, but given better conditions the sound of the *CK9* unit was felt to be a more natural balance and to be preferred. The output from the Sennheiser could of course be 'tamed' externally by an active or passive unit to reduce the hf output if desired, and this would have a small bonus in reducing the hf content of the residual noise of the microphone.

Speech

As with the AKG gun unit, particular attention was paid to speech tests, for the same reasons.

The sound was always clean and clear, with a slight incisive edge which was more apparent on some voices than others. Female speech tended to show an emphasis of consonants, in particular sibilants, more than male speech. The effect was of a slight brightness and sparkle on speech which sounded artificial by comparison with the original, without the harshness associated with the presence (or inherent) bumps in the response of certain microphones. The hf rise is certainly more steep than the slight rise or tilt found with the AKG microphone, and bears out the manufacturer's pen trace which indicates a rise in response of approximately 2 dB at 5 kHz and 7 dB at 8-15 kHz; I have seen no measurements to confirm these figures, at the time of writing, but fiddling with tone and filter controls suggests that the figures are of about the right order.

The slight fall in bass response was not generally noticeable on male speech, particularly in noisy or reverberant surroundings; with the hf rise approximately removed, the sound quality on speech was almost indistinguishable from that obtained with the *CK9*.

Musical box

Direct comparisons and recordings made with the aid of a small musical box were quite revealing in some respects. On axis the sound was slightly over-sharp, 'ticky' or 'white', to use some very subjective descriptions. Off-axis the sound of the musical box was rapidly muffled as the angle relative to the axis increased; the fall in top was noticed at about 10-15° off axis and the sound was distinctly muffled by about 45°, by comparison with what it had been and with the original.

Once again the on-axis sound could be made more nearly like the original by approximately removing the hf rise with tone and filter controls, though the improvement was less easily detected than with speech; the remaining differences between the original and reproduced sound were quite subtle, however, and must in part be due to other links in the reproducing chain.

Music tests

Limited music tests were carried out using singer with guitar, piano, and voice alone. Both guitar and voice acquired an edge or brightness that was not characteristic of the original; it would be perfectly acceptable in many folk or pop music recording contexts, and is not necessarily a criticism of the microphone. It is mentioned here as a pointer to the kind of sound quality to be expected from an uncorrected microphone of this kind; it must again be said that this edge was not one that would be likely to prove objectionable or particularly obtrusive, but it does show up on direct comparisons with the original. Unlike the sharp peaks in some moving coil microphones, it is the kind of smooth and broad rise in response that can if necessary be at least partially corrected if such correction is not considered bothersome in the original choice of the microphone.

In other respects voice and guitar reproduced well, and a respectable balance of both was obtained at about 2.5m in fairly reverberant surroundings; when the capsule part of the microphone was about 1.5m away, about the closest that would give a reasonable balance, the microphone was reasonably tolerant of noise and disturbance from well off axis.

A singing voice on its own again showed up a slightly husky edginess. No particular problems were encountered with the singer on axis, provided the singer kept at least 20 cm from the end of the microphone. Puffs of breath produced quite bad popping at closer ranges. No distortion problems were encountered, but it is quite easy to run into microphone amplifier distortion at the mixer or recorder in view of the relatively large output from the microphone—again, it is easy enough to attenuate the output!

Piano reproduced quite respectably via the *MKH815T;* it was felt preferable to tolerate the slight loss of lower bass rather than accentuate the reduced lf discrimination in reverberant surroundings.

Outdoor sounds

In addition to speech tests undertaken out of doors over long absorbent grass (my best excuse yet not to cut the paddock) recordings were made of birdsong, insects, the sounds of trees in a gale, passing aircraft, cars, etc. All were well reproduced and many proved quite convincing. No peculiarities or vices were revealed, and the microphone handled well.

Polar response

Mention has already been made of the microphone's ability to discriminate against unwanted off-axis sounds, and of the more marked loss of high frequencies off-axis. The polar response was investigated a little further using speech and musical box tests. Comparisons were also made between the performance of the Sennheiser and AKG gun microphones.

