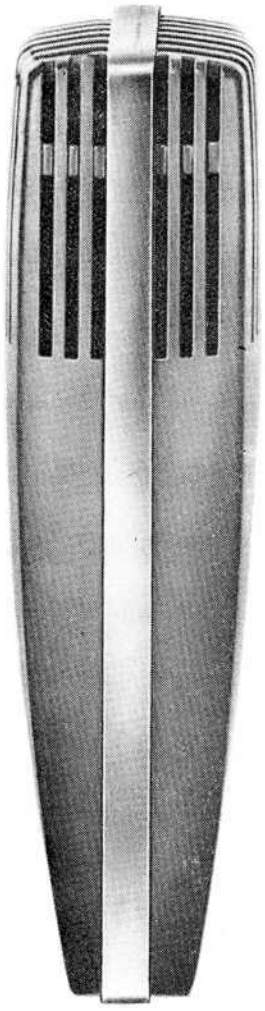
Amateur Tape Recording

AUDIO-VIDEO

September 1967 Vol 9 No 2 2/6

TAPE A HOLIDAY * EDITING AND PROGRAMME PLANNING



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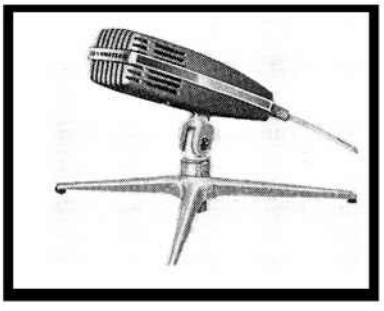

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- ★ **A comprehensive survey of balanced hi-fi systems available today and an appraisal of future trends**
- ★ **A report on magnetic tape**
- ★ **A practical article on creative sound recording**
- ★ **Details of hi-fi cabinets to make and to buy**
- ★ **An exclusive readers' enquiry bureau**
- ★ **and, for the newcomer, the first explanatory articles on circuit diagrams and on elementary faults.**

As from its November issue, *Amateur Tape Recording* will have an exciting new look and a brand new title – **HI-FI SOUND.** Because of the popularity of *Amateur Tape Recording's Hi-Fi Section* and the numerous demands for its enlargement, we know that hi-fi is a facet of the audio field lacking comprehensive coverage.

HI-FI SOUND will be *twice as large* as *Amateur Tape Recording* and will meet the demand for a magazine that takes a balanced view between the boffin and the beginner.
Our coverage of tape recording will not be minimized – in fact **HI-FI SOUND** will offer a greater opportunity for tape recording as an integral part of hi-fi systems.

The first issue provides the keynote for future issues, which will include technical articles on how to get the best from hi-fi systems and tape recorders. For the newcomer there will be a series of practical, profusely illustrated articles explaining various aspects of hi-fi terminology and expertise for a quicker and easier understanding of the science.

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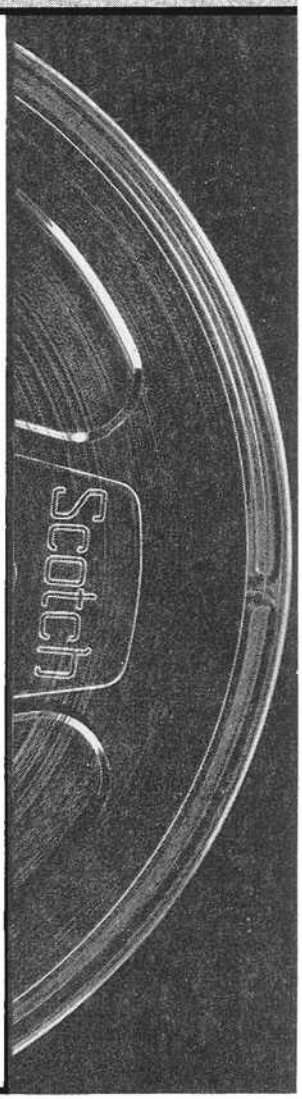

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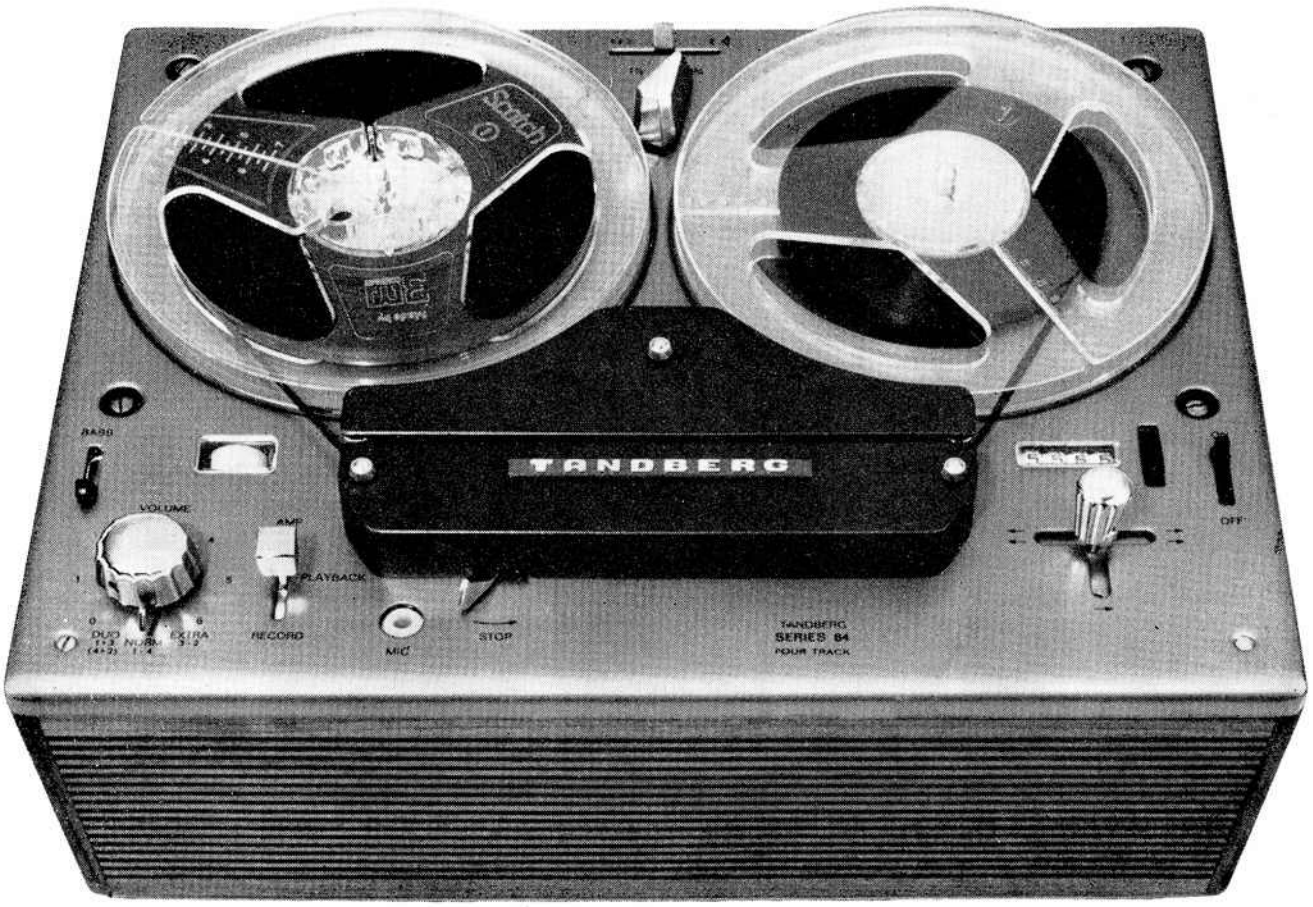

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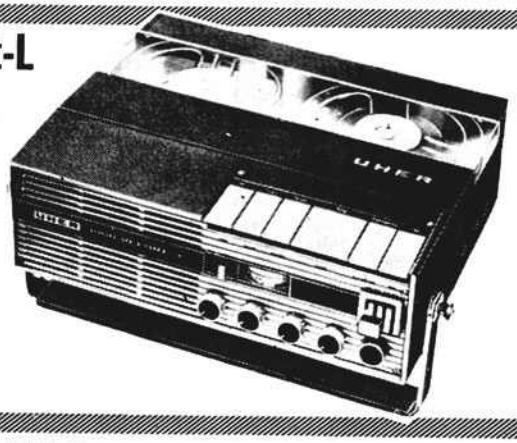

