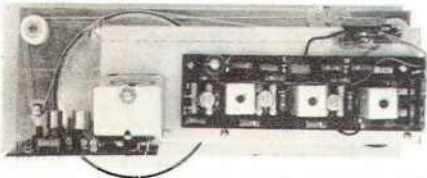


AMATEUR TAPE RECORDING

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AMATEUR TAPE RECORDING

VIDEO & HI-FI

Vol. 6 No. 10 May 1965

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Publishers: Clive Labovitch, Michael Heseltine. Editor: F. C. Judd, A.Inst.E. Assistant Editor: Kim Cook. Art Editor: Robert Morley. Production Director: Denis Curtis. Advertisement Director: Lindsay Masters. Advertisement Manager: E. McKeown. Circulation Manager: David Hughes. Editorial, Advertising and Subscriptions: Amateur Tape Recording, Haymarket Press Ltd, 86/88 Edgware Road, London W2. Ambassador 3200. Amateur Tape Recording is published by Haymarket Press Ltd., (C) 1965. Printed by Athol Press, Douglas, Isle of Man. Title registered at Stationers' Hall. Subscription Rates throughout the world 30s. 0d. Post Paid for twelve issues.



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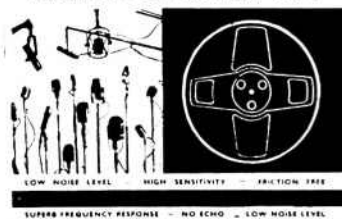
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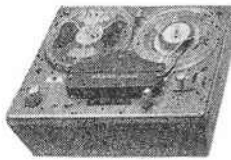
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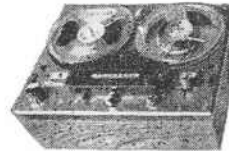
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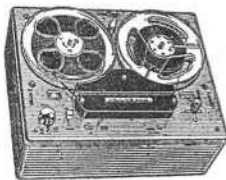


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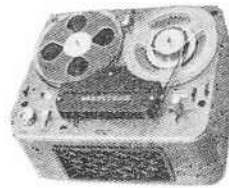


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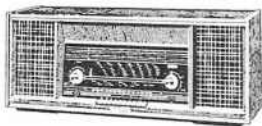
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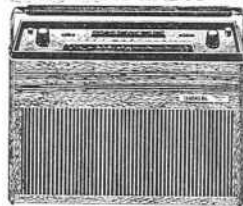
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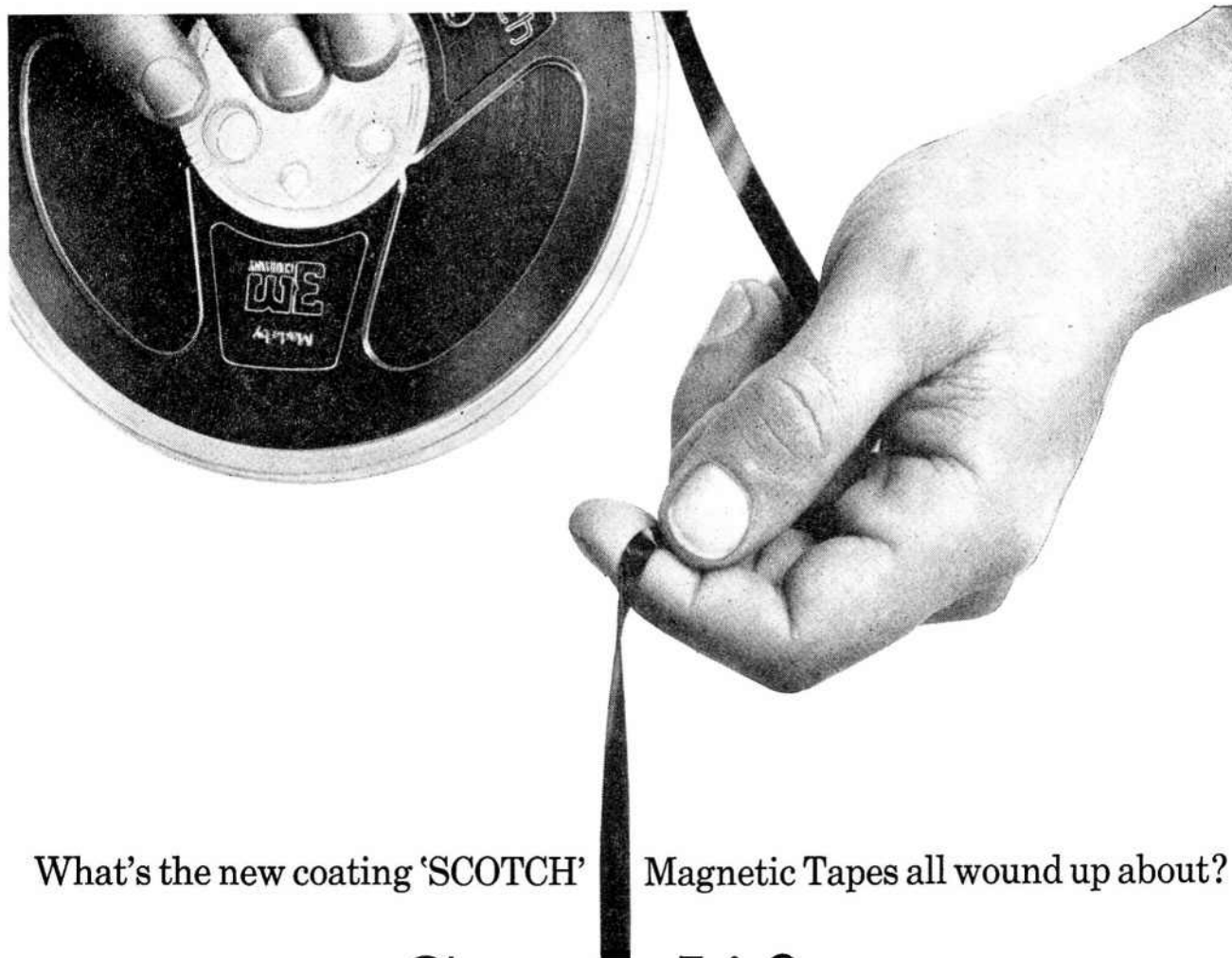
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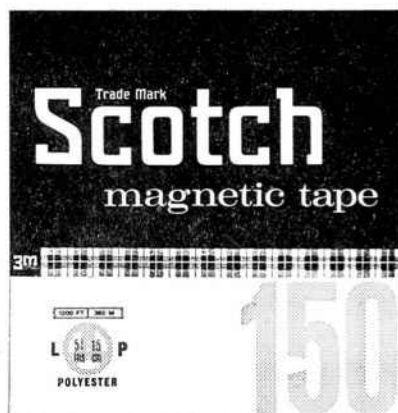
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May, 1965

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SERIES 6



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SOMETHING IS ROTTEN

Something is rotten in the State of Denmark — so wrote the Bard some three centuries ago. Today it isn't the State of Denmark, it's the world of tape recording. Just what is going wrong, and what cures there are, if any? To thrash this problem out, ATR brought together three people who have the future of tape recording very much at heart — Timothy Eckersley, who is well known as a judge of the British Amateur Tape Recording Contest, John Bradley, the Publicity Officer of the Federation of British Tape Recording Clubs, and Kim Cook, our own Assistant Editor and Club News Editor. All three have very strong opinions on the subject, and comments were pretty blunt, as this report of the conversation shows.

TIMOTHY ECKERSLEY: Before getting embroiled in this discussion I must emphasise that although I'm probably known to your readers as a member of the BBC, I'm not here in that capacity. Both as a judge of the BATRC and as a private individual, I'm immensely bothered by the apparent lack of enthusiasm shown by tape recordists in this country in making creative use of their tapes.

JOHN BRADLEY: Anybody who thinks about the situation at all must be concerned. When you consider that there are an estimated 1½-2 million tape recorder owners in the country, and that under 200 entered last year's BATRC Contest, and even less entered the ATR competition, it's very disappointing.

KIM COOK: It makes you wonder why on earth people buy recorders in the first place.

T.E.: Precisely! I suppose there must be loads of reasons why someone buys a recorder, but I doubt if any but a very small minority buy specifically for creative purposes.

J.B.: Gimmick is, I think, the main reason. It's the old old story of buying a novelty, toying with for a while, and then stacking it away and forgetting it.

T.E.: But this is so trivial. They record perhaps the children's Christmas party, perhaps some music off the radio, or Dad scrunching an apple if they're adventurous, and that's it.

J.B.: And why they record the music anyway I don't know.

K.C.: You can understand some people recording music — folk music fans for example — or recording a performance that involves a personal friend, but not the kind of music that most people put on tape.

J.B.: Why listen to an inferior recording? If you're a music fan you want the best possible recording, so you go out and buy the L.P., or if you're a recording fan, then surely the answer is to try something a little more adventurous; either way this kind of taping doesn't make sense.

K.C.: I think the main problem here is portability. If only people could wake up to the vast creative potential of the portable recorder they'd never relegate their machines to the bottom of the wardrobe.

T.E.: But even when people do have portables they don't seem to get out and about with them. Look at the number of people you see out in the streets with cameras slung over their shoulders. But how many do you see with recorders?

K.C.: Surely this is a question of the traditional British reserve. With a camera you can get around taking as many photographs as you wish without getting involved with anyone else. If you snap anyone you don't have to go up to them and talk to them first. An almost silent click and that's it.

J.B.: It's true that reserve plays a big part in this general reluctance, but only on the part of the recordist. I'm always out and about with my portable, and I've never yet been rebuffed by anyone I've approached.

K.C.: But nevertheless, the amateur recordist seems to think that the general public will be unwilling to co-operate. It's a mistaken impression, but it's there.

T.E.: And surely there's the question of the general prestige of the hobby. When you consider the prestige attached to photography for example, the money spent on every aspect of it, particularly advertising, you just can't compare it with recording. Why should this be?

J.B.: Well of course, recording is a much more recent hobby. It hasn't had as long to get established.

K.C.: But with developments moving as quickly as they do these days, you'd think that in fifteen years we'd have got a little further than this.

J.B.: True, the time aspect may be part of the reason, but there must be other factors. This question of advertising and publicity for instance. With one big film tape and camera company advertising fantastic prizes, holidays abroad and all that kind of thing in their latest camera competition, tape recording seems to be very much the poor relation.

K.C.: And the big combines as well. They advertise their radios, electric razors, cameras, adhesive tape and cleaning pads umpteen more times than their recorders and/or tape. We seem to lose out on that angle right from the start.

J.B.: True. Amateur recording at the moment needs a push that no-one seems particularly willing to give.

K.C.: And even when the manufacturers do advertise, few of them plug the creativity angle. Certainly, I watch our own advertisements in particular, and off-hand I can think of only one recorder manufacturer who has really made any effort to put over the creative angle of getting out and about with a recorder. A picture of a machine sitting in the middle of a page, with a few well chosen words about its capabilities will never convey to the reader the versatility of the machine.

T.E.: This is a very good point. If the manufacturers would put over this angle more, they'd arouse much more interest, and in the long run do themselves more good.

K.C.: But even this isn't half the story. Even if someone does manage to make a really worthwhile tape, apart from personal satisfaction, what does he get for it? Those who do enter competitions complain that they don't learn anything from it.

J.B.: This isn't quite a valid complaint as far as the BATR Contest is concerned though. We do go to a lot of time and trouble recording the judges' comments at the time, saying why the winning tape won, and why the runner-up just missed. Naturally this will be extended if there is evidence of a demand for it.

K.C.: But this is just two tapes in each section and I'm sure most tapers feel that they haven't an earthly of being one of the elite few. Now, if they felt there was some way of their small voice being heard on a larger scale...

T.E.: ... and this is where the BBC come in. Or, more strictly speaking, where the BBC doesn't come in. If there was more evidence of originality and imaginative use of tape by amateurs, the BBC would probably sit

up and take more notice. But with less than 200 entries for the BATRC, you could hardly call that sufficient evidence.

K.C.: Which brings us round full circle. People won't try unless there's some incentive, and the incentive won't be provided for people who don't try. So somewhere along the line we've got to break the vicious circle.

J.B.: The problem is how? Recording people must in some way bring themselves to the notice of bodies like the BBC before they can expect to get any allocation of broadcasting time. Now Tim, I know you're not here as a member of the BBC, but knowing them as you do, what would you suggest?

T.E.: Well there are some programmes that use contributions from outside. Not many mind you, but programmes like "Today" and "Home This Afternoon" might be interested.

J.B.: But how would the individual get his tape into such a programme?

T.E.: Well, firstly the tape itself must be of good quality, comparable to the quality of such recordings made by our own men in the field. Secondly, there's no point in sending in a recording of some great national or international event—it's our job to cover these. The real kind of thing is the sparkling interview—not anyone famous, but someone with a touch of colour. A personality that makes the tape crackle with vitality, or old people, perhaps, remembering—you've only got to listen to programmes like "Today" to get a picture of the kind of material used.

K.C.: So the idea is, if you've got a tape that you think is worth airing on radio, send it in?

T.E.: Unfortunately no. The BBC certainly doesn't want to be inundated with little tapes on a diversity of subjects that might not even be of the recording standard they require. They couldn't spend their time listening to them if that was going to be the case.

J.B.: What is the answer then?

T.E.: Well, it really needs some sort of filter, a clearing house so to speak. And of course the BTRC is the filter at the moment. Somewhere there ought to be someone with the time and the technical knowledge to assess the value of a tape. Then, and only then, if the quality is high enough, the subject interesting enough, and the time length suitable, should a tape be sent to the BBC.

K.C.: So at the moment there is nobody at the BBC who could do this job, but if time proved it worthwhile they might consider setting someone up for this purpose?

T.E.: It's possible. Once they felt there was sufficient material to warrant it, they'd use their own assessor.

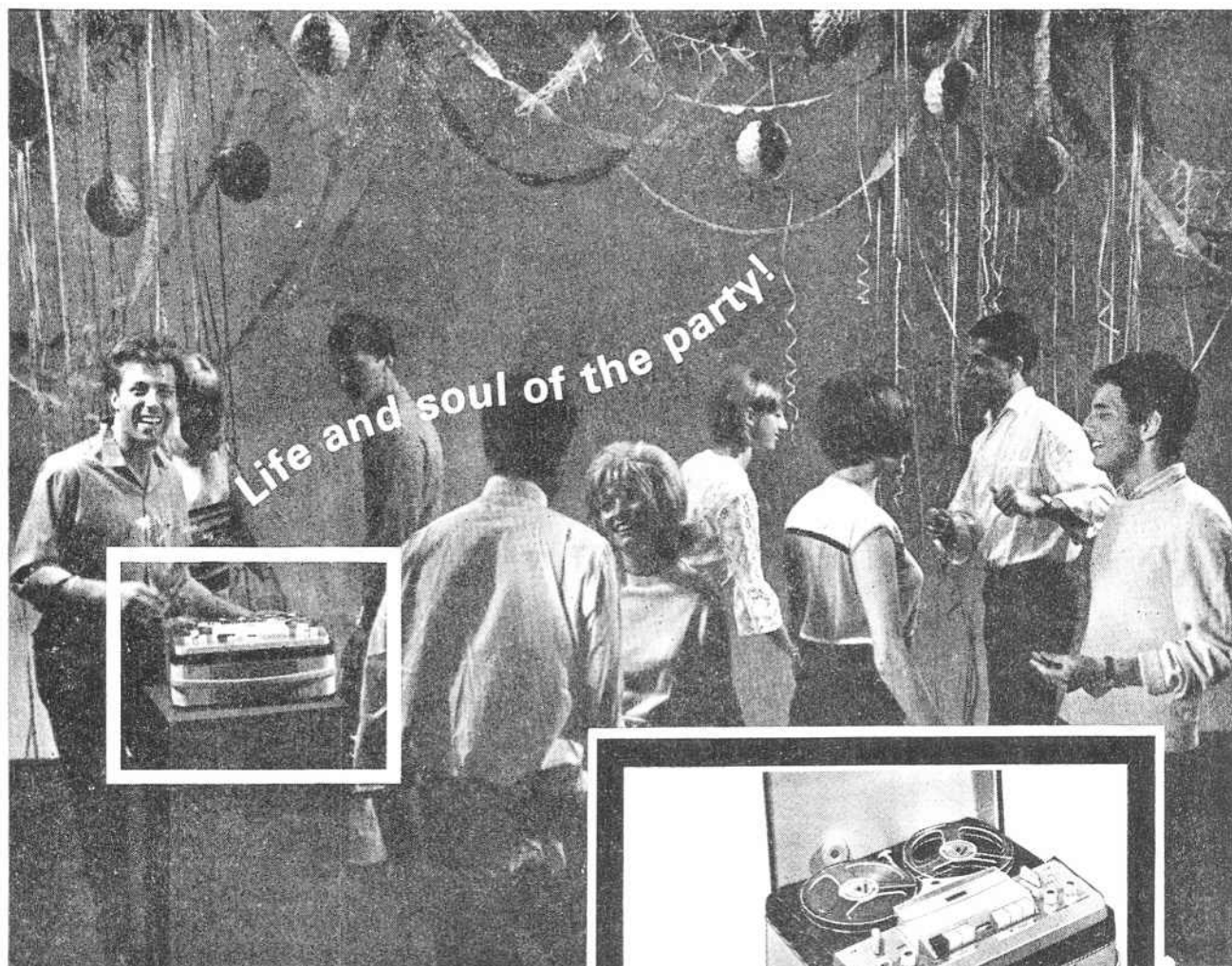
J.B.: But meanwhile it's up to the BTR Contest, people like the Federation and ATR to act as filters...

K.C.: ... And of course basically it's still up to the individual to send material to be assessed.

T.E.: That's about it.

K.C.: But what about this year's BTR Contest? Is there any chance of the winning tapes being played over the air?

Continued on page 52.



Philips de luxe Hi-Fi Tape Recorder Model EL 3549: 62 gns

HERE'S a party that's going with a swing—thanks to Philips EL3549 Tape Recorder! The host recorded all the music needed to make this party a success, and now Model EL3549 is playing it back—superbly! And not only does it make things swing—it catches things on the swing, too! At just the touch of a button, Model EL3549 will record improvisations, songs—in fact, any sounds that are worth remembering. Find out about this and other Philips Tape Recorders—visit your Philips dealer today!

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TAPE AND TRANSISTORS

Gordon J. King

The output from the replay head due to a tape recording of constant magnetic induction over the audio spectrum is shown in fig.1. Previous articles in this series have shown the causes for this type of output which rises at the rate of 6dB per octave up to the "turnover frequency" when the output then starts to fall pretty rapidly. We have seen that the falling treble is equalised to some extent in the record channel where treble boost feeds a greater record current into the head beyond the turnover frequency. The remaining problem, then, is related to the constant rate of *bass attenuation* back from the turnover frequency.

WANTED—BASS LIFT

This problem is solved by equalising either at the front of the playback channel or at some intermediate stage within the channel. What is wanted is an overall response in the playback channel approximating that shown in fig.2. This gives equalisation for a tape speed of $7\frac{1}{2}$ in/sec. For other tape speeds different equalisation characteristics are required, of course, since the output from the playback head differs a little between different tape speeds. This is revealed in Fig.1, where head outputs at $7\frac{1}{2}$ in/sec. and $3\frac{3}{4}$ in/sec. are shown. At the higher speed the turnover frequency is higher and the 6dB/octave rise in output is maintained almost up to the turnover frequency. At the lower speed the 6dB/octave rise is not always sustained up to the turnover frequency. The reasons for this have already been expounded.

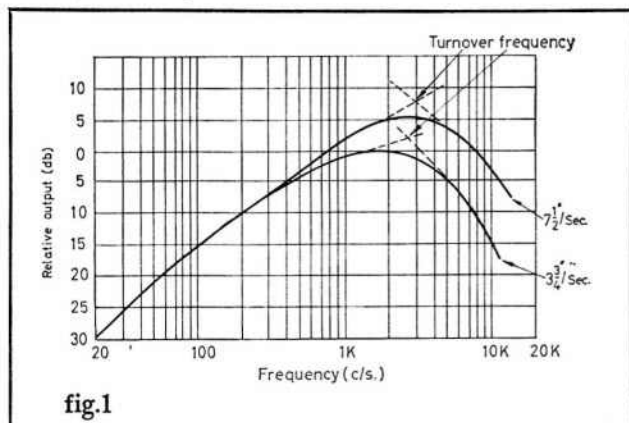


fig.1. The output from the playback head over the audio spectrum due to a tape of constant induction.

Valve playback amplifiers have a relatively high input impedance which means that the true e.m.f. induced into the head winding is in effect measured by the head amplifier. This results in an output from the amplifier which is equivalent to that of the head itself (fig.1). Clearly, then, some form of equalisation is needed in the amplifier itself to compensate for the falling bass. In a valve circuit this is invariably accommodated by frequency-selective negative feedback. A similar technique is also adopted in some transistor tape recorders, but with a transistor, it will be recalled, we require a current input into a low impedance load. The source impedance, i.e., the playback head, must also be low for maximum signal transference and the best signal/noise ratio. Generally speaking, therefore, the playback head of a transistor tape recorder is of lower impedance than that used in a valve recorder.

The idea is to couple as much signal current as possible into the transistor base circuit from the head. A playback head is mostly inductive in make-up. There are, of course, elements of resistance and capacitance, but these are small compared with the inductance. Thus, the impedance of the playback head increases with increase in signal frequency. This progressive increase in head impedance with frequency is useful, since it means that the signal current in the head must fall as the frequency increases.

SIMPLE EQUALISATION

This is really what we need to provide the necessary equalisation. Some transistor tape recorders exploit this

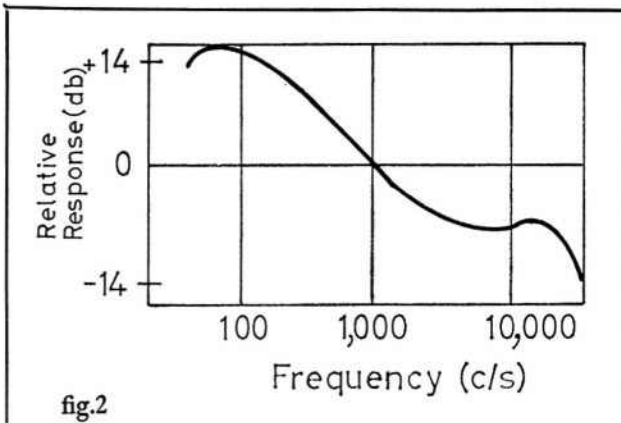


fig.2. An approximation of the response requirements of the playback channel. The necessary equalisation is often accomplished in the head amplifier circuits, which may be a single or dual transistor circuit.

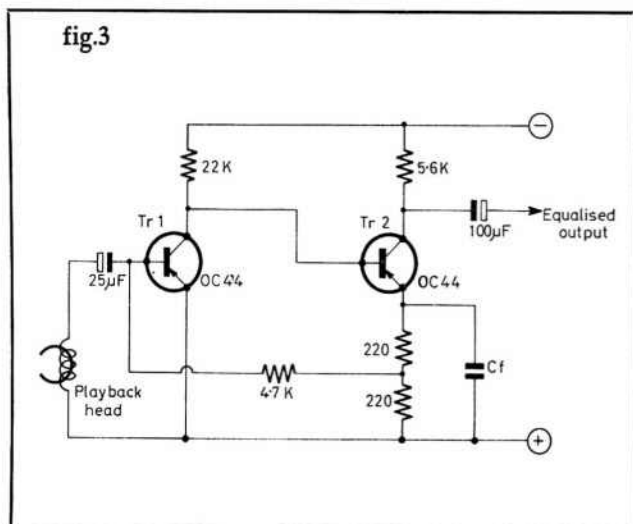


Fig.3. In this circuit the equalisation is accomplished partly by the increasing impedance of the head circuit selective feedback provided by capacitor C_f in Tr2 emitter circuit.