The overall impression was that the directivity of the *MKH815T* and the *CK9* were fairly similar; if anything the Sennheiser is slightly less directive than the other, but we found it difficult to be positive on this score, and no doubt slight differences in the respective microphones' polar patterns at different frequencies would account for this uncertainty and give conflicting impressions on different kinds of programme material.

At 10-15° off axis little change was noticed on speech, but a just perceptible loss of high frequencies was noted when testing with the musical box. At 30° off axis a signal fall off was noticed on both speech and musical box; output was appreciably down by 45°, the musical box sounding quite distant, and rejection between 90° and 180° was very good.

Allowing for the slightly greater output at

high frequencies on the *MKH815T* than the AKG *CK9* (on axis), the sound quality and directivity appeared fairly comparable; the main difference if any appeared to be at around 30° to the axis, where the fall-off in hf seemed more rapid on the Sennheiser than the AKG, but where the AKG seemed marginally more discriminating across the speech band. In other words, the Sennheiser microphone appeared to give a very slightly broader angle of acceptance for speech than did the AKG, with a slightly more rapid initial fall in output at high frequencies than with the AKG at angles off the axis, and a more noticeable change in quality from the extra brightness on axis to the restricted response off axis. At low frequencies the directivity of the two makes of microphone was subjectively similar.

To assess the effect of the slot on the polar response of the microphone about the main axis, the microphone was mounted on a stand pointing upwards, and speech tests were carried out with the voice moving in a circle around the microphone. There appeared to be little variation in speech quality, except that on sounds coming from directly behind the interference apertures—that is, with the apertures out of sight for the person speaking—there was a reduction in top, just enough to dull the sound slightly; curiously, this seemed to be the opposite effect to that noticed when a similar test was carried out with the *CK9* gun tube. The head of the person speaking made an angle of approximately 30° to the microphone; insufficient tests were carried out to ascertain whether the effect was maintained or reversed at slightly different angles, and since it was relatively slight and unlikely to be of too much consequence in practice, I would not attach too much weight to the importance of this observation, mentioning it only as a matter of interest.

Bass filters

The bass response of the microphone is fixed, and falls slightly below 150 Hz, with no adjustment provided on the microphone. As mentioned earlier, a plug-in attenuator for use between power unit output and mixer/amplifier input is available, giving a reduction of approximately 6 dB at 100 Hz and 15 dB at 50 Hz. Lf filters are also incorporated in the adaptors available for connecting the microphone directly to Nagra inputs. In practice it was remarkable how well the microphone handled and behaved out of doors without additional filtering at low frequencies.

Residual noise

The background noise was found to be very low. Because of the relatively high output level from the microphone, noise in the input amplifier of the recorder or mixer used with it is unlikely to prove troublesome. No hum or rf breakthrough problems were encountered during the tests, and the absence of an output transformer in the microphone may help avoid possible problems of induced hum.

Very rarely was background hiss apparent, except when using the microphone for capturing birdsong or the like on certain occasions. It is not easy to say whether the residual noise level of the Sennheiser *MKH815T* or the AKG *C451/CK9* combination is lower, when due account is taken of levels and matching, but my impression is that though the signal-to-noise ratio obtained must be of about the same order, there is slightly more high frequency output in the hiss from the *MKH815T* than in the hiss from the AKG microphone, and this makes it that little bit more noticeable. However, the noise performance of both microphones is very good and the higher signal level from the *MKH815T* could certainly be an advantage in some cases; on no occasion during music or speech testing was there any apparent distortion from the sound levels encountered, and one is unlikely to be recording trumpets at a few centimetres range with this kind of microphone.

Ambient noise

Ambient noise levels achieved, in and out of doors, were good confirmation of the directivity of the microphone, and the noise itself seemed reasonably balanced in spectrum. Out of doors the ambient noise is of course dependent on the direction in which the microphone is facing—quite an amount of rustle may be picked up when the microphone is pointed towards trees, near silence when pointed towards the sky, and this produces quite marked changes when following a bird, for instance.

Popping

Please refer to my comments on this in the *CK9* review. Checks on popping were made with the *MKH815T*. Speech very close to the capsule proper could produce popping, and speech at moderate levels some 6-8 cm from the front of the interference tube also caused it. This became very severe at 3-5 cm from the front of the tube, and the effect was much more violent at the closer range than when a similar test was carried out with the *CK9* for comparison. Use of the windshield should eliminate most such problems, but of course the slim lines are lost.

