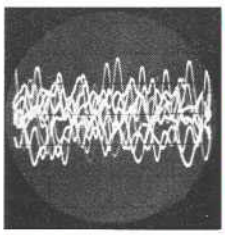
Volume 7 Number 1 August 1965

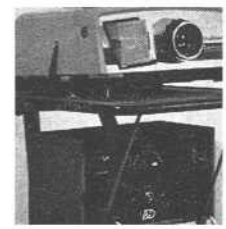
Amateur Tape Recording

Video and Hi-fi /Two shillings & Sixpence



Gordon J King reveals how a video camera works; D J Barnett advises on loudspeaker positioning and E A Rule discusses FM Tuners, their aerials and Matching-in with other equipment.

Full test report on the Akai 44S; its circuitry and performance; when and where to record during August; details of new developments in the world of audio, and latest news from the clubs.



The legalities of recording from gramophone records; the things you say; further suggestions on the marriage of tape and slide; and the sad story of the recordist whose tape came out backwards.

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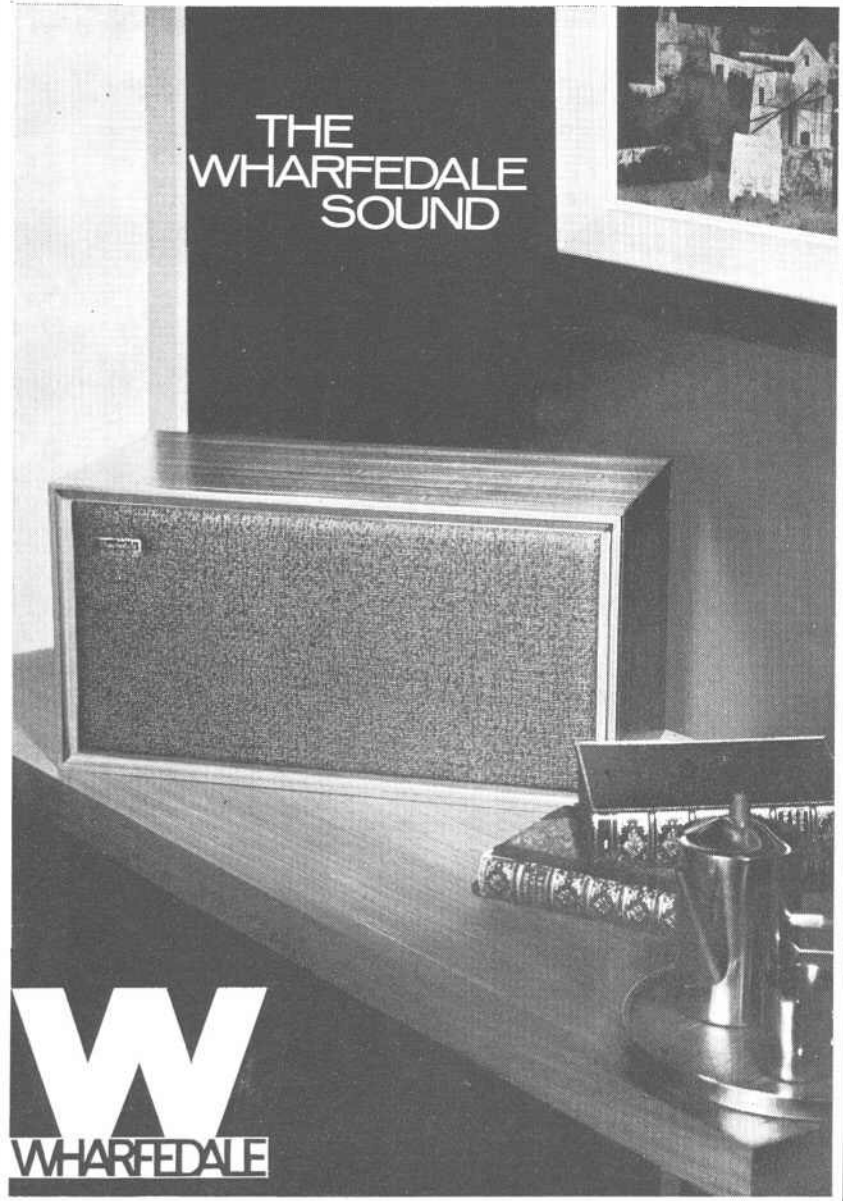
the LINTON



The LINTON is another of the 'new look' loudspeakers developed by Wharfedale and styled by Robert Gutmann, F.S.I.A. The cabinet—made in high density man made timber for reduced panel resonance is superbly veneered. Back radiation is completely eliminated by special internal treatment. A new 8" cast chassis bass unit has been developed by Wharfedale for the Linton. It has a 12,000 oersteds magnet and is fitted with a flexiprene roll surround giving a fundamental open baffle resonance of only 43 c/s. The linear performance is such that the bass distortion is extremely low. A special version of the world famous Super 3 tweeter is combined with a treble control to compliment the 8" bass unit giving an extremely smooth treble response up to very high frequencies. The result is a well balanced twin speaker system of high performance capable of being driven by relatively small amplifiers to provide adequate volume and fatigue free listening.

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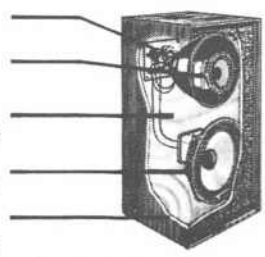

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Vol 7 Number 1 August 1965

Amateur Tape Recording

"Video and Hi-fi"

There is always room for improvement and, as we promised in February, *ATR* will from this issue have a larger page size. Moreover, we have some interesting editorial to fill the extra space – constructional features beginning with an eight-channel microphone mixer next month – more tape and travel articles – more reviews of hi-fi equipment and tape recorders and up-to-date news items as the result of faster production.

Our front cover this month shows the departure of the *ATR* Sound Tour of Denmark with Bob Danvers Walker, a successful venture but also with room for improvement. We hope shortly to announce something very special about sound tours of this kind but meantime watch out for the September issue of *ATR* which will contain a full pictorial report on the trip to Denmark.

The number of entries this year for the British Tape Recording Contest has also showed a marked improvement and, as *ATR* now plays a small part in this, we look forward to knowing and publishing the results at the earliest possible date.

Finally, a word to tape recorder manufacturers, distributors and dealers. How about some improvement in after-sales service? We are still receiving far too many complaints about poor service or lack of any service at all, delays and offhand treatment. We are particularly concerned about UK distributors of foreign-made tape recorders and similar equipment, who fail to make spares available and in fact provide no service whatsoever. Once again we warn readers not to buy foreign-made recorders unless they are completely assured about spares and service.

F. C. J.

Editor: F. C. Judd, A.Inst.E. Assistant Editor: Kim Cook. Art Editor: Robert Morley. Production Director: Denis Curtis. Production Manager: Roy Dennis. 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.. Printed by The Sidney Press Ltd, Bedford. Title registered at Stationers' Hall. Subscription rates throughout the world 30s. post paid for twelve issues.

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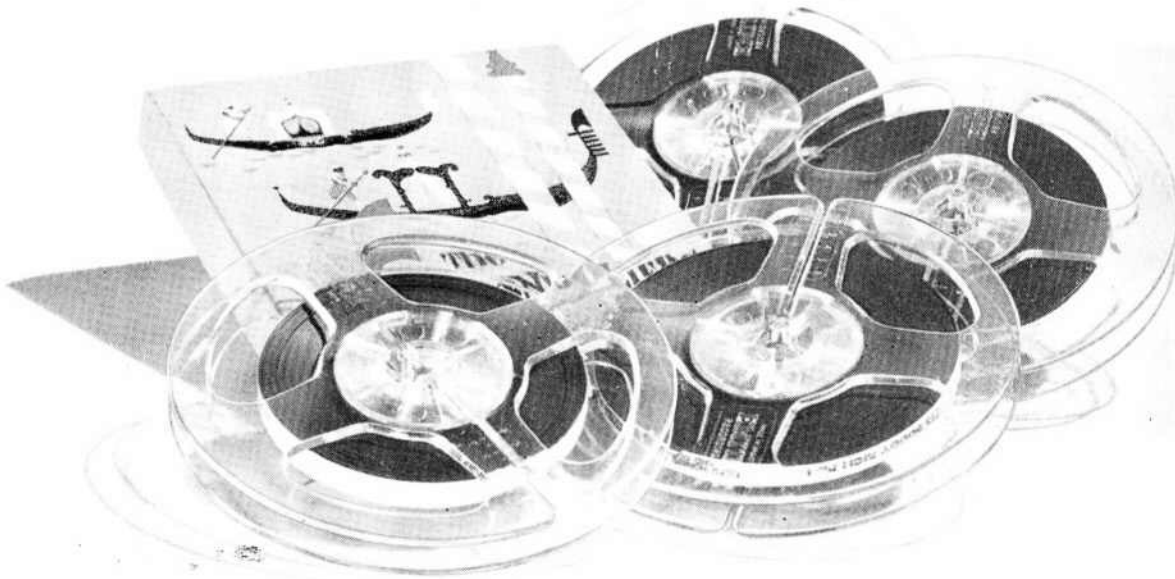


Pop···Light music··· ···and more Serious

32 Star cast and orchestra stage all the famous songs. Getting to Know You, Hello Young Lovers, I Whistle a Happy Tune, Shall We Dance, etc. **Also in stereo.**

25 Ian Wallace, Joyce Blair and chorus. Some Enchanted Evening, I'm In Love With a Wonderful Guy, and all the unforgettable songs from this great musical. **Also in stereo.**

28 Star cast sing Beautiful Mornin', Out of My Dreams, Surrey with the Fringe, People Will Say We're in Love and all the immortal hits. **Also in stereo.**

59 The silken voice of Nat King Cole in 'Walkin', Because, You're Mine, You'll Never Grow Old, Baby Won't You Say You Love Me and 8 more

1 Tchaikovsky **Swan Lake, John Hollingsworth conducts the Sinfonia of London in a great performance of this well-loved ballet music.** **Also in stereo.**

10 Tchaikovsky Violin Concerto. Tossy Spivakovsky with Walter Goehr and LSO in a superb performance of this melodious work. **Also in stereo.**

11 Dvorak Symphony No. 5 — From The New World Leopold Ludwig conducts the London Symphony Orchestra in a dramatic and moving performance. **Also in stereo.**

12 Beethoven Eroica Symphony. Josef Krips conducts the London Symphony Orchestra in a masterly performance of this monumental work. **Also in stereo.**

63 Cuban Carnival, Yesterdays, Blues in My Heart, and eight more great numbers played by George Shearing with vocals by Dakota Staton.

74 Superb Sarah Vaughan on ten great numbers. If I Loved You, Saturday It's Delovely, You'll find me There, etc Every one a hit.

108 Stormy Weather, Sweet Chariot, Somebody Loves Me, Hold Me, I Can't Give You Anything But Love, 7 more top numbers all with fabulous Peggy Lee.

108 Mel Torme's velvet voice in 12 top numbers. Body and Soul, 'Round Midnight, Blues in the Night, That Old Feeling, Where Can I Go Without You, etc.

14 Tchaikovsky Symphony No 5. Sir Malcolm Sargent and LSO combine to give this famous symphony a dramatic and colourful rendering **Also in stereo.**

44 Leopold Ludwig and LSO combine brilliantly in an exciting 'double': two of the world's greatest symphonies receive vivid new interpretations. **Also in stereo.**

53 These two suites containing some of Bizet's most thrilling music are given magnificent performances by the Sinfonia of London under Muir Mathieson. **Also in stereo.**

54 Tchaikovsky's last and greatest symphony, is here given a splendidly moving rendering by the Sinfonia of London conducted by Muir Mathieson. **Also in stereo.**

77 In the Mood, Bugle-Call Rag, Chattanooga Choo-Choo, Serenade in Blue—9 original tracks by the immortal Glenn Miller and his band.

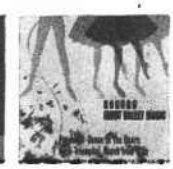
48 Deep in My Heart, Drinking Song, Serenade—all the old favourites fresher than ever with Marion Grimaldi, Linden Singers and Orchestra. **Also in stereo.**

30 Ian Carmichael, Joyce Blair, star cast and orchestra. As Long As He Needs Me, Consider Yourself, all the hit numbers from Lionel Bart's great show. **Also in stereo.**

71 The smooth sound of the Nelson Riddle Orchestra in Touch of Your Lips, Body and Soul, The Tender Touch, As you Desire Me—11 favourites in all.

117 Strauss' most popular waltzes—Blue Danube, Emperor, Vienna Woods, Voices of Spring, Roses from South, Vienna Symphony under Rudel. **Also in stereo.**

111 Ravel's Bolero. Dukas' Sorcerer's Apprentice. Chabrier Espana, Faits Ritual Fire Dance and Dance of Terror. Scherchen conducts Vienna S.O. **Also in stereo.**



112 Faust Ballet Music; Dance of the Hours; Aida March, Ballet Music; Coq d'Or, Hymn to the Sun. Vienna Symph. conducted by Adlerri. **Also in stereo.**

168 'Take a Pair of Sparkling Eyes' and all the great songs from Gilbert and Sullivan's Gondoliers. Star cast, Westminster S.O Faris/Linden Singers. **Also in stereo.**

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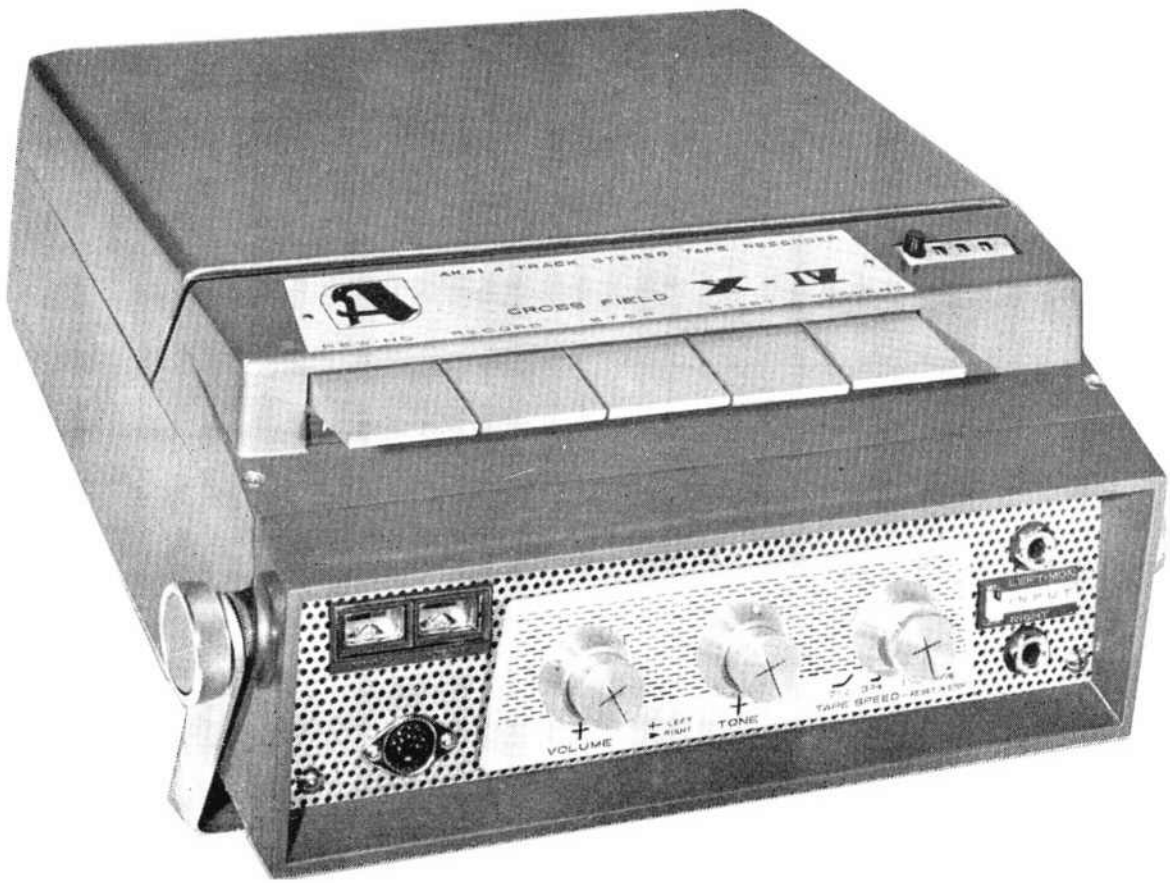

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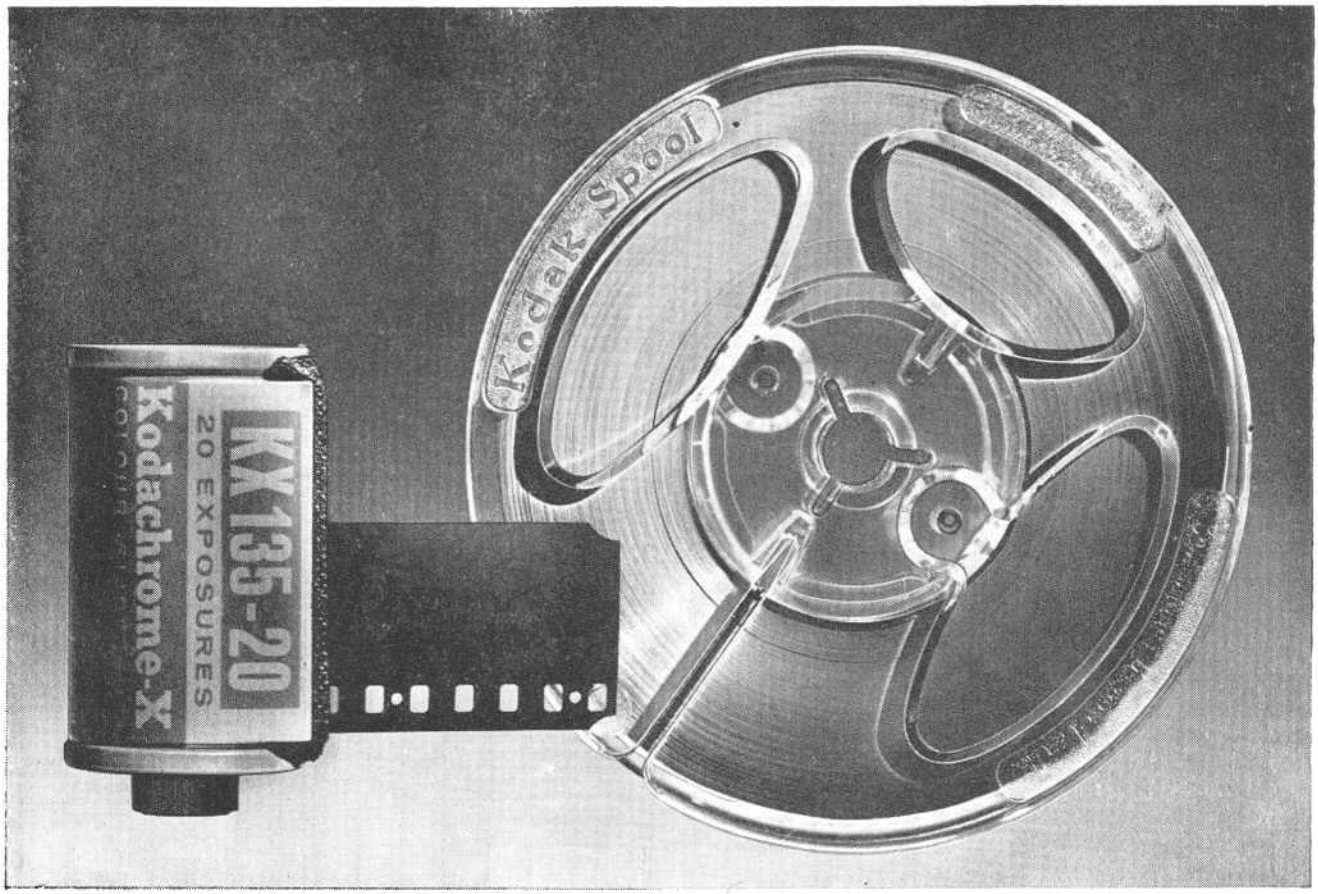

How Kodak's film-coating skills set today's highest standard in tape

Kodak know a lot about surface coating. More than any other manufacturer in the world, in fact. This isn't really surprising, because one of the reasons for the unrivalled high quality of Kodak colour films is the unique evenness of their emulsion coatings.