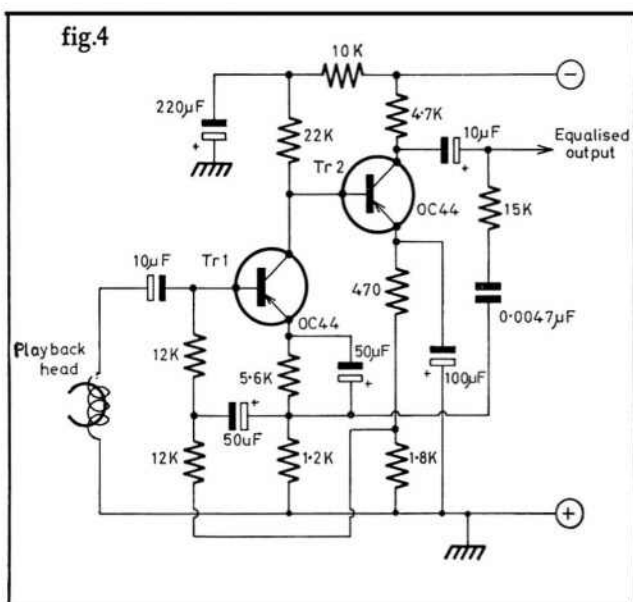


Fig.4. In this circuit, after J. Dinsdale, the impedance at the base of Tr1 is high (about 500k) due to feedback and equalisation is provided by frequency-selective feedback from the collector of Tr2 to the emitter of Tr1. D.c. feedback is from emitter of Tr2 to the base Tr1 and heavy a.c. feedback from the emitter to the base of Tr1. It is this latter which gives rise to the high impedance input of the amplifier.

TAPE AND TRANSISTORS *continued*

factor in terms of head impedance and first stage feedback so that the falling current in the head with rising frequency fully compensates for the rising e.m.f. induced in the head winding with increase in frequency. The output from the first stage is then constant over the major part of the audio spectrum.

By selecting the impedance of the head in relation to the input impedance of the first transistor stage, a useful degree of equalisation is possible even without feedback networks. And straight coupling from the head into the base, via a large value electrolytic capacitor, is utilised in some of the less exacting transistor tape recorders.

In machines of a higher price range, greater attention is given to the playback equalisation. Such equalisation is often given in terms of a time-constant (CR), and the CCIR standard in this respect for a tape speed of $7\frac{1}{2}$ in/sec. is $100\mu\text{S}$. This time-constant is related to the required bass boost based on a turnover frequency of 1.6 kc/s. Thus, we have:—

turnover frequency = $160/\text{CR}$ (kc/s), where CR is in μS
The time-constant for a tape speed of $3\frac{3}{4}$ in/sec. is, in accordance with the above, $200\mu\text{S}$, and this is a value often employed. However, it is worth noting that a time-constant of $120\mu\text{S}$ is used by some designers to match the American pre-recorded tapes which employ this value at $3\frac{3}{4}$ in/sec.

fig.3 shows a very useful transistor tape head equalised amplifier circuit, which could, in fact, be used to operate a monitor head (to feed a separate amplifier system) or to supply a suitably equalised signal from a tape head for feeding into the "auxiliary" input of a hi-fi amplifier or even into the pickup sockets of a radiogram.

COMPENSATING FEEDBACK

Here the head has an inductance of 0.5H and the e.m.f. induced into its winding is coupled to the base of Tr1 through the $25\mu\text{F}$ electrolytic capacitor. Tr1 collector is coupled direct to Tr2 base, and d.c. feedback, providing stabilisation of the operating point, is achieved by coupling the emitter circuit of Tr2 back to the base of Tr1, via the 4.7k resistor. The output is then extracted from the collector of Tr2, and is fed through the $100\mu\text{F}$ electrolytic to the reproducing amplifier. Signal feedback also takes place between the emitter of Tr2 and the base of Tr1 and this is made frequency-selective by C_f . C_f in fact reduces the amount of feedback with rise in frequency above the turnover frequency. In that way the drop in response does not continue beyond the turnover frequency. If it were allowed to continue beyond this point, of course, the treble boost applied during recording would be neutralised and there would be a serious loss of treble on playback. That is, if the self-compensating action of the head, as previously explained, was not controlled beyond the turnover frequency. Capacitor C in fig. 3 provides this control.

A different type of circuit is shown in fig.4. This is after a design in the *Wireless World* of January, 1965, by J. Dinsdale. Here we have a d.c. feedback amplifier

directly coupled between stages Tr1 and Tr2. Again the head signal is applied to the base of Tr1, via the 10 μ F electrolytic coupler. The signal at the collector of Tr1 is fed to the base of Tr2, at the collector of which transistor the amplified and equalised signal appears. This is fed through the 10 μ F electrolytic capacitor. The working point is fixed by the d.c. feedback from the emitter of Tr2 to the base of Tr1, through the two 12k resistors. For equalisation, frequency-selective feedback is applied from the collector of Tr2 to the emitter of Tr1. The frequency-selective components here are the 15k resistor in series with the 0.0047 μ F capacitor. This forms a time-constant which suits the equalisation requirements for 7 $\frac{1}{2}$ in/sec.

HIGH INPUT IMPEDANCE

An interesting aspect of the circuit is the very heavy a.c. feedback between the emitter and base of Tr1 taken via the 50 μ F electrolytic capacitor from the emitter circuit to the 12k resistor connected to the base.

This feedback effectively increases the input impedance of Tr1 up to about 0.5 megohm, and thus makes the stage suitable (via switching and equalisation modifications, etc.) for programme inputs other than tape. It is well worth remembering that negative feedbacks applied to a common-emitter stage serve to increase the input impedance without the need for connecting an extra resistance or impedance in series with the signal to the base. This keeps the signal/noise ratio high since the base of Tr1 can be "loaded" to the earth line via the impedance of the playback head. This high input impedance ensures that the overall response remains independent of the inductance of the playback head, an attribute which is not shared by the circuit in fig.3, as we have seen.

To provide equalisation over two (or more) tape speeds, switching would be employed to change the ratio or values of the RC (15k and 0.0047 μ F) network in the frequency-selective feedback loop.

The amount of feedback depends upon the overall impedance of this loop, the smaller the impedance, the greater the feedback and the smaller the gain of the composite stage. The C element has an impedance (more accurately "reactance") which decreases with increase in frequency. Thus, as the frequency rises the feedback increases and the gain decreases, which is the requirement for a gain which rises with *decrease* in frequency. The R element fixes the frequency at which the feedback is no longer frequency-selective. Without the C element, therefore, the R element would control the feedback at a constant level over the entire audio spectrum.

NEXT MONTH

So much, then, for the most important part of the playback channel. Next month we shall look at the remainder of the playback channel and finalise this series with a discussion on the transistor tape recorder as a whole.

Gordon J. King.

win a tape recorder



the new akai x-4

This superb new portable, which costs 131 gns., is being offered by AMATEUR TAPE RECORDING as the prize for a simple competition. All you have to do is place in your order of importance nine design points. (Full details and entry form will be found in the leaflet inside this issue). Then add another feature that you think makes this tape recorder an outstanding model. You can see this wonderful prize on the ATR stand (No. 50) at the Audio Fair — April 22nd to 25th.



THE THINGS YOU SAY

ATR SOUND TOUR

What an excellent idea this is – just what we have been waiting for!

I have already paid my deposit to Clarksons and should be grateful for further details. In particular, I should like to know the recorder that you propose to issue on loan, its speed(s) and maximum spool size. This will enable me to become conversant with the machine before the holiday and save any mistakes! Will spare batteries be available please, or shall we take our own? How much and what type of tape will be issued, and how much time will be allowed before this has to be returned after the trip? Finally, can you suggest car parking facilities in London for the six days?

Birmingham

M. DAGNALL

The recorder on loan will be the Fi-Cord 202, speeds $3\frac{1}{2}$ and $7\frac{1}{2}$ i.p.s., spool size 4 ins. Batteries, which will take up to 30 hours *solid* use, properly used, should last the tour, and one 4-inch reel of B.A.S.F. standard play tape will be issued. The tape you may keep, but the recorder must be handed back on the return to London.

Finally garaging – always a problem in the London area. However, we do have details of a number of garages and car parks in London, some open, some under cover, at prices ranging from 32/6 a week to 5 gns. a week. Anyone wanting these details should send a stamped, addressed envelope to us, and we'll pass on the necessary information. The Automobile Association also publishes a leaflet giving details of garaging facilities near Victoria Station. Alternatively, if any other ATR reader has any garage space to spare, I'm sure offers will be more than welcome!

WHAT ABOUT TAPE?

In every copy of your excellent journal readers receive sound advice on new tape recorders to guide us in our choice of our first – and second – tape recorder. Your personal comments and those of your colleagues – all experts – are appreciated.

But what about tape – the 'be all and end all' of the science? Do we get any words to guide us? I have not seen any. Having embarked on this interesting hobby, I wish to purchase more tape and what do I find? For $5\frac{1}{4}$ " LP tape, Messrs. Wow & Flutter ask 35/-, Messrs. Rumble & Hum 30/-. On another page of ATR I am only asked 25/-, and one one more page only 24/-. Compare our prices and see the difference! Top price to lower price, the difference is 11/-. Quite a figure.

One 'old hand' tells me 'pay top price and you can't go wrong,' while another says 'I never pay more than 25/-.'

As every detergent on the market is superior to every other brand, it only costs a few shillings to experiment and find out for oneself. But not so with tape. How will tape A stand up to tape B over the months? Will I have wasted time, money and effort with recordings of classical music?

Please can someone guide us? Or is this a subject deliberately shunned by all recording magazines?

Harrow, Middx.

W. H. LLOYD

Questions such as this often come our way, and the brief answer is this. Modern methods in tape making are such that the differences between major brands are almost undistinguishable. In fact, so much expensive equipment would be needed to test the tape in such a way that these small differences could be recorded, that the results would not justify the cash out-

lay. Provided that you stick to the well-known and well-tried brands you should have no difficulties, and if for reasons of finance or pure whim you find that one of these particularly meets with your approval, so much the better.

TOKYO OLYMPICS

After recording each day's radio and television transmissions from the Tokyo Olympics, I made a stupid recording mistake and failed to record the closing Ceremony.

As this is of course an essential to complete the recording, I would be very grateful if any ATR readers could help me in obtaining a copy of this. I would of course be willing to cover any expenses and postage incurred.

Eastbourne, Sussex

R. R. PACK

THE MINSTREL SHOW

I am very fond of the Black and White Minstrel Show, and often record it for my personal pleasure. However, I missed their broadcasts last summer, and am wondering if any reader of ATR could loan me the recordings to dub them for me if I forward the tape. Naturally, I would be prepared to pay postage, etc., and even travel to collect them myself if necessary.

Crowborough, Sussex

G. E. TOWNER

Any replies to Mr. Pack or Mr. Turner c/o ATR will be forwarded.

RECORDING LIBRARIES

I keep a large selection of popular music on my tape recorder, some of which is recorded from radio and television. I would now like to record from discs, specially long players, and wondered if there are such things as record libraries from which I could borrow records, tape them, and subsequently return them. I would naturally be prepared to pay a small fee for this, and I am sure many others would too if they knew such a service was available.

Weybridge, Surrey

J. HOLMES

Many local authorities now include with the central branch of the public library a very comprehensive record section. To obtain records from them, you will first have to join the book library, and it is also likely that you will be required to pay a deposit of about £2 to be held against any possible damage to the records. This deposit is usually refunded when the subscription is cancelled. We know of no private company which performs the same service.

One word of warning however—recording direct from disc whether for personal pleasure only, or for any other reasons, is not permitted, unless the appropriate copyright fee has been paid. We advise you to contact one of the copyright organisations, who will be able to tell you what you may record and what copyright fees pertain to any particular work.

G.P.O. RULES

Regarding the correspondence about 'Fair Postal Play' (January ATR) may I bring the following to your notice.

Page 97 of the 1964 Post Office Guide reads as follows:

'Sound Recordings'—Packets containing recordings on disc, tape or wire which include a current and personal message are chargeable at the letter rate of postage, and are subject to the general conditions applicable to the letter post.'

PS. I am not a postman!

Colne, Lancs.

T. DUCKWORTH

Guess that about sums it up!

ANY SOUNDS AT HOME?

I have followed with interest Mr. Bob Danvers Walker's articles on travelling with a tape recorder. There must be many readers like myself who, much though they'd like to follow his example, simply can't afford the time or the money. Surely there must be places in this country that have events worth taping? How can I find out about them?

Epsom, Surrey

A. J. DOUGLAS

The British Travel and Holidays Association publishes a quarterly list of forthcoming events in the British Isles. This is available from them, price 5/-. However, you will note that this month sees the start of a new feature in ATR which is just what you are looking for. Called 'Recording Diary,' you'll find it on page 47.

ANOTHER BOUQUET

Your correspondent in the January issue of ATR, K. J. Brammer gives a well-deserved bouquet to Ferrograph and letters such as his help to restore our faith in the industry. At the same time, I should rather expect service for an instrument in the price range of the Ferrograph.

What do you think of my experience? I bought a tape recorder from Messrs. Lasky's Radio at less than half its list price . . . a very good instrument indeed, at a real bargain price. After its long journey here it had developed faults.

I advised Messrs. Lasky's and in their prompt reply they apologised for the inconvenience, offered to repair the recorder free of charge or, alternatively, to supply me without charge with the necessary parts to effect the repairs myself.

A bouquet, therefore to Messrs. Lasky's for a fine example of fair trading.

Cosheston, Pembrokeshire

R. C. GOUZENS

A very fair commendation. But have we become so accustomed to slap-dash service that we find this kind of treatment remarkable?

What do other readers think?

PRACTICAL DOMESTIC VIDEO RECORDING

PICTURE QUALITY

by F. C. JUDD

Assessment of television picture quality can be obtained by (a) measurement and (b) observation. For the amateur it is easier to estimate the quality with the aid of "test cards" which can be made for direct use with one's own video camera or use the BBC or ITA test card transmissions. The latter are broadcast frequently enough, together with continuous music or tones running on the sound channel. The BBC and ITA are at present using Test Card "D" for 405 lines, and a modified version of Test Card "C" for 625 lines. Later they will be switching to Test Card "E" for 625 lines. The test card "D" is similar to the earlier test card "C" which it supersedes and takes into account recent improvements in television equipment. It provides a better overall check on the performance of the television chain from studio to receiver and could be of value in domestic video recording.

A complete photograph of the BBC test card "D" is shown in fig.1. Particular characteristics of a TV system can be checked by reference to different features of the test card as follows:—

Aspect Ratio: The central concentric black and white circles should appear truly circular when the width and height of the picture are adjusted to the standard aspect ratio of 4:3 (width and height).

Picture Size: The limits of the transmitted picture are indicated on the test card by the points of the opposing arrowheads in the border of the test card and by the outer edges of the white squares in each corner. As most receivers have a display area with an aspect ratio of approximately 5:4, it is usual to adjust the receiver so that the top and bottom edges of the display area coincide with the arrowheads and the side castellations of the test card just appear in the display area of the receiver. In this way the correct aspect ratio of the picture is obtained.

Contrast: At the centre of the test card is a column of five squares having a contrast range of about 30:1 between the top and bottom squares. The brightness difference between any two adjacent squares, should be

constant on a correctly adjusted receiver. Within the top and bottom squares are small lighter spots; white or black "crushing" is shown by the merging of the top or bottom spot into its surrounding square. The areas of the test card which are at 'peak white' include the spot in the top square of the contrast pattern and the white background. This does not include the 'white' vertical line in the black surround and the 'white' surround of the black vertical line.

Resolution and Bandwidth: At the sides of the contrast pattern are six 'frequency gratings' consisting of vertical stripes designed to produce (after gamma correction) signals of approximately *sine wave* form corresponding to the following frequencies in Megacycles (Mc/s.).

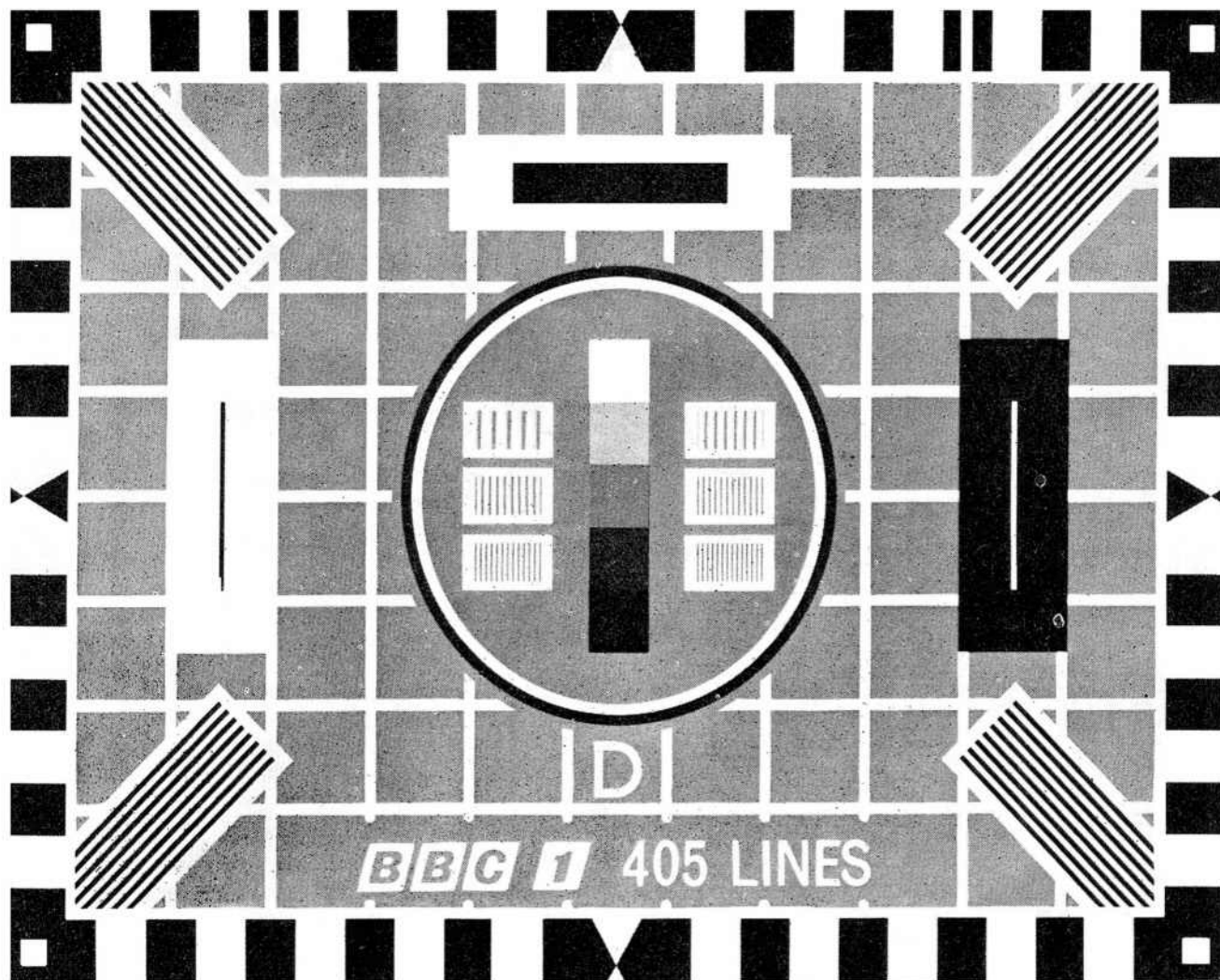
1.0	1.5
2.0	2.5
3.0	2.75

(as they appear on the test card).

The range of brightness in the gratings is the same as that from the top of the centre square of the contrast pattern. The brightest parts of the stripes have the same brightness as that of the area surrounding them.

Scanning Linearity: The background of white lines should be reproduced in all parts as enclosing equal squares and the central black and white rings should appear truly circular.

Line Synchronization: The border of the test card is a pattern of alternate black and white rectangles. The left and right sides of this border serve as a test signal to check the line synchronization of receivers. Faulty line synchronization shows as horizontal displacement of



The BBC television test card 'D'.

those parts of the picture on the same level as the white rectangles in these sides; it will also give the central circles an appearance of 'cog-wheels'.

Low-frequency Response: Low-frequency response can be checked by means of the black rectangle within the white rectangle at the top centre of the test card. Poor low-frequency response shows as streaking at the right hand edges of the black and white areas and also of the border castellations.

Reflections: The 'white' vertical line with the black surround and the black vertical line with the 'white' surround should appear free from displaced images (ghosts). If there are reflections of the television signal, from hills or large buildings, these may result in displace 'ghost' images of any significant feature of the picture. This effect will be most readily seen as displaced positive or negative images of the 'white' and black vertical lines. The lines represent pulses having a duration of 0.3 microseconds.

Uniformity of Focus: In each corner of the test card there is a diagonally disposed area of black and white stripes; the focus of these areas and of the central area of the test card should be uniform. The stripes correspond to a fundamental frequency of about 1 Mc/s.

These test cards can be valuable to those who take up television tape recording and before long we shall probably need special test cards to use in conjunction with amateur video cameras. Whether these will be provided by video camera manufacturers remains to be seen but undoubtedly they will prove a valuable asset to home television recording.

Meantime I have carried out further tests with the Wesgrove VKR500 which has now been modified to bring it up to date. This has left no time in which to obtain photographs from the display and which I had hoped to show this month. However, you will find further information about the VKR500 elsewhere in Video News.

TELEVISION TAPE RECORDING N. RUTHERFORD.

PART 3 SOME MORE FUNDAMENTALS

In my last article we discussed some of the fundamental processes of magnetic tape recording in detail, and analysed various aspects rigorously. I hope that these explanations did not prove too technical for some readers, but the reader should be able to grasp the final conclusions which were simple in concept.

Before going on to some more basic performance factors I feel it would be well worth re-capitulating on the conclusions, which apply to any direct recording system.

(1) The output from the replay head rises in proportion to the frequency of the output. That is, the output rises at 6 dB per octave.

(2) The output from the replay head is proportional to the head current when recording, (assuming an ideal tape with a linear characteristic).

(3) The amplitude response of the tape is not linear and some method of linearisation must be used.

(4) At short recorded wavelengths the output from the replay head will fall to zero when the recorded wavelength equals the replay head gap length.

Before it is possible to predict the nature of a system capable of recording a complete video signal (the requirements for which were discussed in my first article) one or two other fundamental limitations must be explained.

We will first consider further losses in performance which are experienced in any magnetic tape system at short recorded wavelengths (high packing densities) and high frequencies.

We have already discussed the limiting effect of gap length, which is a factor dependent on wavelength. Other wavelength dependent factors also affect the limiting performance of the system. We may deal with these in the categories—wavelength dependent losses and the separation between tape and head.

SEPARATION

This most important loss is a factor which dictates to a large extent the layout of the tape path in any high performance tape transport system. It can be shown that the loss in decibels where there is a spacing between the tape and gap of d and the recorded wavelength is λ ,

is equal to $55 \frac{d}{\lambda}$ dB. Recording a maximum of 2 mc/s at 120 inches per second, the recorded wavelength will be equal to

$$\frac{120}{2} \times 10^{-6} = 60 \times 10^{-6} \text{ inches.}$$

If, whilst the tape is running through the transport it should, for any reason, lose contact with the head by an amount equal to one thousandth part of an inch, we may calculate the resulting loss of output thus:

$$\text{loss} = 55 \times \frac{10}{60} \approx \text{dB.}$$

It can be seen therefore, that head to tape contact is a point of extreme importance in mechanical design. Loss of contact between gap and tape may be avoided (a) by having a high contact pressure between the gap and the surface of the tape and (b) by having a high standard of surface finish on the pole pieces.

TAPE THICKNESS

From the above one would expect the contributions to

the replay head from the surface of the magnetic coating to be considerably less than that from the depth of the coating.

At short wavelengths the lines of flux which leave the surface of the tape have extremely short excursions, and the layers deep within the coating make no appreciable contribution to the external field. Since it is the external field or surface induction which produces output in the replay head, the recording of very short wavelengths is very much a surface effect.

DE-MAGNETISATION

De-magnetisation loss is the loss in recorded intensity which takes place immediately after the tape has left the recording head. The subject is a very difficult one to analyse since the tape coating does not consist of an amorphous magnetic surface. The tape coating actually consists of a suspension of separate magnetic particles. Various theories have been put forward in an attempt to describe de-magnetisation loss in terms of the nature and shape of the particle. It has been found that de-magnetisation losses are small where the recorded wavelength is very much longer than the coating thickness. These losses become appreciable in video recording processes where the head gap length may be almost in the order of L_0 smaller than the tape coating thickness.