Wind noise and movement

Perhaps one of the most outstanding features of the *MKH815T* appeared to be its good behaviour in wind and when moved violently; it would tolerate being swung through the air much more rapidly than I can imagine any sane boom operator doing, and when taken out into a gale that removed branches from a large beech tree the microphone behaved quite remarkably well: true, there was some low frequency rumble, but at quite a low level, much lower than most ordinary cardioids would produce under those conditions, and very much lower in level than produced by the AKG gun mic under those same conditions. There had been no convenient gale at the time of carrying out the windshield tests on the *CK9*, but when the fruit started flying off the trees during the typing of this report I seized the opportunity of a little more testing. Recordings made with the *MKH815T, without windshield*, were perfectly intelligible under these conditions and could probably have been cleaned up satisfactorily with a steep high-pass filter, while recordings made at the same time with the *CK9* unit were so badly blasted as to be totally unintelligible and to cause anxiety for the welfare of the listening loudspeakers! A windshield would obviously have improved things considerably for both microphones (rain stopped play) but I was very impressed at the unshielded performance of the Sennheiser microphone.

Sennheiser can supply a foam windshield (*MZW 815*) or a windshield which appears to be similar to the Rycote one supplied by AKG for test with the *CK9;* Sennheiser state that their version of the latter (*MZW 804*) is water resistant, and claimed reduction of wind noise is 26 dB as against 16 dB for the foam type. Pistol grips and shock mounts are available for use with the microphone and windshields, but neither windshields nor mounts were supplied for review with the microphone.

Handling noise

Even without the shock mounts which are available, the *MKH815T* handled remarkably well, with a minimum of thumps, rumble and chuffing. As on wind noise, it scored over the AKG microphone on these counts. Ideally, though, one would use one of the compliant shock mounts, but in an emergency a reporter could use the microphone as it stands.

Case

The microphone comes in a rigid, padded and lined case with a hinged lid; a piece of foam or the like is necessary to stop the microphone sliding up and down the recess, which is the full length of the box. The case is not really designed to accommodate a lead. While it provides quite good protection for the

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SENNHEISER MKH 815T

microphone in transit, the hinges are a little flimsy and one had come adrift by the time the review microphone had done its rounds and reached me. This is a minor detail on an otherwise well finished and produced article.

Summary

In appearance the microphone is extremely elegant, small enough not to be conspicuous, and is beautifully finished.

It produces high quality sounds with low background noise levels and low ambient noise levels. Although there is some emphasis of extreme top, the sound is clean and the spectrum of the indirect sound picked up is subjectively well balanced.

For naturalness of sound, I would not consider the *MKH815T* quite the equal of the AKG microphone on two scores: the substantial rise in hf output, and the apparently slightly more directional characteristic of the *MKH815T* than the *CK9* at the highest frequencies. On the other hand it must be pointed out that the hf rise on axis can at least be reduced to perfectly acceptable amounts for purist purposes by external equalization; for many purposes the response would be perfectly acceptable and perhaps desirable as it stands, and over the range of frequencies that are important for intelligible speech the angle of pickup appears to be very slightly greater than that of the AKG microphone, which could have advantages in certain situations. The noise performance was considered similar to that of the AKG microphone subjectively with possibly a slightly more toppy hiss from the *MKH815T*.

In terms of flexibility, the AKG microphone scores on the grounds of its modular construction, but for many people this may be balanced by the better wind and handling performance of the Sennheiser. With the appropriate windshields there should be little to choose between them normally, but the Sennheiser seems basically more immune.

I would not attempt to pick a 'better buy' from these two microphones—and there are, after all, a number of others to be considered when shopping around—since the gun microphone is a specialist microphone and it is the specialist's particular needs that will, or should be allowed to, dictate the final choice. It can, however, be fairly said that where a highly directional microphone is required, whether for hand, boom or fixed use, indoors or outdoors, for film work, sound reinforcement or sound gathering, this microphone should be considered as a serious contender.