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MORE ABOUT FM TUNERS

E. A. Rule

All tuners have a certain amount of self-generated noise and at VHF this noise can be considerable. Once the tuner has been designed there is very little the user can do to improve the signal to noise ratio, except to use the best aerial system possible.

Aerials

The aerial is one of the most important and often the most overlooked part of a receiving system and a poor aerial can spoil reception even with the very best of tuners. Exaggerated claims are sometimes made for aerials, particularly those intended for indoor use. Aerials are controlled by electrical laws and like any other part of a receiving system no amount of 'sales talk' can change the basic function and performance.

The most common technical claim (and also the most misleading one), concerns the amount of gain an aerial will provide. A simple dipole is normally used as a reference when measuring the gain of aerial systems and is assumed to have gain of 1 (or 0 dB.). Now in spite of claims saying otherwise, it is necessary to DOUBLE the size of an aerial in order to double the power gain; therefore a two-element aerial (dipole plus a reflector) will provide a power gain of 2 (3 dB), a four-element a gain of 4 (or 6 dB), an eight-element a gain of 8 (or 9 dB) and so on. The figures quoted in dB's refer to power gain and 3 dB is the minimum reasonable increase in signal level worth obtaining. Note that although going from an eight-element to a sixteen-element aerial increases the gain from 8 times to 16 times, it has only doubled the output, i.e., a further power gain of 3 dB. Clearly a point is soon reached where any increase in the number of elements produces no further advantage in gain.

In areas where the transmitter field strength is high (strong signal areas) a simple dipole will meet most requirements. Only in fringe areas (where signal strength is low) will an eight-element aerial be necessary and for general use a three- or four-element aerial can be considered as the ideal. The height of an aerial plays an important part in performance and the aerial should be mounted high up and as far from nearby buildings, etc, as possible. The co-axial cable between the aerial and the tuner should also be of the best quality. Cheap co-axial cable intended for general TV use will lose half or more of the signal strength for every 100 ft used. The type intended for UHF TV is very good and is to be preferred. One final point, avoid sharp turns in the co-axial cable which can also introduce losses.

De-emphasis and pre-emphasis

One method used in the design of FM systems to improve the signal to noise ratio is to boost the treble frequencies to a higher level than the middle and bass. This is called pre-emphasis and is carried out at all BBC FM transmitting stations. By doing the reverse of this at the receiving end (de-emphasis) the audio frequency range is restored to the required 'flat' response. However, in cutting the treble, the noise (mainly hiss) is reduced by the same amount, thus improving the overall signal to noise ratio.

Impedance matching

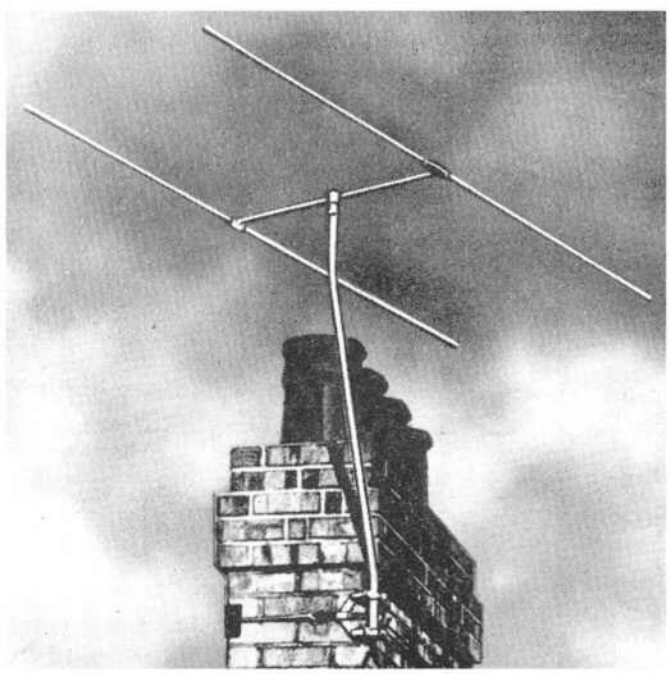
When reading the published technical data on tuners and amplifiers, some confusion may arise over the matching of one to the other. For example, a tuner with an output impedance of 6,000 ohms will work quite satisfactorily with an amplifier whose output impedance is 2 Megohms. How can so large a difference be in order when we already know that a 15 ohm loudspeaker must work from a 15 ohm output?

It is simply a question of transferring power or voltage from one piece of equipment to another. When power (watts) is being transferred, as in the case of a loudspeaker, the two impedances must be the same for maximum power transfer. In the case of tuners, etc, only voltage is transferred and in general, provided the output impedance of the tuner is the same or lower than the input impedance of the amplifier with which it is used, satisfactory results will be obtained.

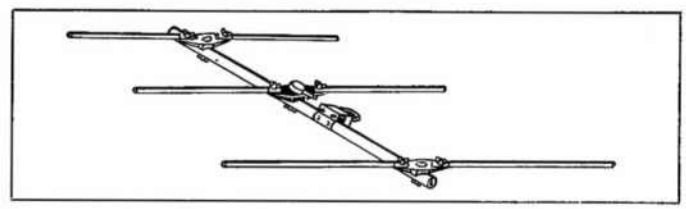
Voltage matching

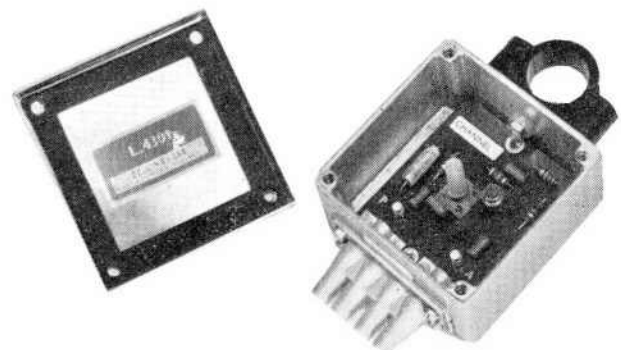
Matching the output voltage from a tuner into an amplifier can be a problem, but provided the output from the tuner is more than

(below) A Belling & Lee 'H' type (two-element) aerial for reception of VHF-FM transmission.



A three-element aerial for VHF-FM reception. In very weak signal areas it may be necessary to use an aerial pre-amplifier like the Belling & Lee type L4301 shown below or the L4202 (which has a voltage gain of 12 to 13).





that required by the amplifier a match can be made. In the ideal case both voltages should be the same; i.e., an amplifier requiring 250 millivolts would be a perfect match for a tuner with a 250 millivolts output. When the tuner output is higher than that required a simple resistor network will enable a perfect match to be made. The procedure is to divide the tuner output (in millivolts) by the amplifier input (also in millivolts). This will provide a ratio of one to the other, for example: *tuner output* = 1,000 *millivolts* (1 *volt*). *Amplifier requires* 100 *millivolts:*

$$\frac{1{,}000}{100} = 10, \text{ i.e. } 10 : 1 \text{ ratio}$$

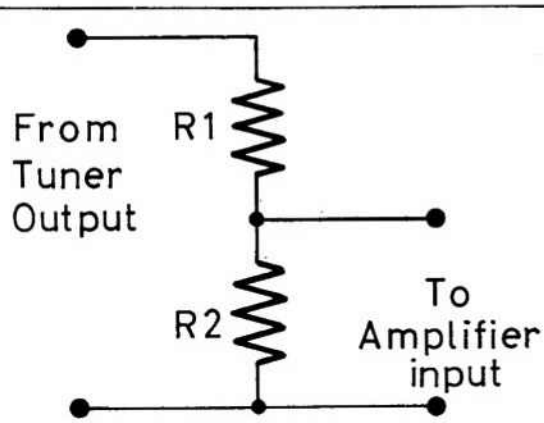
Two resistors with values related by $R2 = \frac{R2 + R1}{\text{Ratio}}$ where R2 and R1 equals output impedance of tuner. These are connected as in Fig.1 and will match the tuner to the amplifier. The combined value of the resistors should be equal to the output impedance of the tuner. For example, a tuner having an output of 2 volts at 50 K.ohms required to match an amplifier of 400 millivolts at 100 K.ohms $= \frac{2{,}000}{400} = 5$. Total resistance to equal 50,000 ohms $\frac{50{,}000}{5} = 10{,}000$ ohms. Therefore, R2 (Fig.1) will be 10,000 ohms and the 50,000 −10,000 = 40,000 ohms. The nearest standard values should be used, which in this case are 39,000 ohms and 10,000 ohms. Other examples are shown in the table. The amplifier input impedance is across R2 and should be allowed for when calculating the value for R2, but in practice, and provided the amplifier input impedance is at least five times higher than R2, its effect can be ignored.

TUNER MATCHING TABLE (SEE FIG.1)

Tuner output Millivolts	Ohms	Amplifier input Millivolts	Ratio	R1	R2
1,000 (1 volt)	1 Meg.	500	2 : 1	500 K.ohms	500 K.ohms
2,500 (2·5 volts)	50 K	100	25 : 1	48 K.ohms	2 K.ohms
100	6 K	2	50 : 1	5·88 K.ohms	120 ohms
2,000 (2 volts)	6 K	80	25 : 1	5·76 K.ohms	240 ohms

The nearest standard value of resistor should be used. In practice, errors of up to 25% will still allow satisfactory results to be obtained.

Diagram showing how R1 + R2 = output impedance of tuner, (see formula below).



R1 + R2 = output impedance of tuner.

$$R2 = \frac{\text{output impedance of tuner}}{\left(\frac{\text{tuner output (millivolts)}}{\text{amplifier output (millivolts)}}\right)}$$

Example: *Tuner output = 2 v at 50,000 ohms. Amplifier output = 100 mV at 1 Mohm.*

$$R2 = \frac{50{,}000}{\left(\frac{2{,}000}{100}\right)} = \frac{50{,}000}{20} = 2{,}500 \text{ ohms.}$$

R1 + R2 = 50,000 ohms ∴ 50,000 − R2 = R1
∴ R1 = 50,000 − 2,500 or 47,500 ohms (47 K.ohms)

TAPING FROM RECORDS

It has been suggested that the public library which provides a gramophone record lending service is a ready and cost-free source of material for the making up of a personal library of music, but stop and think what is involved, not only from the legal position but also from a moral point of view.

Let us look at a record label. This normally bears a printed notice round the outside edge 'ALL RIGHTS OF THE MANUFACTURER AND OF THE OWNER OF THE RECORDED WORK RESERVED. UNAUTHORIZED COPYING, PUBLIC PERFORMANCE AND BROADCASTING OF THIS RECORD IS PROHIBITED', and it means what it says.

The manufacturer and artist

The reason for the notice is twofold. One is that by virtue of the rights conferred upon him by Section 12 of the Copyright Act, 1956, a manufacturer is entitled to prevent the unauthorized copying of his recordings on which he has spent a considerable sum of money in engagement of artists and musicians, studio time and equipment and other costs of production, exploitation and distribution.

Killing the golden goose

The record manufacturers have made it possible to bring into the homes of the people music from all over the world. In the case of the work of serious composers it may well be found that the sales are not sufficient to do more than cover the cost of production, even if they do that. The manufacturers are therefore naturally concerned to prevent the re-recording of their discs, as such action can only result in the loss of a sale. When we consider that over two million tape recorders have been sold in the United Kingdom alone, the seriousness of the position can be realized.

However, not only the manufacturers but the artists and musicians also lose by unauthorized re-recording, as in most cases they receive payment for their services on a 'royalty on sale' basis. Are we then to reach a position where the extent of illegal dubbing will be such that it will no longer be economical for record companies to produce discs covering the whole field of music? In other words, will the golden goose be killed?

The composers

The second reason for the notice is that a manufacturer is permitted to record a copyright musical work or other material only under a restricted licence which does not permit the re-recording thereof by another party. The arguments against the unauthorized re-recording of a copyright work reproduced on a commercial disc or tape is that the composer, lyric writer or other copyright owner is by law entitled to a royalty on all sales. Illegal copying is not only an infringement of the recording right in the work, but also deprives the copyright owner of payment of royalty.

How to obtain licence

Application for permission to re-record from or dub a commercial gramophone record should be addressed to the Copyright Department of the manufacturer concerned.

In the case of a musical work which may be reproduced on a commercial gramophone record, almost all British and American as well as many other copyright owners are represented by Mechanical-Copyright Protection Society Ltd, Elgar House, 380 Streatham High Road, London SW16, which Society is in a position to issue licence to record on payment of a nominal licence fee. Special terms have been arranged with the Federation of British Tape Recording Clubs for its affiliated clubs and individual members.

THE MARRIAGE OF TAPE AND SLIDE

Gordon J. King

Sometimes it is necessary to produce a relatively large number of impressions of a particular tape record bearing control pulses for operating a semi-automatic slide projector. This may be necessary where tape and slides together are used in commerce and industry.

As an example, a manufacturer of, say, an electric typewriter may feel it desirable to supplement his service manual with a set of colour slides and a corresponding tape to reveal to his service agents, in greater detail than the printed page and ordinary drawings of the manual, specialized and complex operating procedures and adjustments.

A number of slide sets and tapes may thus be needed, and these may be sent in particular to overseas agents who are furnished with the necessary tape player and slide projector. In this way it has been discovered that a greater efficiency of service is achieved, especially where the main service department is many miles away from the agent. (Tape recorder manufacturers might employ this idea. Ed.)

Another practical example is in the field of overseas missionary work. On-the-spot photographs and tape recordings are taken and after processing these are sent as complete tape/slide programmes to various parts of the world. In both cases, then, a number of impressions of the tape record are required.

The master tape is easily reproduced, of course, by ordinary dubbing processes, but one problem is that the high-frequency control pip is likely to suffer attenuation by high-speed dubbing. I investigated this problem in an effort to find a different way to synchronize the slides with the tape. The method I sought had to be inexpensive and easily workable by non-specialist operators using standard equipment.

Audio-controlled slide-change unit

After months of experimenting it was found that any recorder without any modification whatever could be arranged to change the slides by utilizing deliberate pauses between the commentaries of the slides. In other words, the deliberate pauses were processed so as to form a control signal for operating the slide projector.

The circuit had to be insensitive to variations in audio signal level and also to natural pauses in the commentary. Eventually a system as depicted by the block diagram in Fig. 1 was evolved.

The amplifier/limiter stage receives the audio signal from the taped commentary and produces an output into the signal rectifier. Owing to the limiting action of this stage, the amplitude of the signal applied to the rectifier is substantially constant from very low-level signals to maximum peak audio signals. Thus, the dc output from the rectifier is constant irrespective of how the level of the audio signal varies.

Adjustable time-constant

The dc voltage produced by the signal rectifier is applied across a time-constant circuit, the value of which is adjustable. In effect, the dc voltage due to the audio charges a capacitor and this capacitor is discharged over a predetermined time through a resistor, the value of which is selected by the variable time-constant control. This is termed the 'pause control'.

The rectifier circuit is arranged in such a manner that the charge across the capacitor is negative with respect to chassis or the 'earth' line. This charge is applied to the control grid of a pentode valve so as to hold it in anode current cut-off. Since the anode of the valve is loaded into the winding of a relay, the relay is de-energized as long as there is a certain level of charge in the capacitor. When the charge has almost all leaked away through the time-constant resistance, the control valve conducts, energizes the relay and changes over the contacts so as to provide switching for the projector.

Thus, to recapitulate, the audio commentary sustains a constant dc charge across a time-constant circuit which holds the control valve in anode current cut-off. During natural pauses in the commentary, the charge does not fall sufficiently to cause the control valve to conduct. However, the deliberate pauses introduced between each slide are that much longer than the natural pauses and the charge across the time-constant circuit falls sufficiently to bring the control valve into conduction and so activate the relay, the contacts of which operate the slide projector. In that way, then, the projector is instigated into a slide-change cycle solely by reason of deliberate pauses introduced between each commentary. Control pulses and all the associated complications are completely avoided.

The ratio of deliberate pause time to natural pause time is in the order of 5 to 1, but the time-constant is made adjustable so as to cater for a wide range of deliberate pause times.

Pause time

The pause time is determined either before a tape is made or after editing simply by sliding-in equal lengths of unrecorded tape or leader tape between each slide commentary. If the pauses are actually introduced during the recording of the commentary, this is easily done by ceasing to record for a period of 3 to 4 sec or what other pause period may be decided upon.

The slide change unit also incorporates a manual slide-change press button and also a switch that de-energizes the relay while it is in the 'manual' position. The exercise, then, to produce a tape to correspond to a slide programme is as follows.

The slide-change unit is switched to 'manual' and the first slide displayed on the screen. At this time the tape recorder is put into action and the commentary corresponding to the displayed slide is recorded. At the end of the commentary the manual slide-change button on the slide-change unit is depressed so as to change the slide. During this period no modulation is applied to the tape. As soon as the slide-change cycle is concluded and the next slide is displayed on the screen the commentary for that slide is started. By adopting that technique the slide-change cycle is automatically related to the time of the deliberate pause.

It is possible to apply a very low level of background music, for instance, during the deliberate pause period, provided the amplitude of the signal is well below the limiting level of the slide-change unit. In practice, it has been found that a background some 20 dB below the average level of the commentary fails to have any effect on the charging of the time-constant.

The background music can often advantageously accompany the spoken commentary, and its level should be adjusted accordingly during the deliberate pause period. If required, a mixer and a source of background music can be introduced at the input to the tape recorder when the tape is being made.

To synchronize the slide changes to the tape during playback, the projector is set up to display the first slide, the tape recorder is started on the first commentary and the switch on the slide-change unit is set to 'manual'. About half-way through the first commentary the time-constant will have charged fully, allowing the switch to be set to 'auto'. Under that condition the tape takes control of the slide changes, the slides changing automatically during the deliberate pauses between the commentaries.