HEAD ALIGNMENT

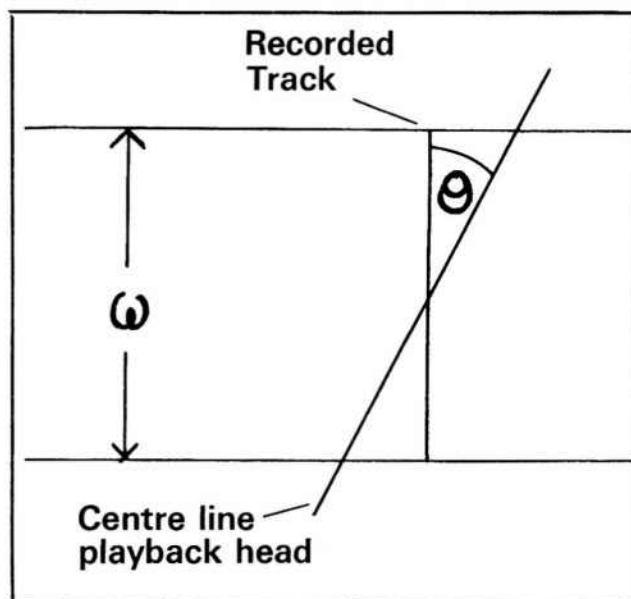
This is a most critical and important factor in high resolution magnetic recording. The reproducing head will not work at maximum efficiency at any wavelength unless both edges of its gap are correctly aligned with the trailing edge of the recording gap. If however, the gap edges are not aligned as shown in diagram a loss in output due to this mis-alignment will result. An expression for this loss can be given as follows:

$$L = \frac{\sin \left(\frac{\pi W \Theta}{\lambda} \right)}{\frac{\pi W \Theta}{\lambda}}$$

where W = track width, Θ = angle between gaps, and λ = recorded wavelength.

In the example of the 120 inch per second and 2 mc/s system mentioned earlier one would expect a loss of 3 decibels at 2 mc/s for an angular mis-alignment in the order of 0.01° , an extremely small angle.

To build equipment where mis-alignment losses may be neglected requires working to extremely high standards of mechanical accuracy. In low cost equipment this difficulty has been overcome by the practice of aligning the replay gap to the recorded track by examination of the re-produced signal. In television recording equipment the action of alignment of the replay gap simply has the effect of a 'focus' control.



FREQUENCY DEPENDENT LOSSES

All the losses we have discussed to date have been a function of recorded wavelengths. Other losses exist which are not wavelength dependant but frequency dependant. These losses exist for the most part in the head core and are due to eddy current or hysteresis. We will discuss these losses in detail in future articles when describing the construction of practical recording and replay heads for video signals. In my next article I intend to start by briefly discussing methods of linearisation of tape response, followed by a discussion of the basic design for a simple video recorder, utilising all the factors of requirement and limitation we have discussed to date.

VIDEO NEWS REVIEW

From a report recently issued by a USA news service it seems likely that various home video recorders will shortly be available over there. Philips expect to put a domestic video recorder on the market for about £620 and Par Limited of Clifton, New Jersey, has reached the 98% development stage of its home V.T.R. which may retail at between £140 and £170.

Winston Research Corp. may have their V.T.R. on the market within a year at about £150 but Ampex seem uncertain although it is known that they are developing a machine for the domestic market. Loewe-Opta of Western Germany showed a prototype V.T.R. last year but at the moment expect their machine to retail at about £1,000 which is of course too high for amateur or domestic use. It is also known that the Minnesota Mining Co. (Scotch Tape) are researching into special tape for home video recording and we know of at least two other large tape manufacturers who are doing the same.

WESGROVE ELECTRICS VKR500

The latest from Wesgrove is a

modified version of the original VKR500 (not in kit form) which has a control panel at the front similar to some sound recorders (below left). Provision is made for TV receiver and camera inputs and for record and playback levels etc. The manufacturers have announced that a video recording level meter will soon be a feature of these recorders.

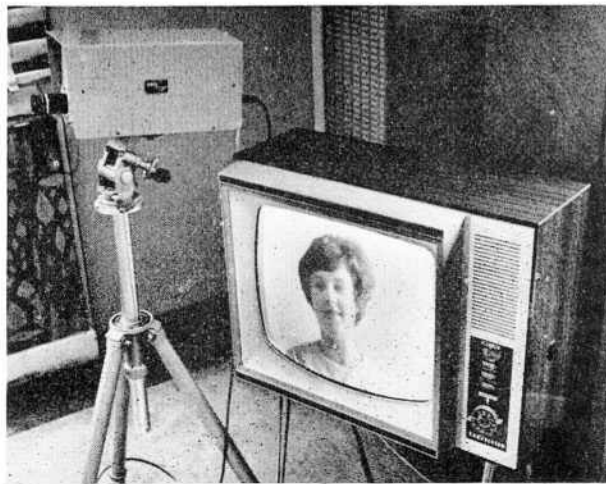
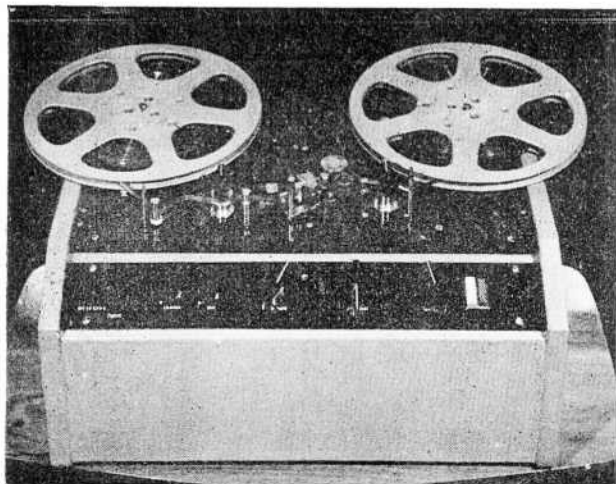
CAMERAS

A visit to the recent Closed Circuit Television Exhibition at the National Audio Visual Aid Centre in South London revealed the surprising number of video cameras available at present. At the top of course were the professional cameras by E.M.I. and others but coming down from the high price range into a bracket nearer that likely to attract the amateur we found a Grundig video camera at about £275 and lower still those marketed by Beulah Electronics Limited of 126 Hamilton Road, West Norwood, London, SE27. The Beulah D.50 transistorised camera is shown right and note that the picture on the TV screen is direct from the camera. This camera can be built from the

"Beukit" which costs £40 less the vidicon tube and lens. A vidicon tube and a suitable lens can be supplied and cost £16 and £13. 19s. 6d. respectively. The complete and ready to use D.50 camera costs £82. 19s. 0d. Other cameras available are the D.80 at £140, the D.80/LL at £130, the D.80/V/R at £150 and D.80/HR at £160. These have various applications but further details will be supplied on request.

VIDEO FLASH

It has been announced that Sony domestic television tape recorder will be available here next spring. Although specifications have not yet been released, we understand that the Videocorder 2000 will employ revolving heads, have a tape speed of 7½ ips giving 63 minutes playing time. Weighing 33-34 lbs. it will be about the same size as a home tape recorder. Adjustments to a TV set to accommodate the Videocorder are expected to cost £10, and the machine itself will retail at £198 in Japan (about £250 in UK). Initial production is estimated at 2-3,000 per month.





R104 Four-Track Recorder

This recorder cost £45,000 (it's yours for 79 gns.)

PD104 Stereo Tape Unit



This is the new TRUVOX Series 100 Recorder—the result of years of extensive research and development. We're convinced the money has been well spent as we have achieved a unique combination of professional performance and simplicity of operation at a thoroughly realistic price.

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May 1965

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RANK Organisation's subsidiary Company Pullin Photographic Limited, will be fully backing the new Akai range of tape recording equipment with publicity in trade magazines, point of sale material and selected audience demonstrations throughout the country.

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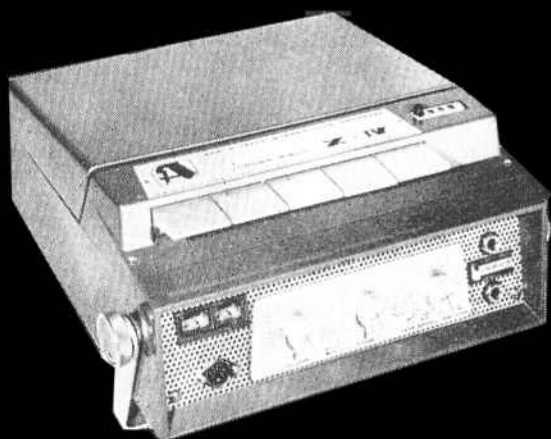
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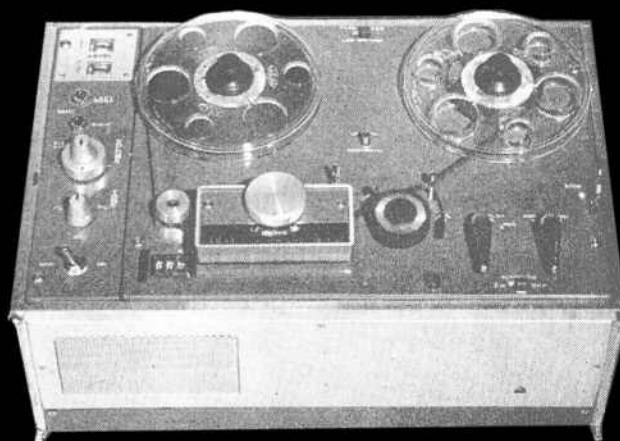
Akai 345 Designed for the perfectionist. The most expensive in the Akai range, the 345 is produced for the discerning and demanding amateur/professional. Every possible feature is included making this the most advanced model for the recording enthusiast. It offers every possible Akai feature including:— exclusive cross field head/three independent hysteresis wound motors/three independent heads, erase, record, play recording monitor/Dual stabilizer giving constant tape speed/Automatic reverse/Auto repeat/Auto shut off/ Provision for remote control/Dual self contained speakers/ professional VU meters/Vertical or Horizontal operation/All mains voltage selector/Tape speed $3\frac{3}{4}$ " and $7\frac{1}{2}$ " per second/



Akai M8 For the enthusiast wishing to achieve professional standards in recording, the M8 offers fantastic performance at a realistic price. This machine can do everything that the professional machine can do, and has these exciting features:— Cross field head/vertical centre speakers/sound on sound/ two speed synchronous motor/unique cooling system/built in tape cleaner to eliminate hiss/3 speeds/4 track stereo-mono/2 large VU meters/automatic stop and complete shut off/



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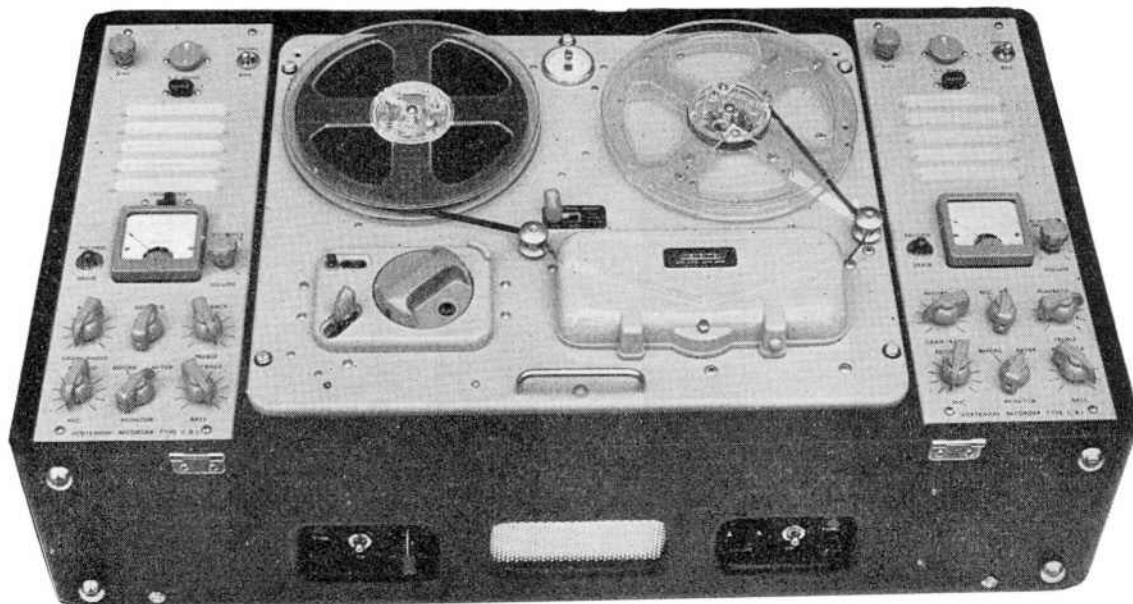


Akai 44s Ruggedly built, competitively priced. For the enthusiast who demands quality, top engineering with rugged construction. This superbly built machine with exceptional value offers the following Akai quality features:— Precision Micro-gap head giving superb performance at $1\frac{7}{8}$ IPS/Vertical or horizontal use/3 speeds, $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{1}{8}$ IPS/ 2 illuminated VU meters/all metal case/powerful stereo main amplifier/automatic stop control/provision for stereo headphones/special ventilation device/

The Crossfield Head is undoubtedly one of the greatest single developments since the inception of magnetic recording systems. The bias current normally fed to the recording head to eliminate background noise partially erases the higher frequencies in the recording signal. The Crossfield System feeds the bias current to a separate head placed before and on the opposite side to the recording head in such a way that the bias current can no longer interfere with the recording head. The normal maximum audio frequency at one centimetre per second tape speed is 790 c.p.s. The Crossfield Head system for the same speed makes possible a signal frequency of 2750 c.p.s.

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IT CAN record monaurally or stereophonically with its own mixed inputs from Gram., Radio or other sources and from high grade low impedance balanced line microphones. With good microphones, etc., the result is a suitable master for disc manufacturers. "Before and After" monitoring is provided, together with adjustable metered bias for perfection.

IT CAN also make a recording on one track and then transfer it to the other track while measuring and listening to it and adding one or two more signals also metered.

IT CAN repeat the process and transfer this combined signal to the first track with one or two more signals. Composers use it for this purpose. One track may have music or commentary and the other cueing signals or commentary, and either may be altered without the other.

IT CAN play back stereophonically or monaurally with its own amplifiers of $3\frac{1}{2}$ watts each. **Price £160 0s. 0d.**

The **Vortexion W.V.B.** is a high quality monaural machine with "Before and After" monitoring. The recording inputs are a high sensitivity socket for moving coil or ribbon microphone and a high impedance socket for radio, etc., either of which can be selected by a switch. Superimposing and echo work can be done, and the playback has reserve gain for abnormal requirements. This model cannot be converted for stereo playback, but it is a thoroughly reliable machine for the engineer specialising on monaural work. **Price £110 3s. 0d.**

The **Vortexion W.V.A.** is a monaural machine which has a performance equal in sound quality to the other models. It possesses all the features of the W.V.B. except for "Before and After" monitoring, Dubbing and Echoes. The recording being made can be heard on the internal loudspeaker, as in the W.V.B. and C.B.L. The controls are uncomplicated. **Price £93 13s. 0d.**

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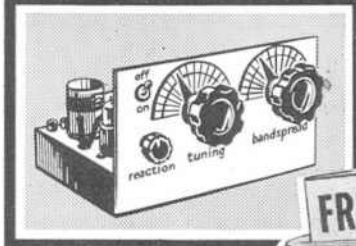
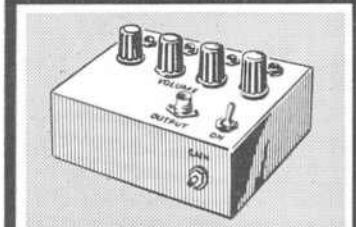
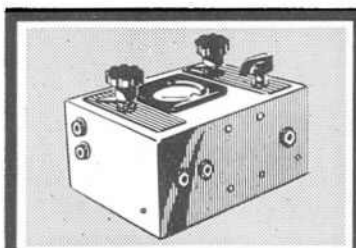
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SPORTS EVENT TIMER

Full details for constructing a large clock-face indicator and the electronic unit that drives it.

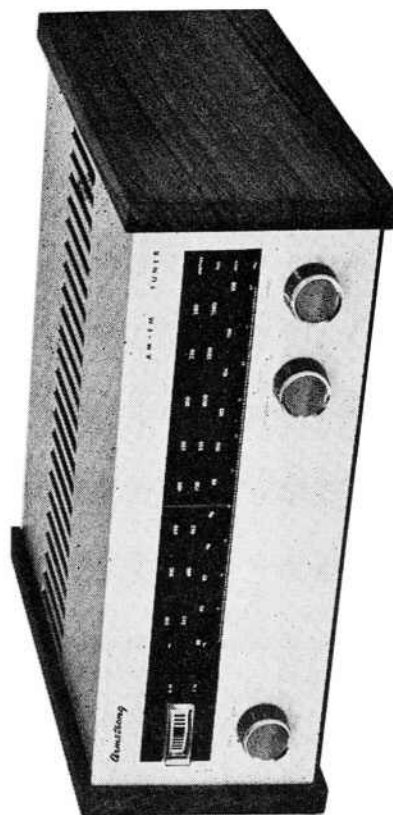
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Details of the theoretical functions of basic electronic circuits.

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COPYRIGHT

As many readers are experiencing difficulty in coping with the provisions of the 1956 Copyright Act, we are reproducing here in its entirety an explanatory leaflet issued by the Performing Rights Society.

The provisions of the Copyright Act, 1956, as regards the right to make and use records of *musical works* can be very simply stated. A copyright musical work may not lawfully be recorded without the permission of the owner of the reproduction right, i.e., the composer of the musical work or anyone who has acquired from the composer the right to reproduce the work on records. This rule holds good no matter what may be the form of reproduction, e.g., tape recorders, gramophone records (discs or cylinders), films, magnetic wire, etc. Except for what is called 'fair dealing for purposes of research or private study' or for class instruction in schools, *the prohibition is absolute, even if the recording is made only for private entertainment.* The copyright in musical works endures for the lifetime of the composer and for fifty years after his death.

The Performing Rights Society is not directly concerned with the copyright in gramophone records and in broadcasts, as distinct from the copyright in the musical works which are the subject thereof, but desires that the differences between these copyrights should be fully understood and appreciated.

COPYRIGHT IN GRAMOPHONE RECORDS

Under Section 12 of the Copyright Act, 1956, the maker of a gramophone record has a copyright in his record, which may not lawfully be copied even for private purposes unless the maker's permission has been obtained.

SOUND AND TELEVISION BROADCASTING PROGRAMMES

Under Section 14 of the Copyright Act, 1956, the BBC and the ITA have a copyright in their sound and television programmes, and these programmes may not lawfully be recorded or copied without their permission unless the record or copy have been made solely for private purposes. It must be emphasized again, however, that, except for 'fair dealing' or with the copyright owner's permission, no records or copies may lawfully be made, even for private use, of any copyright musical works that may be incorporated in the BBC's or ITA's programmes. The performers also have certain rights in respect of the copying of their recorded performances - see Dramatic and Musical Performers' Protection Act, 1958.

PUBLIC PERFORMANCE

A copyright musical work may not lawfully be performed in public without the permission of the owner of the copyright, and this applies whether it is performed by live performers, by means of a gramophone record, tape recording, etc., or by means of a radio or television set. The sole material point is that the licence of the copyright owner must be obtained if the performance is in public, that is, outside the domestic circle, except as regards certain limited performances in children's schools.

In addition, gramophone records, tape recordings, etc., may not in certain circumstances be used for performances in public without the permission of the makers. Nor may television programmes be publicly shown to a paying audience without the permission of the BBC or the ITA, as the case may be. The copyright in records and in broadcasting is somewhat limited (see Sections 12 (7), 14 (4) (c), 14 (8), 41 (5) and 45 of the Copyright Act, 1956, but - except as regards schools - these do NOT apply to the copyright in the *MUSICAL WORKS* so recorded or broadcast.

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CASTLE, 7" 45 r.p.m. records, approximate playing time 5 minutes. Each contains selection of sound effects in separate tracks. Complete with sleeve and paper inner jacket. Sleeve includes description of each sound effect and playing time in seconds.

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Side 2—Elephants, Mississippi Alligator, Indian Tiger, Sea Lions, male Lion. In the jungle (a background of typical sounds).
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Side 1—Sea (breakers). Wind (howling—eerie). Thunder (light rain).
Side 2—Rain (heavy shower). Factory sounds (industrial). Traffic (busy street).
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Side 1—Space ship—take-off. Space vehicle—imaginary take-off. Space vehicle—imaginary landing. Ring modulation—tonal. Modulated tone glide (descending). Modulated tone glide (ascending). Sibilant—white noise (pitch octave low).
Side 2—Sibilant—white noise (pitch). Sibilant—white noise (pitch octave high). Three-tone modulation. Filtered noise Stridor (tonal). Ring modulation and sibilant.
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Side 2—Sound object Montage.
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Side 1—Lion roaring. Twin piston aircraft landing. Building and debris fall. Side 2—Spooks. Intruder. Creaks. Fright. Dungeon Ghosts. Ghouls. Maniac laughter.
- G MFX/1-AUTHENTIC HIGH-FIDELITY SOUND EFFECTS** Price 7/6
Side 1—Lion roaring. Twin piston aircraft landing. Building and debris falling. Road drills and compressor. Ship's siren. Steam train leaving station. Small steam loco and whistle. Cell door, keys and lock.
Side 2—Police car and bell, chase. Police launch and siren. Steam goods train and whistle. Car door slam, and starter. Storm at sea, thunder, wind and gulls. Tube train, stop, doors and start.
- H MFX/2-AUTHENTIC HIGH-FIDELITY SOUND EFFECTS** Price 7/6
Side 1—American police car with siren—arriving. American police cars with sirens—departing. American police car escort with sirens—passing. American police motor-cycle patrol with siren—stopping. Applause (hand clapping). Orchestra tuning up. Car crash. Glass breaking (repeat).
Side 2—City and Waterloo tube train—arriving. City and Waterloo tube—departing. Footsteps (continuous track), in subway (mixed), in narrow streets (female), on pavement (mixed), running in street (female), running in street (male), up and down wooden stairs. Workmen hammering and sawing.
- I MPX/1-MILITARY PARADE AND WARFARE SOUNDS** Price 7/6
Side 1—March past—Guards and crowd sounds, etc. Royal Salute—Parade commands and National Anthem. Drums and pipes—with parade commands.
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- J TFX/1-AUTHENTIC BRITISH TRAIN SOUNDS** Price 7/6
Side 1—Train departure—main line. Train arrival—main line. Express train passing—with whistle. Fast goods train passing—with whistle. Express train passing. Small tank loco—passing.
Side 2—Local passenger—arrive and depart. Fast goods train—passing. Central London tube train—arrive and depart. Train over points and crossing. Slow goods train passing—with whistle.
- K MFX/3-HORSES** Price 7/6
(10 effects). Trotting. Walking. Jumping. Composite recording of foxhounds, calls, horns, etc. Cows, Cats, Pigs, Blacksmith's shop.

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ELIMINATION OF HUM

by E. A. Rule.