RADIO MANCHESTER

another string of offices with double-glazed windows looking out over the traffic below. One can imagine with a shudder the sound leakage problems that would have arisen if Piccadilly Radio had been put together in a four-month rush like the London stations, without time to think out the best way of isolating the studios from the noise of the outside world.

Like Capital, Piccadilly Radio has no shortage of exciting plans for the future. The portable Neve *PSM 12-2* used for outside broadcasts will be built into Control Room 2 and a new mixer brought in for the new studio intended for home-grown jingle production. Also a new portable desk is being designed for permanent availability on outside broadcasts. This will be ganged with a discotheque system of broadcast quality so that Piccadilly DJs can go out to local halls and clubs and broadcast live disco sessions. An extensive range of portable Uhers, radio telephones, uhf walkie-talkies and a radio car mean that if the Bomb drops on Manchester, it will be well covered by Piccadilly. If the worst comes to the worst, a reporter can phone in from a call box and be punched through to one of the holding lines on the studio control desks.

After a month on the air, Piccadilly had NOP carry out a dipstick survey to give them an idea of how many adults (over 15) were listening to their station in Greater Manchester. The results suggest 1.2M, and whether this is accurate or over-optimistic should emerge from the full diary survey which is already being planned. Certainly, local radio advertising seems to work in Manchester. One local shoe shop bought 21 short spots over a weekend for a half-price shoe sale. At 9 o'clock on Monday morning there were 500 people queueing outside.

One national newspaper, that shall be nameless, is certainly none too keen on Piccadilly. After the station gave away track suits with Piccadilly Radio lapels to the Lancashire cricket team, the paper ran a picture showing them training in smart outfits rather than in the usual sloppy sweaters. The same paper made sure that the Piccadilly Radio logo badges had been dutifully and carefully airbrushed out to avoid publicity for the radio station. Somehow I doubt that silly incidents like that will detract from the long-term success of Britain's commercial radio stations. But whether in the long-term the economic climate, the cripplingly high IBA transmitter rentals, and the large number of fresh stations due to open over the next few years will enable the broadcasters to make a profit, is quite another matter. Only time will tell that particular story.

SCHOEPS CMT 36+56

different situations. We would suggest that other studios would also find a lot of interest in trying different mics. All of the mics compared here are of very high quality indeed and one has little if anything to lose in trying something new. They are all in the same price bracket, and all have their fortes—the Neumann *U87* for brass and percussion, the AKG *C414* for strings and piano, and the Schoeps for a predictably flat sound that can be 'bent' to whim with equalizers.

The technical performance of all of the microphones matched their individual reputations on the whole—the Neumann *U87* and the Schoeps microphones both had marginally lower noise than the AKG *C414* but there was little in it. The Schoeps microphones at −58 dBV for 74 dBV gave 4 dB more output (1 kHz octave filtered pink noise) than the Neumann *U87* at −62 dBV which in turn gave a further 4 dB more than the AKG *C414*, at −66 dBV.

When choosing a microphone to buy, the more modest fixed polar diagram microphones should not be forgotten (such as Neumann *KM84*, AKG *C452* or Calrec *CM1050*) which start at a fraction of the price of these three variable polar mics. When we carried out these comparison tests, a Calrec *CM1050* stick cardioid capacitor mic was included on one occasion—and did very well against its more expensive colleagues, although it obviously lacks the flexibility of variable polar pattern.

AGONY COLUMN

Following the normal routine, it was requested that a reference acetate be cut of the new album by a rising superstar; the tapes had appeared from America and were awaiting processing. The afternoon was boring, and a fairly dubious lady singer's album was lying around in line for similar treatment. The lathe's varipitch was not working, although fortunately when this happened (often) the resulting grooves were very steady and certainly the tolerances were well within the manufacturer's specification. After more than twice the usual time needed for the job, for cutting two parallel grooves is an exacting task, it was sent upstairs to the house producer. After about half the time taken normally, he rang down complaining that there was some appalling woman on the disc who didn't sound at all like a superstar. Up went the engineer, put on the disc and, as a toss of a coin might have it, out came the superstar. Exit engineer, leaving house producer in some confusion. The next phone call took longer, but said the same; and there the joke ended, because the chances against were 7:1 anyway and couldn't be stretched that much farther.