Circuit description

The basic circuit of the device is given in Fig.2. Here V1 is the amplifier/limiter valve, V2 the relay control valve and the D1 the signal rectifier diode. The time-constant is formed by R1 + R2 and C1 and transformer T1 feeds signal from the amplifier to the rectifier. C1 thus charges up so

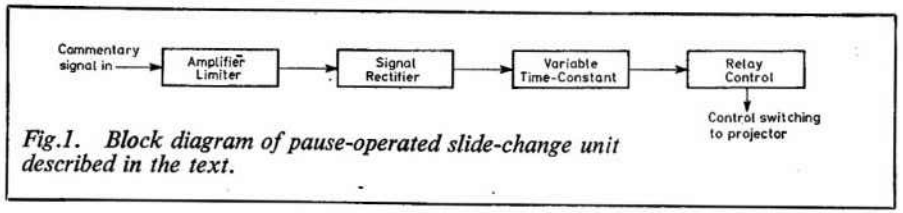


Fig.1. Block diagram of pause-operated slide-change unit described in the text.

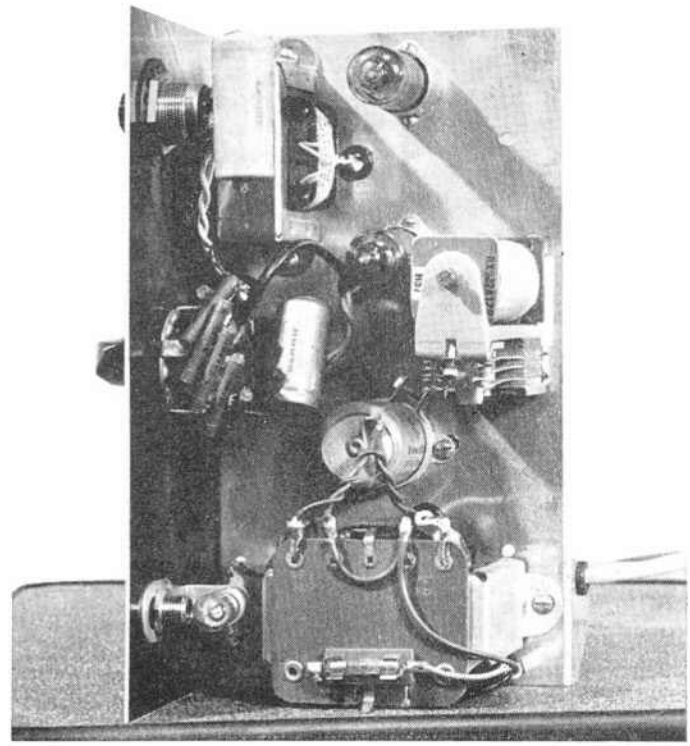
Fig.2. Circuit diagram of the AVD pause-operated slide-change unit.

manual change
to projector
A1
6·3 V A.C.
D2
T1
D1
R4
C2
A2
V1
RLA
2
auto/ manual
V2
R3
+200V
mains power unit
Audio in
R1
C1
R2
chassis

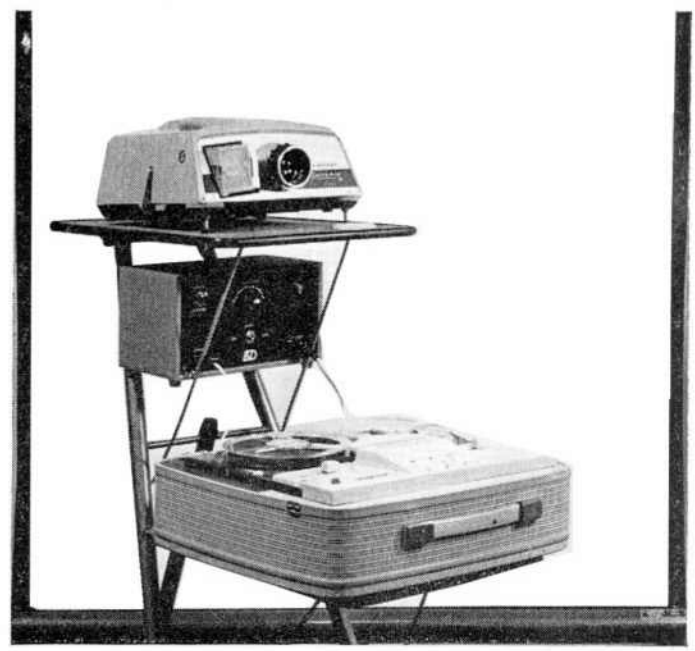
Fig.3. Front view of the AVD pause-operated slide-change unit.
Fig.4. Inside-top view of the AVD pause-operated slide-change unit.
Fig.5. Complete outfit for tape/slide programme, incorporating the AVD pause-operated slide-change unit.

The Marriage of tape and slide *(continued)*

that the control grid of V2 is held negative (the valve being held at cut-off) during the commentary.
V1 functions as a limiter partly due to grid current in R3 and partly because of the bias fed back from the time-constant circuit. The value of R4 also influences the limiting action.
When V2 conducts, during a deliberate pause, the relay energizes and contact A1 closes. This instigates a slide-change cycle.
At that time contact A2 also closes. This puts the diode D2 in series with the 6·3 volt heater supply, thereby rectifying the supply and charging C2. A negative voltage is thus applied to the control grid of V2, the effect of which immediately pulls V2 away from conduction and charges C1. All this happens during the pause period and finally sets up the conditions which exist during a commentary. This means that when the next commentary commences C1 is already charged and there is no danger of V2 falling out of cut-off before the commentary has been running for a sufficient period to charge C1.
The action, then, during a deliberate pause is that contacts A1 and A2 make and then almost immediately break, but A1 is closed for a sufficient period to operate the slide-change action of the projector, this being aided by the capacitor connected across A1.

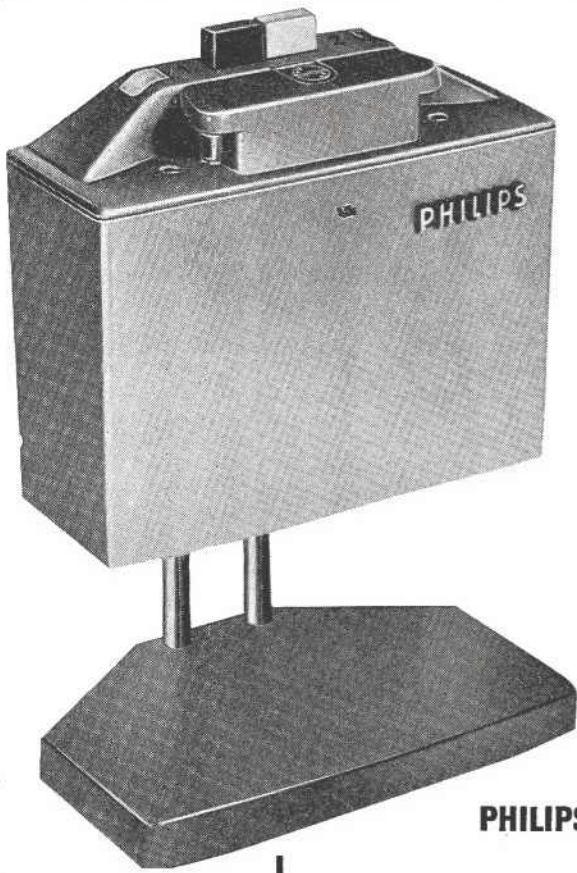


Auto timing
Another feature given by the supplementary charging circuit is that the unit can switch the projector automatically and at intervals determined by the set time-constant even when there is no audio signal applied. This is because C2 charges (and thus charges C1) when V2 falls out of cut-off. V2 is then immediately pushed into cut-off again by the charge and remains there until the charge has leaked away through R1 and R2, at which time the switching cycle repeats. This action is useful should one wish to show a programme of slides without direct synchronization to a taped commentary.
The unit is designed to limit with an input signal in the order of 50 mV. This signal can be obtained either from the 'monitor' socket or the 'extension speaker' socket of any tape recorder. This is the advantage of this system; it requires no complicated connections or oscillators. Indeed, it is possible to achieve the synchronization without any electrical connection at all. A microphone is in this case connected to the 'audio in' socket on the unit so as to pick up signal from the loudspeaker of the tape recorder employed for the commentary. For this application either a separate microphone amplifier stage is required in front of the slide-change unit or a pre-amplifier between the microphone and the unit. Fig.3 shows the very attractive appearance of the complete unit. Fig.4 shows the inside top and Fig.5 the set-up of a complete system of tape recorder, projector and slide-change unit ready for delivering a tape/slide programme.



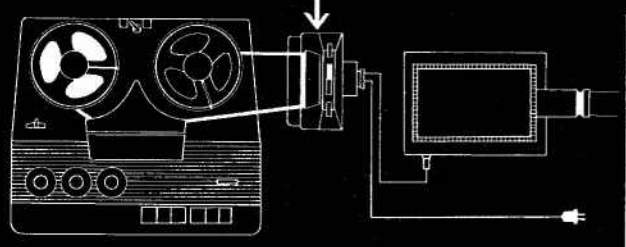
Acknowledgments
The author wishes to express his thanks to Mr Harry Mudd, Managing Director of AudioVision Developments (Oxford) Ltd, for permission to publish details of the pause-operated slide-change unit and for the photographs used in this article. Thanks are also due to helpers with the project, including the engineer responsible for the supplementary charging circuit and the prototype engineer for his assistance.
The unit was developed by the author for AudioVision Development (Oxford) Ltd and is the subject of a full patent application. Further details of the unit can be obtained from the above company at the New Road office at Brixham, Devon.
Next month we shall consider the circuit of a unit that operates by the recording of pulses on the tape. We shall also see how tape and slides serve in industry and education.

AT LAST!
Automatic slide/sound synchronisation at a realistic price!



Lucky you – now you can liven up your slide shows with a professionalism that all your friends will admire. Now your running commentaries can be *automatically* synchronised with every slide you show – not only will your audience enjoy themselves more, but you too, are able to sit back and relive the occasion! And this undeniable luxury costs so little–only 15 gns. With Philips Slide Synchroniser your automatic slide projector is operated by impulses on the tape. The height of the Synchroniser can be adjusted to match that of your tape recorder. It's simple to use – only two push-buttons. For details of all the other features and uses that make Philips Slide Synchroniser such superb value for money, write to the address below. It could open the door to a whole world of entertainment for you, your friends and your family!

PHILIPS SLIDE SYNCHRONISER ONLY 15 GNS
FOR AUTOMATIC ENTERTAINMENT



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THE THINGS YOU SAY

Rotten . . .

I read your article 'Something Is Rotten' (May Issue) with great interest. I must say I agree whole-heartedly with the panel concerning the lack of enthusiasm in amateur tape recording.

I have had several mains-operated machines, but I must admit that since getting my portable I have had far more fun and my interest in recording has increased so much that I can't go anywhere now without my portable slung on my shoulder.

As for people not being willing to talk into the microphone, this is ridiculous. They will talk, and so easily too. Among my favourite tapes is one recorded in a Lancashire bakery at about 8 o'clock one night. Without my portable I would never have been able to capture the true scene – the dialect, the machinery thumping away in the background, and the delightful conversation that needed so little prompting. Even though I have played this back many times now, with each new hearing I can pick up some small sound or inflection that I hadn't noticed before.

I hope your article has brought home some of this to your readers, or at least made some impression on them of the vast capabilities of portable recorders.

Lyneham, Wilts — K. Hardman

. . . Or Not ?

Your printed discussion 'Something Is Rotten' (May issue), while being very interesting, was surely incomplete. Your three experts did not even mention the obvious 'creative' use of a tape recorder, as used by many hundreds of cine and still photographers (slides) throughout the world today.

True, just as there are millions of tape recorders lying about, so there are millions of cine cameras lying about – neither being used for 'creative' work.

The same arguments apply to both hobbies, but the serious cine user combines the two in producing films with sound on tape.

I would have thought that this point would have been mentioned if only in passing by your experts, Messrs Eckersley, Bradley and Cook.

And what about the thousands of tape recorder owners who use their machine principally for tape correspondence? Whilst this may not be considered to be 'creative' recording, it is very widely used as a personal means of contact between peoples and a great influence to international understanding.

I would sum up by saying that things are not as rotten as they appear to be to your three-man panel – if it's entries they are after for the tape contest, then ADVERTISE! Who knows of the competition outside the readers of this magazine? Precious few! Take a lesson from the amateur cine magazines – the national cine competitions draw hundreds of entries each year and the two major competitions (Top 8 and Ten Best) get public showings.

More efficient organization is needed – tape recording is not getting this.

Weymouth, Dorset — R. J. Shipman

Certainly many mains machines are used for straightforward commentary to films and slide shows, but surely if you want an authentic background commentary or soundtrack you will have to get out and about with a portable as suggested in this discussion. Tapesponding too is much enlivened by the inclusion of local sounds, dialects, etc., recorded out-of-doors.

As regards advertising, publicity of any sort on a national scale is extremely expensive and, as was emphasized on page 11 of the May issue, manufacturers are far more willing to spend money on camera and film publicity than they are on tape and recorder advertising.

Portables Abroad

I have just bought your magazine for the first, but certainly not the last, time, and have been particularly interested in the various articles on outdoor recording with portables.

I bought my Philips EL 3586 specifically to record soundtrack for a film on my holiday in Spain.

Will the temperature (85°+) affect my recorder, tapes batteries and/or microphone? Will my present mic be good enough or should I change to the LV 59 as John Bradley has done? Will I need a reflector and/or extra lengths of microphone cable and will the shoulder carrying case supplied with my machine be strong enough? Also when I record Flamenco dancing, etc., should my microphone be on the floor or will vibrations spoil the recording? I hope these questions from a pure novice will not annoy your obviously further advanced mind. One can learn only by experience and asking others who know, and therefore any advice you can give me would be very much appreciated.

Halifax, Yorks — T. Simpson

These are questions which must bother many a first-timer taking a portable abroad. Certainly the temperature should not affect your equipment in any way. Your present microphone and the LV 59 are quite comparable in quality, but with your present mic even slight movements of the hand will be reproduced in sound on the tape and will need careful editing out if you are to produce a really good sound commentary. A reflector is not really necessary but you could take one spare length of cable, preferably of about 20 ft fitted with three-pin din plug and matching socket. Your carrying case may well need strengthening and this is done quite simply by taking the strap right round underneath the recorder and stitching it to the case. When recording Flamenco dancing, never put the microphone on the floor as this will certainly pick up far too much vibration. Try standing the mic on a table on a small pile of tissues to muffle any vibration. Finally, for a newcomer with only one machine editing is much easier if you record using one track only.

Copyright

The reproduction in your May 1965 issue of the leaflet on Copyright published by the Performing Rights Society Ltd is appreciated by this Society, setting out as it does the correct legal position in connection with the recording of music, and it is hoped that your readers will take due note of this,

Your own magazine and others have often in the past carried articles on copyright, some more well informed than others, but as is evident from the letter from one of your readers published in the May issue, the position is still not understood either from the legal or moral standpoint. I am therefore enclosing an article prepared by myself which deals with a certain aspect of recording which is known to exist from the admission of many who write to this Society for information and advice, and it is hoped that you will be able to find space for this in a future issue of your magazine. I would mention that the article has been read and approved by an official of the gramophone record industry.

Your co-operation in making known our views would be appreciated.

London SW16 — Mechanical-Copyright Protection Society Ltd

The article sent to us by the Mechanical-Copyright Protection Society Ltd is reproduced in full on page 34.

Amendment

With reference to your article 'Audio View' in the May issue of *ATR*, my Board note that you refer to the decision of this company not to participate in the Audio Fair this year, and you also state that the reason for this was that it no longer benefited us.

I think it would be fairer to the organizers of the Audio Fair to inform you of the reasons behind this decision.

1. We have our own Grundig showroom situated in the West End about two miles away from the Russell Hotel. Here excellent facilities exist for the demonstration of all our products, including the provision of an excellent hi-fi lounge. We consider that these facilities, which are available to the public all year round, provide first-class conditions for judging the quality of our products.

2. We had already reserved considerable space at the International Radio Show, which was to be held at Earls Court in the autumn. Unfortunately, this show has now been cancelled, and we shall now be holding instead a full-scale trade and public exhibition at our London showrooms.

It was entirely because of the above arrangements that we felt it quite superfluous for us to exhibit at the Audio Fair this year.

London SE26 — J. Wagner, Managing Director, Grundig (GB) Ltd

MY FIRST TAPE CAME OUT BACKWARDS

With unusual modesty, I can claim to be a pioneer in making tapes for educational purposes. And by 'pioneer', I mean that I learned the hard way, making all those mistakes that even the most junior member of the Lower Tooting Tape Club would avoid these days. For about three years I worked for a well-known educational organization, and, being an enthusiast in the matter of tape recording, I proposed that we open an 'audio-visual aids department'. My chief, realizing that the quickest way to peace and quiet was ready agreement to my suggestion, gave me his blessing. But he added that I would have to *prove* the value of educational tapes before the Powers That Be (i.e. the management committee) would give permission to buy recording and dubbing equipment. The first tape was a discussion on the merits of advertising, in which three 'experts' gave their points of view, and I went to Manchester to make this memorable tape. I say 'memorable', because that day was punctuated with disaster – the train was late, I felt sick, and, when I arrived at the offices where the recording was to be made, I discovered that substantial demolition work had just commenced across the road. You could hear the noise the other side of the city.

However, the experts, carrying sheafs of notes, turned up, and we gathered in the Board Room. Then I discovered that there were no power points in the room – all lighting was by sealed fluorescent units, and heating was centrally controlled. We marched around the building, looking in room after room. My Manchester 'helper' – Sidney – made various suggestions, most of which made matters worse. He had, for example, suggested that I use *his* tape recorder, which had recently been serviced, and was, he said, in wonderful shape. It was, however, a very substantial machine, and I soon wearied, wandering around the building, demolition noises crashing and thundering off, looking for a power point. But we made the recording in a room on the ground floor, although, on return home, I had to go to bed for a few days. Severe nervous strain, the doctor suggested. This was probably 'shock', caused by the discovery that the recorder so generously provided by Sidney was an early Grundig with non-standard tracking. In short, playing the tape back on any other machine produced a wonderfully clear signal . . . *backwards*! Eventually, some kind friends in the Nottingham Tape Club managed to produce one or two copies for standard playback, but this was a complicated matter. As they said: 'You're bound to lose quality doing *that*!'

That early traumatic experience gave me a new confidence, however, summed up in a tape adaptation of the Boy Scout motto, 'Be Prepared for anything – if it can go wrong, it will!' For example, I discovered that, however much you explained the necessity for a convenient power point, information regarding voltages, etc, and, above all, relative quiet, people often missed the point. I remember making a tape in a splendid conference room in the centre of London – a luxurious place in the offices of a newspaper. The only problem was the clock set in the wall. It gave a slow, deep, thoughtful 'tick . . . tock . . . ' which came out, as clear as Big Ben, on tape. And nobody seemed to know how the clock could be stopped. So, as my speakers (humanwise, not stereo) produced their opinions, I stood on a chair, and pressed large sheets of cardboard over the clock, in a not entirely successful attempt to 'smother' its ticking. Every tape had its problems. Borrowed recorders (even new ones) suddenly became temperamental, a forgotten telephone under the table would ring in the middle of the discussion, ambling office girls would crash into the room, having failed to see several warning notices placed on the door outside. Yes, I was a pioneer all right; I knew just what Daniel Boone must have felt like!