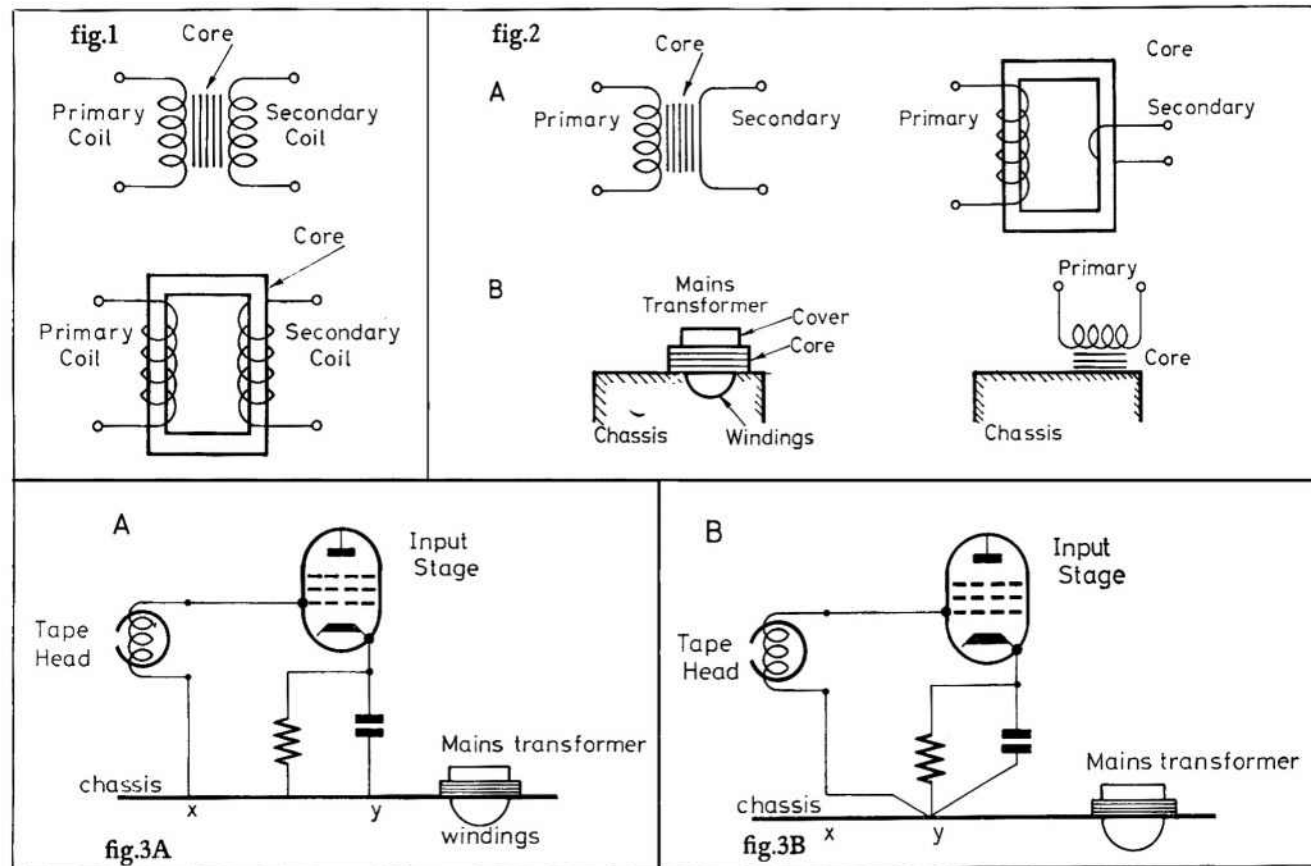
One of the most difficult problems encountered by designers and indeed users of audio amplifiers is how to eliminate 50 c/s. hum usually induced into chassis and wiring by mains transformers and similar inductive components such as tape recorder motors. In this article the author attempts to show some of the many causes and cures.

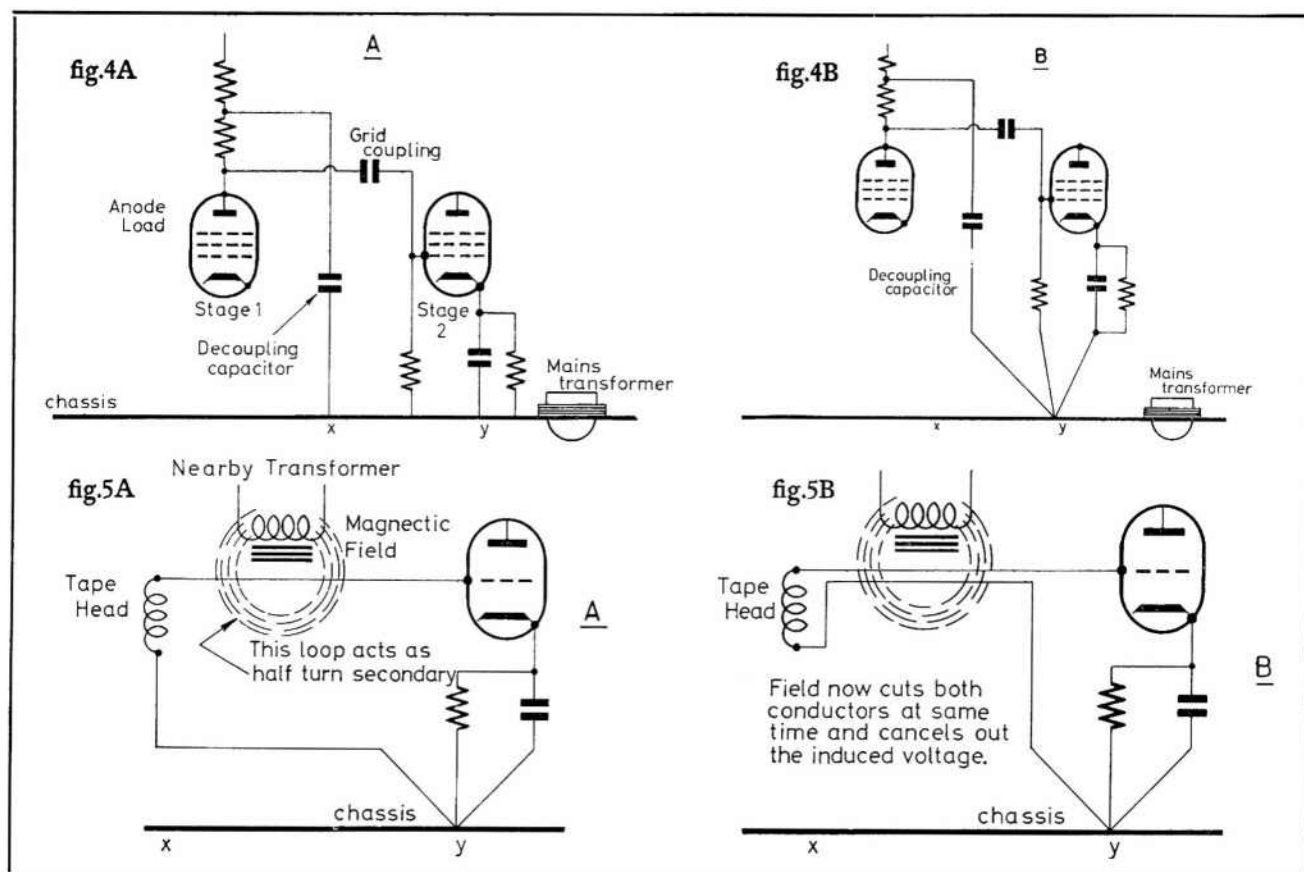
When an alternating current is passed through the primary winding of a transformer (fig.1) a similar current will be induced in the

secondary winding and an alternating voltage will therefore be available across the secondary terminals. The voltage available will depend on the turns ratio between primary and secondary and may therefore be higher or lower than the input voltage. With a secondary of only half a turn, as in fig.2, a voltage will be developed across the winding.

A metal chassis on which a transformer is mounted can also behave as a fractional turn secondary wind-

ing to the transformer and current will be induced into it (fig.2B). The resulting voltage can actually be measured by connecting an A.C. meter across the ends of the chassis. Now let's see how this voltage can reach certain parts of the amplifier circuit. Fig.3A represents the first amplifier stage of a tape recorder, the cathodes of the valve being earthed at point 'B' and the tape head at point 'A'. Any 50c/s. voltage developed between points 'A' and 'B' on the chassis will be





ELIMINATION OF HUM

continued

in series with the earth return lead from the tape head and will consequently be amplified along with signals from the head. The 50 c/s. voltage developed across a 'hum loop' as in fig.3A can amount to several milli-volts, even half a volt is not unknown. The usual method of eliminating hum induced in this way is to re-arrange the amplifier wiring as in fig.3B. In this case the grid and cathode circuits are returned to a common earthing point on the chassis.

A not so obvious type of earth loop is shown in fig.4A between the cathode in stage 2 and the anode decoupling capacitor in stage 1. The circuit should be re-arranged as in fig.4B. The same precautions should be followed even when using a thick copper wire 'bus bar' for earthing. As far as the alternating magnetic field is concerned, one conductor is the same as another and a hum voltage will be induced into a bus-bar just as easily as a chassis.

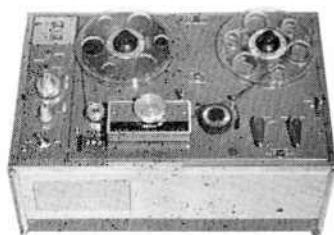
Amplifier wiring should always be arranged so that each stage has a common earth point for its grid and

cathode circuits. When the input socket is some distance from the first amplifier stage, the signal lead to the grid and its earth return must be close together. Failure to do this can result in a 'wiring loop' and hum could be induced in the same way as illustrated in fig.2. The circuit diagrams in figs.5A and 5B will serve to clarify this.

Yet another example of earth loops is shown in fig.6A. This often occurs in the wiring of negative feedback circuits and may be the cause of 50 c/s. hum voltage being fed back into the cathode of an earlier stage. Because the amplifier stages concerned are often at opposite ends of the chassis the hum voltage will be included with the normal signal feedback. One way of avoiding this is shown in fig.6B. When tracing hum loops in existing equipment it sometimes happens that eliminating an obvious loop increases the hum. In this case there may be other hum loops and it is actually possible for the hum created in one to cancel out that from another. The best way to trace hum

AKAI

TAPE RECORDERS



model 44S



model M8

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model 44S

3 speed, four-track stereo/monaural record and play back • Precision micro-gap head • 6 watt amplifier (3 watts per channel) • Two VU meters • 5" speaker for monitoring • Automatic stop and shut-off • Stereo headphone jack.

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fig.6A

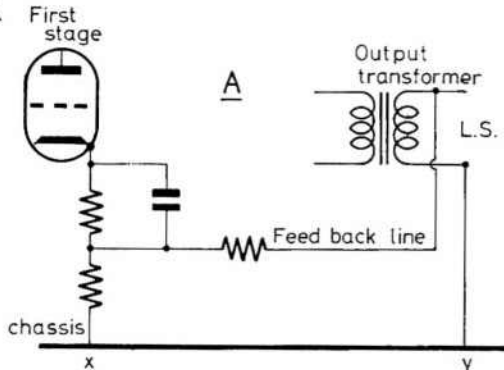
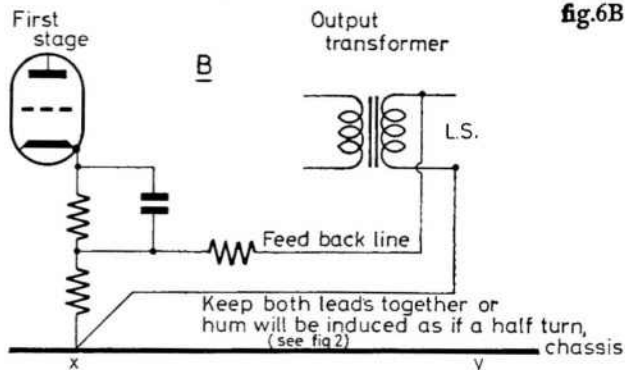


fig.6B



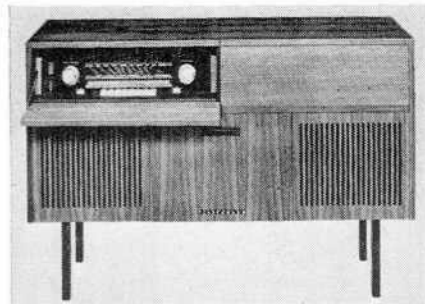
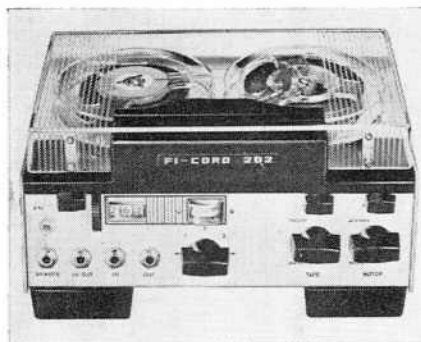
is to start at the output stage and work back towards the inputs. Mains hum can be introduced into amplifiers in various other ways, for instance by mutual coupling between a mains transformer and a tape head or pick up. The signal from a tape head may be only a few milli-volts and it is easy to induce a hum voltage of the same order from a nearby mains transformer or tape recorder drive motor. Re-positioning or orientation of the mains transformer will often reduce or completely eliminate hum induced in this way.

With a tape recorder motor this may not be possible of course and one may have to resort to using 'hum bucking' coils. These usually consist of a small coil of about 50-100 turns for a high impedance head or 10-20 turns for a low impedance head. The coils need only be about one inch in diameter and are connected in series with the earthy side of the tape head or pick up. The position or orientation of the coil is then adjusted until the hum is reduced to the lowest possible level. Incidentally the valve used for the first amplifier

stage should be mounted well away from nearby mains transformers and motors as the magnetic field from these can modulate the electron stream from the cathode. Hum introduced in this way can be very difficult to trace but the remedy is obvious.

Providing earth loops are avoided and all signal leads are screened, trouble with hum in audio amplifiers should never arise. Other possible sources of hum are of course H.T. smoothing and cathode heater leakage in valves.

AUDIOVIEW



NEWS OF TAPE RECORDERS AND HI-FI

The International Audio Festival is probably the one event of the year which triggers off a desire to 'go in for hi-fi' or to buy a new and more expensive tape recorder or perhaps an F.M. tuner. Whatever you seek you may well find at the Audio Festival.

Among the exhibitors are **Fi-Cord International**, with their new 202A portable recorder. This has the same basic specifications as the 202 (i.e., speeds of $3\frac{1}{2}$ and $7\frac{1}{2}$ i.p.s., frequency response 50 to 12,000 c.p.s. \pm 3dB. at $7\frac{1}{2}$ i.p.s., etc.), but incorporates many new features. It has a new battery testing system, redesigned control panel, a new Vu-meter, and a new colour scheme. The 202A, normally powered by mercury batteries, can, if desired, be operated by a 12-volt D.C. car battery, 105 to 240 volts A.C. mains, or accumulators which can be recharged with the aid of the Fi-Cord rechargeable battery unit.

Also from Fi-Cord are the first two microphones of their own make, the 801 and the 901. Both are studio quality dynamic moving coil microphones, the 901 being directional and the 801 omnidirectional.

If you happen to be looking for some hi-fi all in one box, listen to the **Telefunken 'Wein'**, which is a complete stereo radiogram and with provision for

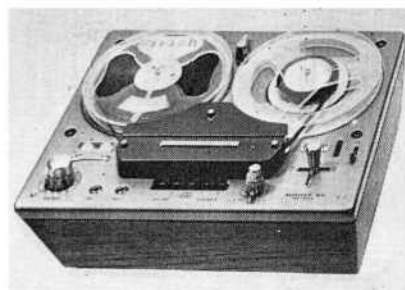
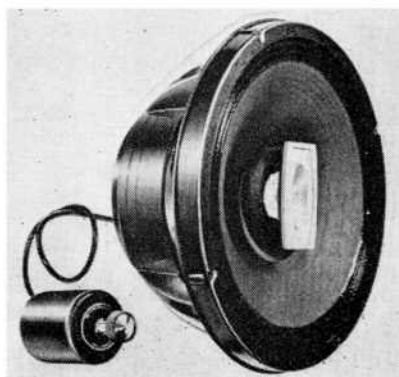
four wavebands — F.M. and short, medium and long. It has also provision for F.M. stereo broadcast reception and retails at 129 guineas (above). Telefunken are also showing a whole range of tuners, radio receivers, tape recorders and microphones.

C. E. Hammond will be unveiling two entirely new compact loudspeaker systems. The 'Europa' contains four units (two tweeters, one mid-range and one bass) built into a teak cabinet. The 'L7' is a single unit loudspeaker, $20" \times 13" \times 4\frac{1}{4}"$, for use where space is at a premium. Also new is the Hammond condenser microphone, which is a re-designed version of the Microkit. At 28 gns., it is the lowest priced condenser microphone in its class available in this country.

Sony will be displaying four of their recorders, the 'TC 500,' 'TC 200,' 'TC 777A' and the 'TC 600.' Also on display will be the 'TC 263D' precision stereo tape transport, and the 'SRA 3' complete stereo record pre-amplifier.

If you are looking for a hi-fi transcription unit visit **A. R. Sugden Ltd.** and see their Connoisseur range. The 3-speed Connoisseur Craftsman model shown above has a built-in stroboscope and performs to a very exacting specification. This and other Sugden products can be seen on Stand 34.

Amateur Tape Recording Video & Hi-Fi



Radford Electronics are showing two new loudspeakers. The "Series 3" super bookshelf loudspeaker incorporates two drive units, together with an acoustic corrector to provide a response previously unobtainable from dynamic systems. The "XLS" medium sized loudspeaker uses three drive units and is integrated by means of an eighteen element electrical network.

The **Ferrograph Company** have added their series 6 instruments to their existing range of hi-fi recorders. The series comprises the following models: The 631, at 88 gns., 631/H, at 92 gns., 632 at 115 gns. and the 632H and the 634 each at 120 gns. All have three speeds, the "H" models from $3\frac{1}{2}$ to 15 i.p.s., and others from $1\frac{1}{2}$ to $7\frac{1}{2}$. All are housed in new modern style cabinets.

Also among the new recorders is the **Akai X4**, shown above. This is a unique battery/mains portable stereo/monaural recorder, with rechargeable batteries. Features include interlocked piano key controls, quarter track record/play, erase and cross-field bias system of heads, as well as a new design of constant speed DC micromotor to ensure superb quality at the four tape speeds. Performance figures are: 40-20,000 c.p.s. ± 3 dB and wow and flutter less than 0.16% r.m.s. at $7\frac{1}{2}$ i.p.s. with equally impressive figures at $3\frac{1}{2}$ and $1\frac{1}{2}$ i.p.s. and an outstanding 30-5,500 c.p.s. ± 3 dB with

wow and flutter less than 0.35% r.m.s. at 15/16 i.p.s. Maximum reel size is 5". The transistor amplified gives 2-watts maximum on each channel and can be monitored on the internal 5" elliptical speaker or fed to hi-fi speaker enclosures. Two high sensitivity dynamic microphones are supplied for stereo-recording and twin VU meters (as well as providing a battery check) ensure perfect recording level. Up to $6\frac{1}{2}$ hours running time are achieved with a single charge. Price 135 gns. Further details from Akai - U.K. distributors, Pullin Photographic, 11 Aintree Road, Perivale, Middlesex. We considered the Akai X IV such an excellent machine that we have chosen it as the prize in our simple, free-to-enter competition open to all ATR readers. Full details of this competition on page 15, or from Stands 25 and 50 at the Audio Fair.

For budget-priced hi-fi speakers or enclosures visit the **Goodmans Stand** (No. 68). Ask for their booklet on speakers and enclosures, which includes designs and full details for constructing these and the crossover networks to go with them. One of the newer additions to the Goodmans family of speakers is the Triaxiom 1220 C 12" triple element unit which comes complete with cross-over network and attenuation control.

From the same distributing company come two famous foreign products - the

Norwegian **Tandberg** recorders, and the **Scott American** amplifiers. Tandberg will be demonstrating the monaural Series 8 and Series 9 recorders, as well as the stereo Series 6 and Series 7 versions. The new Series 8 is available in two-track and four-track models in the well-known Tandberg teak case, and also as a completely portable machine with special fabric cabinet incorporating lid and carrying handle. H. H. Scott Inc. will be demonstrating their 229 stereo amplifier, and introducing their new solid state amplifier, the Model 260, which has two 30 watt channels, and is transistorised. Also shown will be the model 200 amplifier with two 15 watt channels, separate tone controls for each channel, tape monitoring facilities, derived centre channel output, and low volume compensation circuits.

New from **S. G. Brown** is a dual function microphone which by the simple operation of a shutter mechanism is transformed from a conventional pressure operated configuration to differential operation, which renders the microphone sensitive only to sound originating in close proximity to it. Thus the instrument is well suited to deal with the majority of programme situations. Most of the Brown range of audio products will be on display including the new Canada headset which uses circumaural earpieces with liquid filled earpads.

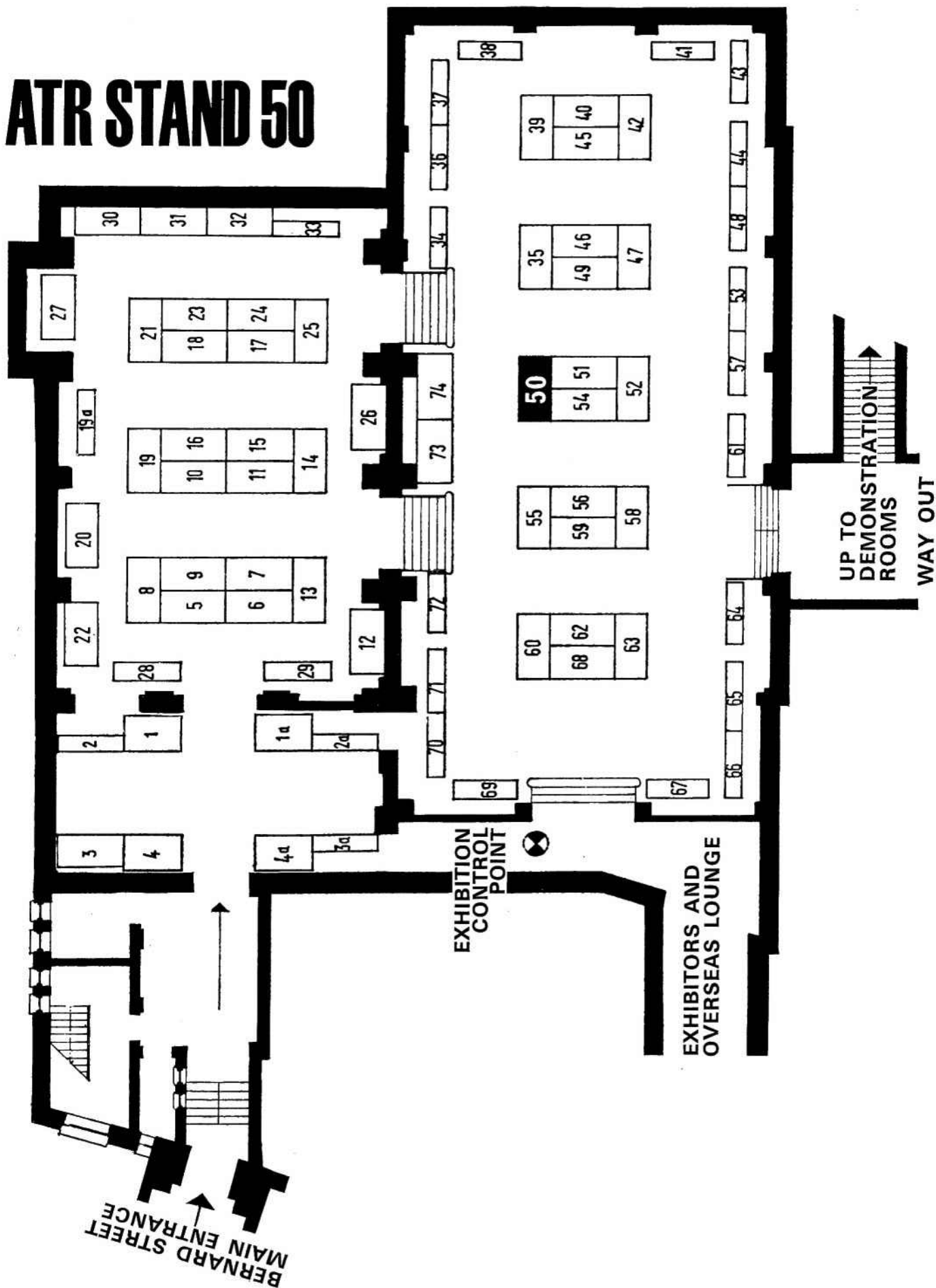
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INTERNATIONAL AUDIO FESTIVAL & FAIR