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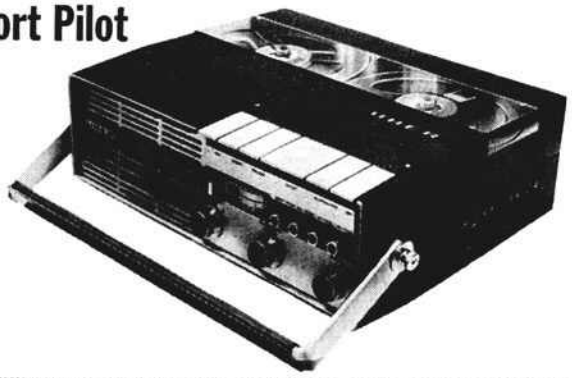

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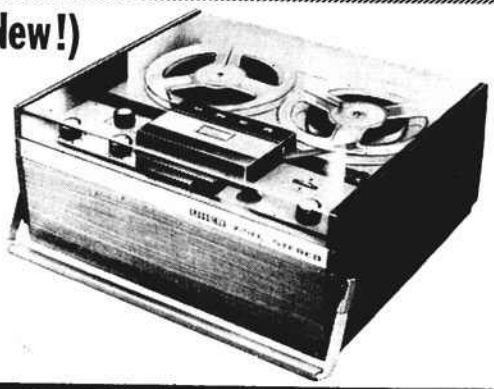

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Vol 9 Number 2 September 1967

EDITORIAL COMMENT

Much has been said and written lately about cassette music tapes but with little or no mention at all of standards with regard to frequency range, distortion factor and signal to noise ratio. Cassetted music tapes are undoubtedly convenient and almost as simple to use as the gramophone disc record. Moreover a cassette tape player occupies far less space than a turntable and pick-up. Future all-in-one hi-fi equipment may well feature the tape cassette as its main signal source, but will the quality of pre-recorded cassettes now. or in the future, do full justice to the equipment through which they are played? We refer to high fidelity equipment of course and not to small cassette recorders or replay machines with low audio output and small loudspeakers. What, in fact, is the standard of recording quality of a present day cassette music tape? To find out we went along to one of the largest and most well-known manufacturers and asked a few pertinent questions. The not too surprising answer to our question 'are their cassette music tapes recorded to a standard which can be classified as hi-fi' was 'no'. An honest answer indeed but we were also told that reproduction from these tapes via a hi-fi system will be of very good quality.

A system for copying and producing cassette music tapes that will enable manufacturers to reach true hi-fi standard has yet to be developed. We hasten to add, however, that cassette music tapes do at present compete easily with standard quarter-track and half-track pre-recorded tapes and indeed are not very far behind the disc record. Finally a tip from the manufacturers. The azimuth alignment of the replay heads on cassette recorders must be very accurately set in order to get maximum high frequency response from cassette music tapes. So if your replay should sound woolly at any time it may well be that the replay head has moved out of alignment. We suggest that manufacturers might make an azimuth alignment cassette tape available, but a word of warning here – the actual alignment of a cassette head is a rather tricky operation and best left to a competent dealer or the manufacturer of the recorder.

FCJ

FRONT COVER

Train sounds are essential to a 'tape your holiday' recording. Our front cover shows the compact Philips cassette recording sound tracks for a cine film.

Fig. 1. The recorder connected to a pair of GL559 loudspeakers.

ON TEST - PHILIPS CASSETTE STEREO RECORDER EL3312

by Peter Knight

One of the smallest stereo recorders on the market, the mains-powered EL3312 was launched by Philips concurrently with the first *Musicassettes*, which are fast gaining popularity as more and more titles are introduced and as more machines are made to play them. The Philips tape cassette has already been described in these pages, and the device can be seen in various photographs accompanying this report.

The tape contained in the cassette is approximately half the width of ordinary $\frac{1}{4}$ inch tape, and upon this the Philips recorder can record and playback *four tracks*, based on two stereo tracks! The difference between the Philips cassette system and that used by some other manufacturers it that the tape runs through the machine at the standard $1\frac{7}{8}$ ips, whereas the other machines work at the sub-standard speed of 2 ips. The cassettes are physically different and they cannot be interchanged. In addition to Philips, other firms are now beginning to manufacture machines to handle the *Philips* cassette system.

The tape is affixed to reels within the cassette so that it cannot pull off when it ends on play, record or rewind. Insertion and removal of a cassette are simple, non-technical operations, calling for less skill than generally required for working a disc record player. The second stereo tracks are recorded or replayed simply by pulling out, turning over and re-inserting the cassette in the machine. Sides 1 and 2 or A and B are marked on the cassette for reference. More is said about the Musicassettes later.

The EL3312 provides compatibility of mono or stereo recordings. This simply means that the left- and right-hand stereo tracks are alongside each other on the tape, so that when a stereo head records or plays these, separate information is used or provided for the two stereo channels. The head of a mono machine, however, embraces both tracks together, giving mono from a stereo tape. Conversely, when a mono tape is used with a stereo machine, both stereo heads respond to the information on the one track, since this is embraced by both heads of the machine. A pair of similar tracks are arranged on the other half-width of the tape to provide the two-track stereo attribute. Of course, on a mono tape there are just two tracks, one each half-width of the tape.

The recorder unit alone measures $12\frac{3}{4} \times 8\frac{1}{2} \times 3\frac{1}{2}$ inches, and this contains sockets for connecting a pair of external loudspeakers which can thus be orientated for the very best stereo effect (see Fig. 1). The speakers supplied with the recorder are Type GL559, having dimensions of $10\frac{1}{4} \times 7\frac{1}{2} \times 7\frac{1}{2}$ inches, and can easily be set-up on a bookshelf or wall-furniture very unobtrusively.

The various functions of the machine are handled by push-keys, while there are control knobs for the electronics. There are seven keys, and one of these works the cassette loading 'tray'. When this is depressed the tray or container springs up allowing the cassette to be inserted. Automatic mechanical coupling to the tape is made when the container is pushed back into the body of the machine. The other keys give *start*, *stop*, *pause* and *rewind* in

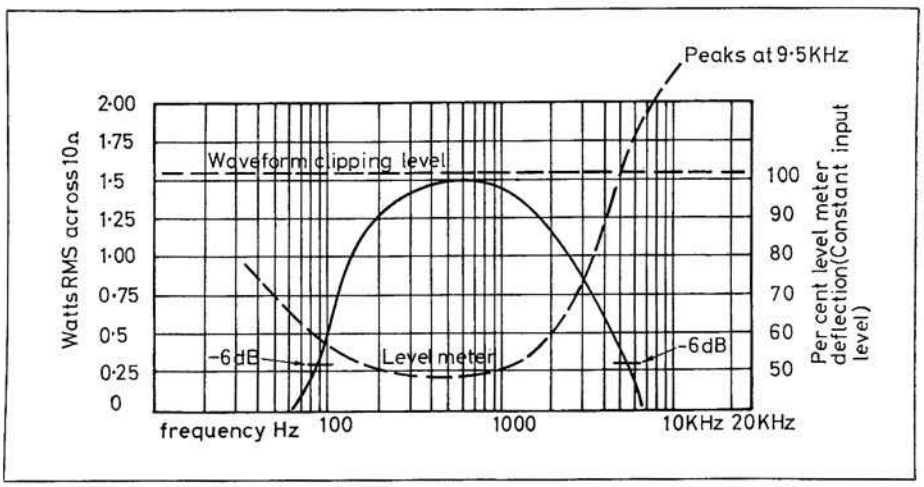

Fig. 2. Overall power-response characteristics (as measured).

two directions and *record*. The latter is a red key which is interlocked to the start key to avoid accidental erasure.

There are four control knobs and from top to bottom they give *tone* (treble-cut), playback *volume*, playback channel *balance*, working both on stereo and mono tapes and *recording-level* control, which operates both channels simultaneously. The top of the machine also carries a three-digit tape counter and meter-type level indicator, working on both channels together. The rear of the machine features four DIN sockets, two for the left and right loudspeakers, one for use with a gramophone and the other for connection of stereo microphone, radio, hi-fi amplifier and so forth. These latter two DIN sockets have input and output stereo terminations in accordance with the normal DIN pattern on tape recorders.