In the most calm and dignified voice at 0.05 am on August 11 last year, Radio 3 vhf: 'This is the Open University and that was the signature tune at the wrong speed'.

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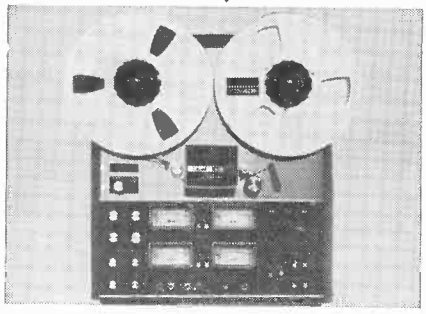

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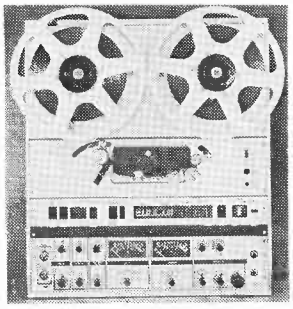

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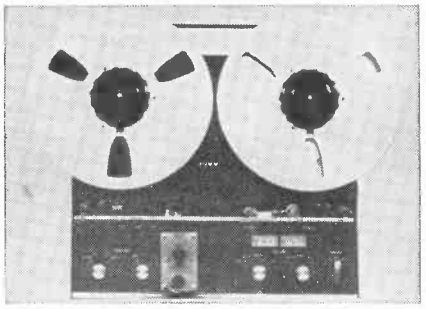

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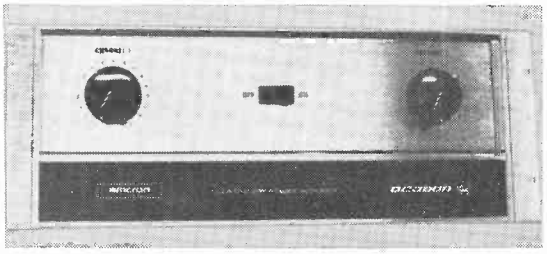

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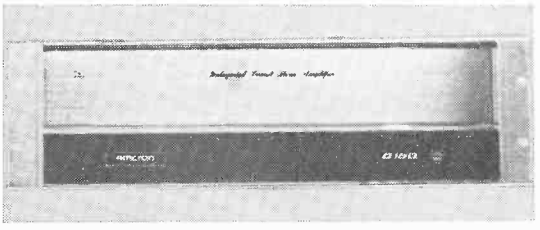

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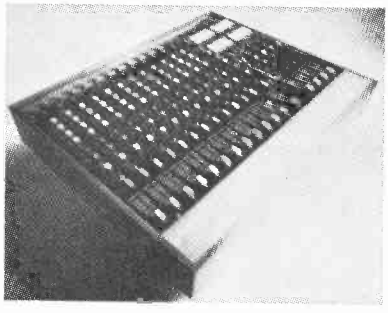

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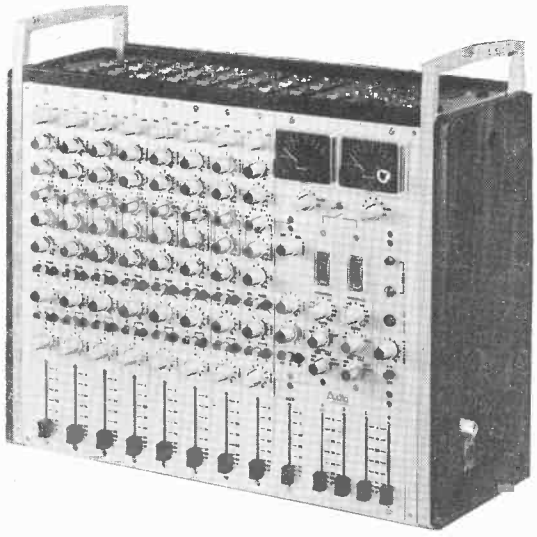