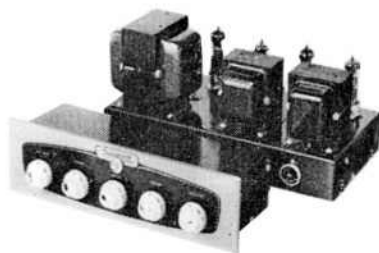
HOTEL RUSSELL APRIL 22-25

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Acoustical Manufacturing Co. Ltd.	Quad	65	Lustraphone Ltd.	Lustraphone	16
Agfa Ltd.	Agfa	33	M.S.S. Recording Co. Ltd.	M.S.S.	9
Akustiche U Kino-Gerate GmbH	AKG	51	Metro-Sound Mfg. Co. Ltd.	Sonotone	2A
Ampex (Great Britain) Ltd.	Ampex	15	Minnesota Mining & Mfg. Co. Ltd.	Scotch	58
Armstrong Audio Ltd.	Armstrong	52	Mullard Ltd.	Mullard	19
Audio Dynamics Corporation (KEF)	ADC	37	Ortofon (Metro-Sound)	Ortofon	3A
B.A.S.F. Chemicals Ltd.	B.A.S.F.	28	Peto-Scott Ltd. (Philips)	Peto-Scott	-
B.M.B. Sales Ltd.	B.M.B.	48	Philips Electrical Ltd.	Philips	8
Beyer (Fi-Cord)	Beyer	10	Planet Projects Ltd.	Planet	30
Boosey and Hawkes Ltd.	Jordan Watts	55	Print and Press Services Ltd.	Tape Recording Magazine	-
Braun Radio	Braun	22	Pullin Photographic Ltd.	Akai	25
Brenell Engineering Co. Ltd.	Brenell	12	Pye Ltd.	Pye	56
S. G. Brown Ltd.	Brown	73	Radford Electronics Ltd.	Radford	5
Butoba Ltd.	Butoba	42	Record Housing	Record Housing	21
Celestion Ltd.	Celestion	46	Records and Recording	Records and Recording	74
Clarke and Smith Manufacturing Co.	Clarke & Smith	35	Reslo-Sound Ltd.	Reslo	70
Decca Radio and Television	Decca Radio	31	Revox-Studer (Hammond)	Revox-Studer	72
Decca Record Co. Ltd.	Decca Records	23	Rogers Developments Ltd.	Rogers	44
Derritron Radio Ltd.	Chapman	71	S.M.E. Ltd.	S.M.E.	57
Design Furniture Ltd.	Design Furniture	45	Saba Electronics Ltd.	Saba	47
Dual Electronics Ltd.	Dual	66	Scandinavian Radio & TV Co.	S.R.T.	13
E.M.I. Tape Ltd.	E.M.I.	24	H. H. Scott Inc. (A. C. Farnell)	Scott	17
Elcom (Northampton) Ltd.	Elcom	6	Shure Electronics Ltd.	Shure	64
Electroimpex Hungarian Co.	Qualiton	43	Sony Corporation of Japan	Sony	49
Fane Acoustics Ltd.	Fane Acoustics	38	Standard Telephones and Cables	S.T.C.	3
Ferrograph Co. Ltd.	Ferrograph	61	A. R. Sugden & Co. Ltd.	Connoisseur	34
Fi-Cord International	Fi-Cord	11	Svenska Høgtalabriken	Svenska Hog.	1A
G.K.D. Ltd.	G.K.D.	26	Tandbergs Radiofabrikk A-s	Tandberg	18
Garrard Engineering Ltd.	Garrard	67	Tannoy Products Ltd.	Tannoy	63
Goldring Mfg. Co. (Great Britain)	Goldring	41	Thorens S-A	Thorens	4A
Goodmans Industries Ltd.	Goodmans	68	Truvox Ltd.	Truvox	2
The Gramophone	The Gramophone	-	Vortexion Ltd.	Vortexion	27
C. E. Hammond & Co. Ltd.	Hammond	14	Welme Corporation Ltd.	Telefunken	7
Haymarket Press	Amateur Tape Recording	50	Wharfedale Wireless Works Ltd.	Wharfedale	53
Ilford Ltd.	Ilford	62	Whiteley Electrical Radio Co. Ltd.	Whiteley	60
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Link House Publications Ltd.	Hi-Fi News	39			
Loewe-Opta AG (Highgate Acoustics)	Loewe-Opta	40			
The Lowther Manufacturing Co.	Lowther	29			

ATR STAND 50



AUDIOVIEW



NEWS OF TAPE RECORDERS AND HI-FI

But perhaps the most interesting item of news this month is the fact that **Grundig** will definitely not be exhibiting at the Audio Fair, as they maintain that this is no longer beneficial to them. They have however just introduced a new range of four recorders, one of these is the TK 18L, which is a two-track recorder designed to make perfect recordings under difficult conditions. It incorporates the Grundig "Magic Ear" system of automatic recording level as does the TK 23L. The latter is a four track machine on which the automatic facilities may be switched out to allow the recorder to be manually controlled. Full details of these, and the TK 14L and TK 17L may be obtained from Grundig at 40 Newlands Park, Sydenham, London, SE26.

Record Housing will be showing as many of their products as can be accommodated at the Audio Fair. Look for the Longfellow a six-foot long low model which will hold turntable, complete tape recorder, amplifier, tuner, tapes and records. Last year's Lowflex and Lowline 2 have undergone slight improvements in style but prices remain unchanged. The centre piece of the exhibit will be the new Hi-flex Audio System comprising equipment housing unit, record housing unit and twelve inch speaker enclosure. The Hi-flex unit can be used as free-standing cabinets, in continuous runs

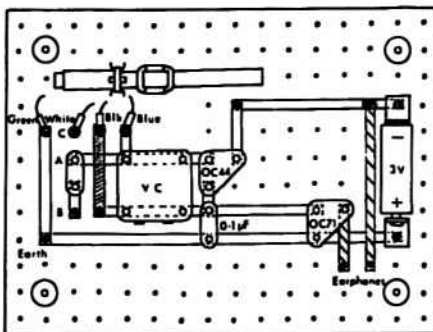
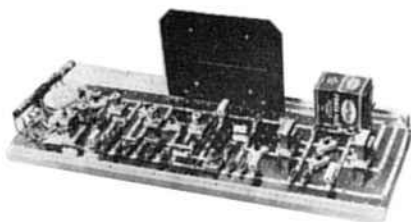
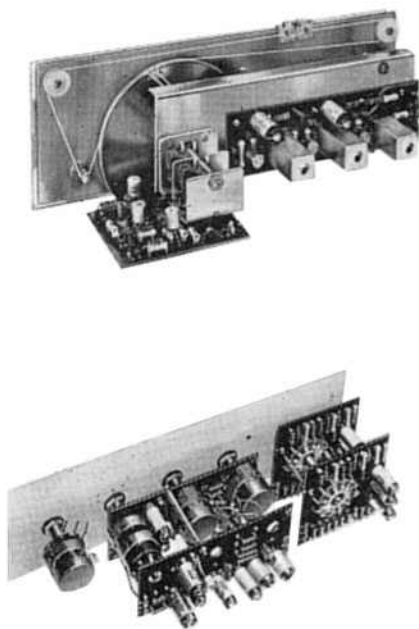
along the wall, or even (with the use of Hi-rak) up the wall. (Stand 21).

Lustraphone too have their range of microphones on show. These include the model TH 59/SB tubular hand dynamic model with press-to-talk switch, the model D 59/RT which is a combined/transmitter, and the now famous Lustraphone radiomic system (Stand 16).

The centre of interest on the **Leak** stand should be the demonstration of the Stereo 30 and Sandwich loudspeaker system. Other Leak products will of course be on display at Stand 69. On show for the first time will be the new portable model from **Lowe-Opta** – the Optacord 416. Basically the same as the 414, it incorporates two speeds, i.e., $1\frac{1}{2}$ and $3\frac{1}{4}$ i.p.s. (Stand 40).

One example of budget hi-fi is the **Tripletone** range of amplifiers which have received very favourable reviews and which we can also recommend. The **Tripletone** catalogue is worth writing for and from this we have chosen the Stereo 8-8 model which consists of the dual pre-amplifier and power amplifier shown above. This retails at £25 18s. 9d. and provides 8 watts of audio power per channel (16 watts total on mono). **Tripletone** also do mono only amplifiers and

Amateur Tape Recording Video & Hi-Fi



F.M. tuners. For the catalogue, write to the Tripletone Manufacturing Co., Ltd., 241a, The Broadway, London S.W.9.

Building from kits is both interesting and instructive and these days is simplicity itself. Most kit manufacturers provide printed circuit boards and all that is required is the ability to solder in components and wire up sockets etc. The **Martin Audio** kits excel themselves when it comes to simplicity and economy for you can build up an entire hi-fi outfit stage by stage. The kit contains a number of separate units for a complete F.M. tuner. These are unit 15, the F.M. head with tuning capacitor; unit 16, the IF amplifier; unit 17, the tuning drive and control panel. It assembles into a complete tuner as shown above. Total cost £12 17s. 6d., but you can purchase the units separately. They also do a complete amplifier system on the same unit construction principle, the complete pre-amplifier of this being shown above. Their leaflets are well worth writing for. Martin Electronics Limited, 154-155, High Street, Brentford, Middlesex.

Finally we must mention a new range of kits by **Radionic**. These are primarily for educational purposes but with them one can build a vast range of working circuits. For instance with Kit No. 2 one

can build 20 different kinds of simple radio receivers which incidentally work quite efficiently and can be used with a tape recorder. The construction of any of the circuits is so simple that children can do it for everything just plugs in. Take for instance circuit No. 14 from kit No. 2. It is all put together from an assembly plan as above. Just conducting strips and plug-in components all mounted on a perspex board. If you are looking for something even more ambitious then circuit 26 from Kit No. 4 offers a complete six transistor superhet receiver as shown above. For amplifiers, kit No. 3 offers 22 circuits including a push-pull amplifier complete with loudspeaker. **Radionic** kits are an ideal way to learn radio and electronics by easy construction and operation. For details of all kits write to Radionic Products Limited, Stephenson Way, Three Bridges, Crawley, Sussex.

Another well-known kit manufacturer is **Daystrom Limited** of Gloucester who market the **Heathkits**. These cover just about everything including tape recorders, hi-fi amplifiers, F.M. tuners, radio receivers, test equipment, and even electronic organs. Their fully illustrated catalogue can be obtained just by writing to Daystrom, Gloucester.

The range of **Harvey** bulk tape erasers,

one of which is shown above, will no doubt be of interest for a unique feature of these erasers is that they cater for spools up to 12" in diameter and also one inch wide N.A.M. tape. Complete erasure of even the largest spools can be accomplished in seconds, the tape being left in a completely neutral condition. The usefulness of this instrument is not limited to erasing tapes, as it can be used to demagnetise small items such as hand tools, ball races, gears, etc., and even watches. Prices range from £6 5s. 0d. to £15 10s. 0d. retail and a detailed leaflet is available from the manufacturers — Harvey Electronics Limited, 308 Farnborough Road, Farnborough Hants.

Truvox are releasing Britain's first ever all-transistor range of quality tape recorders and tape units. The complete sound system will be demonstrated with full monitoring facilities at the Audio Fair. Full details from Truvox at Stand 2.

E.M.I. will of course be displaying their four grades of tape, together with the six instructional taped Emiguide and the Emitape guide to better recording, a 64-page booklet, written by John Borwick. Recorders on display will include the new L4 portable professional recorder, as well as the TR52 and the VTR 4.

IN last month's article we gave a brief outline of the history of the stereophonic art up to the middle 1930's, and ended by mentioning the work being carried out at that time in the U.S.A. and in the United Kingdom. This month we will describe the differences in approach to the problem in the two countries, and in the next article see how the present-day techniques are directly descended from principles established at that time.

As we said last time, the American team under Dr. Harvey Fletcher, working at the Bell Telephone Laboratories, had to develop a technique of stereophonic reproduction, as well as the necessary equipment to enable their famous public demonstration to take place. It is the technique, rather than the apparatus, which concerns us here. Two engineers of the team, J. C. Steinberg and W. B. Snow, were given the job of evaluating this. They started their work on the assumption that if it were possible to erect a "curtain" consisting of an infinite number of microphones in front of the sound source, then every minute part of the "wavefront" coming from that source would be picked up by its own individual microphone. If then

each of these microphones was connected via its own amplifying system to a loudspeaker placed in the identical position in a similar curtain of loudspeakers, then this curtain would reproduce the same wavefront as received by the microphone. This, of course, would be the ideal case, impossible to achieve in reality.

In order to bring the experiments to more manageable proportions, three microphones were set up in a small studio, and each was connected to a loudspeaker in a rather larger auditorium. A "caller" moved about in front of the microphone, and observers in the auditorium were asked to mark on a plan of the stage area the apparent position as he moved. The system also allowed different connections between microphones and loudspeakers. The best reproduction of the movements of the caller was obtained when three channels were used, and this gave a good representation of both the width, and the depth, of the stage area. When the number of channels was reduced to two, the width of the reproduction was slightly increased, but the depth was reduced. Furthermore, positions in the centre of the stage seemed to be

INTRODUCTION TO STEREO

H. Burrell Hadden

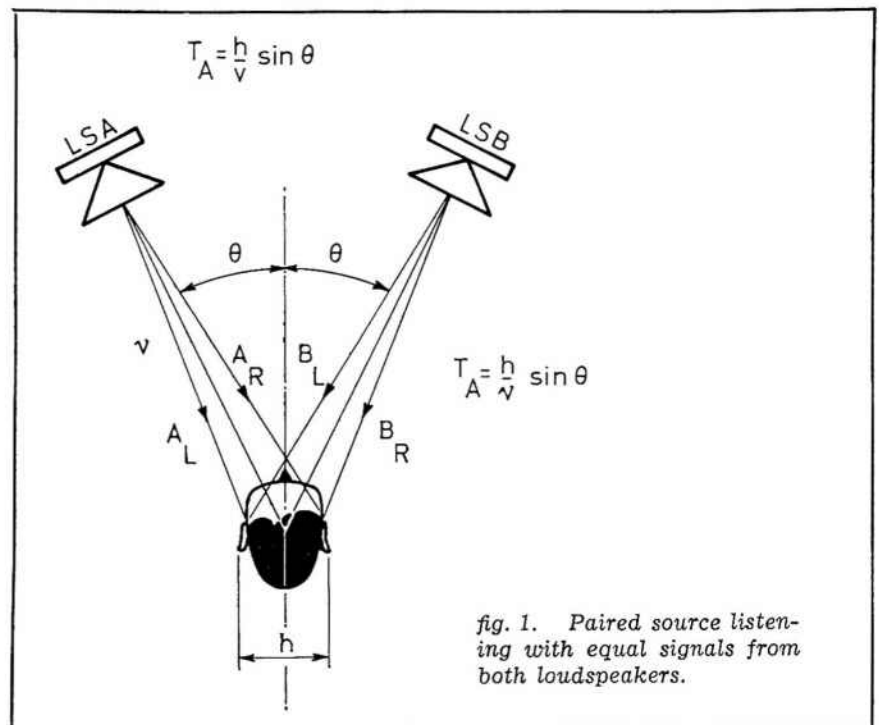


fig. 1. Paired source listening with equal signals from both loudspeakers.

more distant from the observer than they in fact were. This effect could be corrected to some extent by reconnection of the centre microphone, so that it fed equally into the left and right hand channels. This helped to fill up the "hole in the middle" but reduced the stage width somewhat, and did little to restore the lost depth. Other combinations were tried, and each test ended with the caller making his moves actually in the auditorium, unseen by the observers of course.

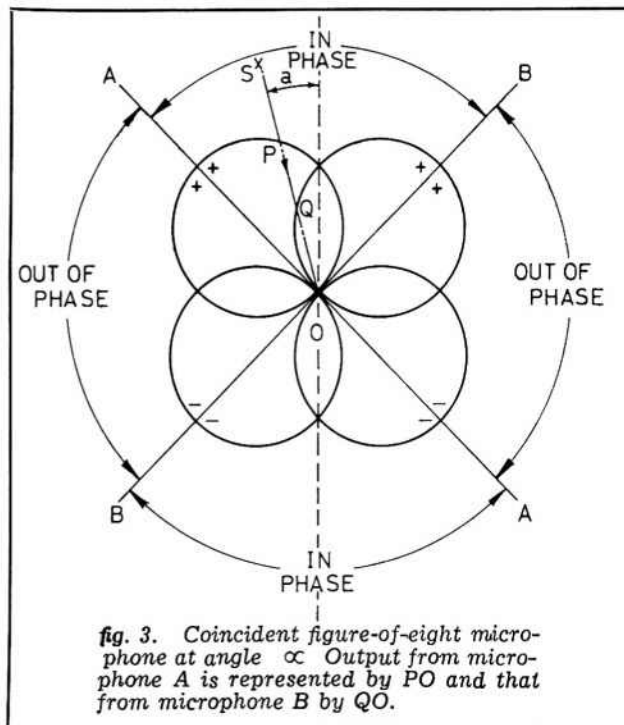
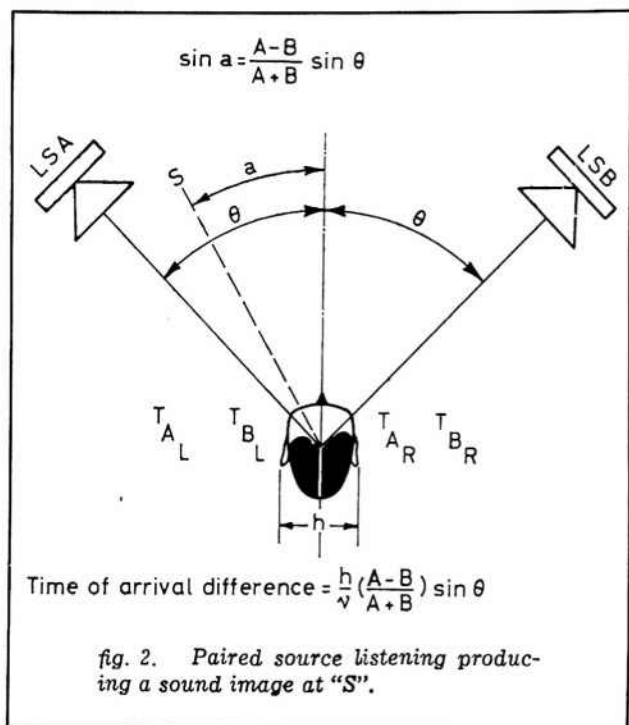
Let us for a moment examine what happens acoustically in a set-up as described. Suppose the sound source is directly in front of the left hand microphone. The sound will be received by that microphone, and also by the centre and right hand microphones. These microphones will receive the sound with progressively less amplitude, since they are further away from the source, and these differing amplitudes will produce differing electrical currents, which in their turn will produce differing amplitudes of sound from the three loudspeakers. In addition to this, the sound from the source will arrive at the second and third microphones progressively later in time

than it arrives at the nearest microphone. This means that the three loudspeakers will show differences in time and amplitude depending on the position of the sound source with respect to the three microphones. The same will obviously apply in the simpler case of the more common two-channel system. We shall see later how these *inter-channel* differences affect our ability to fuse the sounds from the separate loudspeakers into a complex sound source extending across the space between them.

At more or less the same time as the work with spaced microphones was being carried out at the Bell Laboratories, A. D. Blumlein and a team of workers at the laboratories of the Columbia Company at Hayes (since incorporated in the E.M.I. organisation), were attempting to achieve stereophonic reproduction from a somewhat different fundamental assumption. Instead of considering the "wavefront" coming from the sound source, as the Americans had done, Blumlein tried to reproduce the effects on the ears and brain which would occur if the listener was in front of the original sound source. Various theories had been put forward, and many experiments carried out, to

at the two ears. Obviously if a sound is, say, at the left hand side of the head, it will reach the left ear before it reaches the right. As the sound moves round the head, this small time difference will decrease until the sound is directly in front of the head. When it is the same distance from both ears there will be no time difference. As the sound moves further round towards the right ear, the difference in time of arrival, known as the "interaural" time difference, increases again, but in the opposite direction. In Blumlein's day, it was believed that we used other information to perceive the position of sounds at high frequencies, but recent investigation by Professor Cherry and his workers at London University has proved that this theory holds good, with slight modification, in this part of the frequency spectrum as well. It can easily be shown that the interaural time difference is proportional to the sine of the angle at which the sound meets the "normal" to the head, i.e., the line drawn straight in front through the nose.

Let us now consider the case when we are listening to two loudspeakers, both producing the same sound (fig. 1). Both ears are hear-



INTRODUCTION TO STEREO

Continued

ing sounds from both sources, and the time of arrival difference can be shown to be proportional to the sine of the angle each speaker makes with the normal. If we then vary the relative amplitudes of the sounds from the two loudspeakers, such that the volume from speaker "A" is represented by A, and that from "B" by B, then the sound at each ear will be A_L , B_L , and A_R , B_R . In this case it can be shown that the angle of incidence from the virtual sound source created by system is:

$$\sin \Theta = \frac{A - B}{A + B} \sin \Theta$$

and the time of arrival difference will be as shown in fig. 2. The only variables in this expression are the amplitude of the sounds from the two loudspeakers, and so in this case the inter-channel *amplitude* difference produces an interaural *time* difference. This argument is

only strictly true at low frequencies, but an extension can be shown to fit the high frequency case.

To return now to Blumlein's work. He described several methods of producing the required inter-channel amplitude difference using alternative types of microphone arrangement, but the simplest is the one which has been carried forward to the present time. In this (fig. 3) he used two figure-of-eight microphones, mounted as close together as possible with their main axes at right angles. In this case, the inter-channel time differences can be neglected, since the microphones are so close together, and only inter-channel amplitude differences will be present in the two outputs. These will be proportional to the angle of incidence of the sound source to the line bisecting the right angle between the two microphones. This of course occurs because of the variation of output of each microphone as sound is moved around in front of it, due to the polar response.

This "coincident" method of microphone technique can produce extremely accurate directional information. Recent work by Cherry has shown this to be due in part to the relative absence of inter-channel time differences. There will always be slight time differences, because it is physically impossible to mount the two microphones exactly at the same spot. With modern microphones, however, with two capsules in the same case, they need not be more than an inch or so apart.

The two main systems described above, one developed in America and the other in England, are still the basis of all stereophonic recording and broadcasting taking place at the present time. Whilst the Americans still stick basically to their system and most of Europe to the British system, there has been some interchange of ideas, and so many workers use effectively a combination of the best parts of both systems. Next month we shall consider some of the modern techniques.

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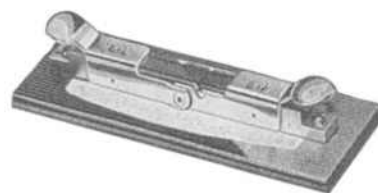
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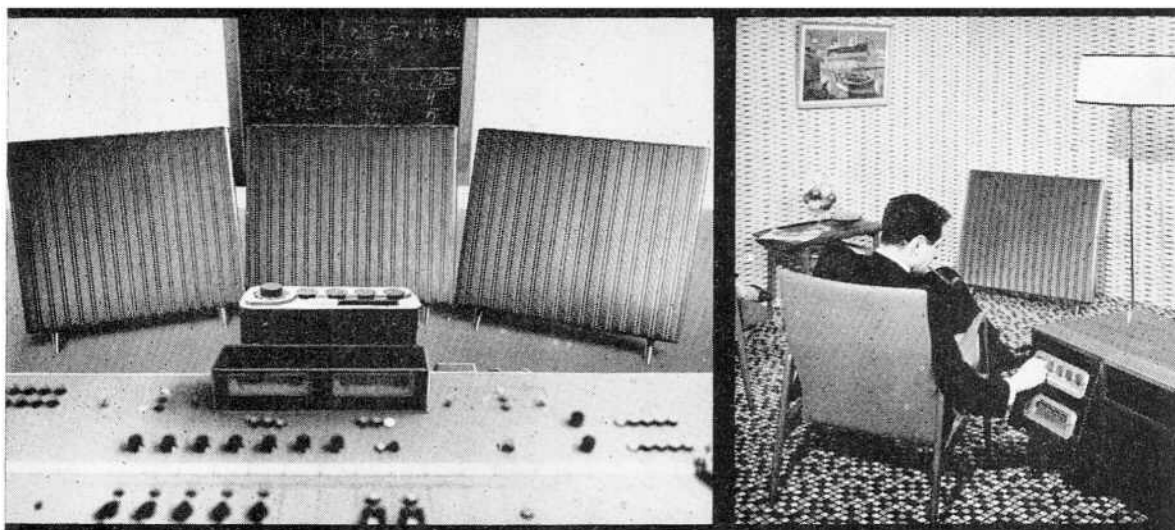
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TAPE RECORDERS IN THE MAKING

TOUCHDOWN 0930 hours in a fierce but short lived snowstorm about sums up our rather cold welcome at Aldergrove Airport just outside Belfast. Cold that is from the weather point of view but sincerely warm on the part of our hosts of the day—Grundig (Great Britain) Limited, whose giant factory at Dunmurry turns out nearly 500 tape recorders a day.