The most amazing experience of all took place at Leicester. I had been despatched to a meeting hall to record a conference held by a women's organization. As this hall was being painted in a ghastly yellow (enough to make any recorder go haywire) I realized that this wasn't a good omen. Then I had to move a substantial quantity of folding chairs to reach the power point. Eventually, when the conference began, I regained a little confidence when the most terrible noise came from outside. A large number of heavy-booted schoolboys crashed their way upstairs and into the room above us. They were on some kind of tour, and a meal was being provided for them at the hall. Most of them appeared to stamp their feet on the floor with every mouthful. It was like trying to record poetry in the middle of a herd of stampeding buffalo. The ladies did their best for me, of course, talking at the tops of their voices. Indeed, this may have unnerved them, because an argument broke out, some of the members accusing others present of 'incompetence' and 'apathy'. So, when I came to the end of the LP tape, I quietly packed up, and crept away. But we were able to use that recording, much to my surprise. One person asked me how I'd managed to get the special sound effects.

And one or two people commented that the tapes I made were so much clearer than others borrowed for educational work from other organizations. Heaven knows what problems those other organizations must have faced . . . ! Yes, I've often thought that overcoming the problems in getting those tapes completed might have been worthy of a Duke of Edinburgh award (with proper respect, of course!). They also serve who only stand and tape . . .

D. Lazell

STEREOPHONIC BROADCASTING

H. Burrell Hadden traces the development of modern stereo broadcasting systems

Stereophonic disc and tape records have become increasingly popular in the last few years, and I understand that the sales of stereophonic discs of serious music are now as great as, and in some cases more than, those of monophonic recordings. All this is as it should be, since there can be no doubt that a good stereophonic recording must be better than a good monophonic one of the same performance. This increasing interest in recorded material makes it more imperative that stereophonic broadcasting should quickly become a normal part of domestic entertainment. For some time all the radio organizations in the world have been working towards this end, and in the USA stereophonic broadcasting has been an accepted thing for over four years. At the time of writing there are over four hundred stations broadcasting stereophony in that country. The system used was chosen after an exhaustive series of tests carried out by the Federal Communications Commission (FCC), the body controlling all broadcasting in the USA.

In Europe, the start of regular stereophonic transmissions has not been as rapid. It is obviously very desirable that, if it is at all possible, all the different countries of Europe should use the same transmission system, so as to make the interchange of programmes easier, and to enable the receiver manufacturers to make a standard type of circuit which will operate in all countries, thereby reducing the cost. The two bodies responsible for the co-ordination of ideas and techniques in European Broadcasting are the European Broadcasting Union (EBU) and the International Radio Consultative Committee (CCIR), and these bodies have also been studying all the available transmission systems in order to discover which would be the best for use in the crowded conditions on this side of the Atlantic. So far, no final decision has been reached, but of the many systems considered the American system, known as the General Electric/Zenith, or 'pilot tone' system, is the most favoured. Pending a final decision, however, it seems unlikely that there will be any general commencement of regular stereophonic broadcasts in any of the member countries of these organizations. The BBC in this country has officially recognized the advantages of stereophonic sound, particularly in the field of music, and has said that it will start a service when a suitable system has been agreed. In the meantime it is continuing with its experiments with the pilot tone system, and building up the very necessary expertise in the studio. Other countries, notably Western Germany and Holland, have gone rather further with regular daily experimental transmissions, and in Holland these are announced in the weekly radio journals, stereophonic transmissions in normal programme hours being marked with a large, unmistakable 'S'. These countries are both using the pilot tone system, and in Holland it is now possible to have a choice of two different stereophonic broadcasts taking place at the same time.

Before describing the 'pilot tone' system in detail, it may be appropriate to go over briefly the various other systems which have been proposed for stereophonic broadcasting in the past. In the earliest experiments, which, incredibly enough, took place in the early 1920s, two complete medium-wave transmitting systems were used, with one channel on one carrier and the other on the second. This system gave fairly good results on headphones, using the simple omnidirectional microphones then available, but it must be remembered that the basic work on microphone technique was not carried out until some ten years later. It was this system, using two complete transmitter chains, that the BBC adopted when they recommenced experimental transmissions in 1958. Whilst this system can give excellent stereophonic reproduction, a broadcasting organization has also to consider the many monophonic listeners to the programme, and if the stereophonic listeners are to hear good stereophony neither channel alone will give an acceptable sound for the monophonic ones. It is, of course, possible to degrade the stereophonic signals so that both classes of listener can receive a fairly good signal, but this cannot do real justice to either. If this system is adopted for stereophony, a third channel would be necessary, carrying the same programme material for the monophonic listener. This would clearly be most uneconomic, both in transmission equipment, and in broadcast channel space.

Various systems have been proposed to overcome this difficulty, so that both stereophonic listeners and monophonic listeners to the same programme can have the best possible reproduction. These are known as 'compatible' systems, and all manage to combine both stereophonic channels on one radio carrier in such a way that the monophonic listener hears the sum of the two channels, a signal which can, in most cases, give perfectly satisfactory reception.

The earliest of these systems, for use on medium wave amplitude modulated transmitters, made use of the fact that AM transmissions produce two 'sidebands', one above and one below the frequency of the carrier (fig.1). In normal monophonic broadcasting both these sidebands carry the same information, but in this system of stereophony one channel was transmitted on the upper sideband and one on the other. The stereophonic receiver could separate the two signals, but the monophonic one merely reproduced them simultaneously. Unfortunately, the system was only capable of mediocre fidelity in reproduction, and so was not adopted.

All the other compatible systems are designed for operation on VHF transmissions, and they all depend on the use of a supersonic subcarrier. The differences in these systems are in the way in which the subcarrier is modulated, and in the way in which the receiver is locked to the transmission. In every case, the main modulation of the transmitter is by the sum of the two stereophonic channels, so the ordinary monophonic listener will hear the compatible programme. The additional information required so that the stereophonic receiver can reconstitute the two stereophonic channels is transmitted as modulation of the subcarrier, and both sets of information, main and subcarrier, can be either of the amplitude or frequency type. So various permutations are possible.

The modulation signal for the subcarrier is, in all these systems, composed of the difference between the two channel signals, so that after the receiver has extracted both the main, or sum, signal, and the subcarrier, or difference signal, these two must be subjected to a further sum and difference circuit in order to extract the original channel signals. If the channel signals are A and B, then the system is:

$$\frac{(A + B)}{2} + \frac{(A - B)}{2} = A$$

$$\frac{(A + B)}{2} - \frac{(A - B)}{2} = B$$

The first system of this type was proposed by Crosby, and in this case both the main and the subcarriers were frequency modulated. Fig.2 shows, in block form, the transmission and receiving schematics.

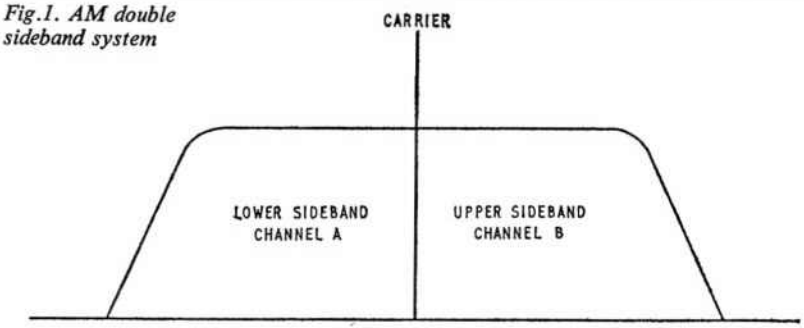
A somewhat different system, using time division multiplex, was developed by Browne, of the Mullard company. At first this might not seem to be a subcarrier system, but in fact it can be considered as such. As proposed, the method employs a high-speed switch, operating at 32 kc/s, which switches first the left, then the right, signals alternately to the transmitter. A monophonic receiver not equipped with a similar switch will reproduce the two signals on its one loudspeaker so rapidly that the listener can hear only one sound, effectively the sum of the two. The stereophonic receiver has a second switch, synchronized with the one in the transmitter, and this directs the left-hand signal to its appropriate amplifier/loudspeaker combination, and similarly the right (fig.3). As mentioned above, it is possible to show that this system is the equivalent of a subcarrier system with the subcarrier amplitude modulated.

The pilot tone system, developed by the General Electric and Zenith companies in the USA, is a variation of the amplitude modulated subcarrier system just described. In this case, however, the subcarrier itself is suppressed, and only the sidebands of the amplitude modulation are frequency modulated on to the main carrier, along with the sum signal (fig.4). The subcarrier in this case is at 38 kc/s, and a pilot signal, from which the system gets its name, is radiated at 19 kc/s so that the receiver circuits can decode the stereophonic signals.

Of all the systems described, the pilot tone system has some advantages, both for the monophonic and the stereophonic listeners. One of the great problems in all the systems is that the signal to noise ratio, for both types of listener, is worsened by the fact that more information has to

(*continued overleaf*)

Fig.1. AM double sideband system



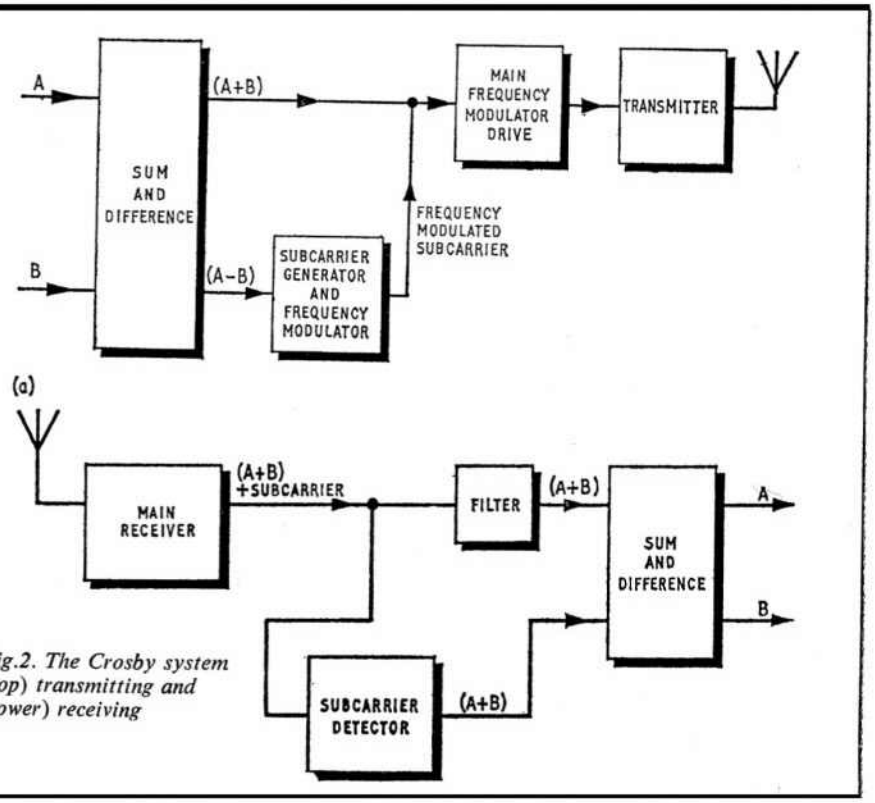


Fig.2. The Crosby system (top) transmitting and (lower) receiving

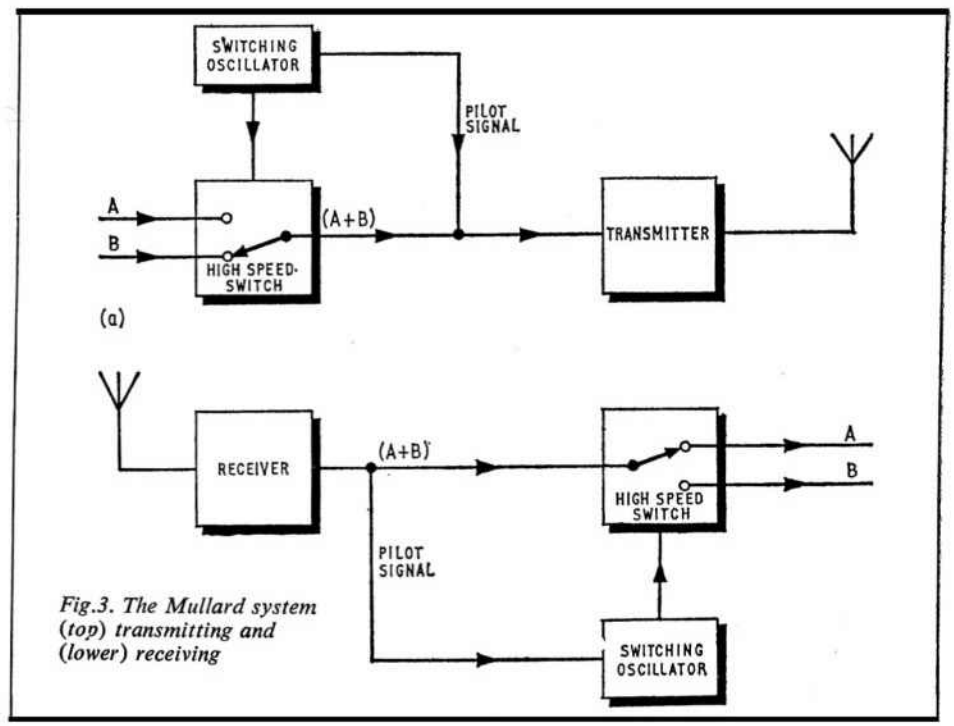


Fig.3. The Mullard system (top) transmitting and (lower) receiving

be impressed on the carrier. In the present case, it has been found that this deterioration is less than in any of the other systems. In fact, for the monophonic listener the degradation may be as little as 1 dB, but on an average 4 dB is more likely. For the stereophonic listener the degradation will be of the order of 15 dB, and in some circumstances this might cause a decrease in the effective service area of the transmitter. However, in most cases, the difference can be overcome with a more sensitive receiver, together with an improved aerial system. This should present little difficulty, since the stereophonic listener, having already spent more money on his extra amplifiers and loudspeakers, would presumably be prepared to spend a little more to achieve satisfactory reception. As listeners who have heard the experimental transmissions on this system carried out by the BBC will agree, the results obtainable are certainly well worth while, and amply justify the added expense involved.

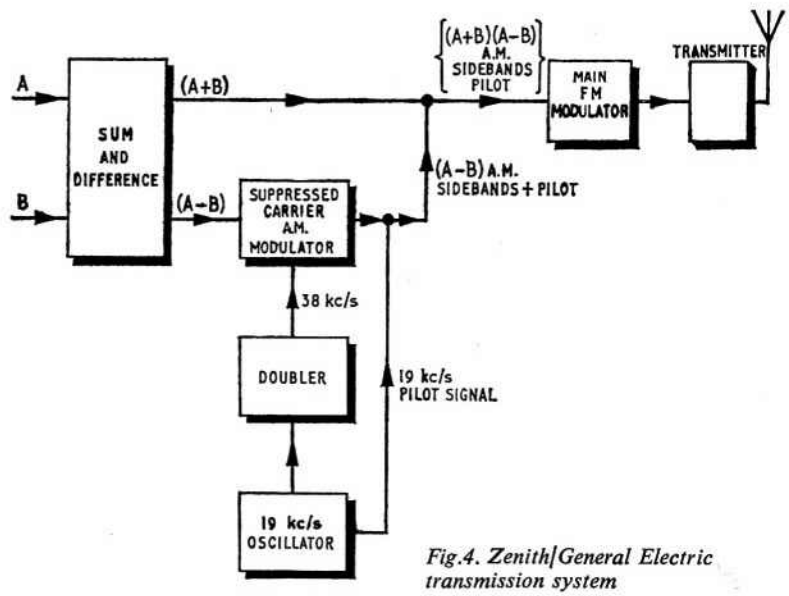


Fig.4. Zenith/General Electric transmission system

RECORDING DIARY

when and where to record in August

Old Customs being observed this month seem to have a special bias towards sound rather than sight, the most obvious example being the National Town Criers' Championship at Hastings (21). The Blessing of the Fishing Fleet at Whitby (29), the Plague Commemoration Service at Eyam (29), and the 'Relief of Derry' pageant at Londonderry (12) are others.

Aviation takes a bow this month with two famous air races. The Middleton St George Air Races (6, 7) cover an 81-mile circuit, starting and finishing at Middleton St George, while the celebrated King's Cup Air Race takes place at Bagington, near Coventry (20, 21).

Highland gatherings should provide the focus of attention for recordists in Scotland. The MacLeod Parliament at Dunvegan Castle, Skye (29 July–3), the Clan MacPherson Rally at Kingussie and Newtonmore in Inverness-shire (6–8), the Highland Games at Edinburgh (21), and the Cowal Highland Gathering at Dunoon (27, 28) should provide a good skirl of the bagpipes.

Engines ancient and modern can be heard at a number of centres throughout the country. The Bank Holiday car race meeting at Brands Hatch (30), the Ulster motor cycle Grand Prix at Dundrod (7) and the International Hutchinson 100 races at Silverstone (14) provide the internal combustion noises, while the National Traction Engine Club Rally at Witney (21–22) should produce engine sounds reminiscent of a more bygone day.

Carnivals are still with us. This month it's the turn of Canterbury (6), Dover (4), Herne Bay (12), Lytham St Annes (21–28), Mitcham (12–14), St Neots (23–28), Southend (14–21), Southwold (4), Totnes (29–4 September), and Weymouth (18).

Son et Lumiere at Southwark Cathedral continues throughout the month, to celebrate the diamond jubilee of the diocese and the Cathedral. This is a 60-minute production entitled 'The Four Seasons', and traces a history studded with historical figures including Thomas à Becket. The programme is recorded on twelve-track tape, of which only six tracks are used – two for stereo sound signals, one for special sound effects, and three control the lighting control relays. This is the only Son et Lumiere display scheduled for showing in London this year, and is well worth a visit.