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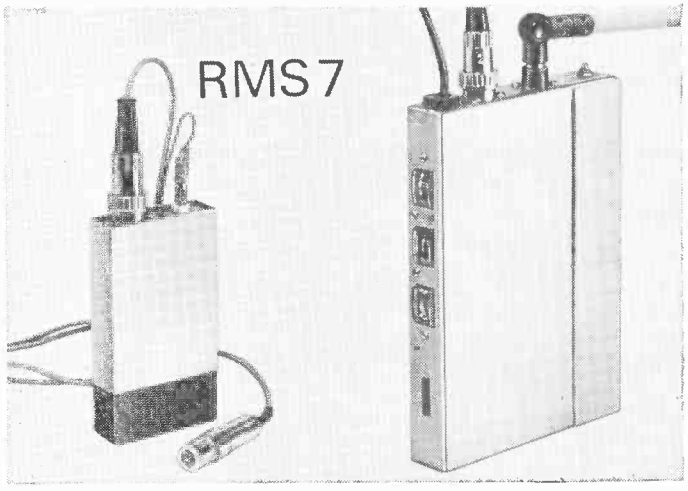

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★**County recording service** stereo and mono masters and lacquer discs from your tapes. Telephone Bracknell 4935. London Road, Binfield, Bracknell, Berks.

★**For hire.** Revox A77's, Quad amps, A.K.G. BX20 echo unit, mics stands. Short and long term rates. Phone Ian, 01-586 0064.

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Specialists in small orders of 7" and 12" vinyl pressings, manufactured in our own pressing plant.
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SITUATIONS WANTED

★**Musician** (23), experienced in record production, seeks position as tape operator/assistant engineer. Tel. 0223-44125 (evenings).

★**Experienced** recording engineer at present working on studio construction project in Nashville, seeks position in or near London upon return from U.S.A. Enquiries please to Box No. 689.

WANTED

★**Lee Electronics.** The Tape Recorder and Hi-Fi Specialists wish to purchase good quality Tape and Hi-Fi equipment for cash. 400 Edgware Road, W.2. Phone PAD 5521.

★**All Nagra** equipment urgently required for cash. J. J. Francis (W.G.) Ltd., Manwood House, Matching Green, Harlow, Essex CM17 0RS. Tel. Matching 476.

★**8 in 2 out** or 10 in 2 out or 16 in 2 out mixer, suitable for mixing 16mm mag. film tracks. Please state make, details and price. Lenra Associates, P.O. Box 10599, Honolulu, Hawaii 96816, U.S.A.

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We offer a good starting salary, with considerable fringe benefits. Plus a career in a leading company in the TV systems field.
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BBC TV

FILM DEPARTMENT

REQUIRES

ASSISTANT FILM RECORDISTS

To undertake the operation of recording and reproduction equipment in sound transfer and dubbing areas situated in various television premises.

Candidates must have practical knowledge and experience of film sound transfer and/or dubbing recording methods and techniques, coupled with an understanding of the use of sound and film production.

Salary: £2,397 p.a. rising by annual increments of £111 to £2,952 p.a.

Candidates who do not meet the full requirements of the advertisement may be considered for appointment as Trainee Assistant Film Recordists at a salary of £2,127 p.a. with promotion to Assistant Film Recordist upon satisfactory completion of a one year training period. This would apply to applicants in the age group 18 to 28 with G.C.E. 'O' Level standard of education who have some knowledge of basic electronic theory and are able to show evidence of a practical interest in recording. A course is scheduled to start early in 1975.
Based at Ealing or Shepherds Bush.

Write or telephone immediately for application form (enclosing addressed foolscap envelope) to Appointments Department, BBC, London, W1A 1AA, quoting reference 74.G.1138SS, telephone 01-580 4468, ext. 4619.

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Audix manufacture a wide range of public address, communications and broadcast studio equipment. To satisfy the increasing demand for our products we require engineers preferably with previous audio test/service experience and a good practical knowledge of transistor circuit techniques. Applicants will be expected to carry out systems and unit testing of custom-built equipment, supervise junior staff, and work with the minimum of supervision.