A small trap-door underneath the machine accommodates the mains cable and its plug when not in use, and the tape on the supply reel in the cassette can be viewed through windows, the rear of which is lit when the machine is switched on.

Transistor Circuit

Each playback output amplifier features three transistors in transformerless, complementary push-pull mode, and each preamplifier (acting also as the recording amplifier sections) also has three transistors. A transistor is used for level indication in each channel, with the single meter in their common emitter circuit. Finally, an n-p-n transistor is arranged as an hf oscillator for erase and recording bias. This is synchronized to both channels.

Mains power is connected to a completely isolated winding, which is the field winding on the drive motor. A separate winding then acts as the supply power secondary, and this feeds a bridge rectifier and second two-element rectifier system for providing the ripple-free dc voltage for the transistors. An elaborate smoothing and filter network is employed, really getting rid of all traces of mains hum.

Testing Overall Response

A test tape was recorded with sine-wave signal at intervals over the audio spectrum at a constant voltage input level and with 50% deflection on the recording-level indicator at 1,000Hz. The signal was matched into the microphone sockets of both channels simultaneously so that recordings were made on two stereo tracks. This recording was then played back so that its output *power* was monitored both on a wattmeter and oscilloscope. The playback volume control was advanced on a 1,000Hz recorded reference tone to waveform clipping level as indicated on the oscilloscope and, across 10 ohms, this was found to be just a little above 1·5 watts. The volume control was then turned down to give a power of 1·5 watts, and relative to this frequency and power, the power curve in Fig. 2 was plotted. The 6dB (power) points occur at about 90Hz and 6,000Hz, with the power response flat at the middle of the spectrum. The dotted-line curve in Fig. 2 shows how the recording-level meter behaved during the constant input voltage recording of the tape. There was a slight rise at the bass end of the spectrum and a far greater rise, peaking at 9,500Hz, at the treble end. For a machine running at a quarter of a $\frac{1}{8}$ inch tape track at $1\frac{7}{8}$ ips this is a remarkably good power response characteristic, taking in both the recording and the playback amplifiers, along with the equalization. Plenty of top-boost is given, of course, to keep the output up towards the treble end at such a low tape speed.

With the machine working with its own speakers and a Philips Musicassette, very pleasant sounds are produced, equally as good as could be obtained from a good disc record with a better-quality type radiogram. The stereo effect on the Musicassettes is truly dramatic, and the small speakers make it possible to secure the best possible stereo placement with the least domestic inconvenience.

The EL3312 is also supplied with a very good stereo microphone for making one's own stereo tapes. This is shown in Fig. 3. When the word *stereo* is pointing in the direction of the sound source the two microphone elements are each displaced by an angle of 45 degrees (90 degrees relative to each other) relative to the source, and right and left stereo signals are automatically generated. These are fed in isolation to the two channels terminated by the DIN microphone socket. The recording level

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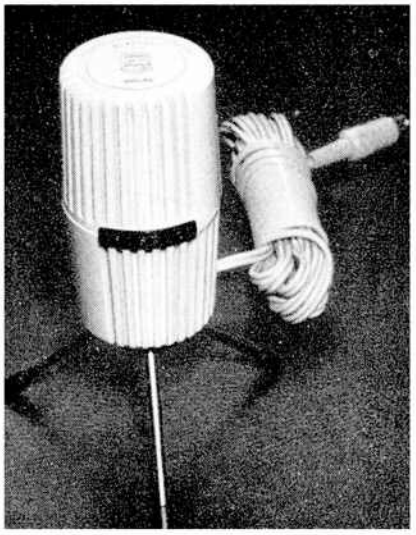


Fig. 3. The Stereo Microphone supplied with the recorder.

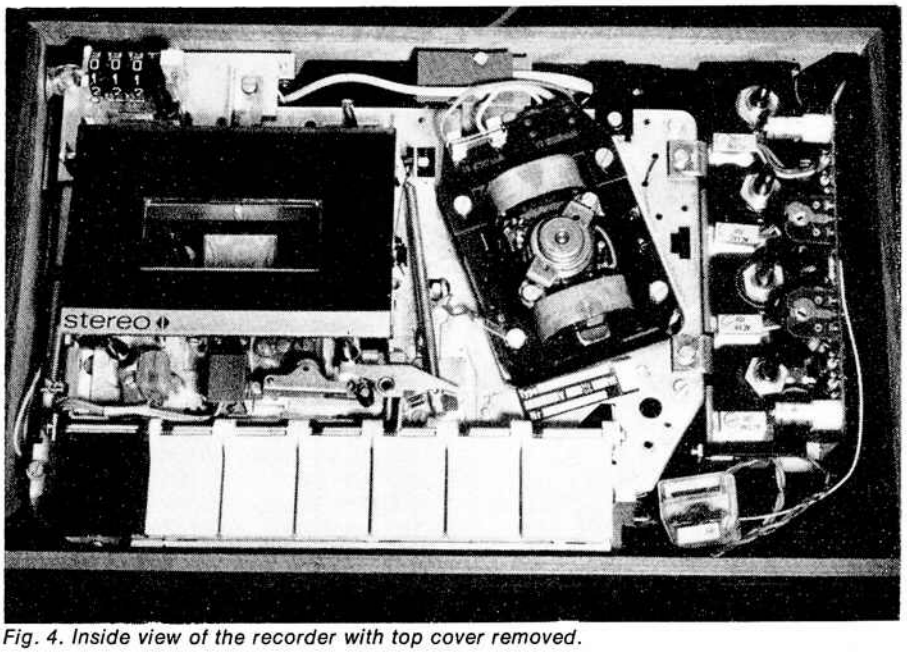


Fig. 4. Inside view of the recorder with top cover removed.

Fig. 5. Philips EP Musicassette, showing the matchbox-type enclosure.

ON TEST - PHILIPS CASSETTE STEREO RECORDER EL3312

continued

indicator reads the signals in both channels simultaneously, and no technical know-how is needed to obtain quite good stereo recordings. Any mis-balance can be corrected on play-back by the *balance control*.

The sensitivity of the microphone and the microphone channel is such that when the microphone is placed 12 inches from a person speaking at ordinary level, full recording level indication is given with the recording level control turned up about 60%.

The machine is extremely well made, and a large flywheel coupled to the capstan keep wow and flutter to a relatively low figure for this tape speed. Fig. 4 shows the inside of the machine from the top, with the top plate removed. This clearly shows the drive motor and its windings which serve as the mains transformer, and also the tape head and associated mechanism.

The machine was tested in various other ways, including the connecting of a ceramic pick-up to the appropriate DIN socket. A *non-copyright* stereo recording was made from the disc to the tape at remarkably good quality. Such a pick-up usually requires a load between 1 and 2 megohms for the best non-equalized response (to keep the bass up), and in spite of the lower pick-up input impedance of the recorder, the bass was quite adequate. This was possibly due to the fact that the lower-value pick-up loading reduced the bass, thereby giving the reciprocal treble boost effect on the recording, required for the best musical balance. *It must be stressed, however, that dubbing from an ordinary gramophone record onto tape constitutes an infringement of copyright as, indeed, does taping direct from a radio set.*

The preamplifier output of the recorder was also connected to the 'tape' input of a hi-fi amplifier, working from its own hi-fi loudspeakers. With the latest Musicassette, CPC 0003, of Tchaikovsky's *Swan Lake*, with Pierre Monteux conducting the London Symphony Orchestra, the effect was truly astounding. Fantastic contrast (dynamic range) is recorded on this tape in spite of the low speed and very narrow tracks and, although drop-out effects are sometimes vaguely discernible, the replay quality is far higher than would ever have been thought possible two or three years ago. Tape hiss is fairly low, although present to some extent, but the chief trouble when playing back through a hi-fi channel was found to be transistor hiss in the first stages of the replay channels.

This was quite noticeable when the hi-fi amplifier was adjusted to give full power on the high-level parts of the recording and when low-level recordings were reproduced. It was at first thought that the hiss was on the tape itself, but this was disproved later, since with the cassette removed and the machine switched to playback the hiss was present at almost the same level.

At ordinary replay powers, however, the hiss was unobtrusive and was barely noticeable when the reproduction was through the recorder's own replay output stages. Of course, it is more apparent on tapes such as the excellent *Swan Lake* where the dynamic range is particularly high. It is virtually non-existent on popular music cassettes.