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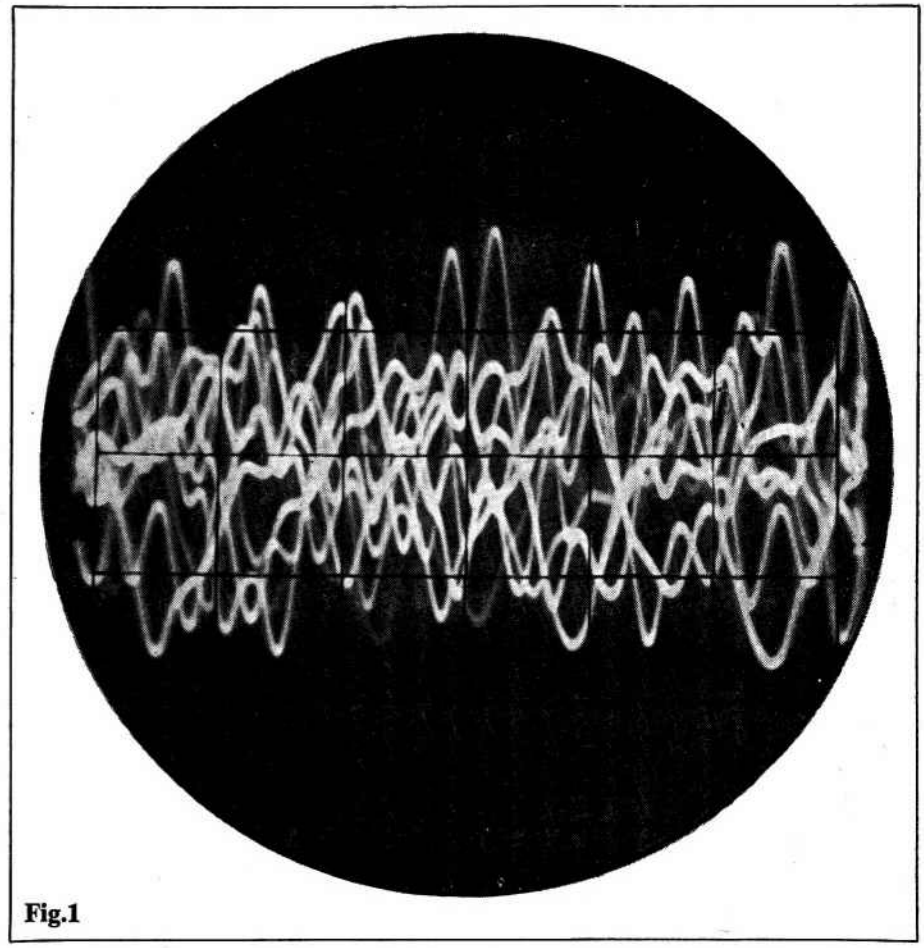


Fig.1

HOW A VIDEO CAMERA WORKS

Gordon J. King

Most of us have a good idea of how the microphone works. We know that the sound waves impinging upon its diaphragm give rise to a very small electrical voltage, the nature of which varies in sympathy with the sound waves. The microphone, in fact, translates sound waves to equivalent electrical waves. The microphone, then, is a 'transducer', as is a loudspeaker, the latter translating the electrical waves back to sound.

The electrical waves generated by a microphone are very weak, and they need to be greatly amplified before they can be applied to the record head of a tape recorder. As a matter of interest, an oscillogram of the electrical waves produced by music from a microphone is shown in Fig.1. This shows the very complex nature of the waves.

Now, when we go into video – which will not be very long, I am sure – we shall be dealing with an entirely different sort of waveform. Here, as well as a microphone in front of us, we shall have a television camera. The television camera is the visual equivalent of the microphone, but its method of working is much more complicated.

The Vidicon

A television camera has in front of it a lens system – just like any ordinary camera for that matter. The image of the scene it 'sees', however is sharply focused on the screen of what is called a 'camera tube'. There are several types of camera tube, but the type that we shall be mostly concerned with is called a 'Vidicon'. In some ways the Vidicon is like the picture tube used in television sets. It works the opposite way round, though. That is, it is not designed to produce pictures from a video signal, but it is arranged to produce a video signal from a picture. Audiowise, we have the microphone and loudspeaker analogy. The diameter of the Vidicon tube that we shall be using is only 1 in, while, as we know, the diameter of a picture tube screen may be as large as 28 in.

The camera tube thus provides the picture information which is required by the video tape recorder, the same as the microphone provides the sound information which is required by the sound tape recorder.

It is far easier to translate sound waves to equivalent electrical signals than it is to translate pictures in a similar manner. Sound can be followed completely with time. The horizontal axis of the waveform in Fig.1, for instance, is based on time, and the ears follow this changing waveform.

Unfortunately, a picture needs to be broken down into very small component parts for translation to equivalent electrical signals. At this present stage in the art it is not possible to secure electrical representations of complete pictures.

Each picture, then, needs to be broken down to very small elements of an electrical nature. This is done by the camera system. The camera tube by itself cannot do this. It needs other things to work in conjunction with it, as we shall see, the whole being called the 'camera system' or simply 'television camera'.

Electron gun

Before we go on to investigate the television camera as a whole, let us look in a little detail at the camera tube. This comprises three main

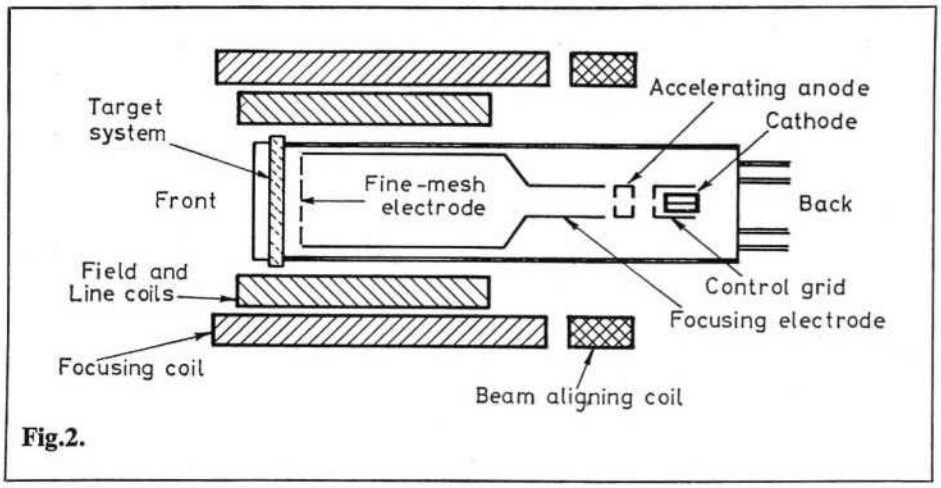


Fig.2.

Fig.1. Waveform of music. See how this differs from the video waveform.

Fig.2. Details of the Vidicon camera tube.

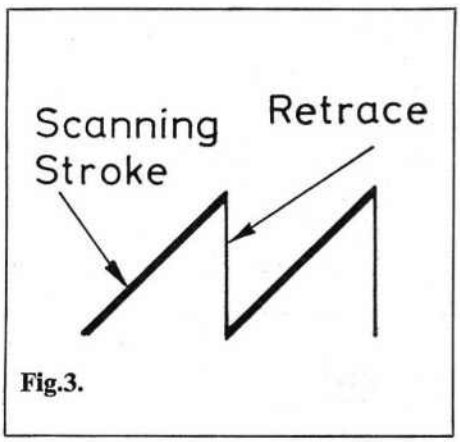


Fig.3.

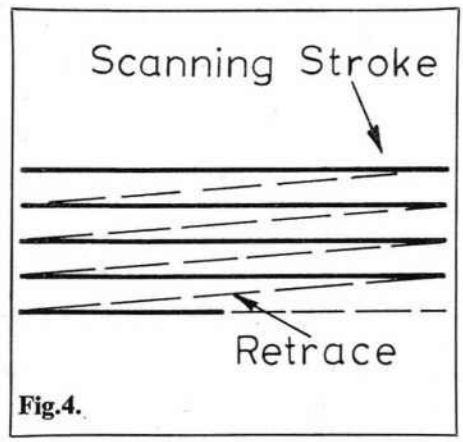


Fig.4.

Fig.3. This nature of sawtooth current is required in the line and field scanning coils to deflect the electron beam horizontally and vertically.

Fig.4. This section shows how the target area is scanned by the electron beam.

elements. There is the 'electron gun', the beam scanning system and the so-called 'target area'. These are shown in the diagram in Fig.2.

The electron gun, as its name implies, produces a stream of high-velocity electrons. This it does by virtue of a heated cathode and accelerating anodes. There is also a control grid and a focusing electrode in the gun assembly. The former brings the beam of electrons to a fine point of focus on the target area, while the latter controls the density of the electron beam, rather like the control grid of an ordinary thermionic radio valve controls the density of electrons passing from cathode to anode.

The scanning system deflects the electron beam both horizontally and vertically so that the beam is caused to 'scan' the whole of the target area, akin to the manner in which the screen of the picture tube is scanned by the scanning spot produced by the electron beam in this component.

In effect, the principles with regard to scanning are virtually the same as in the picture tube. There are one or two differences in detail, as would be expected. One is that at the end of the cylindrical focusing electrode there exists an electrode made of fine wire mesh, the purpose of which is to retard the beam electrons.

Scanning action

The scanning system consists of two sets of coils, called the 'field coils' and the 'line coils'. Current of a sawtooth waveform is passed through these coils and this changes the magnetic field through them. As revealed in Fig.2, these coils are placed round the tube, the effect being that the changing magnetic field influences the electron beam. Actually, the beam can be considered as an invisible conductor passing an electric current. The magnetic field of the field and line coils acts on the magnetic field of the electron flow and causes deflection of the beam. The coils are so arranged that the beam is deflected vertically by the field coils and horizontally by the line coils. What happens is that the beam is deflected from the left to the right of the target area as the current in the line coils rises up the sawtooth waveform, while simultaneously it is deflected from the top to the bottom of the target area as the sawtooth current in the field coils rises.

At the end of each deflection (line and field scan) the current in the coils rapidly collapses, an effect which causes the electron beam speedily to return to its starting position to commence the next scan (see Fig.3).

The line scan occurs much more quickly than the field scan. On the 405-line system there are 10,125 line scans per second and 15,625 on the 625-line system. In both systems, however, there are 50 field scans per second. One reason for the use of this figure is that it corresponds to the frequency of the mains supply in Great Britain. It is possible to employ a different field frequency, but then interference between the field and mains frequencies can cause a kind of ripple on the picture due to beat interference. Getting rid of all residual mains hum can, however, eliminate this.

Since the electron beam is being deflected both vertically and horizontally at different speeds, it follows that it will trace a number of lines over the target area, as shown in Fig.4. The target area is then said to be 'scanned' by the electron beam.

The number of lines is equal to the line scanning frequency divided by the field scanning frequency. Thus, at a line frequency of 10,125 c/s 202½ lines are traced and at 15,625 c/s 312½ lines. In a normal television system there are two frames each made of half the number of lines of a complete picture. These two frames are then 'interlaced' to give a complete picture, one every twenty-fifth of a second. Thus, a complete picture is made up of twice the number of lines as computed above – 405 lines at a line frequency of 10,125 c/s and 625 lines at a line frequency of 15,625 c/s.

Random interlace

A system of 'random' interlace is generally used by the closed-circuit TV and video tape enthusiast. This means that some of the lines of one frame of a picture may not exactly interlace with the lines of the partnering frame of the same picture. The full 405 or 625 lines may not then be utilized since some of the lines of one frame may 'pair' with the lines of the other frame. This, however, is rather a technical problem which need not bother us at this stage in the art. More will be said about line pairing and so forth in later articles dealing with video.

To clear up a couple of points with regard to Figs.2 and 4, it should be noted that the electron beam is generally suppressed by a negative potential being applied to the control grid of the gun assembly during the retrace period, and that additional items like a focusing coil and beam aligning coil are used in conjunction with the camera tube. We need not concern ourselves with these items right now, but reference will be made to them in future articles.

(continued overleaf)

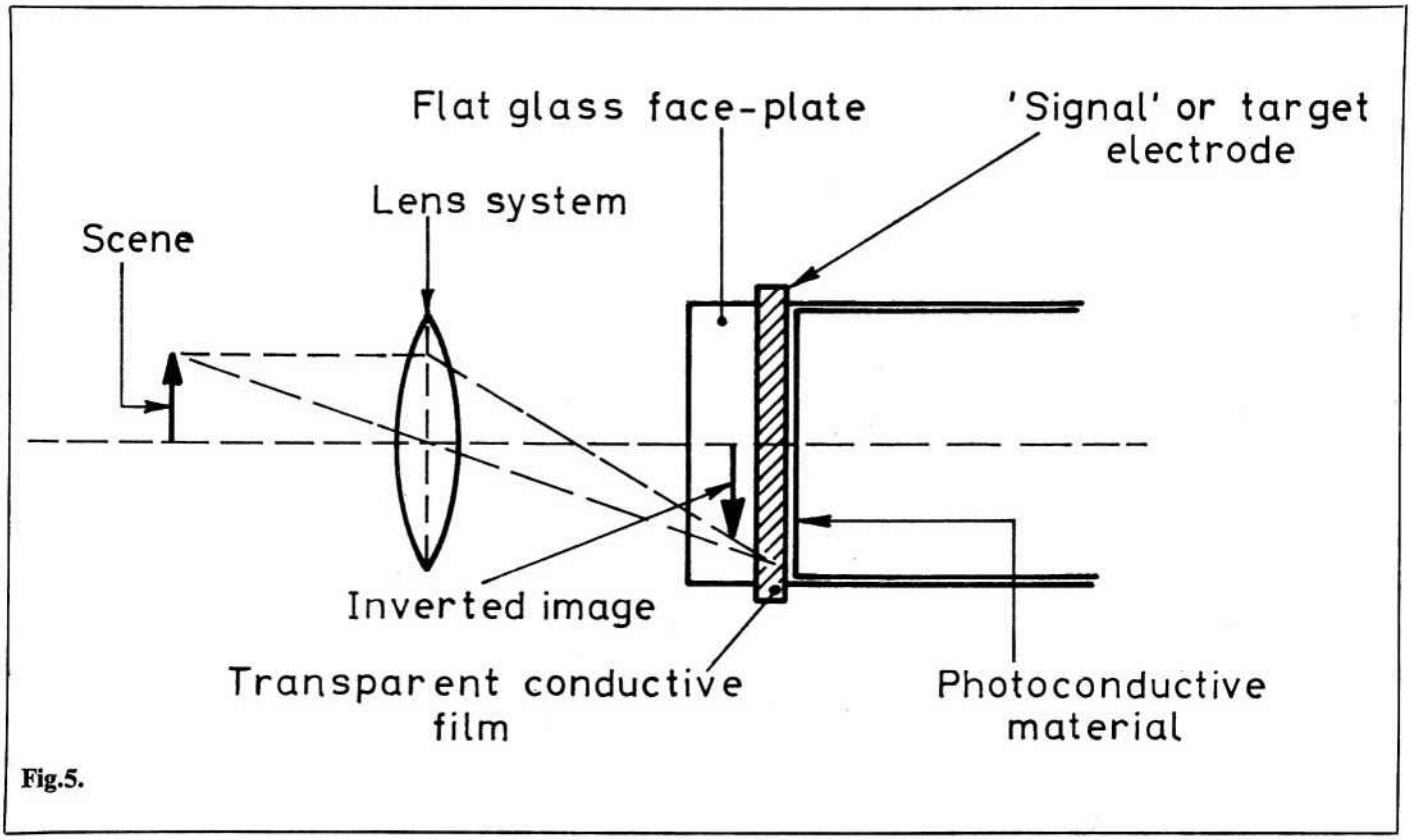


Fig.5.

How a Video Camera Works (*continued*)

So much, then, for the electronics of the camera tube. Now let us have a look at the optics. Fig.5 shows that the scene to be televised is focused by an ordinary camera lens system on to the front of the target area. The target area has an image of the scene upon it and this complete scene is scanned by the electron beam. This is the fundamental action of the camera tube. Now, how, then, does the camera tube translate the image of the scene to electrical signals?

This is done by the photoconductive material comprising the target area. The photoconductive material has many of the characteristics of a light-dependent resistor (LDR). That is, its electrical resistance is very high when the intensity of light falling upon it is low (it then has what is called 'dark resistance') but decreases as the light intensity increases.

RC elements

Owing to the scanning action by the electron beam, the photoconductive material is effectively broken down to form a very large number of very small resistive elements, across each of which is a capacitance formed by the photoconductive material itself as one plate and the transparent conductive film as the other plate, as revealed in Fig.5.

The target area can be considered to be a large number of very small LDRs in parallel with small capacitances. One side of each combination is, of course, commoned to the target electrode. The other side of each combination is effectively open-circuit until the electron beam comes into play, as we shall see.

It has been shown that the electron beam closely scans the whole of the target area. This means that each RC element is connected to the electron beam in turn. Since the beam consists of electrons, it is a conductor of electricity, so that when it falls upon an RC combination the capacitance C of the combination is caused to acquire an electric charge. The charging circuit is from the positive side of the target potential through the load resistor, through the electron beam, through the electron gun of the camera tube and back to the negative side of the target potential. This is shown in Fig.6.

Since the C element of the combination has a value of resistance across it, it will commence to discharge as soon as the beam leaves it. Now, when the beam again arrives back at that particular RC combination, after it has scanned the remaining combinations, the charge on that C element will be restored. This will cause an instantaneous flow of current through the load resistor, of a magnitude depending on just how much charge was lost when the beam was not in contact with it.

The charging current results in a video voltage being produced across the load resistor, and this is conveyed from the camera tube via the coupling capacitor.

The amount of charge lost from one C element during the scanning process depends upon the value of the R element effectively connected across it. This, then, depends upon the amount of light falling upon the target area. Let us suppose that light is cut off from the photoconductive layer. The R element of each RC combination would then be at a high (dark) resistance. Little of the initial charge across each C element would thus be lost during the scanning process, and there would be only a small voltage developed across the load resistor.

Conversely, a great deal of light falling on the photoconductive layer would cause the resistance of each effective R element to fall. The C elements would then speedily lose their charge and a greater video signal voltage would appear across the load resistor.

Clearly, the voltage across the load resistor is governed by the pattern of illumination falling on the photoconductive layer. The image of a scene focused upon the layer gives rise to a sort of resistance pattern over the layer. This results in different and corresponding discharge rates of the C elements, and reciprocally changing recharge currents through the load resistor.

In that manner, therefore, the image of a scene is broken into very small elements and each element corresponds to a relative value of voltage across the load resistor, governed by the relative illumination, as each element is scanned by the electron beam. An 'electrical picture' is thus obtained as a video signal waveform from across the load resistor.

Video waveform

The video waveform is composed of a series of waveforms corresponding to line scans, as shown in Fig.7. The gap between each waveform is equal to the time taken by the retrace. It will be seen that the amplitude of the waveform elements is a measure of the brightness of the corresponding picture elements; the greater the brightness, the greater the waveform amplitude.

Now, the process is for the changing amplitude of the video signal to cause a spot of light (called the scanning spot) on the screen of the picture tube to change accordingly in brightness. This is achieved by the video signal varying the bias on the control grid of the picture tube. We shall see in future articles exactly how this is performed.