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Applications should be made in writing to:

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STANSTED,
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★**Electronics** engineer required for Central London recording studio. Experience in audio electronic work essential. Must be keen and prepared to work long hours. Box No. 690.
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Drive circuit, 35 x 80mm, for 1 ma L.H. zero meters to BBC ED 1477. Gold 8-way edge con supplied.

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Complete kit	**£10·00**	**£9·50**	**£9·00**	**£8·50**
Built and aligned	**£14·00**	**£13·30**	**£12·60**	**£11·90**

ERNEST TURNER PPM meters. Below scalings stocked
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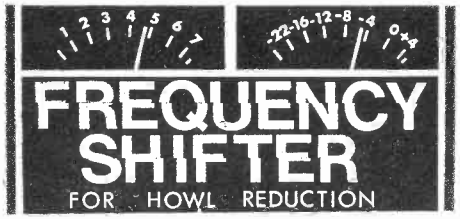

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SHIFTER CIRCUIT BOARDS FOR WW July 1973 article
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Board built and aligned **£28** mains transformer
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ALICEAD52, used (for location mastering) **£80**
ALICE SM 10/2 bristling with extras, EMT faders, power amplifiers **£850**
ALICE TM 22/16 22 channel 16 track console, new, but not fully completed.
All modules, cards, etc, in jackfield and enough parts to build another mixer.
£6,500 or offer

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REVOX G36 **£40**
2 off REVOX HS77 new boxed **£300** each
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LOUDSPEAKERS:

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2 off TANNOY 15″ monitor gold in home-made cabinets **£120** the pair

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RAC plug-in audio modules for building your own mixers.

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★**Ten** different colours of 14/.0076 x 2 braided mic cable in stock. Phone 01-586 0064.

★**Nagra** III and IV and SN models available. Immediate delivery. Write or phone J. J. Francis (Wood Green) Ltd., Manwood House, Matching Green, Harlow, Essex. Tel. Matching 476.

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★**Revox** A77 sold, serviced and modified, accessories supplied. Full range of modifications that only we carry out. Ring 01-586 0064 for details.

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★**Journals**—sets—B.K.S.T.S. 1970-73; Tape Recorder 1964-69; Studio Sound 1970-72. Lot £9; offers. Phone Watford 26285.

★**Large** attractive free-standing mixer, 8 in 8 out, electronics in need of rebuilding. Also Brenell MK6 replay deck (15 ips) with preamps, reverberation unit, jackfield, large loudspeaker cabinet (contains E.M.I. 19 x 14), AP75 record player, four packs of Rockwool sound insulation, all at rock-bottom price for immediate clearance. Tel. 01-437 8470.

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★**Audio** Developments mixer, 16 into 4 with 3 limiter compressors, £3,000. Nagra 4D mono NAB, Beyer phones, £550. Richardson, Fowlmere House, Nr. Royston, Herts. Tel. Fowlmere (076-382) 453.

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REVOX

REVOX A77 SERIES

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The tape equipment of your system is your musical memory bank. It is the **one** area where only the best makes sense. Choose carefully, select a recording instrument that neither adds nor detracts from the sound you put into it. Few machines really meet this requirement. The Revox A77 does – and by a safe margin.

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A **truly** professional quality tape unit is your wisest audio investment. It will last for years and years.

Witness the number of Revox machines built more than 20 years ago that are still in service! It's hardly surprising then, that Revox recorders command very high prices second or third hand – if you can find them available!

Revox owners seldom change – other than to a later model Revox.

It's also interesting to note that our warranty records show that on average our users have bought 2 or 3 other makes before choosing Revox. Then we read the lament "I only wish I'd bought a Revox sooner."

When you play it later, will it still sound the same?
At first sight this could seem an unnecessary question. It's not though. In the course of time a high fidelity enthusiast upgrades one or more units in his system.

With time, rising affluence plus advancing technical innovation in all aspects of audio, will bring better reproduction within the scope of all.

The recordings that you make now could, therefore, sound even better in the future – when, as finances permit, you add a better amplifier or loudspeaker to your equipment.

Conversely, a poor recording made now will sound **really** inferior when exposed to more exacting playback.

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So visit your nearest Revox Dealer for full information and a demonstration.

Record it on a Revox A77

REVOX

The illustration contains optional extras.

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