Musicassettes

In addition to the LP Musicassettes (carrying programme material equivalent to that on LP disc records), Philips have recently introduced EP Musicassettes, which cost a little less than twice the price of the equivalent EP disc record, but these are stereo. The packaging of the EP Musicassettes is shown in Fig. 5. This differs from the packaging of the LP Musicassettes in that it is contained in a matchbox-type container, while the LP Musicassettes are contained in a plastic lift-up lid type of box.

It is of interest to note that Philips are also marketing cassetted language courses in Spanish, German, French and Italian under the Philips/Visaphone label. Each course comes complete with a comprehensive illustrated booklet. Each cassetted course is equivalent in length to that given by three LP disc records. The cost complete with cassettes, *Interpret* guide book and special supplement is £4 12*s* 6*d*.

Manufacturer's Specifications

Power Supply: 110, 127, 220 and 245V 50Hz (can be adjusted to suit 60Hz mains). *Cassettes:* Suitable for use with both stereo and mono recordings and playback. Twin-track stereo system. *Tape Speed;* 1⅞ ips. *Maximum Playing Time:* Two times 45 minutes with Compact Cassette C90. *Frequency Range:* 60 to 10,000Hz within 6dB. *Signal/Noise ratio:* Better than 45dB (DIN standard). *Wow and Flutter:* ±0·3%. *Fast winds:* 60 seconds for Compact Cassette C60 (per track). *Output Power (Replay):* 1·8W per channel. *Socket for Gramophone:* 2 × 100mV across 1M. *Socket for Microphone, etc:* 2 × 0·25mV across 1Kohm *Output at socket:* 2 × IV across 1Kohm. *GL559 Loudspeakers. Power Capacity:* 6 watts. *Frequency Range:* 90 to 20,000Hz. *Resonant Frequency:* 135Hz. *Impedance:* 8 ohms. Weight: 4½ lb. *Price complete system:* Recorder 48*gns*, speakers 10*gns* each (small tax on speakers).

EDITING AND PROGRAMME PLANNING

by H. Ibbotson

Advice on Creative Recording for the Beginner

Editing is the art of producing a programme, with smoothness and continuity from what may at first have been several separate recordings. With amateur production editing is just as essential as with professional work, since straight recordings without previous planning are usually a series of disjointed sounds, often at greatly differing levels of volume, the incidents involved having no particular relationship to each other. Thoughtful editing removes the unwanted parts, adds a spoken commentary, linking the finished programme parts together into a final performance to be appreciated by the listener.

Generally speaking, the purely manual task of tape editing, consisting of cutting and splicing, can be quickly done by any recordist after a few attempts, but the other side of editing which involves the actual planning is quite a different matter. This is a form of art, just as painting or the composition of music, where the picture or music tells a story. The finished tape must do likewise and is created out of all the material gathered by the recordist.

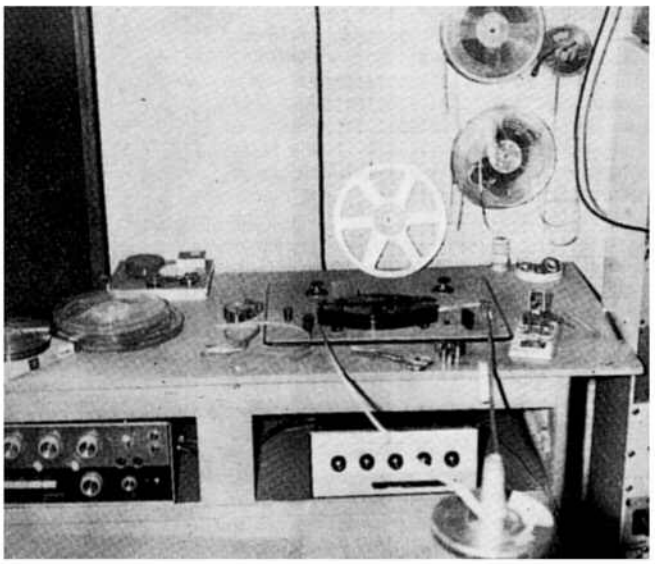
In documentaries the commentary will help to build up the sound picture to convey sense to the listener. In the case of a play, explanations are not possible and the production must stand on its own merits. This is the art of editing, to make the listener feel those same sensations that the editor himself felt at the time of making the finished programme and since this is abstract it cannot be taught; it is already present in the mind.

Choose a simple subject

For a first attempt at editing it is better to choose a simple subject, such as a music programme, and string this together to form a story. For instance, we will suppose that you are keen on pop music. To simply record the 'top ten' in one straight session, would not be very interesting, but the same material could be used to form the basis of a programme that would be of interest to many listeners. The music could be used to illustrate the rise of pop music to its present day peak. Alternatively, the story of one of the well known groups could be told. All that is required is splicing tackle and plenty of tape, plus enthusiasm. If you happen to own two recorders you have an advantage, because this makes editing easier, but in any case, even if you have only one recorder you can still make a successful job of editing.

Always record plenty of material, you can erase and use again any excess, but if you are short of any recorded item, you will not be able to complete your programme. Therefore, first record all the music relevant to your proposed documentary; if you are telling the story of a particular group, you will need to record perhaps all their music, but especially the tune that made them a hit group. Fade in the music of an outstanding number, give about six seconds then slowly fade out and announce the title, then fade in the music once more, but this time softly, as a background and begin your commentary, explaining the names and interests of each member and how the group was formed. Fade up the music in appropriate places to play the full song, if it is a well known number, carry on in this manner to the end of the tape, and finish with the sound of applause and the voices of screaming fans. You have now completed your first creative recording; a real programme, that will be a pleasure to play back at any time and will never 'date' because it tells a story.

There is one point that perhaps I should mention. You may find it difficult to remember all your spoken commentary as you go along (this comes with practice) but if you find yourself stuck for words, it would be advisable to draw up a script before actually starting the recording. The script need not be elaborate; just a few notes to jog your memory. Take everything in sequence, making notes of the songs, and sound effects, and where they should be brought into the recording. You should then be able to follow your sound script right through the recording. As an amateur you have at least one advantage over the professional. Being sound engineer and editor you know what was in your mind when you made the recording, which makes the editing easier. In professional practice the recording and editing are two separate jobs.



An 'editing' bench using a Brenell tape deck. Note—effects loop running through the deck. This method is often used to provide a continuous background sound such that is heard in a train in motion.

The right mood for a story

You could next try your hand at a short story. Read the story through over the mic, they play back, noting how long the recording has taken. Play the tape back again, and this time note any points in the story where you think a sound effect would build up the suspense or help to put over some other point such as the setting. Maybe suitable music would set the correct mood. Imagine yourself actually present at the scene; what kind of music would help to build up the picture you hold in your imagination? For example, if your story is set in the country, a tune such as *Largo* played softly, or sound effects such as birds singing, would quickly establish the setting.

Start by making out your rough recording script from the story, making a note of your sound effects, and the appropriate music, at the places in the story where they are to be introduced. Remember the time factor too; each fade in, or out, will extend the actual recording time, as will also the sounds which are introduced. Make sure the tape is long enough to take the full programme, as nothing spoils the continuity of a sound play or story, more, than stopping to turn over the tape. Always try to have your full programme on one track.

Be ambitious

Slightly more ambitious, but still well within the scope of the average amateur, is the play or short sketch with sound effects. Try recording a short sketch with members of the family or friends as the players. As with the story, first run through the sketch with each character speaking the parts. Now play back the recording and make your sound script, with a note of what sounds are required and the point at which they should appear in the final recording; then go ahead and have fun....

INTRODUCTION TO TAPE RECORDING PART 5

This month — stereo recording and track designation

by Gordon J. King

We finished last month's article with a promise to compare half- and quarter-track machines replaying their own recordings. It was explained in that article why a quarter-track machine will play half-track tapes without appreciable loss of technical quality, but with some impairment in the signal/noise ratio. The extra noise, we saw, is caused by the need for running at greater replay gain due to the smaller signal induced into the head winding from the shorter, quarter-track gap.

Half- or Quarter-Track Working?

This same basic philosophy applies also to half- and quarter-track machines making and replaying their own tapes. The signal/noise potential is thus higher on half-track machines than quarter-track counterparts. It is even higher on full-track machines, which is one of the reasons why such machines are used for professional and studio applications (it also helps with the editing).