To describe the complex production system of Grundig would take an entire magazine and the individual stages through which a tape recorder goes before it emerges as a complete and tested unit are themselves too numerous to recount. As with everything else, the production of a tape recorder has to have a beginning, and at Dunmurry the beginning is the actual design. This is achieved in close co-operation with laboratory and production. From here a tape recorder emerges as a prototype ready for breakdown into the vast number of separate production stages. Machines must be set up to turn out small parts, giant presses must be tooled to stamp out the one piece chassis around which the tape recorder will be assembled, enormous automated plastics machines geared up to turn out the cases, thousands of electronic components must be distributed to the production lines and a new tape recorder is on its way.

New Models

During our tour we saw four new models being produced and by the time you read this, these new additions to the long line of Grundigs

will be on the market. The four newcomers are the TK 14L, a two track machine, the TK 17L, a four track recorder with track synchronizing, the TK 18L another automatic model and the TK 23L, also automatic but with a lot of extra interesting facilities.

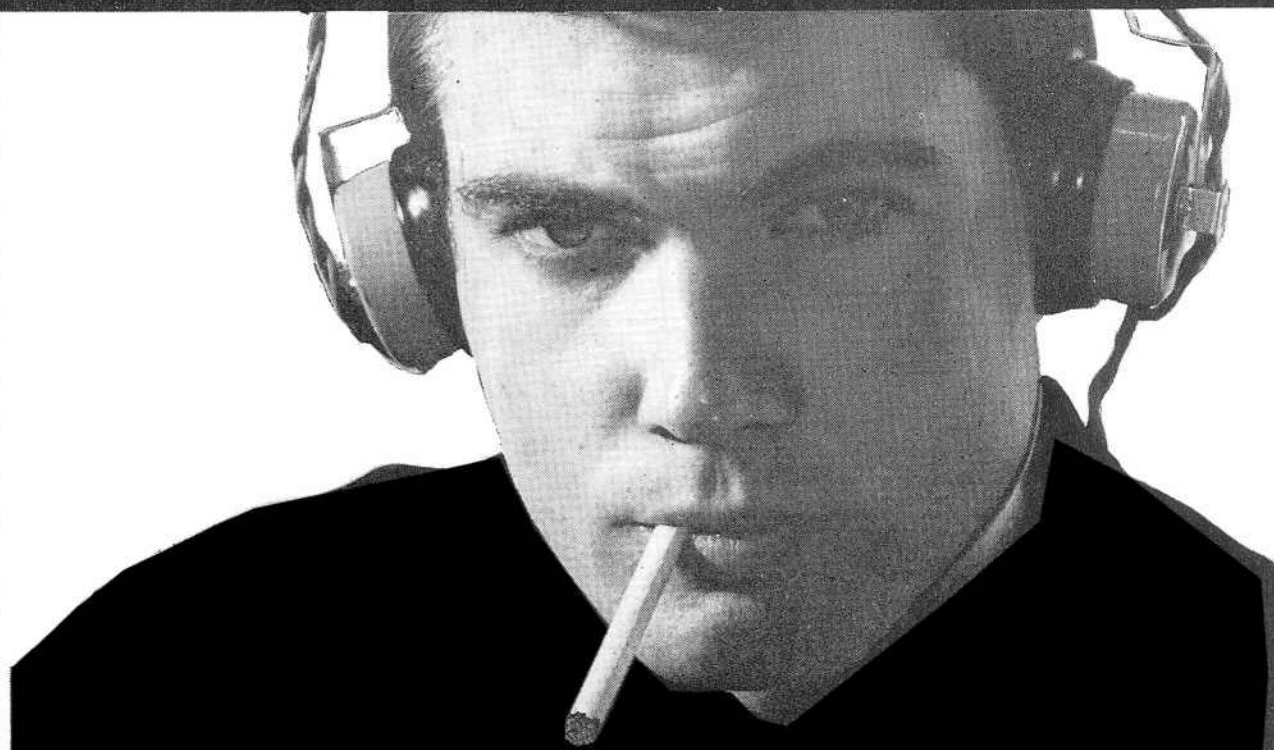
Production

Let us then take a turn around a production line to see how they are made. We start with the all important chassis which is polystyrene covered steel and makes for absolute rigidity — an important factor in a box full of intricate and carefully balanced mechanism (top). Then there are the specialised parts, those made by Grundig themselves, such as mains transformers, chokes, coils and so on. Whilst these are being made (below) the chassis moves slowly through the tape drive mechanism assembly lines finally emerging complete with its quota of wheels and levers ready for electronic production.

Still mounted in its protective production frame it moves stage by stage collecting resistors here, capacitors there, recording heads, valves and soon we see the familiar lines of a tape recorder taking shape. It is now ready for the critical adjustments that will make it comply to a rigid specification. On page 45 for instance we see circuit tests being carried out, and last but by no means least on page 45, the head azimuth and frequency response being set accurately with test tapes and electronic measuring apparatus. The innate box of mechanics and

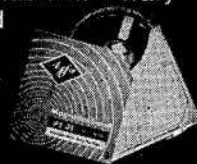
*Top: I make a thorough inspection of a Grundig tape recorder chassis.
Below: The winding of mains transformers.*





if it's true that one tape is as good as another, why do recording studios throughout the world insist on Agfa?

Stands to reason doesn't it? With money no object and the chance to choose what he wants, no discerning Engineer is going to pick Agfa tape unless it's the best. And when you consider that his Agfa tape is the same that you can buy in any shop and that it costs much the same as other tapes it must be best for you too. So look for the bright Agfa pack and remember — the one with the Agfa diamond is *your* best friend. Agfa Polyester recording tapes are available as long play, double play or triple play. The range is extensive from long play 210' with a playing time of 11 minutes for 9/- to 3,600' in triple play with a playing time of 3 hrs. 12 mins. for £5. 15. 0. A range of popular sizes is available in library cassettes. A splicing tape dispenser at 6/6, and accessory kit at 34/6 are useful extras. **FREE! MAGNETON ILLUSTRATED** — an informative and lavishly produced colour magazine. Please write for your copy.



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TAPE RECORDERS IN THE MAKING CONTINUED

below left: Circuit and frequency response tests.

top right: Azimuth alignment of the record play head is carried out with a special test tape.

below right: This machine operates push button controls thousands of times to ensure that they will stand up to hard wear.

electronics is now a fully fledged tape recorder, ready for the deck cover and a final critical inspection which includes a record and play-back listening test by Grundig's 'synthetic customer'.

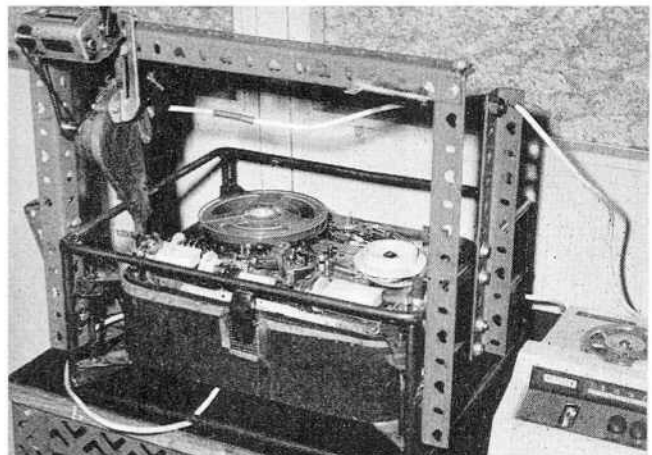
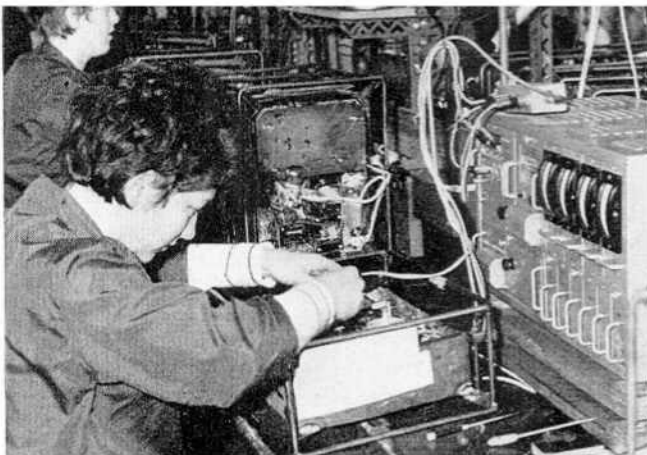
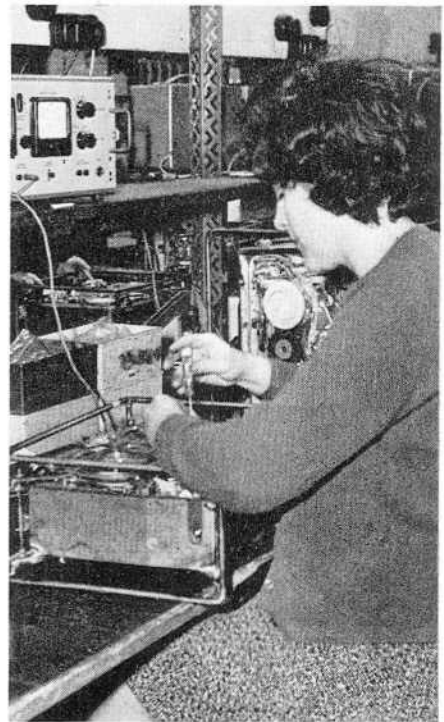
In a sound proof cabin an experienced inspector actually makes a recording, checking at the same time all the controls and facilities that may be required during recording. When this has been done a re-play test is carried out, again taking all controls into account. When, and only when, the inspector is satisfied, can the finished tape recorder, its reel of tape and other accessories be packed ready for distribution.

Our tour of Grundig covered several production lines including a unique automated plating system which ensures full protection to chassis and small metal parts against rust and corrosion. It ended in a rather special laboratory. Here highly trained engineers carry out all kinds

of tests to ensure that a production tape recorder will stand up to the claims made by its makers. Take a look below right which shows how a non-stop test is applied to push buttons. The testing mechanism had already clocked up several hundred continuously repeated operations of just one push button which also included the wind re-wind mechanism inside the recorder.

This is but a brief report on Grundig thoroughness when it comes to making a tape recorder. I am sure that my fellow visitors to the Dunmurry factory were as impressed as I was by the high standard of manufacture that backs the name of Grundig.

When we left Dunmurry, the skies had cleared but the snow still chilled the night air. Two hours later the twinkling lights of London 15,000 feet beneath our B.E.A. Vanguard heralded the approach to London Airport.—F.C.J.





Monday



Tuesday



Wednesday



Thursday

CAPTURE SOUND 7 DAYS A WEEK



Friday



Saturday



Sunday

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202A

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- * Input socket for any microphone with an impedance from 20-1000 ohms.
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- * Separate speaker and amplifier sockets.
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RECORDING DIARY

THIS MONTH we present another new feature to guide the amateur recordist—a diary of tapeworthy events and unusual sounds to collect. Towns are shown in bold type for easy reference, and dates (in brackets) are all in May, unless shown otherwise. But before you rush 'out with your portable, one word of warning. Check for copyright restrictions. And if in doubt, turn to page 15 of this issue, where you'll find a handy reference to the complexities and problems of copyright.

WHAT WHEN AND WHERE TO RECORD DURING MAY

MAY-TIME CEREMONIES

Keen sound hunters are in for a feast this month, particularly with an abundance of traditional May-time ceremonies. With celebrations at **Abingdon** (3rd), **Berwick** (28th-2nd June), **Boston** (3rd-10th), **Elstow** (13th), **Gravesend** (15th), **Great Torrington** (6th and 8th), **Hereford** (4th-6th), **Knutsford** (1st), **Ludlow** (30th April-4th), and **Spalding** (8th).

ARTY OR ANCIENT

Those of you lucky enough to be in **Pitlochry** during Festival season (10th April-9th October) should find a wealth of beautiful sounds, or by way of contrast, there's the 4th Annual **London-Brighton** Run of Historic Commercial Vehicles (2nd) and the National Traction Engine Club Rally (29th-30th) near **Boston**.

TRADITIONS

It's worth enquiring if there's a "Beating the Bounds" ceremony in your parish — quite a few take place in May, notably **Berwick** (1st), **Oxford** (27th), and the **London** Manor of the Savoy (also 27th). Morris dancing at **Thaxted** (21st-23rd), **Highgate** (28th) and in **Kent** (8th onwards), as well as the Festival of English Folk Dance, Song and Music at **Birmingham** (19th and 20th) could provide a mediaeval note.

MOTOR RACING

Finally, if you like the high whine of really powerful engines, try **Oulton Park** (1st) or **Silverstone** (15th).

THE LOUDSPEAKER PART 5 TOP UNITS

by D. J. Barnett

THERE ARE FIVE MAIN GROUPS IN THE HIGH FREQUENCY SPEAKER RANGE:—

CONE, DOME, HORN, RIBBON AND ELECTRO-STATIC.

CONE TREBLE UNITS

These are a miniature version of the standard moving coil loudspeaker. Due to the fact that the speaker is going to handle only high frequencies, the diameter of the diaphragm is small, usually about 2 to 3 inches. The cone weight is kept as low as possible without introducing distortion due to the cone "breaking up" in order to increase the efficiency of the speaker and also to increase the high frequency extension. Similarly the voice coil is light and often wound in aluminium wire. The principle of lightweight diaphragms and coils does not apply only to the conventional cone treble unit but to all moving coil speakers that are intended to handle only top frequencies.

The movement of the coil and diaphragm at high frequencies is very small and consequently the length of the voice coil is usually the same length as the magnetic gap. This differs from full range moving coil speakers where the voice coil is either considerably longer or smaller than the magnetic gap to ensure that the coil works in a constant magnetic field. As the efficiency is high owing to the light weight of the moving parts of the speaker, the magnet system is considerably smaller than that of the full range speaker.

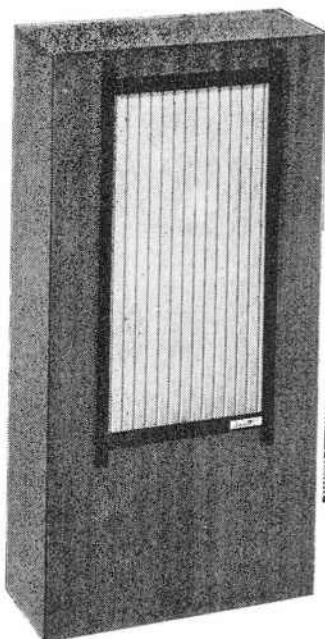
The shape of the cone and the cone surround are of the utmost importance in the design of these units. The cone itself usually has a curved profile, and the shape of this will not only affect the frequency response on axis but will also determine whether the speaker will be very directional or not. As it is at high frequencies that the polar response tends to become directional, it is important to design top units that have a reasonable response up to 30° off axis. Response curves both on and off axis for a conventional cone treble unit are shown in fig.1.

As with full range speakers the rim of the cone must provide satisfactory termination for the speaker and it is common to use a rim of different material from the cone body. The body is normally of paper and the rim of PVC, plastic foam or of paper treated with some damping material.

However it is a mistake to think that any small speaker will act as a tweeter. A normal commercial speaker used in radio or television is not designed to have an extended frequency range and so it is essential that the speaker is correctly designed and manufactured, if it is intended to reproduce high frequencies.

DOME TWEETERS

Instead of using a small diameter coil driving a diaphragm at the centre, an alternative is to use a domed diaphragm driven on the outside by a larger coil. The dome is usually about 1" to 1½" dia. and is made from a fairly rigid plastic, metal or treated cloth. The edge of the diaphragm is again suitably terminated with some resistant material.



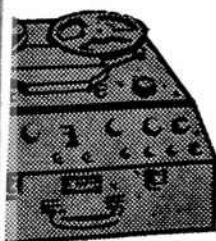
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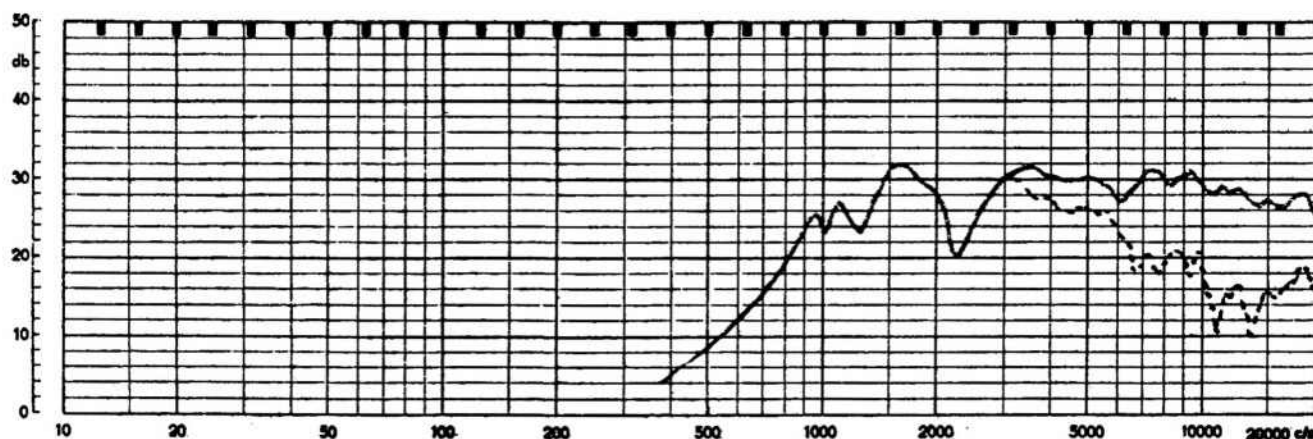


fig.1. Response curve of a cone treble unit—on axis — — 30° off axis.

HORN LOADED PRESSURE UNITS

It was mentioned in a previous article that to horn load a speaker for use at low frequencies was impractical because of the size of the horn. Once the unit is required to reproduce high frequencies only, the horn becomes very much smaller and quite feasible. A correctly designed horn is extremely efficient and this has been a reason for its popularity. The diaphragm must be closely coupled to the horn in order to take advantage of the loading, and correct design will be responsible for the high frequency extension. Again the diaphragm is made either of metal, plastic, paper or treated cloth.

May, 1965

One disadvantage of the horn loaded tweeter is that it tends to be more directional than most other units. fig.2 shows a typical horn loaded top unit.

RIBBON TOP UNIT

An aluminium ribbon is stretched in a magnetic field in such a way that the ribbon itself is the conductor and the radiator. The ribbon is usually corrugated to help strengthen the aluminium which is only about a thousandth of an inch thick. When the signal is applied to the ribbon, it will vibrate and radiate sound. However the system is very insensitive and so a large magnet is

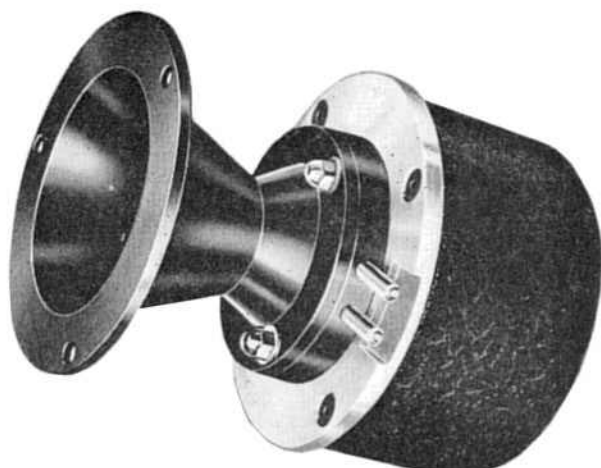


fig. 2. A typical horn loaded high frequency speaker unit. The Goodmans "Trebax 100".

THE LOUDSPEAKER *continued*

usually necessary, together with horn loading. In order to protect the ribbon at low frequencies a crossover is built into the unit.

A popular model of this construction has been held by many experts as being the best available top unit over the last few years and there is no doubt that the response and distortion of such speakers makes extremely pleasant listening.

ELECTROSTATIC TOP UNITS

All the units described above are variations of a moving coil electromagnetic system but the electrostatic speaker works on an entirely different principle.

The simple electrostatic tweeter consists of a rigid perforated electrode and a thin moveable electrode which acts as the diaphragm of the speaker. The diaphragm is mounted in such a way that it can vibrate without touching the rigid electrode. Most diaphragms are made of plastic coated with a conductive surface.

If an alternating signal is applied between the two electrodes then alternating force will result and the moveable plate will vibrate. However the force will be dependent upon the applied voltage and will not be affected by the direction of the voltage. Thus if a sine wave is applied the plate will vibrate at twice the frequency of the signal.

To stop this happening, a bias voltage is applied to the diaphragm of such a value that the signal always remains in one direction. Then the diaphragm will vibrate directly with the signal. This is the principle of the simple electrostatic tweeter, which will generally give a smooth response with fairly low distortion. A development of this can be applied to full range speakers but there are considerable problems regarding suitable diaphragms and suspensions, electrical breakdown and efficiency.

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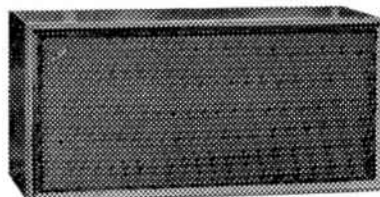
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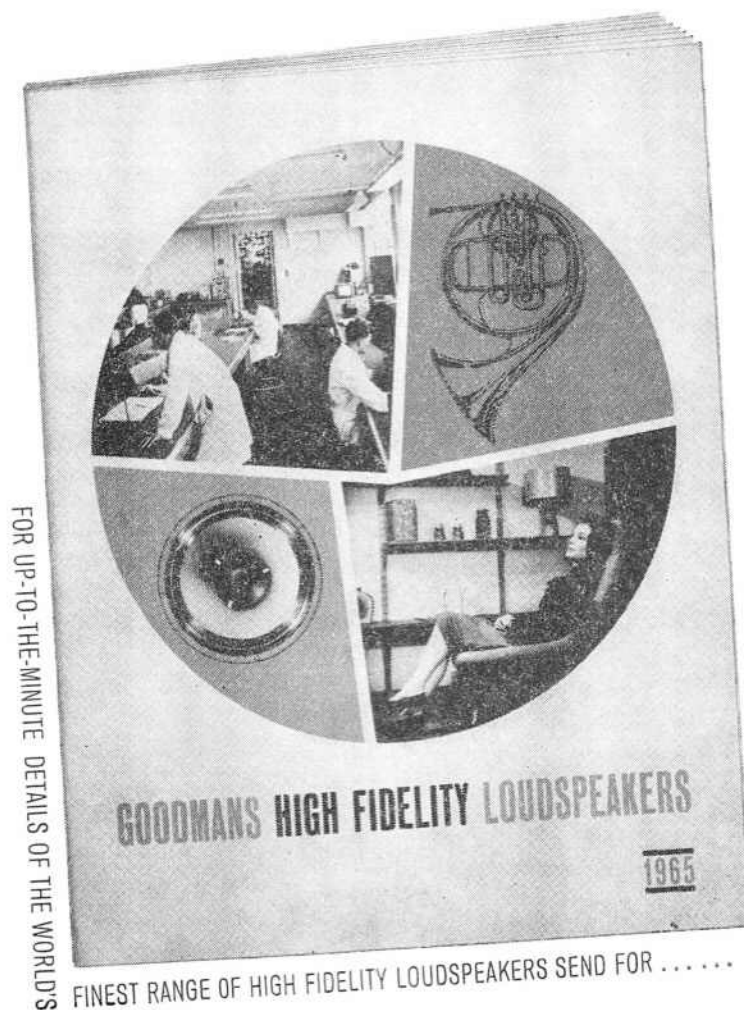
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May, 1965

51

SOMETHING IS ROTTEN ROTTEN

Continued

T.E.: It depends on the kind of entry. Two of last year's prize-winning tapes have been broadcast by the BBC.