To reproduce the image of the scene falling upon the photoconductive layer, however, it is necessary to cause the electron beam in the picture tube to be scanned in exact synchronism with the electron beam in the camera tube. The changes in scanning spot illumination will then build up the picture in terms of variations between black and peak white on the screen of

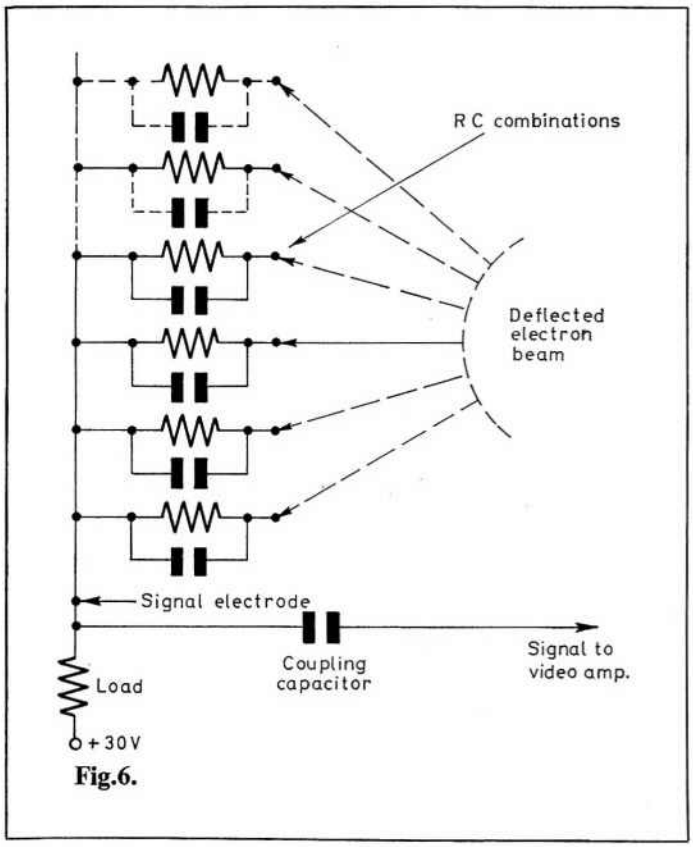


Fig.6.

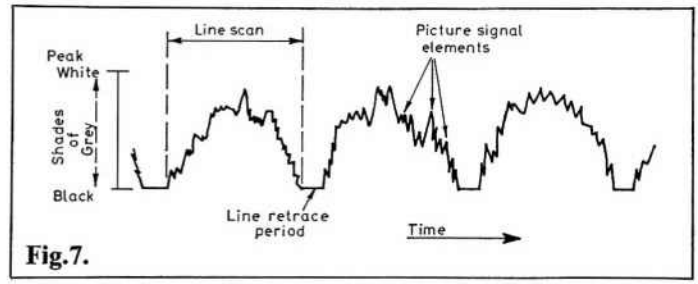


Fig.7.

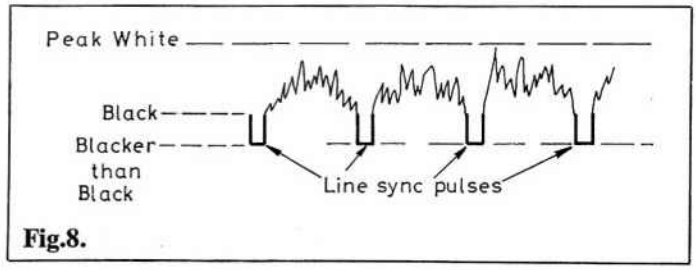


Fig.8.

Fig.5. Details of the target and optical system of the Vidicon camera system.
Fig.6. The photoconductive material consists in essence of a large number of RC elements, the R parts of which are light dependent in value.
Fig.7. Three line scans of video waveform.
Fig.8. This diagram shows how the sync pulses are added during the line retrace period to the waveform.
Fig.9. (below). This television camera kit is marketed by Beulah Electronics.

the picture tube.

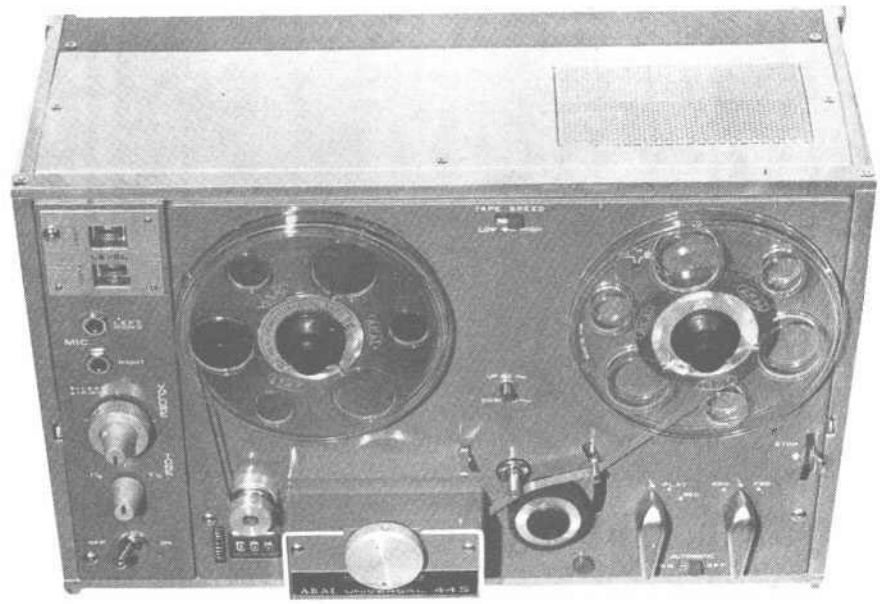
To hold both the camera tube electron beam and the picture tube electron beam in exact step with each other, synchronizing pulses are superimposed upon the video waveform during the line retrace periods, as shown in Fig.8. Similar pulses in the form of a train are superimposed on the overall video waveform after each frame.

The line and field sync pulses serve to instigate the retrace period of the current waveform in the scanning coils associated with the picture tube, at the receiving end. In this way it is ensured that each line and field scan at the receiving end commences at exactly the same instant as the corresponding scans at the camera end. The scans are thus held in step.

The sync pulses are produced by special generators in the camera system, but these need not bother us at this moment. We shall see in future articles how the sync pulses are produced and exactly how the picture is built up on the screen of the picture tube.

This article has shown the form of signal delivered by the camera tube and camera system and how it is derived. In an ordinary television broadcasting system the video signal is caused to modulate a carrier wave. In a closed-circuit television system it is fed to the display screen or tape recorder through cables, while, as far as video tape recording is concerned, the video signal is used to produce a magnetic pattern on the tape oxide.

Video tape recording is that much more difficult than ordinary sound recording for several reasons, one of which is that to preserve the square- and transient-wave nature of the picture signal elements of the video waveform, the record system has to handle signal frequencies well above the audio spectrum, up to 3,000,000 c/s (3 Mc/s) or even higher for very high quality pictures.



AUDIOVIEW

AKAI 44S

Gordon J. King examines the circuitry of the Akai 44S and puts the machine through its paces

First opinions on this remarkable tape recorder could be somewhat inconsistent depending on whether an initial study is made of the circuit and electronics or whether operations are commenced by listening to the performance and then running through a test procedure. Nevertheless, there is not a great deal of doubt about second opinions.

Whatever scheme is adopted, however, it is proper to make a close study of the instruction book before plugging the instrument to the mains supply. This, then, leads naturally to a perusal of the circuit, especially when this is contained in the instruction book, as it is with the 44S.

The 44S is a fully-fledged stereo tape recorder on the high side of the price scale. It features a matched pair of isolated audio channels and a single, inbuilt monitor 5 in speaker. On the face of it, the amplifier circuits look quite ordinary and a little out of place in an instrument which sells for 107 *gns.*

Each channel (for record plus playback) uses a pair of valves. And there is a 6AR5 pentode which serves as bias and erase on both channels. This adds up to five valves in all. Not bad for a high-quality stereo tape recorder capable of delivering 3 watts maximum of audio in each channel! Simplicity in the amplifier seems to be the key-note. A very successful one at that.

In each channel the first valve is a 12AX7A, double-triode, and the second a 6BMB, triode-pentode (this is incorrectly drawn as a double-pentode in one channel of the circuit diagram).

The first triode is used only on playback as the head amplifier. The second triode is the microphone amplifier and the second amplifier on playback. The third triode is common to both record and playback and feeds the pentode valve. This latter is the playback output and, curiously, the record output as well.

Record Head Feed

This method of feeding the record head is not very often practised nowadays, although I recall using the technique in conjunction with an early Ferrograph tape deck way back in the 'fifties. The idea is to connect the head from the anode of the output valve via a resistor and/or resistor-capacitor combination. The arrangement utilized in the 44S is shown in Fig.1.

Here it will be seen that the audio 'record' signal is fed from the anode (from across the primary of the ordinary output transformer) of the output valve, via C1, C2, R1 and R2 to the record head. Hf bias is fed to the head direct from the anode of the oscillator, via C3. Record equalization is accomplished partly by frequency-selective negative feedback and partly by the feed network to the record head. R1 provides constant-current recording, while C2 across it gives a lift of record current at the treble end of the spectrum. Normal bass boost is secured by the negative feedback ratio decreasing with decrease in frequency, thereby giving a greater effective gain with falling frequency. The feedback components are C4, C5 and R3, and the feedback from the output stage is taken back to the cathode of the triode af amplifier prior to the output valve. Both channels are the same.

There are twin VU meters, one for each channel. These are illuminated when the machine is switched on. They consist of moving-coil movements fed from the secondary of the ordinary output transformer through a simple rectifying circuit consisting of a semiconductor diode and normal resistors. There is an indication at zero VU.

Equalization on playback is accomplished by a simple, treble-cut tone control in the first triode section which serves as the playback head amplifier. The control is nothing more elaborate than a variable resistor connected in series with a 5,000 pF capacitor between the anode circuit of the head amplifier and chassis. It employs two ganged elements, catering simultaneously for each channel.

The scale is in terms of tape speed. In practice, then, it is adjusted to coincide with the velocity of the tape in use. This is not really such a bad idea, since it does permit a realistic

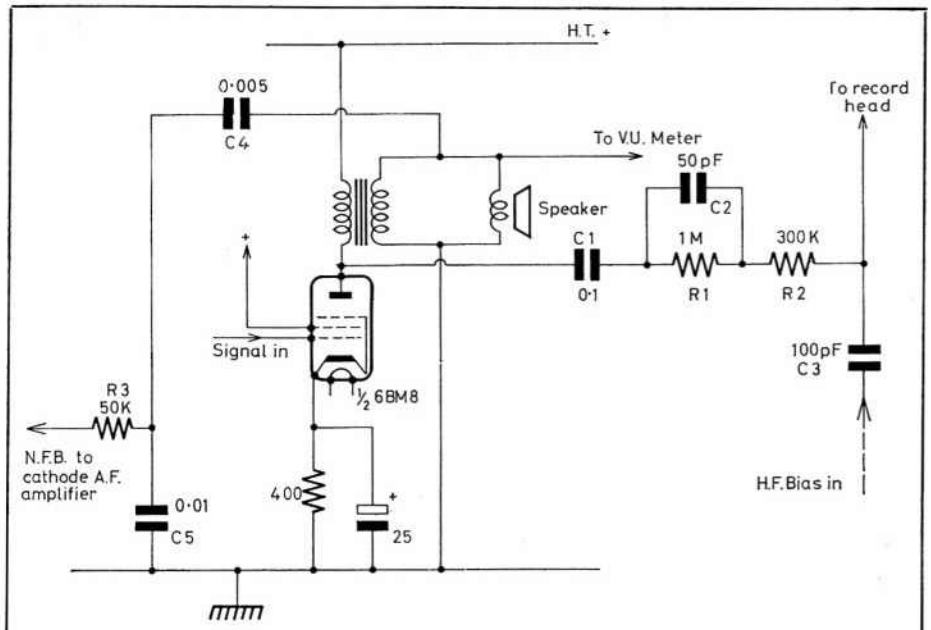


Fig. 1: Circuit diagram of replay and record output stage. This is fully explained in the text.

adjustment to be made to the playback equalization characteristics to suit the way that the tape has been recorded.

The usual arrangement, of course, is for fixed or preset playback equalization, sometimes adjustable automatically by the tape speed. The ordinary tone control system then adjusts for room acoustics and any shortcomings in the recording.

The 44S has no ordinary tone control system, so a slight up or down adjustment either side of the speed to which the control is set keeps any response alterations necessary within sensible range of the correct equalization.

Speeds and frequency range

The instrument employs a very fine record/playback head to give mono or stereo four-track recording. It can thus playback mono four-track, mono two-track, mono single-track, stereo two-track and stereo four-track. It accommodates three tape speeds, 7½ in/sec, 3¾ in/sec and 1⅞ in/sec. Within ± 3 dB the overall frequency range is from 40 c/s at all speeds and up to 14,000 c/s at top speed, to 8,500 c/s at intermediate speed and up to 4,500 c/s at the lowest speed.

The amplifier has jack pairs for two inputs, for extension speakers and for high-level signal output. There is also a jack which will accommodate a pair of stereo headphones for personal listening.

One input is for microphone at an impedance between 10 k and 50 k. Dynamic (moving-coil) microphones with matching transformers are recommended and supplied with the recorder.

The other input pair is for a high-level signal (between 0·5 and 1 volt required for OVU record level) across a high impedance (in excess of 1 megohm). This input will accept the signal direct from a piezo type pickup and provided the output is in the order of 500 mV full recording drive is obtained, both mono and stereo.

By the use of a pickup of this kind, therefore, it is possible to record from mono or stereo disc records without equalization, having in mind that a piezo pickup when loaded into a high impedance provides a signal which is automatically equalized.

A magnetic type of pickup, on the other hand, cannot be applied direct to this input, as this type of pickup demands an equalizing circuit and the output voltage, in any case, is well below that required for full drive. This sort of pickup thus calls for extra equalized amplification. However, the microphone input could be used with a signal source of much lower level provided it would work into a load in the order of 10 k.

The 'stereo headphone' output is arranged for a low impedance headset. It picks up signals simultaneously from both channels at the secondary of the output transformers and feeds them to the jack through 100-ohm resistors.

Monitoring Facilities

The 'extension speaker' outputs are connected across the secondary of the output transformers, and since these transformers are in action during a recording session, the outputs can also be used to take a pair of monitor headphones – mono or stereo. However, in this application it is important not to load the transformers with a low impedance to avoid reducing the record current (in the record head). High impedance magnetic or ceramic headphones are recommended.

The monitor speaker in the recorder is fundamentally across the left-hand channel, but it can be switched on and off as required. Thus, by plugging a speaker into the right-hand speaker jack socket, a stereo tape record can be played by using the monitor speaker for the left-hand channel and an extension speaker for the right-hand channel. Best reproduction and stereo effects, of course, are obtained by the use of a pair of matched speakers, with the monitor speaker muted.

The high-level signal output ('line out') is taken from across a 100 k resistor in a resistive potential-divider at the grid circuit of the output pentode. The other element is valued at 250 k. The signal level at this point is thus quite high and is equalized. This means that it can be applied direct to a high-level input on a hi-fi amplifier, via screened cable. The signal is, in fact, sufficiently strong to feed direct to the input of most power amplifier sections of hi-fi amplifiers without the need for a control unit or preamplifier.

Track selection

The 'track selector' switch is located at the top of the head assembly. It has three positions, giving tracks 1–4, stereo and tracks 3–2. Mono is recorded in the track sequence 1, 4, 3 and 2, while stereo uses the two channels given by tracks 1 and 3 and by tracks 4 and 2.

Frequency checks performed on the amplifier revealed that the overall response is from about 30 c/s to 17 kc/s, dropping a little below 3 dB at the lowest and highest frequencies. This is rather amazing for this kind of amplifier, but is attributable to excellent design and the use of rather special output transformers.

The total harmonic distortion (at 1000 c/s) at 3 watts (per channel) is about 3 per cent, dropping substantially below this level at smaller outputs. The distortion (amplifierwise only) to the high-level output is less than 1 per cent.

The 44S is designed for either horizontal or vertical use, the controls and jacks being well placed for operation in either position.

The machine features a three-digit counter for tape position indication and resetting to zero is by an edge-operated knob.

A single, heavy-duty ac motor is employed for all functions. This is switchable in terms of both speed and frequency, the former by the switching of windings and the latter by a switch which alters the phasing capacitor.

The low speed is given by the motor switched to 'low', the intermediate speed (3¾ in/sec) is given by the motor switched to 'high', while 7½ in/sec is given by the use of a capstan sleeve with the motor switched to 'high'.

Tape speeds were measured and found to be pretty well exact, and there was no apparent reduction in speed when the mains supply voltage was dropped about 10 per cent from the set value.

A massive capstan flywheel coupled with very good mechanical engineering holds the wow and flutter to within the specification figures of 0·15 per cent at 7½ in/sec, 0·25 per cent at 3¾ in/sec and 0·35 per cent at the lowest speed.

It would not seem a difficult matter to arrange for the machine to give a tape speed of 15 in/sec, should the improved top response and the reduction in wow and flutter ever be needed, simply by the use of a larger diameter capstan sleeve. (The 44S uses a similar deck to the model M8 and a capstan sleeve and pinch wheel for 15 in/sec are supplied with the M8.)

Rewind time on a 50 c/s supply is about 90 sec (quoted at 75 sec on a 60 c/s mains supply, but not tested) relative to 1,200 ft of tape.

Auto shut-off

The tape deck features an instant stop level and a switchable automatic shut-off switch. The former releases the tape from the capstan drive while the motor is running, and is useful for setting record levels prior to actually making a recording.

The latter takes the form of a lever which operates a micro-switch, the switch being in the 'on' position when tape is running under load via a roller at the end of the lever. The micro-switch is in series with the mains input to both motor and amplifiers. It opens at the

(continued overleaf)

NEW PRODUCTS

AUDIOVIEW

A look at some of the latest additions to well-known ranges of audio equipment

New Metrosound stereo amplifier
Just announced by Metrosound is their new MST 15 solid-state all-transistor amplifier. Capable of producing 15 watts per channel, the amplifier is based on a design by Mullard and uses the pi-mode class AB system. Specification of the MST 15 is as follows:
Selector switch 4 positions
Sensitivity–Magnetic pick-up 2 mv at 1 Kc/s.
Crystal pick-up 500 mv (source capacitance 500 pF)
Radio 100 mv.
Tape 100 mv.
Pick-up correction RIAA Standard.
Inputs Magnetic pick-up; crystal pick-up; radio; tape.
Outputs Loudspeaker; tape.
Hum and noise 68 dB below full output on radio and tape; 56 dB below full output on pick-up inputs.
Cross-talk Better than −55 dB at 1,000 c/s.
Output impedance Less than 0·2 ohms over the frequency range of 30 c/s to 10 Kc/s.
Output stages 2 × AD 140s in class; AB pi-mode in push-pull.
Output rating 15 watts per channel into a 15 ohm load (inductive); 20 watts per channel into a 3 ohm load (inductive)
Tone controls – bass +12 dB to −13 dB at 100 c/s; +8 dB to −12 dB at 10 Kc/s.
HF filter Enables steep cuts at 8 Kc/s, 12 Kc/s or 20 Kc/s.
LF filter Enables steep cuts at 20 c/s, 40 c/s or 80 c/s.
Mono/stereo selector Normal stereo A–B; mono; reversed stereo B–A. (In mono position the two inputs are coupled in parallel.)
Further details of the MST 15 are available from the Metrosound Manufacturing Co Ltd, Bridge Works, Wallace Road, Canonbury, London, N1.

Stereo amplifier with decoder
The Dualtone Electra 2000, which has been under development for the past year, is a stereo amplifier which incorporates an automatic stereo decoder for the reception of stereo multiplex broadcasts.
Designed to operate in conjunction with the Dual 1009 turntable and CL3 speaker system, the Electra 2000 incorporates a variety of innovations designed for the connoisseur, and each separate unit has been individually developed. It has FM stage, audio stage, power amplifier, pick-up amplifier, and all specifications and ratings conform to the most stringent demands of the hi-fi enthusiast. Further details from Dualtone Ltd, at 166 Oatlands Drive, Weybridge, Surrey.