From the electronics point of view, however, modern components and circuit techniques, including the latest kind of low-noise silicon transistors, have made it possible to obtain adequate quarter-track signal/noise ratios, although some difficulties are encountered at the very low tape speeds due to the need to run higher and higher gains towards the treble end of the replay amplifier. This extra gain encourages more noise at the treble end of the spectrum, which is not particularly good. At 3¾ and 7½ ips less treble lift is needed to hold a reasonably flat overall response, and so the signal/noise performance is better.

We are now in the age of the cassette tape recorder which uses tape about half the width of ordinary ¼-inch tape and upon this four tracks are recorded, giving so-called two-track stereo recording and replay. This tape runs through the machine at 1⅞ ips (the Philips system), and in spite of this low speed and incredibly narrow tracks the signal/noise performance is perfectly satisfactory for domestic use, which goes to show how the noise problem is being solved by the use of low-noise transistors, more exacting heads and better tape.

Tape Noise and Drop-Outs

We have not yet considered the tape itself in the half- and quarter-track equation. From first principles, the tape can be looked upon as carrying very small oxide particles which become magnetized to the pattern of the recording signal. The greater the number of such magnets so produced for each part of the recording signal, the greater the influence there is on the replay head, and the greater the strength of signal developed for replay amplification, as we have seen. Now, apart from fewer 'magnets' being exploited, so to speak, on narrow tracks, there are fewer oxide particles active relative to the head gap. The effect is similar to running a car with narrow tyres on a cobbled road. As the tyres are reduced in width, so it becomes increasingly more difficult to obtain a vibration-free ride. The tyres seek out the dips between the cobbles. Wider tyres, of course, average-out the ride and fail to respond to the bumps of individual cobbles.

Electrically, the effect is similar with narrow tape tracks and correspondingly short-length gaps. There is no mechanical 'bumping', of course, but electrically the oxide particles are picked out more readily by the short-length head gap. This in itself tends to encourage noise as the tape passes the head, but, more important, is the effect on replay produced by improper covering of the tape plastic base by the oxide particles. Very small zones of missing or low-density oxide particles are revealed on replay by very short-duration discontinuities in output, but rarely enough to be troublesome, though they can be disconcerting in some cases. These are referred to a *drop-outs* for obvious reasons.

Drop-out effects are more likely to occur as the track width is reduced, and become more noticeable at the very low tape speeds. Modern tape, however, is designed to have the very minimum of drop-out defects, but inexpensive tape and tape made a number of years ago can prove troublesome in this connection.

For the highest of quality, with the least tendency towards noise, half-track working is desirable, but for the majority of domestic applications quarter-track working is adequate, provided reasonable quality tape is used. Quarter-track working at 3¾ ips is now becoming very popular so far as the average enthusiast and tape recordist are concerned. The great advantage of extra playing time per tape-length-unit is given by this combination.

Enthusiasts whose main concern is towards optimum fidelity should adopt half-track working, possibly at 7½ ips tape speed. This combination is also best for multiple superimpositions from one track to the other with extra programme material 'mixed in', as already explained (ie, see *A To Z in Audio and Video* elsewhere in this issue of *ATR*). More information will be given on this technique later in the series.

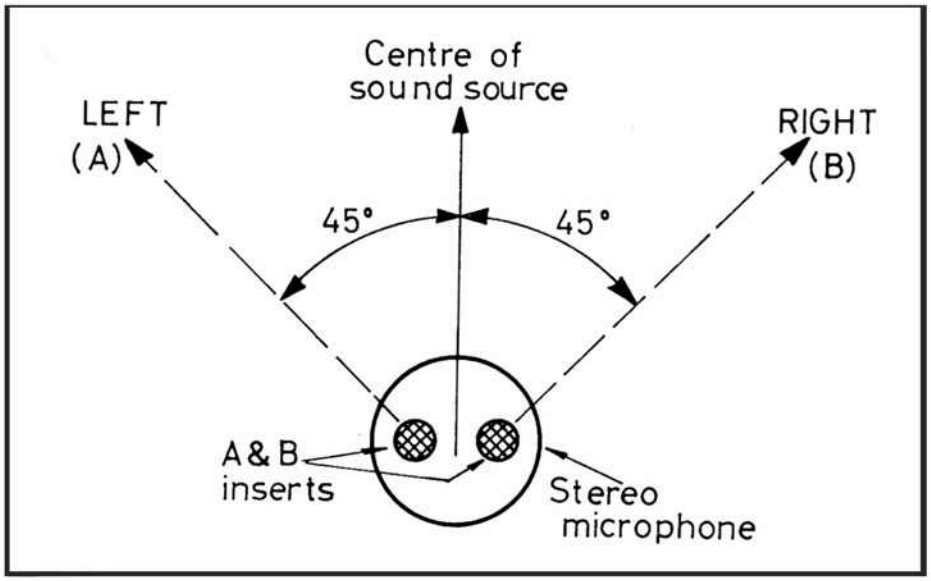


Fig. 1. The stereo microphone system.

Stereo Working

At this stage we must introduce stereophony (*stereo* for short). Most readers will now be aware that for stereo recording and playback the recorder must have two separate recording channels and two separate playback channels. When a microphone recording is made, two microphones are used, and these simultaneously record on the same tape, but on different tracks. Both tracks will thus record the same programme material, but since the two tracks are recorded from either a special stereo microphone or from two separate microphones there are subtle differences between the two sounds recorded, one being louder (or softer) than the other. This difference is the 'stereo signal' and it can be analysed by subtracting the sound in one channel from that in the other channel. If the answer is zero, then there is no stereo signal. When

there is considerable difference between the nature of the two signals, then there is maximum stereo signal.

By adding the signals in the two channels together we obtain the ordinary mono signal. In stereo jargon, the left-hand channel is called the *A* channel and the right-hand channel the *B* channel. Thus, A − B = stereo signal and A + B = mono signal. Since the same sound source is being recorded by both microphones it might be wondered what the stereo signal really is. This is a highly technical question, and has to do with relative sound levels, the phasing of the sounds as they arrive at the two microphones and other rather involved factors which fall outside the scope of this beginners' series.

Nevertheless, it can be said that when the isolated A and B signals are reproduced separately in loudspeakers spaced from each other, in the now well-known stereo loudspeaker formation, the overall sound from the two speakers heard by the listener is far more 'lifelike' than the A+B sound emanating from one loudspeaker. The same applies to sound coming via one channel only, no matter how many speakers are used to reproduce it. The sound source is effectively 'projected' into the listening room and brought into perspective, rather akin to the visual '3-D' effect obtained by viewing pairs of pictures through a special 'two-channel' optical device. *(Stereoscope. Ed)*.

Stereo recording brings into action a sort of 'sound locating' attribute. Many tape enthusiasts will recall at some time or other making a mono recording in a domestic environment, probably of a group discussion or play and, in spite of careful attention having been given to microphone placement, sound-proofing and so forth, being singularly disappointed with the results of the take on playback.

Typical symptoms are the jumble of voices when two or more people are speaking at the same time, the ticking of a clock in the apparently quiet room, the passing of a car or train, a bell chiming, etc. All these noises – wanted and unwanted – merge into the one general sound coming from the single-channel mono loudspeaker.

Exactly the same conditions, but this time using stereo, would reveal a dramatic improvement in overall intelligibility. The stereo effect places voices and sounds in correct perspective. The individual noises are effectively removed from the general background noise, and it becomes possible to pick out – and listen to – one from the others with considerable ease; this is what is meant by the 'sound locating' attribute of stereo.

With transistors taking over the role of valves in tape recorders (as well as in almost everything electronic), more and more stereo recorders are being made, and at reasonable cost. Some models have the loudspeaker of one channel in the usual position in the cabinet and that of the second channel in a detachable lid. This allows the two speakers to be separated from each other and placed in the room for the best stereo effect.

Not many years ago it was extremely difficult to make a stereo tape, and only the experienced enthusiast tackled this highly technical exercise. Nowadays it is no more difficult than making a mono tape. Some stereo models, such as Philips machines, come complete with a special stereo microphone that plugs into a single DIN socket at the rear or side. Other makes might use a pair of mono microphones, one for placing to the left and the other to the right of the sound source.