J.B.: But if there were to be considerably more good entries it might be possible to extend this?

T.E.: Well, the chance of finding acceptable material would be that much better! If the entry figure was doubled . . .

J.B.: . . . and we're back again with the problem of getting the individual to be creative and then enter his creation. Doubling the entry figure would make it three hundred. Now how many clubs would you say there were in this country?

K.C.: At a rough guess I'd say that Britain has about 300 tape clubs.

J.B.: Well then, if each tape club were to do what my local club is doing, you'd have three times that amount for a start.

T.E.: Well what exactly are you doing then?

J.B.: As most clubs do, we run a monthly tape contest. This produces some excellent little tapes, but the members seldom enter them for the national contest. What we have resolved is that every winner, and possibly runner-up, of our monthly contest this year will automatically have his tape sent in by the club on his behalf. Unless of course he has really strong personal objections, but I don't think that's very likely.

K.C.: And if every club could do this, with the tapes sent in by private individuals, we could top the thousand mark. That would be tremendous if we could manage it. But perhaps we're being rather over-optimistic.

J.B.: Unfortunately we may be. But on the other hand, it is possible if only everyone would do their part, shake off the cobwebs and really get down to it.

K.C.: I think the problem with most people, particularly those who don't belong to one of the many clubs, is that they tend to run out of ideas too quickly.

J.B.: Myself, I'm all in favour of the actuality recording — that is, anything that is real, genuine, not "fudged" in any way. And as Tim said, this too is the kind of subject that the BBC uses in programmes like "Today". Local colour, unusual interviews . . .

T.E.: . . . You can't beat that sort of thing. Get hold of the bewhiskered old man in the pub, or the little old lady who has her little memories of some famous personality of the past. The older generation have so much to offer the young recordist in his search for the unusual. There's not much point in recording anything that looks like lasting another ten years or more. The real value of many recordings is that fact that they just couldn't be made at a later date . . .

J.B.: . . . the obvious example here being the steam trains. Soon that'll be a sound impossible to capture. And it's no use leaving it till the last minute — all the professionals will be there recording the last steam train as it leaves Victoria or where-have-you. What I shall do, for instance, is start collecting later this year. Talk to the people who work with steam trains, the people whose jobs will die with the steam train. This sort of thing really does have a point.

K.C.: And what's more, you don't have to sit down and consciously dream up a gimmick. If you're there and it's happening and you've got your recorder you can't really lose.

J.B.: Of course it isn't always possible to have an idea come to you just like that, but I have found that if you carry a portable the way some people carry a camera, the wealth of subjects you can capture on tape is amazing.

K.C.: And of course, it's a big mistake to scorn anything as being un-tape-worthy. Take the old rag-and-bone

man for example. The local Steptoe may not look as though he's got much to say, but what he does have to say will be said colourfully, you can be sure of that. And I know John will agree with me here — he won the ATR contest last year with his interview with a rag-and-bone man, Thomas Edward Ward, Esq.

J.B.: And this brings up another point. This particular kind of tape needs what you might call considerate editing. For example, my Mr Ward's opening gambit was a really fruity bronchial cough. Many people would have cut this out. But I felt that this was part of him, so the cough stayed in.

K.C.: And the amazing thing was that it didn't sound revolting. In any other context it might have done, but as John says, because it was so much part of the man, a part of his character, it went a long way into making the tape the success it was.

T.E.: I think after a while any thinking recordist will realise that to edit out all the ums and ahs isn't always a good thing. It does make for a natural feeling, if you leave some in, and conveys character far more than a stilted, over-edited recording. Mind you, you don't want to go to the other extreme — just get a reasonable balance between the stilted and the rambling.

J.B.: And, bearing these things in mind, it shouldn't be too difficult for anyone with even an inexpensive portable recorder to produce something worth while for the contest.

K.C.: Even if they only start thinking about it now, for the first time, there's still time, until the end of May in fact, to get something on tape.

T.E.: You persuade your readers — every single one of them — to do something, and we might be able to do justice to the International. After all, we are hosts to all the other member countries this year, and it's going to look pretty poor if we can't even command reasonable entries for our own contest, let alone the International.

J.B.: This is something that worries me too. After all, we're only hosts to the International once every five years. For us this year, it's come at the right time. Tape recording needs a big boost, and the International could be just the thing to bring it — if we can get the response.

T.E.: And of course, tape recording may have immediate news value while the International judging and prize-giving is actually going on.

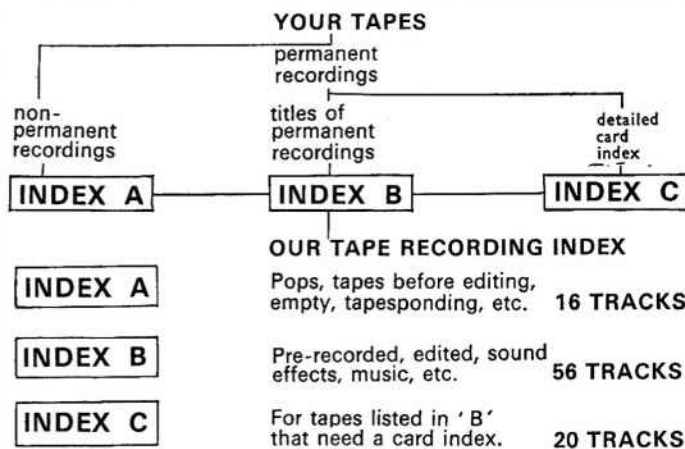
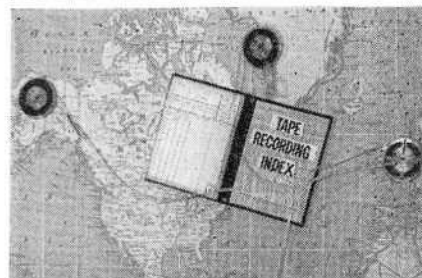
K.C.: So all that remains for us to do is to press home this little advantage while we have it. After all, it won't come our way again until 1970, and by then — depressing thought — it might be too late, particularly if people won't rouse themselves. In fact all along the line it's up to the individual and clubs. If they'll do their part, all the necessary powers-that-be are quite willing to help.

T.E.: That seems to sum it up admirably.

J.B.: It certainly does. Three or four entries from every active club, plus plenty of individual entries, and we're home and dry.

K.C.: And of course, anything that we at ATR can do, we'll do. But first, I think, recordists need to show us that they're worth it!

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TAPE CLUB NEWS

What's happened to the enthusiasm and hard work for which tape clubs have hitherto been so well known? Where has all that drive and keenness disappeared to? Or is it just lurking temporarily we hope — beneath the surface? Either way, it's time you all shook yourselves out of the little rut you appear to be in. Club reports for the first four months of this year are not only down considerably on last year's, they're also sadly lacking in evidence of that vital element of get-up-and-go.

Is there a lack of incentive to hard work? Maybe there has been, but there isn't any more. Elsewhere in this issue (pages 10 and 11) you'll find the report of a challenging discussion I had recently with two other well-known tape enthusiasts. Read, mark, learn and inwardly digest it — and don't let that reference to clubs go over your heads. It's addressed to each and every one of you. You can make or break the future success of the British Tape Recording Contest, and its participation in the International.

At the next club meeting, make a point of bringing this well and truly home to your committee members. Don't rely on someone else to do it. Do it yourself. Make a formal request that the best tapes from each monthly competition this year be entered in the B.T.R.C. And if you haven't been having monthly contests, now's the time to start, and enter the first and second tapes from this month's contest. You'll find all the rules and regulations of the B.T.R.C., together with an entry form and plenty of tips, on page 16 of the March issue of ATR. If you want more forms, and I hope you do, write and ask me for them.

You've got six weeks left — enough time for every single member of your club to make a really worthwhile tape and enter it for the contest — if only you can muster some of that latent enthusiasm and really get down to it.

CLUB OF THE MONTH

Undoubtedly top marks for **Thornton Heath** for being the only club in the country to recognise the present situation, and what's more, for doing something about it. The suggestion of a tape a month from every club came from them, and they're taking the lead by entering at least six tapes made by club members. And having studied the rules very carefully, they found that even if a tape was made some time ago, it would still be eligible for the contest.

Their February competition, entitled "Help — Let Me Out" certainly produced some tapes for the B.T.R.C. The winning tape, made by John Bradley, was the life story of "Willie," the champagne bubble, and other entries which did well came from Christine Thompson (who thought up the competition subject) and John Thompson, father of the said Christine.

But perhaps the noisiest night was the live recording night, when music from an electronic accordion, a gong, two flutes, and an assortment of Christmas cracker whistles, squeakers and blowers, were all recorded on ten machines and all played back at once! Great fun, as well as being something of a technical experiment(?).

JOIN IN AND SING

When the **Birmingham** Tape Recording and Audio Club records programmes for the Birmingham and Midland Ear, Nose and Throat Hospital, Alan Crook always plays an active part — possibly because his wife is the matron! Lately, several live recordings have been made at the hospital, so that patients and staff can join in and sing. Another club night was devoted to dubbing a collection of hymns, mixed over many spools of tape, on to tapes tabulated into seasons of Easter, Epiphany, etc., so that they can be found easily for Sunday services. A fascinating session along the lines of a "brains trust," a visit from the Kidderminster club, and an excursion to record the last sounds of the organ of the old Piccadilly Cinema completed an interesting programme for the past few weeks.

RECEPTION AND REGALIA

Les Bridges, of the **Walthamstow** and District Club, recently had a 3½-hour recording session with a new Bang and Olufsen stereo recorder at a silver wedding celebration. The tape is being edited down to 45 minutes to be sent to relatives of the couple in Australia. The B. & O. was also demonstrated at a club meeting, when members of the London club were visiting.

Two blind members of the club, Mr. and Mrs. Don Cooper, have interviewed the Mayor of Leyton about his regalia. Details of the past and present history of these items were taped, as a fitting record, for the regalia will no longer be used, following the rearrangement of the London boroughs.

HARLOW IN THE BOX

When members of the **Harlow** Tape Club visited their local Odeon cinema for a tour of the projection room, they were somewhat surprised to hear it referred to as "the box." Nevertheless, it proved a box full of weird and wonderful things, and provided a very interesting evening for all. The first tape for the local Blind Folk's Club consisted of readings from the local papers interspersed with a liberal amount of old-time music to provide a lighter, reminiscent touch.

A particularly informative talk/demonstration was provided by Messrs. Nash and Horner, of Cosmocord Ltd., on the production of their Acos mics.

NO PRESIDENT

The **Montrose** and District Tape Recording Club, which was formed in September, 1963, lost its first honorary President in January of this year when the Welsh tenor Trefor Jones collapsed and died suddenly. The club virtually owes its existence to the generosity of the late president, who not only made members most welcome at the many meetings held in his home, but was always willing to provide live material of the highest standard.

In spite of the fact that club funds are now at a low ebb, they are managing to

keep going, and have staged a small display at a local hobbies exhibition. In spite of a shortage of time, money and publicity, the display was successful enough to warrant more intense preparations for something similar next year. Club members also made recordings when the Gordonstoun School choir gave a concert at the local Town Hall.

NEW HOME?

The committee of the **London** Tape Recording Club are seriously considering proposals to move the club's HQ from Chandos Place to somewhere off Oxford Street, and also for meetings to be held fortnightly instead of monthly. At the same time members will consider what can be done to broaden the outlook of the club.

Certainly recent activities have been wide enough in scope, including 'Audio-scope,' a tape/slide show, visiting Tele-Radio of Edgware Road for a demonstration of almost every kind of recording equipment imaginable, entertaining members of the Southall tape club and arranging a practical exercise on the art of interviewing.

MEMBERS' CHOICE

At a recent meeting of the **North London** Tape & Hi-fi Club, members conducted a consumer test on various tape recorders and tapes. The results showed that the three most popular recorders were: 1, Philips EL 3515; 2, Philips EL 3538; 3 (tied) Truvox PD 92 and Ferguson 3205 (export model). Among the tapes the results were: 1, Philips double play; 2, Philips triple play; 3 (tied) Philips long play and EMI 88 long play. I understand that the club does not hold any shares in Philips! Keith Parker won the January competition with a very amusing tape of the January sales at a radio dealer's — one for the BTRC I hope.

CO-OPERATION

Members of **I.V.A.S.** have, in the past, experienced some difficulty in getting members of the public to co-operate

when they are out recording on location. If this has been because they have been using the wrong approach, it could be that they have now mastered this. On a recent excursion into the City of London, members were waiting to cross at a set of traffic lights when a Mini-Cooper with a very throaty exhaust note drew up. Wishing to tape it, they approached the driver, and were treated to some discreet revving, a beautiful take-off and acceleration in the best Grand Prix style. Unfortunately it seems as though the Vision side of I.V.A.S. has been falling off somewhat, and all the ideas for films and soundtracks seem to be coming from the Sound Section — as well as much of the hard work. Two new members have been recruited, but there's still room for more.

WELCOMING OUR MAN ABROAD

'Our Man Abroad,' or, to give him his proper title, Mr. Bob Danvers Walker, was a very welcome speaker at a recent meeting of the **Reading Cine and Tape Recording Society**. His talk was liberally illustrated with recordings made on Fi-Cord equipment, in all corners of the globe, from Morocco to Lapland. With him came Mr. Monk of **Fi-Cord International** who gave a very comprehensive demonstration of Fi-Cord and Beyer equipment for professional and amateur recordists. All agreed it was a most stimulating occasion. The Abbey Cup for the best tape and slide programme of the year was won by Mr. Lee, the Chairman. Runner-up was Mr. Chaney.

JOGGING ALONG

The new secretary of the **Bournemouth Tape Recording Club** are 'jogging along, although membership shows no sign of increasing yet.' The club held its first tape contests recently, and the entries are to be judged by someone from the **Federation of British Recording Clubs**. Another contest took the form of a sound hunt, with sounds, real or faked, that were 'found' included a bus crash, cows chewing the cud, and early morning tea. It is hoped that the club can make contact with other clubs in Sussex with a view to promoting tape exchanges, inter-club visits and other joint activities.

BOWLS BY TAPE

I've heard of people who play chess by tape, but never bowls. However Peter Warden, treasurer of the **Coventry Tape Recording Club**, and his wife Kathleen have discovered that their taperspondents Don and Doris Gowdy of Coventry, Connecticut, are bowling fanatics themselves. A challenge was issued, and now Peter and Kathleen tape their Sunday game, and airmail the results to America. Don and Doris play their game on Friday and airmail the results back! The club's annual competition showed Roy Reynolds the champion, with Stan Day second, closely followed by Ken Preston, Peter Warden, Bob Tucker and Walter Stacey.

NO CLOSED SHOP

A Dudley Chadwick, U.K. Representative for **Catholic Tape Recorders International** tells me that the club is not the 'closed shop' it might at first seem. Members of other faiths are always welcome, and the club is at present very pleased to be able to say 'snap' to us at ATR. They have just announced their first club pilgrimage to Rome, where it is hoped that many members will be able to meet in person for the first time. It should certainly help to promote the family feeling which all tapersponding clubs strive for.

WAYZGOOSE

For those of you who don't have the faintest idea what a wayzgoose is, the dictionary defines it as 'an annual outing or feast for printers.' Members of the **Ipswich and District Tape Recording Club** had a chance to see and hear for themselves what a really first class wayzgoose consists of when Mr. Ivor Pinch presented a very interesting tape/colour slide show of the **East Anglian Daily Times** wayzgoose to North America last September. The places visited included New York and the World Fair, Niagara Falls, Boston and Ipswich (USA). The latter part of the programme provided a very interesting comparison with the two towns. (That's the second tape twin town in the USA this month. Any more?)

The club's blind services, hi-fi, cine and outdoor recording groups are still very active. Secretary Malcolm Wilding has now moved to 4 Meadowvale Close, Ipswich.

OUR MAN ABROAD AGAIN!

Bob Danvers Walker was again a most welcome guest, this time at a recent meeting of the **South Devon Tape Recording Club**. Again accompanied by a Fi-Cord representative he enthralled the club with details of his foreign tours in search of sounds. Two recent visits to Plymouth included a visit to the BBC studios there, and an interclub battle against members of the Plymouth club.

ANNUAL AWARD

Another club annual award to be presented recently was the Terry Davis Trophy, given to the best tape made by a member of **Rugby Amateur Tape Recording Club**. Keith Fisher was the proud winner of the Trophy and a cheque for two guineas. Second place was gained by president Len Stephens, and Bill Long came third.

GENERATING POWER

Members of the **Dartford Tape Recording Society** were astounded at the amount of noise that exists inside a power station. They discovered this when they were taken on a conducted tour of the three stations which comprise the Littlebrooke Generating Station.

Material for a very interesting documentary included facts and figures about the processes which were quite startling—900 tons of coal and 1,200 tons of oil used daily, 20 million gallons of water per day from the Thames used to cool the condensers, and 100 tons of grit and dust cleaned daily from the flues!

PUPPETS

A novel puppet show, which included one scene showing the characters landing on the moon, was staged by Mr. and Mrs. Jeffries for the benefit of the **Derby Tape Recording Club**. All voices and sound effects had been previously recorded on tape, and much impressed the club. The club in its turn impressed Mr. and Mrs. Jeffries in such a way that they have both become members.

REDUCED FEE

The **World Round Robin Club** are proudly announcing a reduction of membership fee, by almost half the original amount. The club already has many more members than anticipated, and at present has many tapes circulating round the world. Anyone interested in joining this club should contact the Secretary, John Page, at 45 Elgin Avenue, Belmont, Harrow, Middlesex.

NEW SECRETARY

The new secretary of the **Bournemouth Tape Recording Club** is Miss Doreen Slack, of Studio One, 18 Kingswell Road, Ensbury Park, Winton, Bournemouth. Meetings continue to be held fortnightly on Tuesday evenings at 8 p.m. in the Pembroke Hotel, Poole Hill.

NEW CLUB

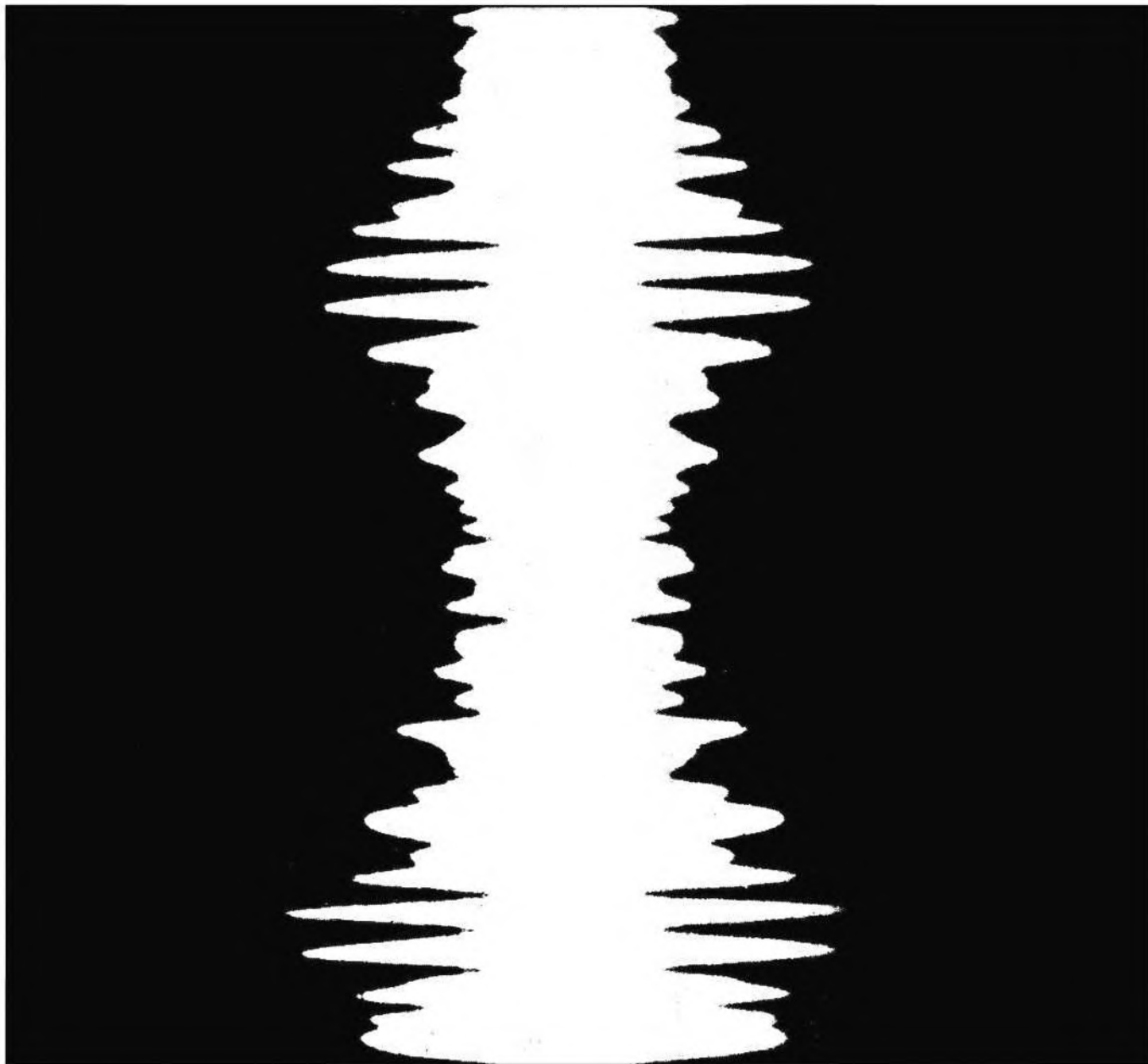
The Gateway Social Centre, at the Coppice Hospital, Ransom Road, Nottingham, has started a tape section, to be known as the **Gateway Tape Recording Club**.