Record player amplifier
Those looking for an inexpensive amplifier suitable for building into a record player may be interested in the Adas-

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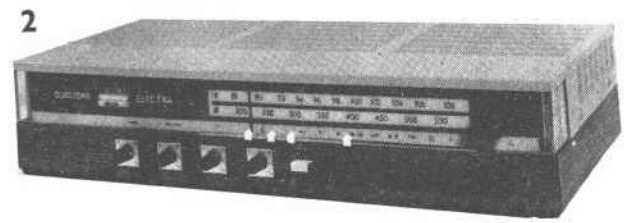
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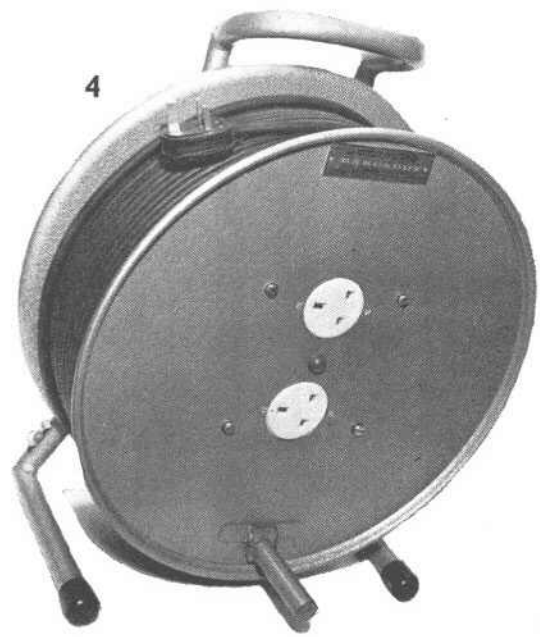
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trette unit. This is a 2–3 watt printed-circuit amplifier which joins the ever-popular Adastra 3·3 audio amplifier, and supplies the answer for the demand for a well-built, reasonably priced and reliable amplifier for the home constructor.
The Adastrette is supplied complete with a control panel (on/off, tone and volume switches) on a flying lead, a colourful self-adhesive escutcheon for achieving a professional finish, and a comprehensive instruction and installation booklet. The two valves are also supplied.
These are Brimar ECL 82 and EZ 80 valves, and the whole amplifier is so presented that the printed-circuit chassis and mains amplifier can be easily removed from the base board for assembly into any size or shape of cabinet.
The Adastrette is fully guaranteed and retails at £3 17*s* 6*d*. Further details from Adastra Electronics Ltd, of 167 Finchley Road, London NW3.

New Marcaddy hand reel

V. L. Martin & Co Ltd, of Witley Works, Southall, Middlesex, announce the introduction of two new open-type heavy-duty hand reels to their range of Marcaddy cable reels.
The two new models are the 15 in 380.SO and the 18 in 460.SO, and have been designed for the user who requires storing facilities for longer and thicker lengths of cable, with no limitations on the number of cores.
Both reels have been designed and finished to a very high standard and have been very finely balanced to facilitate ease of handling. The 15 in model weighs only 14 lb and when carried inclines away from the body. Overall dimensions are 18 × 7½ × 6 in. Reel flanges are sheet metal and can be removed to enable simple cable fitting. A brake is fitted as standard on both models, a neon indicator is visible on the drum and any number or type of socket outlets may be fitted to order.
The 15 in 380.SO will hold from 200 ft ¼ OD to 500 ft of $\frac{9}{32}$ OD cable, and the 18 in 460.SO will hold from 320 ft of ¼ OB to 800 ft of $\frac{9}{32}$ OD cable.
Further details and prices available from V. L. Martin Ltd at their Southall works.

Amendment

In our June issue we referred to the Telefunken M 300 recorder, quoting its price as 59 gns. However the price of this machine was recently reduced to 49 gns. Battery life for this recorder on two hours' intermittent use per day (using standard U2s) is about 17-20 hours.

(1) The new Metrosound MST 15 stereo amplifier. (2) The Dualtone Electra 2000 stereo amplifier. (3) The Adastrette construction kit for building a record player amplifier. (4) The Marcaddy hand reel, showing (centre) neon indicator.

AKAI 44S test report *(continued)*

finish of a tape when the 'hold-on' pressure is removed and thus switches off both motor and amplifiers. This action is common to 'record', 'playback' and 'wind'. When this auto facility is not required, it can be muted by putting the 'auto' switch to the 'off' position.

The recorder was subjected to a series of normal operation tests on both mono and stereo, playback and record, with and without external speakers. It performed one hundred per cent.

Remarkably good quality is delivered by the internal 3-watt amplifiers, and when these were fed to a pair of corner horn speakers in my listening room (lounge!) results were virtually indistinguishable from the domestic hi-fi rig up to levels of about 2½ watts per channel.

The hum level on the test model, however, was found to be a little higher than expected and that is tolerable hi-fi-wise. It could be reduced a little (but not to zero – as discernible) by the 'hum dinger' presets on the amplifier heater circuits.

Motor whine also caused a little trouble at first during the making of stereo tape recordings. This was found to be more of a whistle than a whine, and appeared to develop as the machine got hot. This was no doubt a defect on the test model.

Playback equalization appeared to be to NARTB with the 'tone control' set to the appropriate speed and use of a test tape.

The recorder comes complete with a stereo demonstration tape record which is a most interesting piece of programme material to reproduce. It certainly reveals the stereo effect potential of the recorder to the unconverted! Channel separation was found to be within the specification of 55 dB (measured at 1,000 c/s).

Recordings were made from disc record and microphone without any difficulty whatever. The machine is extremely simple to operate. To sum up, then, the 44S is most definitely a very well designed and engineered piece of equipment. It is the kind of recorder that one likes to show off to friends, knowing full well that it possesses that something extra. It is a recorder that one can really use.

After using the machine for a while, it becomes apparent why the Rank Organization has adopted it in this country, via its subsidiary company, Pullin Photographic Ltd. The Akai is one of a range of fine Japanese models, all handled by this company.

It is built into an attractively finished metal case with lift-off lid. A ventilation fan is located at the bottom of the case, beneath the motor. Accessories supplied with the model are a pair of dynamic microphones, two rubber reel adaptors, splicing tape, a pair of jack-terminated cables, 5 in demonstration tape, 5 in empty spool and three-way mains cable.

Manufacturers' specification

Quarter-track stereo tape recorder. *Speeds:* 7½ in/sec, 3¾ in/sec and 1⅞ in/sec. *Wow and flutter:* Less than 0·15% at 7½ in/sec, less than 0·25% at 3¾ in/sec and less than 0·35% at 1⅞ in/sec. *Channel separation:* Better than 55 dB. *Frequency range:* Within ± 3 dB from 40 c/s to 14 kc/s at 7½ in/sec to 8·5 kc/s at 3¾ in/sec and to 4·5 kc/s at 1⅞ in/sec. *Tota harmonic distortion:* Within 3% at 1 kc/s at OVU. *Power output:* 3 watts per channel. *Level indicators:* Two illuminated VU meters. *Input impedances:* High. *Playback equalization:* By calibrated 'tone control'. *Mains input:* 100/110/120/200/220/240 volts ac, 59 or 60 c/s, switchable. *Weight:* 36 lb. *Dimensions:* 15½ in × 10 in × 8½ in (height, width, depth). *Distributors:* Pullin Photographic Ltd, 11 Aintree Road, Perivale, Middlesex. *Price:* 107 *gns.*

LOUDSPEAKER POSITIONING

D J Barnett advises how to arrange your speakers and furnishings to produce the best audio results

This article is intended to assist the tape recorder enthusiast to get the best possible results from the loudspeaker enclosures, by paying some attention to the positioning of the units and also to the room furnishings where possible. Many of the recommended schemes will prove to be completely impracticable due to other domestic requirements. Doors, windows and fireplaces all add to the complications of designing a suitable layout. If a room is to be used mainly for listening to good quality sound, then the design is relatively simple, but in the average living-room the high fidelity system is just one of many features that must be considered when arranging the furnishings.

The positioning of the speakers will obviously be dependent upon the listening area. Now that central heating is rapidly becoming more common, the listening area no longer surrounds the open fire and, consequently, layouts can be more flexible. For mono use, when only one speaker cabinet has to be positioned, the problems can usually be solved easily. In the past it has been very popular to utilize a corner of the room in order to direct the sound waves into a more narrow beam. Some cabinet designs have been dependent upon using the two walls that form the corner to help load the loudspeaker. Particular examples of this use are the several corner horns that were very popular, and some enthusiasts will still insist that these designs have yet to be surpassed. However, the size of these cabinets has led to a decline in this popularity, and most corner cabinets now are reflex enclosures. These cabinets are naturally smaller, and therefore their use for stereo reproduction is more practical. Disadvantages in using corner cabinets for stereo soon become apparent. There are only four corners in the normal living-room and thus there are also only four possible combinations of adjacent corners. When the position of the listening area is also considered, then it is highly unlikely that more than one combination of these corners is practical. However, if one is fortunate to possess a room where the corners can be utilized, then this will almost certainly be the ideal arrangement. As seen from Fig.1, the speakers should be a minimum of 6 ft apart, and the listening area should also be 6 ft away from the speakers. It will quickly be appreciated that if one wall of a room is much longer than the other, then sometimes it is impossible to get far enough away to get a good stereo image. As a general rule always try to use the corners where possible. Assuming that either the shape of the room, or else other domestic considerations mean that corner cabinets are impossible, then it is usual to use the normal rectangular enclosure with all parallel cabinet walls. Although this shape is most popular and pleasing to the eye, there are many acoustic engineers who will argue that an ideal cabinet will have no walls parallel. Such cabinets would, however, be very expensive to make and the advantages are so small that these designs are very rarely used.

Rectangular cabinets can be used in a variety of ways depending upon size and shape. The enclosure can either be directed towards the listening area in order to improve the high frequency response

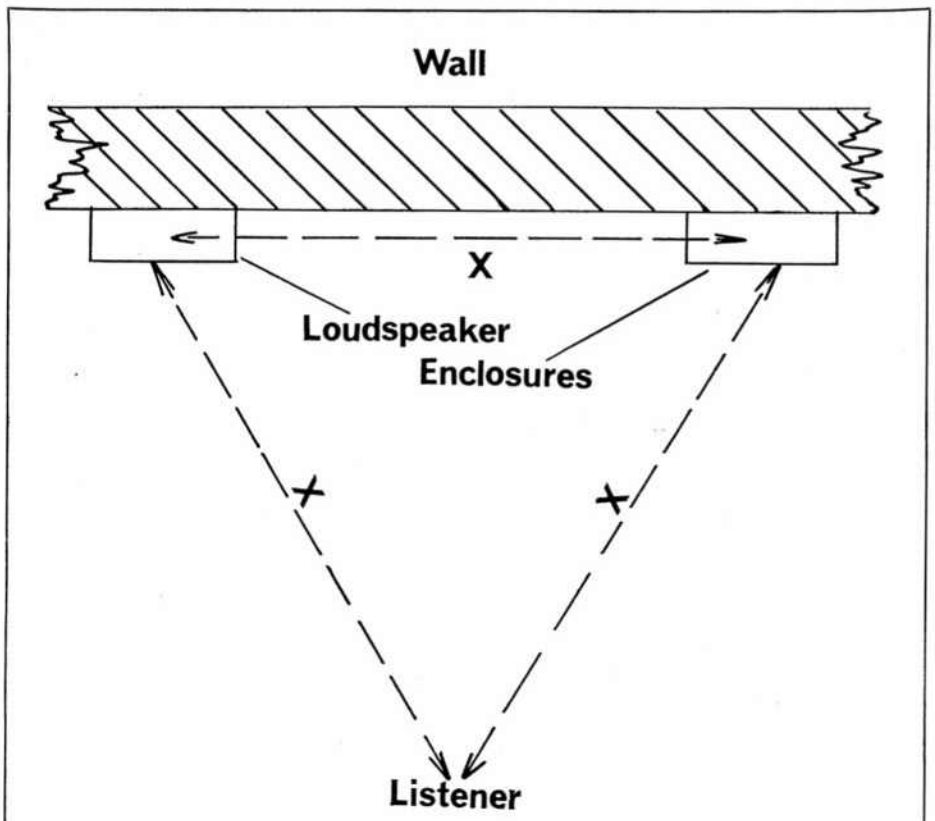
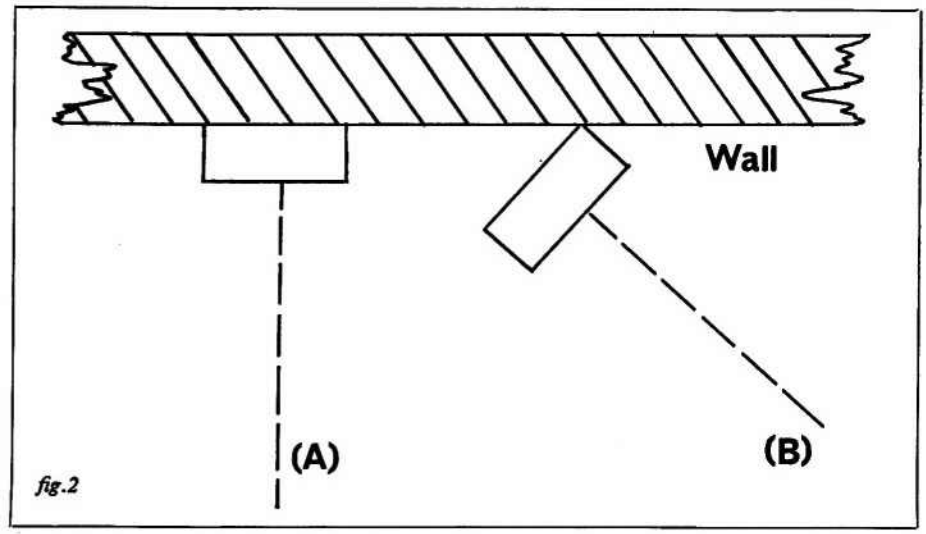


Fig.1. Ideal speaker arrangement for stereo reproduction. Distance 'x' should never be less than 6 feet.

Fig.2.
(a) Speaker flush against wall
(b) Speaker axis directed towards listener
(centre) The Goodmans maxim speaker
(below) The Celestion Ditton 10 speaker

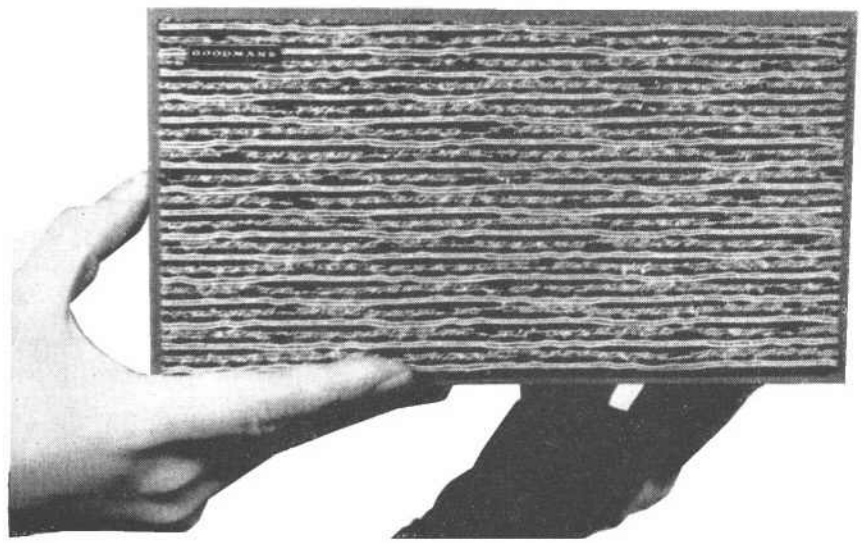


or else the back of the cabinet can be pushed flush against the wall (Fig.2). It is my opinion that the latter is the best arrangement, especially now that loudspeaker systems are designed to have wide polar response. By placing the speaker against the wall, the effective baffle area is increased by the area of the wall itself. Any gaps that are formed by the cabinet being away from the wall or just off the floor will cause interference effects that will make the response more uneven. The response of loudspeaker cabinets in anechoic and live rooms will be dealt with in a further article.

Once again the proportions regarding the distance between cabinets and the listening area will be as Fig.1. While the larger cabinets will still have to be placed on the floor, much more exciting prospects are available from the use of miniature loudspeaker systems such as Goodmans Maxim (centre) or the Celestion Ditton 10 (below). These units are truly bookshelf models and can be hidden amongst a row of books. The performance of such units has to be heard to be believed, although obviously they cannot be as good as a well-designed larger system. For stereo use, however, their flexibility in positioning is an important asset, and this should be well considered before buying new systems.

The speakers should be placed at approximately ear level. Assuming that the listener is reclining luxuriously in an armchair whilst appreciating his high fidelity, then the speaker should be about 3 to 4 ft off the ground. One final arrangement that I think will prove very popular in the future is the use of two miniature speakers for the left and right channels and a larger bass unit fed with the combined bass in order to supplement the low frequencies. Several arrangements of three-speaker systems have been tried in the past, and for the person who likes to experiment, some extremely pleasant listening will be the result.

The question of standing waves, reverberation and general room acoustics will be discussed in my next article.



tape club news

Another year in the life of ATR is now behind us, and we go into our seventh year of publication with a new size, new-look cover, many new friends and, we hope, a renewed spirit of enthusiasm. And to bring home just how much the personal effort of each one matters, for all club secretaries as key members of the club movement, and indeed for all club members everywhere, I reprint the following extract from the Rugby club magazine *Tape Life:* **Xvxn though my typxwritxr is an old modxl, it works wxll xnough xxcxpt for onx of thx kxys.**
I havx wishxd many timxs that it workxd pxrfxctly. It is trux thxrx arx forty six kxys that function wxll xnough, but just onx kxy not working makxs all thx diffxrxncx. Somxtimxs it sxxms to mx that our club is likx my typxwritxr, not all thx kxys arx working propxrly. You may say to yoursxlf, wxll, I am only onx pxrson. It won't makx much diffxrxncx. But, you sxx thx club nxxds thx activx participation of xvxry pxrson to bx xffxctivx.
So thx nxxt timx you think you arx only onx pxrson, and that your xffort is not nxxdxd, rxmxmbxr my typx-writxr and say to yoursxlf, I am a kxy pxrson and nxxdxd vxyr much. **KC**

Club of the month
For unearthing the above piece of wisdom, Len Stephens, **Rugby** president, deserves a special mention, but in spite of Len's misgivings, most members do seem to be pulling their weight and combining to make the club a very happy, active and successful one. At the recent AGM Len and secretary Mike Brown were both re-elected unopposed. It was also proposed that the club should have a second annual tape competition. Such a competition would take place in the summer months and the existing annual competition for the Terry Davis trophy would become the winter contest and be held in February instead of at Christmas. Recently Rugby acted as hosts to Mr R. A. Margoschis of Atherstone, who revealed some of his techniques in making such prize-winning tapes as 'Lane Setting', 'Battle of the Brook' and his famous 'Songsters' Fantasia'. Bill Long has demonstrated his Optacord 414 recorder to club members and Mike Brown displayed the club's new bulk eraser, built by fellow member Keith Fisher.