The true stereo microphone embodies a pair of microphone inserts within a common casing with their axis of maximum sound pick-up displaced 90 degrees from each other. This kind of microphone is orientated so that a line between the two inserts (45 degrees from each one) points in the direction of the sound source, as shown in Fig. 1.

There are so-called single- and two-track stereo machines. The single-track version uses half-track tape, heads etc, with the A channel occupying one half track and the B channel the other half track, as shown in Fig. 2(a). Note here that single-track stereo simply means that only one stereo recording can be accommodated on the tape, using two half-tracks simultaneously. The two-track version uses quarter-track tape, the tracks divided into two stereo pairs, as shown in Fig. 2(b).

The Philips cassette system differs from this in that the A and B channels are recorded on adjacent tracks, as shown in Fig. 2(c). There are two adjacent-track-pairs, so when one side has been played (or recorded) the cassette is turned over to play the other stereo pair of tracks.

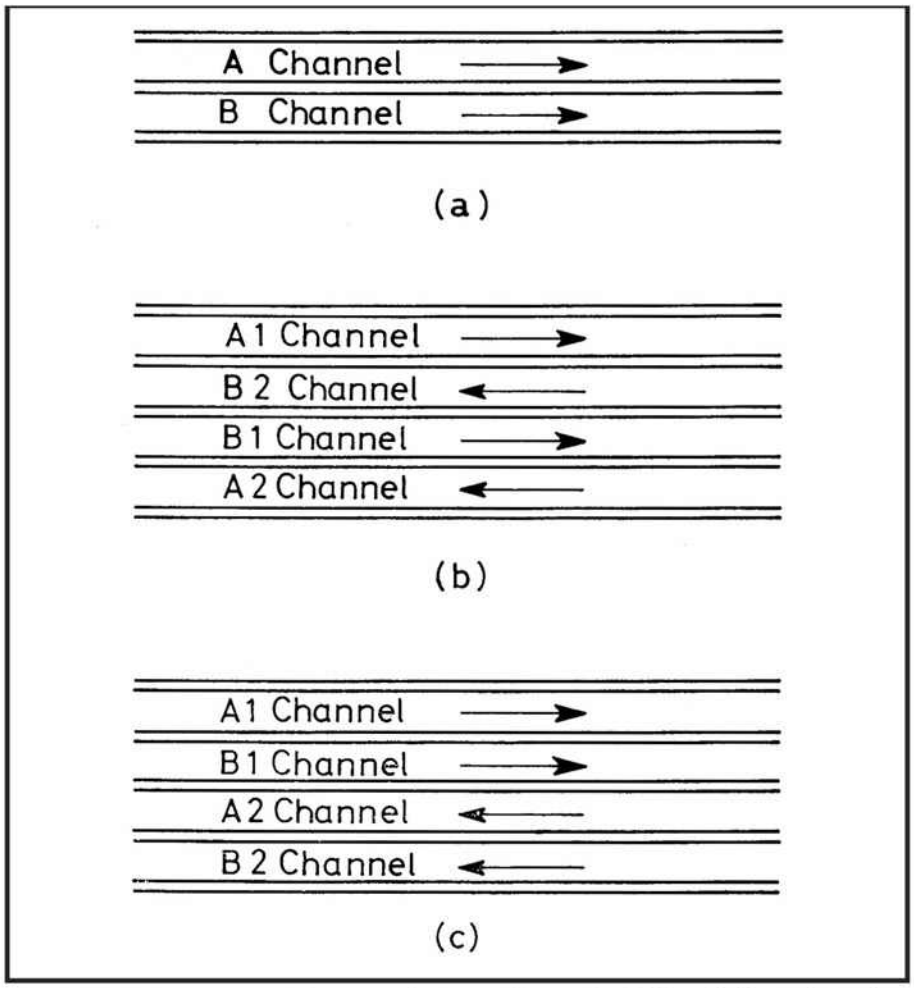


Fig. 2. Single-track stereo (a), two-track stereo (b) and the Philips Musicassette system for two-track stereo (c).

Compatible System

The reason why the tracks are arranged in this manner is to make the cassette (and its taped material) suitable for working in both mono and stereo cassette machines. Stereo machines, of course, feature a pair of heads individually arranged so as to traverse the adjacent tracks, giving A and B signal outputs. Mono machines, however, have only a single head whose gap length is sufficiently long to embrace both stereo tracks together. Thus, the signal induced into this head is equal to A+B, giving mono from the basically stereo tape. This is a clever arrangement and works well in practice. Stereo tape records (called Musicassettes) thus work on mono and stereo machines and, conversely, mono Musicassettes work in both mono and stereo machines. The system is therefore compatible.

Stereo recorders, although needing separate A and B recording channels, may have only one level control and indicator. The control sets the recording level of both channels in balance, while the indicator shows the level of signal in both channels. Thus, operating such a machine is

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INVESTIGATE - DON'T PROCRASTINATE

or the importance of research before recording

by George Wilkinson

We, that is the three who get together on nights apart from the normal club night, are all interested in the creative side of tape recording. It is from these get-togethers, and the discussions that ensue, that our best efforts have resulted. The idea is born, and then the planning of the way that the research will be carried out is completed before the actual project is begun.

It is the research into the subject that provides that ring of truth, the authenticity that is essential before the listener can be really interested. And it is only the work resulting from thorough research that will eventually receive the credit it deserves.

These discussions, which often started on tape recording had a habit of wandering onto other subjects, ones on which we had little or no knowledge, like the 'brain drain'. How the brain drain turned itself into bird migration, I never really found out, but I think that it was Edwin who installed the enthusiasm into us, 'installed', yes that's the right word. His graphic words conjured up thoughts of immense flocks of birds emitting their cries as they circled before landing. One could almost hear the fluttering of their wings, the groan of the trees under the weight of their tiny bodies, multiplied by their numbers.

The interest in the prospect of recording this exciting event overshadowed the thought of the essential research that should have been carried out before embarking on an enterprise of this nature. As the enthusiasm grew, we probed our minds for hidden facts, facts long forgotten, facts unearthed whilst searching for other facts, facts distorted by memory, and facts we believed to be true. It was common knowledge that the birds migrated during the autumn, and that they followed certain routes. The probing of our minds had revealed that the birds for some unknown reason followed a flight path that led them to the centre of England, that is for those from the north, and they were the ones in which we were interested. For us this was a piece of luck, for we live surrounded by places all claiming this honour. As some of them were in towns we ruled them out as resting places for the birds, and considered only the more rural ones. The ones too near the major trunk roads would be too noisy, but then the flight path must be of considerable width, so some open space of a good area would be needed.

The place up the road fitted the bill, with a good deal of open ground well away from the towns, and located between the main roads. It was an ideal resting place for the birds to stay the night. We had heard that people came from miles around, and that they brought expensive equipment with them to record the song of the birds as they arrived, and as they departed. Yes we had the

'I have a very excellent rendering of a cut-off cry of horror.'

place figured out, but what about the time? John had worked, and spent a number of years in the south of England, and he remembered seeing the birds resting on the cliffs before flying across the water to the Continent. This would be in late September. He was sure of that because he always took his holidays during the last two weeks of that month. I think we all knew that the migratory period lasted some weeks, and next Saturday being the 24th of September, would be about the height of the period. So why not have a go, weather permitting.

Yes, we had it all figured out – the time and the place. Early morning would be the best time, but we would have to be careful not to disturb the resting birds, or we might spoil the real moment of departure. Then the birds would rise as one into the air, their wings blotting out the sky, their song would fill the air, and our recorders would possess that moment of time, a moment heard by so few.

We had talked ourselves into making the attempt and agreed to meet two nights hence at a point from which we would find the best place to set up our equipment. One essential that the birds must have would be water, so we must find a place near a pond or a brook. It would have to be a wide brook. A wide brook, well we thought that the birds would like a wide brook, but there are no wide brooks in the area. There are a number of ponds, which we narrowed down to two. The first one we found was in open country, and the nearest house was some distance away, it was ideally situated for the birds to have a good night's rest, but the only perching places would be on the very small bushes and they were not too numerous. The pond was formed by the natural slope of the ground, and was used by the cattle as much for cooling their feet as for drinking.

We agreed this would not be to the liking of the birds. Now the second place was the one we had been looking for, plenty of trees, good clean water with rushes and lilies in and around its edges.