REMINDER

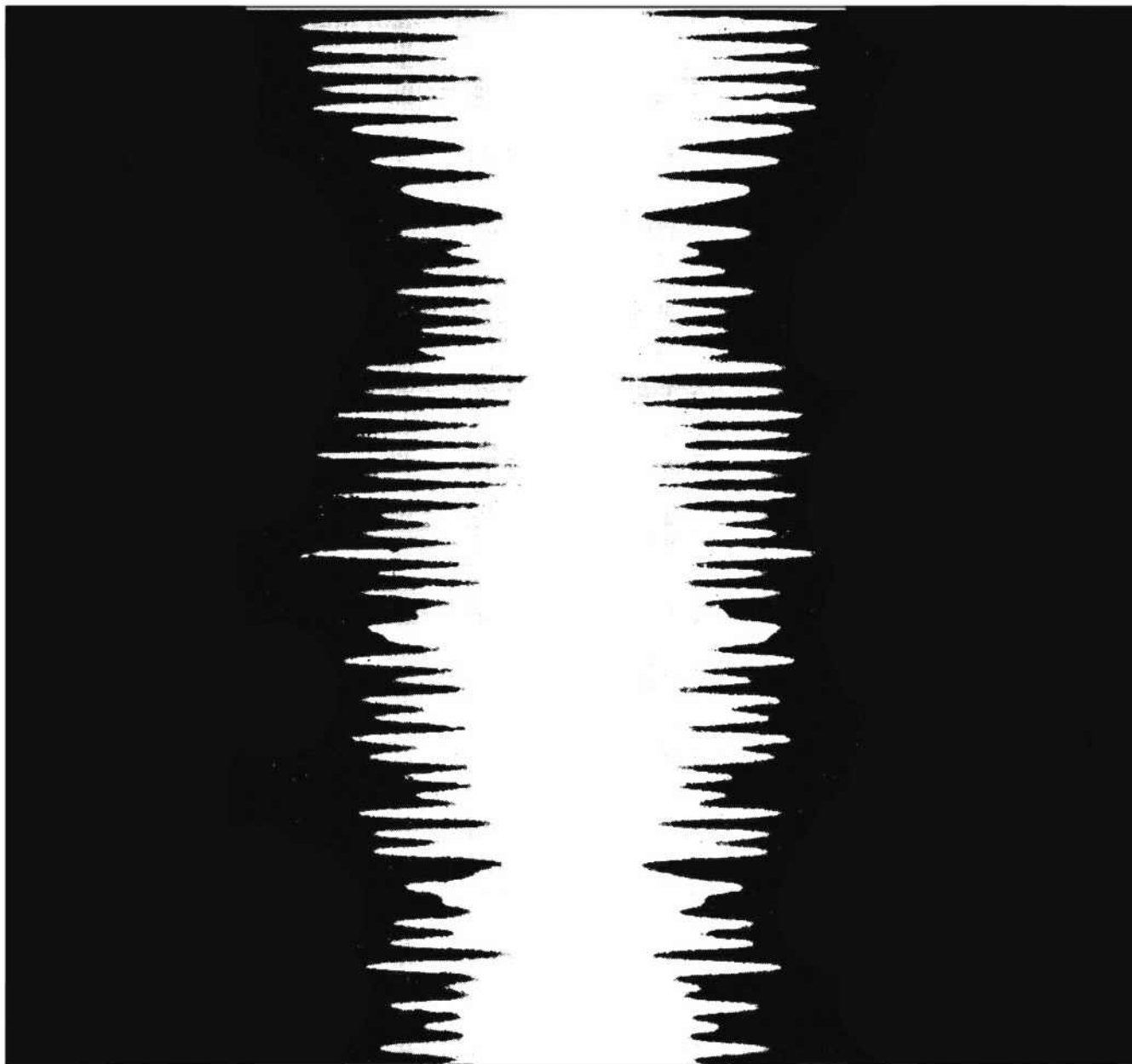
Reading through the reports received this month, I've spotted mentions of at least a score of tapes which could well be entered for the **British Tape Recording Contest**. After all, if they're good enough to gain a high place in the club's contest, and good enough to be published in these pages, they should certainly be good enough to be sent in to the contest. So make sure they're entered.

SEE YOU AT THE RUSSELL

Finally, I expect many of you will be reading this at the Audio Fair. I thoroughly enjoyed meeting many of you last year, and hope to see even more club enthusiasts at the Russell this year. On those occasions when I'm not actually at the ATR Stand (No. 50), I'll be around, like you, listening for all the sounds to be heard. Hope to meet you there. **K.C.**



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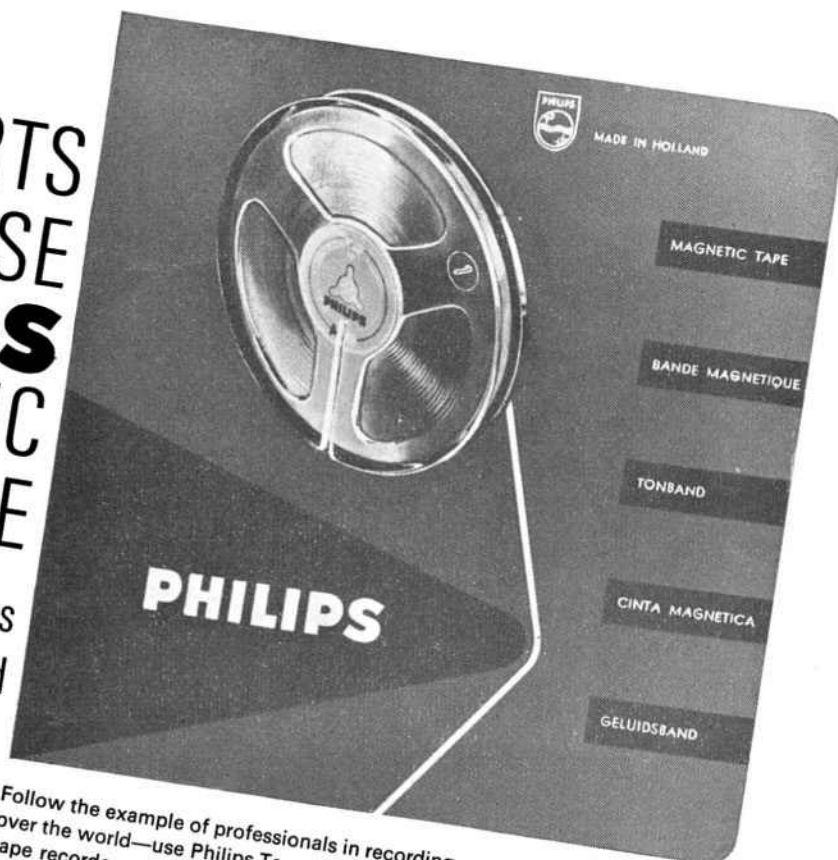


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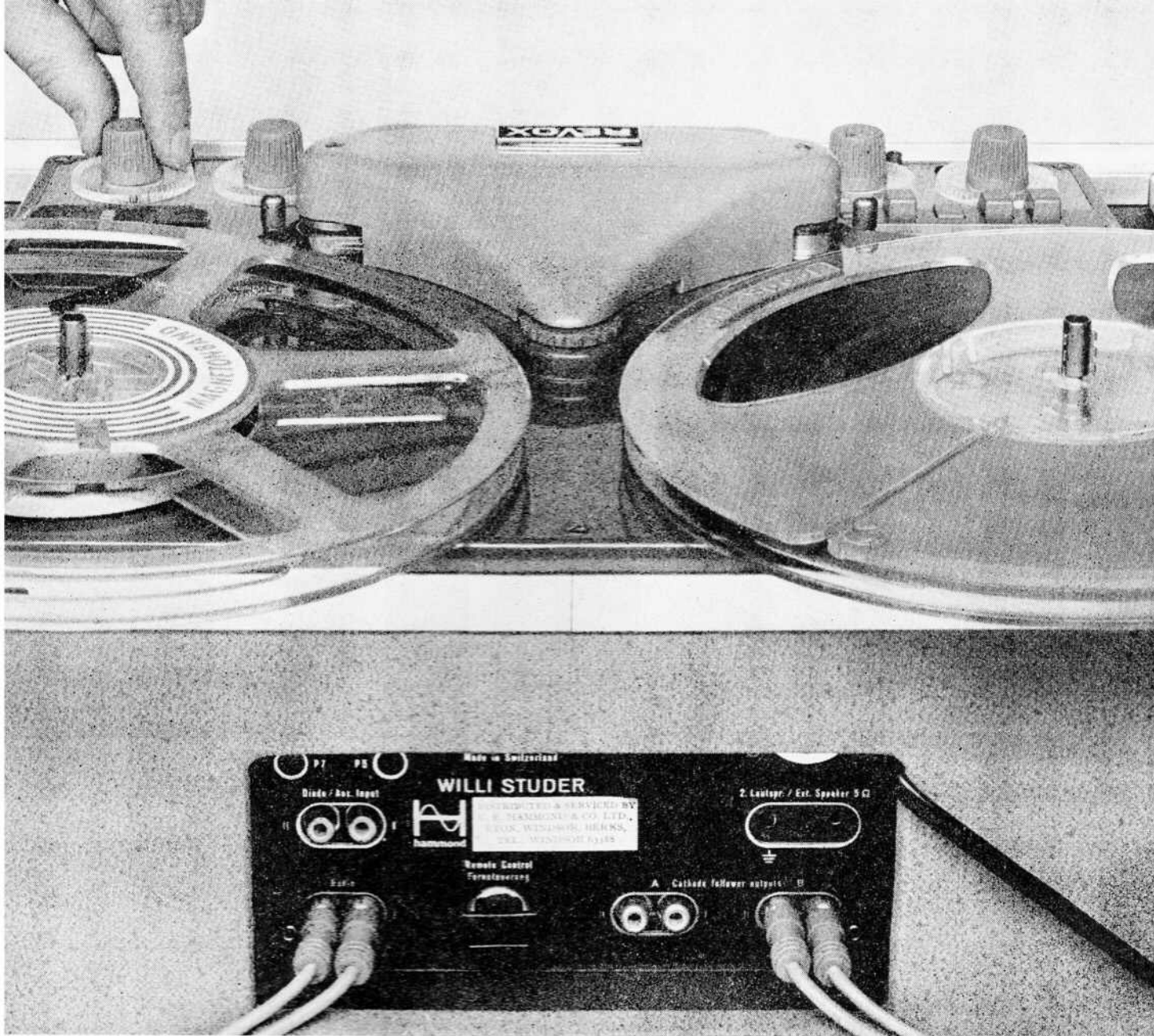
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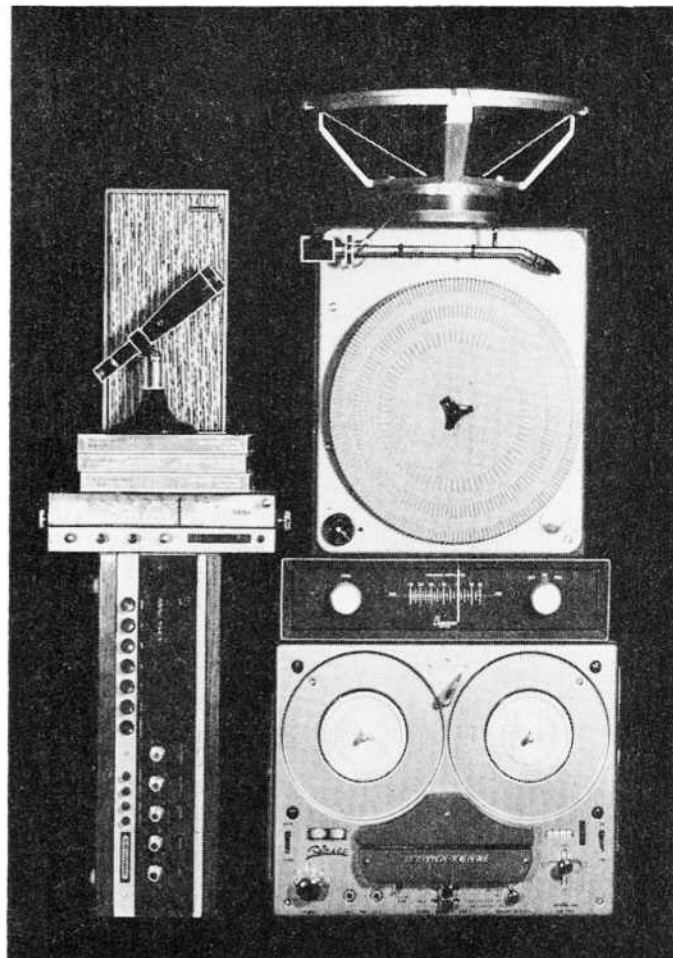
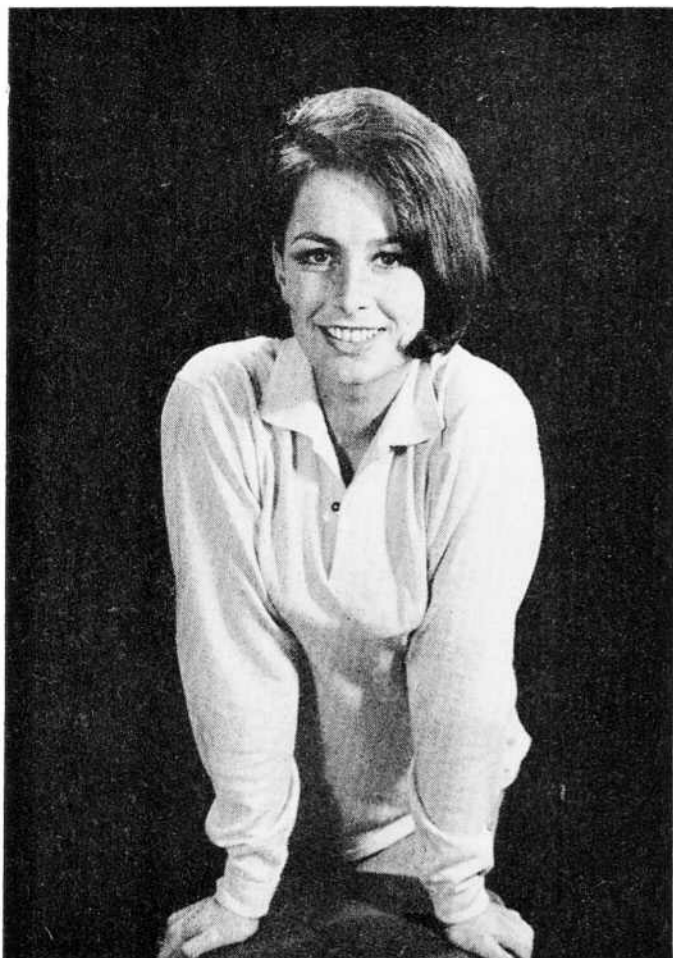
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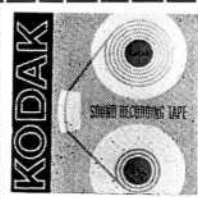
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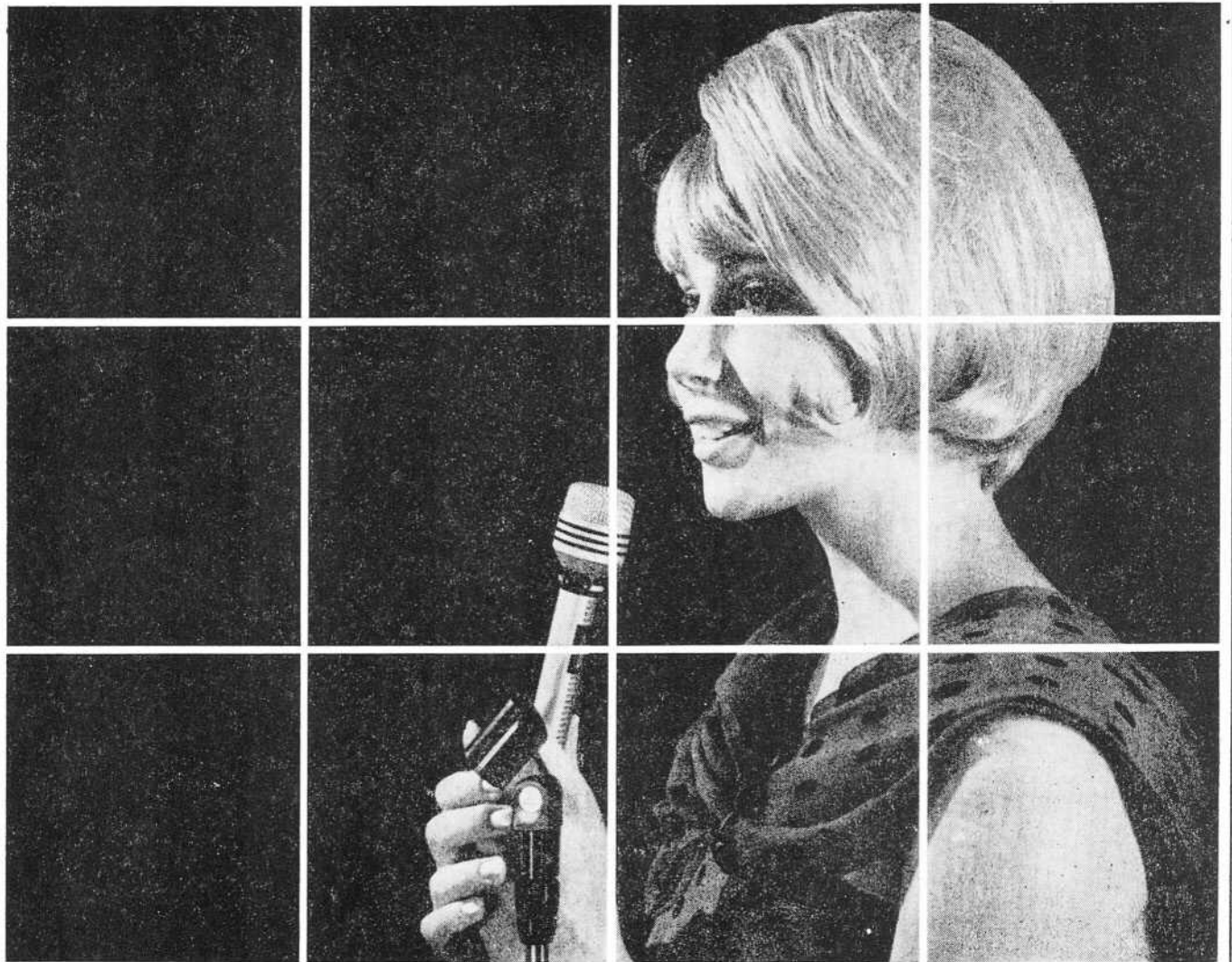
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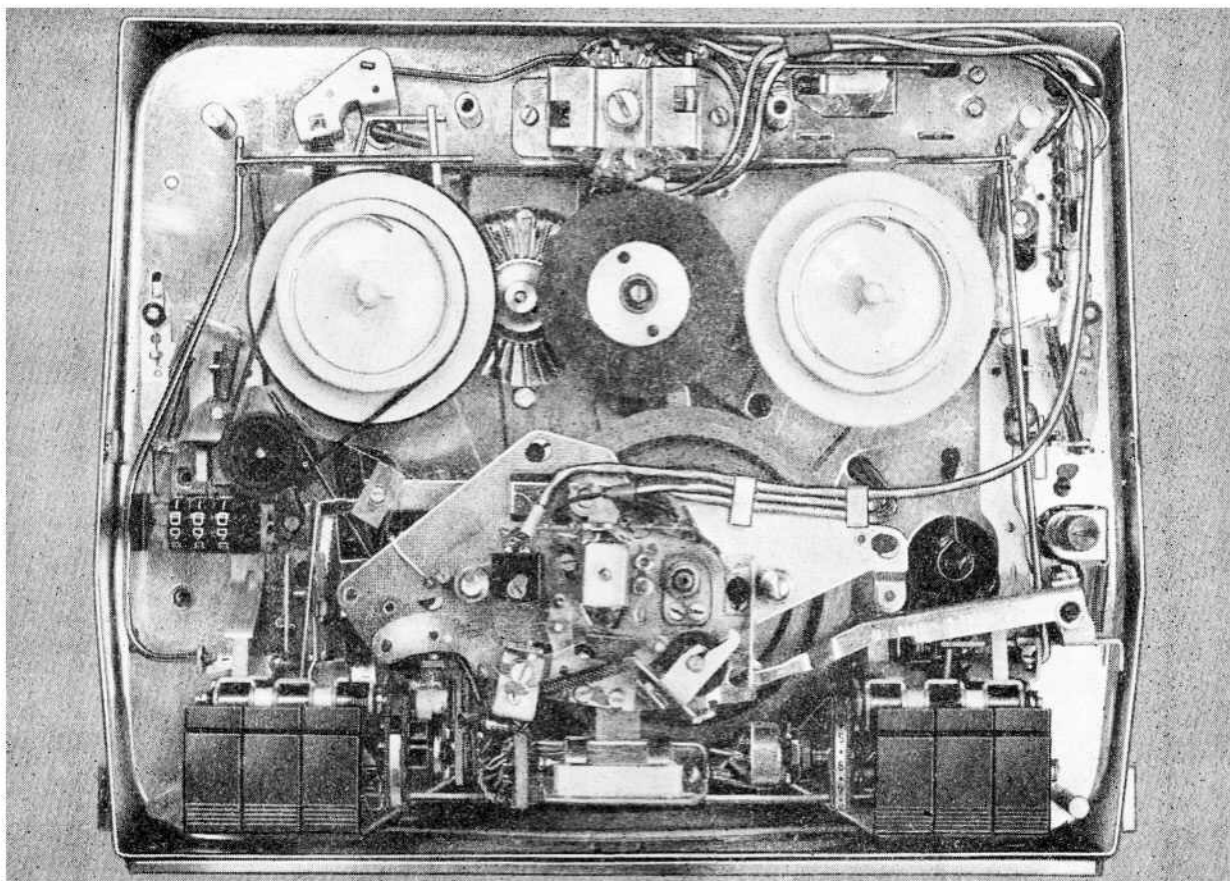
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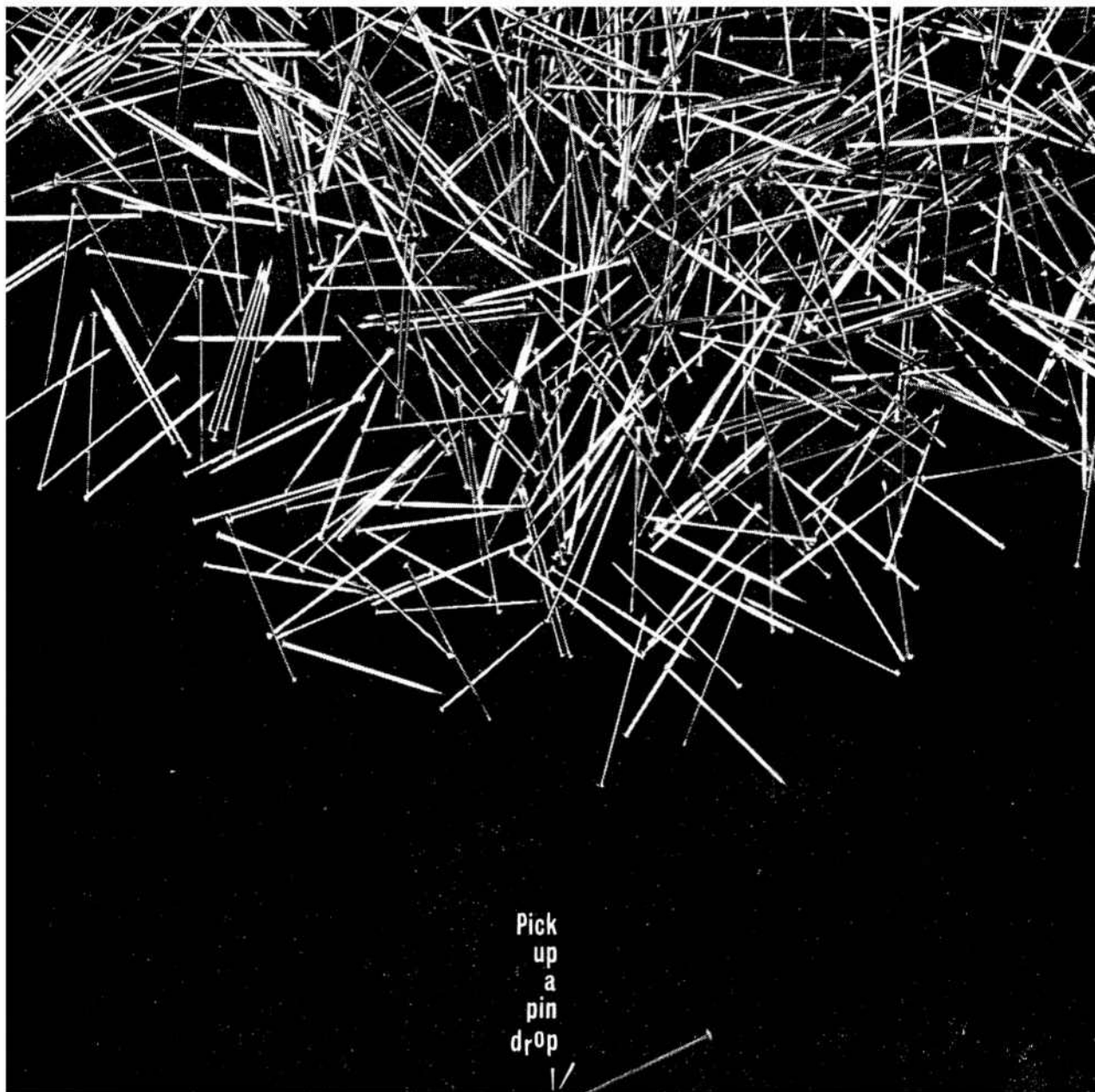
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