Sad farewell
It is with real regret that **Birmingham-TRAC** report the unexpected resignation of their secretary, Mrs Dawn Knee, who for many years has devoted almost her whole life to the club. Dawn has become well known to other clubs and manufacturers throughout the country, and will be sadly missed by taping enthusiasts not only in B-TRAC, but everywhere. Her successor is Alan Bird of 15 Watt Road, Erdington, Birmingham 23.
Club members learnt much about the art of accurate splicing from guest speaker and demonstrator Mr E. Walford, who is responsible for editing many BBC programmes. At a later club session members were faced with the dilemma of having two recording locations to visit – the Birmingham Traction Engine Rally and a special recording session arranged by the Midland Association at Kidderminster Town Hall, where there is a fine organ. Members were also able to record some of the organs on display when they took part in the Sixth International Mobile Rally of the Amateur Radio Mobile Society, held at the USAF base at Barford St. John in Oxfordshire.

Busy on location
Members of the **Southall** TRS have been kept busy with a number of location recording sessions. A number again assisted at the Annual Festival of Music, Speech and Drama prize-winners' concerts presented by the local Arts Council. PA facilities were provided and the entire proceedings at all three concerts (Junior, Intermediate and Senior) were recorded and are now being edited into separate programmes for the Arts Council. At Ealing Town Hall a performance of 'Il Trovatore', presented by West London Opera, was successfully recorded. Nearer home, members provided PA for three performances for a Southall Operatic Society presentation and also recorded the children's choir of a local junior school at the request of the headmistress.

Non-existent programme
I understand that at present members of the **Doncaster** and District TRC are feeling, understandably, bewildered and a little despondent. It seems that the local hospital authorities can't make up their minds about hospital broadcasts. Doncaster club members have gone to much trouble preparing suitable programmes, collecting interviews and campaigning for support from famous personalities, but each time they want to get under way some obstacle (usually in the form of red tape) is put in their way. This time the excuse is that alteration schemes lasting for the next three years will not allow anything to happen unless it is for the direct benefit of the patients! This seems completely cock-eyed, for surely a hospital broadcast scheme is purely for the direct benefit of the patients, helping to cheer them up, boost their morale and stop them from becoming introverted and depressed about their ailments. Mr Terry Thornton, owner of the Esquire jazz club of TV fame, has offered the use of his club and many artistes have agreed to make recordings for them – all it needs now is for the hospital authorities to say the word. And the sooner they do so the better. Apart from working on this non-existent programme, members took a Ferrograph, three Fi-Cords, two Philips, one M 300 and an Optacord to a private recording session at a local Traction Engine Rally.

Nuts in May
This was the title of a zany revue for which members of the **Thornton Heath** TRC supplied sound effects. They found that taping the sounds and splicing in leader so that the sounds came out on cue was a very good test of skill and ability. However, at the dress rehearsal the producer needed a last-minute item of about 90 seconds to cover a costume change and it was decided to try a pure sound item with a stage lit only by two dim spots. Peter Bastin's 1962 BATRC winning tape 'Nightmare' was chosen and the audience was astounded and much impressed. At the AGM of the Federation of BTR Clubs, Thornton Heath's Vice-Chairman Morris Webb was elected treasurer, and John Bradley retained his position of press and publicity officer.

Still growing
Radio **Blackburn** is still expanding, both in membership and activities. Membership has grown to over forty. The club received great publicity from a recent trade show in Blackburn at which they were given a stand in return for supplying a microphone for the fashion shows and continuous music for the whole show. All club members helped to keep the stand open continuously and, at the same time, put together a programme for patients in hospital with the many requests from their relatives at the show.
The club is now broadcasting four nights a week for an hour and a half with two hours of broadcasting on Sunday. Not to be left out, the women in the club are now providing their own programme, 'Women's Spot', intended mainly for women patients and including interviews and talks by women in all walks of life.

Successful year
At the recent AGM of the **Ipswich** and

District TRC, Mr J. Steggall, retiring Chairman, reported that the club had had a very successful year with several new ventures and that the new accommodation at the Royal George Hotel had resulted in increased membership. As club treasurer Mr R. P. Burgess was unable to attend at the beginning of the meeting as he was helping with municipal elections, and his report (indicating that the club is in a very healthy financial position) was presented on tape to the meeting.

Club members have recently enjoyed a visit from Mr G. C. Balmain of Mastertape, who traced the development of recording tapes over the years, and another from Mr W. A. Jamieson of Wharfedale, who gave a very interesting talk and demonstration of the various types of loudspeakers and enclosures used for mono and stereo reproduction.

Doubled meetings

Members of the **Montrose** and District TRC recently voted to double the amount of their meetings and will now hold sessions weekly instead of fortnightly. It is hoped that this will enable them to fit more into their already tightly packed programme. Recently, in two successive weeks, the club recorded full operatic productions – 'Bless The Bride' by the Brechin Operatic Society and 'The Quaker Girl' by the Montrose Operatic Society. A presentation tape has also been compiled for the club chairman who emigrated to South Africa in June, and it is hoped that the Club will obtain some interesting material from this source in the future. Members have under review the possibility of forming a junior section, for which there appears to be a demand and would like to hear from young people of either sex in the under-eighteen group who might be interested. Secretary is J. McAlpine of 32 Mount Avenue, Montrose, Angus.

Wanted – women!

The **Radio Scotland** TR section now boasts one lady member, the wife of another member, but would like to attract more. Club secretary. J. A. Douglas, of 113 Novar Drive, Glasgow, W2, would like to have advice from clubs who already have lady members on how to attract them to this predominantly male activity. The club is to record a play written by member John Wilson but members are at present completely in the dark about the whole ploï. The author has cast his play using over half of the club's thirty members, but each player will see only his part and until the actual recording starts the players themselves will not know how it's going to end. The club is planning another get-together with the Dundee club and is also in contact with the Rugby club with a view to exchanging tape material.

All on tape

The highlight of the recent activities of **ITAC** was the screening of entries for their Film of the Year competition. Of the fourteen entries, not one was entered as a silent film and although the society has quite a number of members who own striped sound projectors all soundtracks had been recorded on separate tapes. Winner was Stan McMurtry of Melbourne, second was Nico van Rensburg of Bellville, CP, South Africa, and third was John Rudkin of Leicester. The judges' markings were so close that in a number of cases a film earned its placing by the quality of its soundtrack.

For their second AGM members were hosted by the Welling and District Cine Club at their HQ in Wrotham. The day's programme included an exhibition of members' equipment and recorders on show included a B & O Stereomaster 2000, Truvox R 92 and a Reps R10. Various microphones and loudspeaker systems were also demonstrated.

Boffins at work

The **Bournemouth** TRC is fortunate in having a number of boffins among its members. Roy Dunn recently won the annual tape contest for the 'Silver Mike' trophy with his tape 'Reality'. This gave fellow members a very entertaining insight into sound and the important part it plays in our lives. Runner-up was another boffin, Clifford Rees, with his tape 'Club Night', a humorous look at some of the mysterious idiosyncrasies that sometimes afflict tape recorders. Cliff Rees and fellow expert Tony Rawlins (club chairman) are getting together to produce a guide entitled 'The Fundamental Principles of Recording', which explains, in layman's language, the functions of various parts of the recorder.

Informal group

A newcomer to the sound scene is the **Croydon** Sound Recording Group. This is an informal group of enthusiasts who wish to get together purely for the purpose of doing really active recording, without necessarily having regular meetings, subscription fees, committees or other official impedimenta. Numbers will be limited to about six or seven, but the group will be associated with the Thornton Heath club. First big production is to assist the Harlequin Repertory Company with their performance of Rattigan's 'Adventure Story' at an open-air theatre in London. Producer Ronald Porter, who is production manager for Mecca Ballrooms, wanted to make it a sound production, all the lines and sound effects being recorded beforehand, with actors performing to the tape. All enquiries to the Secretary at 33 Fairlawnes, Maldon Road, Wallington, Surrey.

1087 to 1965

In one day members of the **Derby** Tape Recording Club visited two entirely contrasting locations for some outdoor recordings. The first port of call was the little village of Swarkestone, first mentioned in the Domesday Book in 1087. The village is also the site of the final defeat of Bonnie Prince Charlie, and members were able to glean some interesting recordings. Their second port of call was the new West Midland Airport, opened on 1 April this year. Here, they were able to record the receptionist giving details of the opening ceremony, the facilities at the airport, and facts about the routes taken by aircraft flying in and out of the airport.

New club

The **Elmwood** Tape Club has recently been formed in Stockton, and the club's first meeting attracted about 25 prospective members. Publicity was given by the local press, and Messrs Sparksound of Middlesbrough gave a demonstration of various recorders and accessories. A committee has now been elected, with Mr John Flint as chairman, Fred. J. Hay as secretary and Miss Pat Bootland as treasurer. Fortnightly meetings have been arranged in the Elmwood Community Centre, Hartburn, Stockton, and further details may be obtained from the secretary at 27 Crayke Road, Stockton-on-Tees.

Birds and bells

The **Fi-Cord Owners'** club is appealing to all other clubs and to Fi-Cord owners everywhere for certain sound effects. Those most urgently required are small tapes of bird songs, particularly thrush, blackbird and canary. The club is also looking for recordings of either Bow Bells or the bells of St Clement Danes Church. Anyone who can lend the club any of these recordings is asked to contact club organiser Dennis Osborne at 75 Millmead Road, California, Birmingham 32.

New secretary

Graham Wykes, former secretary of the **Great Yarmouth** and District TRS, has now left the town for a new home in London. He has not, however, left the club, for he has been made an honorary life member in recognition of the work he has done. His successor is Leonard A. Ask, of 7 High Street, Gorleston, Great Yarmouth.

Book reading

After making trial recordings of material for the Royal Institute for the Blind, members, of the **IVAS** group were delighted to hear that the Institute found their recording excellent in all the required categories – recording level, acoustics of studio, quality of reading, etc. They are now awaiting their first book to read on to tape. IVAS has also at long last been able to open their hospital programme service as the necessary equipment has now been installed in Edgware General Hospital, and a hut has been built in the grounds so that production of programmes will not interfere with hospital routine.

(continued overleaf)

Tape Club News (*continued*)

Scraped home

Leeds and District TRC are very proud of the fact that in the Yorkshire Federation's Newsletter Cup they scraped home to a win by ½ a point! Competition was stiff coming from such clubs as Barnsley, Doncaster, Hull and York. The club has had some very interesting evenings recording a pop group, learning about editing and playing back their favourite music on tape.

New venue

The **London** TR Club now has a definite new venue for its meetings. This is at 23 Manchester Square, London W1, where meetings are held on the second Thursday in every month. The club recently welcomed Richard Keen as guest of honour to judge their annual competition for the McManus Cup and the Novice Cup.

News from 'Down Under'

Members of the **North London** Tape Club are receiving regular reports from Richard Collinson in Australia. His latest report covers the field of commercial radio in Australia, where Melbourne alone has five commercial stations. Unfortunately, tape clubs as such don't exist 'down under', so there have been no ready-made documentary and interviewing experts for the radio stations to draw on. But sooner or later, says Richard, commercial radio will be made legal in this country, and then clubs will really be to the fore. North London is keeping in the picture by pairing up with the St James Film Unit for a couple of evenings. On the first evening North London visited the unit to discover the joys of cine as a hobby and this month will be entertaining the unit to show them the joys of recording.

Current controversy

Reading Cine and Tape Society took advantage of the recent controversy over their new local paper to get some comments from the local population. The new *Evening Post* is a Thomson paper and will be produced in colour by the most modern methods, but the question among the local people was still 'Do we really want another paper?' Club members toured cafes, hotels, stations and bus queues and found that most people had very definite ideas one way or the other.

More creativity

In an effort to introduce more creativity into club recording work, members of the **South Devon** TRC have decided to do more group work and to hold more frequent competitions. Vice-President J. W. Stockman has agreed to donate a cup for a contest in some particular aspect of recording, but the final details have not yet been decided.

Marathon day

Members of the **Walthamstow** and District TRS recently had a marathon day when they turned out in force to record the local carnival. Commenting on the proceedings were Vi Manning, Maurice Dudley, Ken Perks and Tony Norton, while controlling the actual recording were Colin Stares and Jack Watson. Recording over, producer Noel Britton had the task of turning the recordings into a programme at the local hospital for that afternoon. Also assisting in this rush job were Ted Higgs, Alec Lucas, Tom Tomlinson and John Nightingale.

New copy dates

Secretaries of these and all other clubs will be pleased to know that, as a result of our new printing arrangements, I can now extend the date by which club news must be received for inclusion in a particular issue. News for publication in the September issue (published 27 August) should be in by 26 July, and news for the October issue (published 24 September) should arrive by 23 August.

All club news reports should be addressed to Mrs K. Cook, at Haymarket Press, 86–88 Edgware Road, London W2.

Top ten for August

1. Rugby	6. Blackburn
2. B-TRAC	7. Ipswich
3. Southall	8. Montrose
4. Doncaster	9. Radio Scotland
5. Thornton Heath	10. ITACS

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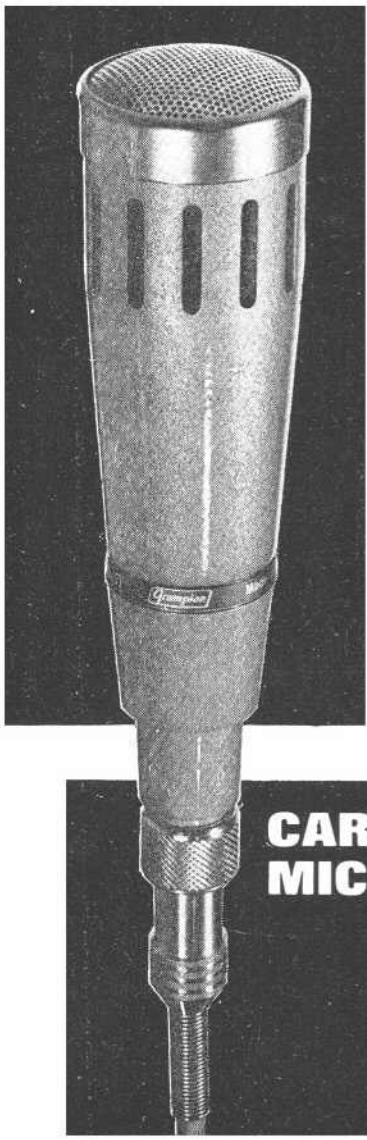

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C BGX/1—BACKGROUND SOUND EFFECTS Price 7/6
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Side 2—Rain (heavy shower). Factory sounds (industrial). Traffic (busy street).

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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). Sibilation—white noise (pitch octave low).
Side 2—Sibilation—white noise (pitch). Sibilation—white noise (pitch octave high). Three-tone ululation. Filtered noise Stridor (tonal). Ring modulation and sibilation.

E EFX/2—ELECTRONIC THEMES AND MUSIC CONCRETE Price 7/6
Side 1—Delta F Study in Sinetones.
Side 2—Sound object Montage.

F HMX/1—HAUNTED HOUSE, MYSTERY SOUNDS AND MUSIC Price 7/6
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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.

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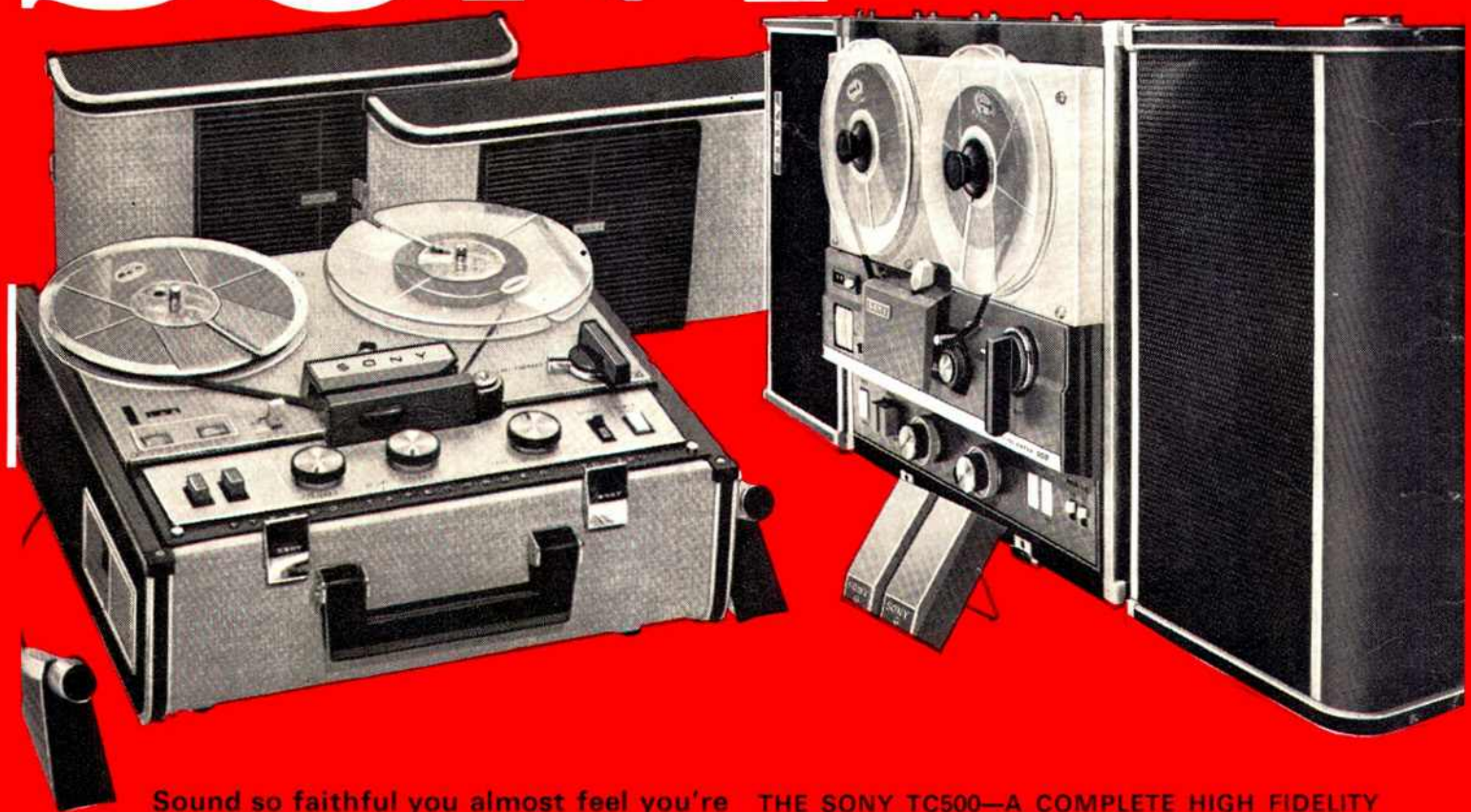

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