The peace surrounding the pond was a haven of rest, and any doubts we may have had were banished as we saw a flight of ducks come in and land on the water. We picked our spots. We measured the amount of cable we would need for our microphones. We estimated the recording time. We observed the prevailing wind. We were now prepared to record the moment of take-off. It was decided to delay the attempt until the Sunday morning, as the road and air traffic would be less than on the Saturday, and we would stand a far better chance of getting a better recording with less extraneous noises. We went home very pleased with our evening's work, and arranged to meet again very early, some two hours before dawn on the following Sunday morning.

We met as arranged, and on foot made our way towards the selected site, but in the darkness we missed the gate that led straight to the pool. Instead we wandered round for some time, or rather it would be nearer the mark to say blundered round. We were con-

stantly entreating each other to be quiet, and my main regret is that I did not have my recorder switched on during that trip along that uneven path. I would have obtained some very interesting recordings, and one of the finest owl hoots ever recorded.

We had paused to rest, and were clustered round the trunk of a fairly large tree, I think it was an oak, *'Too Wit, Too Woo, Too Wit, Too Woo,'* the sound came from about three inches to the right of Edwin's left ear. Unfortunately his roar of surprise would have completely drowned the second part of the bird's call, but I would however have been compensated by the very excellent rendering of a cut-off cry of horror. For in thrusting himself away from the tree against which he had been resting, and in an endeavour to escape, he had crashed headlong into the bole of a nearby tree. John and I were stunned by the suddenness of the calamity that had struck, and the silence of the night went unheeded, as we clustered round our fallen companion, why by the dim light from a torch, could be seen to be mouthing words better left unrecorded. The damage was only slight, in a physical sense – a few cuts, not worth bothering about, and a slightly twisted finger. But there are other sides to the human being, and I wondered if Edwin would ever be allowed to forget this night in the woods. With one thing and another, we had made enough noise to wake all the birds in the vicinity, as well as the entire population of the birds who had no intention of migrating anyway.

But luck seemed to be with us, for the silence remained unbroken, as did the recorder Edwin had shed in his headlong flight, and without further incident, we arrived at our selected places. With our microphones positioned as planned, we sat waiting with our recorders at the ready. This was a point in our endeavours which could only be surpassed by the actual recording of the birds.

We each had our own ideas of what would happen. Mine was that in the dim first light of dawn, I would see the birds perched in the trees. I would be able to see the small movements that they made as they began to awake, the stretching of a leg, and then the fluttering of the wings as they beat them together, to restore life into their now rested limbs. Then I would switch on my recorder, and the first sounds would soon begin to fill the air. Each bird must leave its perch to drink, before beginning the next stage of its flight to the warmer countries. Then when they all had had their fill, I could see them waiting for the command to take flight.

I could not believe that there would be one bird in charge, and I presumed that nature must give the command. Then with a flurry of wings the whole flock would take to the air. I would be able to feel the wind from their wings as they thrust themselves into the cool clear air. Their cries would drown out the beat of their wings as they circled their resting place, only to press on to the next point planned by nature.

As the first rays of the dawn began to colour the sky, I felt the cold, and I pulled my coat a little tighter. This was the time for me to look for the resting birds, they should be all around, some must be in the tree above me, but perhaps the dim light prevented me from seeing them. As the light grew, so did the thought that there were no birds in the tree above me, or any in the trees around the pond. I waited, as did my two friends, until the sun was well clear, and the light quite strong. Never have I seen a sight so awe-inspiring, so bewildering, for on every bush and tree, nothing else could be seen but leaves. Not one single bird. We waited hopelessly as the sun rose higher, perhaps they would come, or go, but as we packed our gear to the quacking of the three ducks, who seemed to live there, we knew we had come to the wrong place, or it was the wrong time.

'Right, lads! They've set up—let's go!'

We had learned a very important lesson, and our lost sleep was, in part, payment for that knowledge. We had failed to find from reliable sources, the correct time, and the proper place.

In other words we had not done our homework, and we had failed in our objective, but that failure did in fact increase our determination to succeed on our next attempt. During the next few days we sought information from the library, the local ornithologists, and others who had actually made recordings of the birds migrating. We learned that birds do not think like humans and that what looked good to us, they avoided. They did in fact prefer the open pond, even though it had only the small bushes. I learned a lot of interesting facts about birds, the feathered kind, although I never did record the migrating period, perhaps I will sometime.

But from that time on, I have always given plenty of study to researching my subject. Research is vital, research is essential, research is not dull, but enlightening. Many interesting facts come to light, to be stored away and used at a later date.

Don't *think* you know, make sure you know every detail of your proposed operation, don't procrastinate, investigate.

A RECORD LEVEL INDICATOR

Another do-it-yourself feature

by B. E. Wilkinson

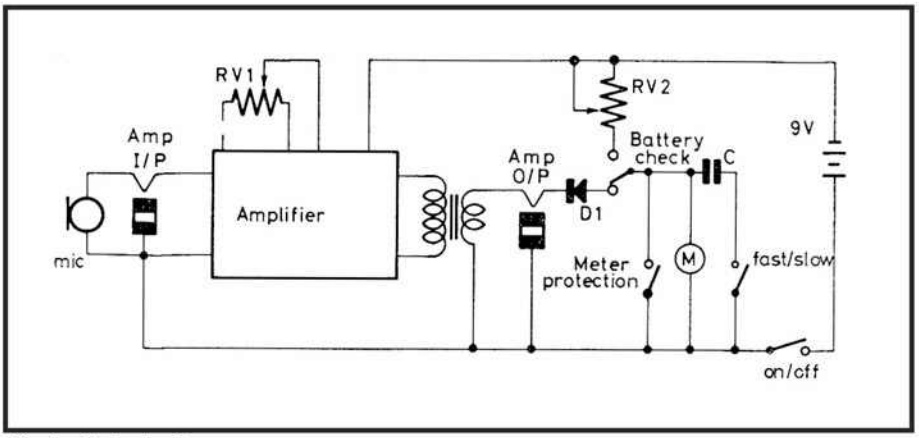


Fig. 1a. Basic circuit

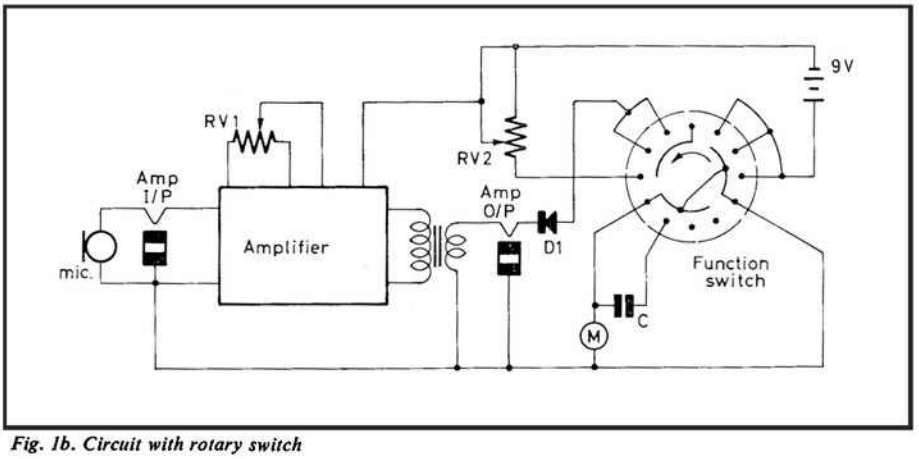


Fig. 1b. Circuit with rotary switch

A portable, battery-operated instrument, the record level indicator is intended for use with:

(a) Battery tape recorders with no means of record level indication.
(b) Recorders with a magic eye, where meter indication is preferred.

A jack socket is connected into the amplifier output circuit so that the unit can be used as a general-purpose, high-gain, af amplifier. The instrument could also be used as the basis of a sound level meter, although the problems of calibrating the meter in decibels are considerable.

The circuit is shown in Fig. 1a and consists of a sensitive microphone (crystal) matched into a high-gain transistor amplifier, the output of which is applied to the movement of a moving coil microammeter via a rectifier. An amplifier gain control is fitted so that the indicator can be calibrated for use with a particular recorder. The amplifier is supplied from a 9 volt battery and while this is large enough to ensure long service, the ultimate exhaustion will affect the unit performance. For this reason a battery check circuit is fitted and converts the microammeter into a voltmeter. The circuit setting is such that a battery in good condition is indicated by needle deflection above an index mark. When the reading has dropped below the mark, amplifier performance would be affected and the battery should be replaced. Meter response can be varied by the use of a 'response' capacitor across the meter movement and two settings are provided – *fast* and *slow*. In the *fast* setting, there is no capacitor across the meter, which thus follows the transient sound variations. This setting would be used where the sound level is fairly constant and the meter reading is thus easy to assess. Where there is considerable variation in sound intensity, the needle movement is erratic and difficult to follow. At the *slow* setting therefore, the needle is damped by the action of the response capacitor. Two jack sockets are provided, one to receive the microphone, which when in use is placed near the recorder microphone. The second socket is in the amplifier output on the low impedance side of the output transformer. A jack plug, pushed into the socket, disconnects the meter circuit so that the unit can be used as an af amplifier.

Construction

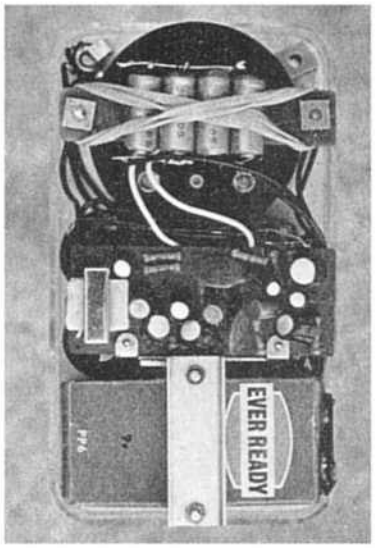
The main feature of the level indicator is, of course, the amplifier, which is a three- or four-stage transistor unit. These are now available at a price which makes it uneconomic to try to build one. Such units are mounted on small printed circuit boards and are complete with output transformer, battery leads and battery clip; they are in fact complete and ready for use. The amplifier used in the level indicator shown is built on a board 2·8 × 1·1 inches and is about 0·75 inches thick. It is fitted with a small L-shaped bracket for mounting. The microammeter is the most expensive item and, as such, would probably cost around 25*s*. However, sensitive meters (not always graduated in microamps) from ex-Government equipment can be purchased more cheaply. The meter shown was taken from an old pre-war light meter and requires a current of 100μA to effect full-scale deflection (fsd).

If, having obtained a suitable meter, it is decided to retain the existing scale, then two relevant positions – overload and battery check can be drawn either on the scale or on the glass window using a heavy, black ink. However, it is perhaps more effective if the existing scale is replaced by a simpler and more suitable one (see photograph). Such a scale is made and fitted as follows:

(a) carefully remove the meter movement from its case – this usually involves removing three screws at the circumference;
(b) taking great care not to touch the needle, remove the two screws securing the face and slide it out carefully;
(c) cut out a paper face and draw in the scale in black ink, using a pair of compasses. If ink-compasses are not available, a black ball-point pen can be used successfully in the ordinary type of compasses intended for pencils. Divide the scale into three (approximately) and blacken the upper two thirds. The beginning of the blackened area represents the overload point;
(d) the position of the battery check mark is a matter of choice. As we shall see, the mark represents 7 volts, and if we arrange for the full scale deflection to represent 10 volts, then the mark will fall 7/10 the length of the scale.
(e) Now stick the paper face on the original face and refit on the meter, taking care to avoid the needle. Fit the movement in the case ensuring that the 'zeroing' screw below the window is correctly lined up. Replace the three screws at the circumference.

Control face of record level indicator

I experimented with a 4-diode full-wave rectifier bridge, but found that there did not seem to be any more sensitivity than with a single diode. The component used is a GD10, although any crystal diode is suitable. A very small response capacitor will have no effect on the needle, while a very large one will effect too much damping. In practice, 200μF is found to reduce the erratic movement, but does not render the response too sluggish. Since the voltage involved is very small, an electrolytic capacitor of suitable value



Component layout

will not be physically large. It will be seen from the photograph that the capacitor is built up of four 50μF capacitors connected in parallel. These are held in position with an elastic band. The battery test circuit consists simply of a resistor in series with the meter, the combination being connected directly across the battery. The circuit should be arranged so that battery voltages below 7 volts will not deflect the needle beyond the index mark. I decided that the 7 volt mark should be $\frac{7}{10}$ along the scale – ie, at a current of 70μA. The resistor which will cause the needle to deflect to this current when 7 volts is applied is given by,

$$RV_2 = E/I = \frac{7 \times 10^6}{70} = 100\text{Kohms}$$

In practice, RV_2 should be somewhat larger than this and should be adjusted in the circuit until the meter needle coincides with the index mark, using a known 7 volt battery. In the indicator shown, RV_2 is 250Kohms.

The reader will observe that the circuit incorporates 4 switches:

(a) On/off.
(b) Meter protection.
(c) Meter response.
(d) Battery test.

Although these can be separate toggle switches (Fig. 1a) operated independently when required, the sequence is such that they can be conveniently incorporated in a single rotary function switch, the circuit being shown in Fig. 1b. Fitted with 12 contacts, the switch has three wipers, two of which are joined for this application. The switch (viewed from the back) is shown in the *off* position and it will be noted that the meter is short circuited. This represents the meter protection switch and the effect is to damp the needle movement so that it will not run hard against the stops in spite of vigorous movement. It will be appreciated that the meter coil is suspended in a strong permanent magnet field and that movement of the coil, due to shaking the meter, will generate a current. If the coil is short-circuited the current will flow in the coil and produce a magnetic field which, due to Lenzs' Law, will oppose the field due to the magnet. The needle thus resists any sudden movement. At the first position from *off*, the meter is no longer short-circuited, the 9 volt supply is applied to the amplifier and the 200μF response capacitor is shunted across the meter. In this position (slow), the meter is behaving as a level indicator for use where there is considerable contrast in sound level. At the next step (fast), the conditions are identical except that the response capacitor is disconnected. At the next step (batt), the supply is connected to the meter via the resistor RV_2 for the battery test function. The fourth and final step is not used.

As the level indicator is portable, it is important that it should be built in a convenient and compact case. The reader may well have his own idea of a suitable container, but the unit shown is housed in a plastic 'elevenses pack', identical to the one containing the acoustic switch (*ATR*, June 1967). The components are all mounted in the lid and as the case is deeper than required, a section has been cut out to make the final dimensions $5\frac{1}{2} \times 3 \times 2$ inches. Owing to the plastic being transparent, there is no need to cut out a circular hole to receive the meter. Due to its previous application, the meter shown is not fitted with the normal mounting flange, but is held inside the plastic lid by means of a tufnol strip and two long 4BA nuts and bolts. In the interests of symmetry, the meter is positioned on the centre-line of the lid at the top. Owing to the lack of space in the lid, it was necessary to use a miniature potentiometer (RV2) for the battery check circuit. This is an inexpensive ex-Government component. The amplifier volume control (5K) is a miniature component anyway. The battery is a PP6 and while more space is available using a PP3, the larger battery has greater capacity and will thus give longer service. 6BA battery-securing bolts are lengths of studding held in the lid by 6BA nuts, the battery itself being secured by means of a short length of H-section alloy curtain rail and two 6BA nuts. There was insufficient space on the lid to mount the amplifier unit, so this is carried on an L-shaped bracket, fixed to the lid with a 6BA nut and bolt. It will be seen from the photograph that the amplifier is laid flat and is positioned directly over the two potentiometers and the function switch. The two jack sockets (Amp I/P and Amp O/P) are fitted at the top on each side of the meter.

Where a transparent case is used, it is convenient to position a white card under the control face with the appropriate switch positions and potentiometer settings typed in. I found the best way to obtain this card is to make it initially of paper, marking on the positions of the potentiometer and switch collars, etc. Information is then typed on and the paper stuck to a piece of card. If the excess card is then trimmed off, the card can be fitted under the lid and the holes cut out. The card is held rigid by the components when mounted. It should be pointed out that the arrangement described and shown was found to be the most convenient in respect of the container used. Varying shapes of container will indicate different layout and mounting arrangements. Wiring up is carried out from a circuit or wiring diagram, previously prepared. Fig. 2 shows the component layout and wiring arrangement of the indicator; the amplifier has been displaced to one side to show the function switch contacts.

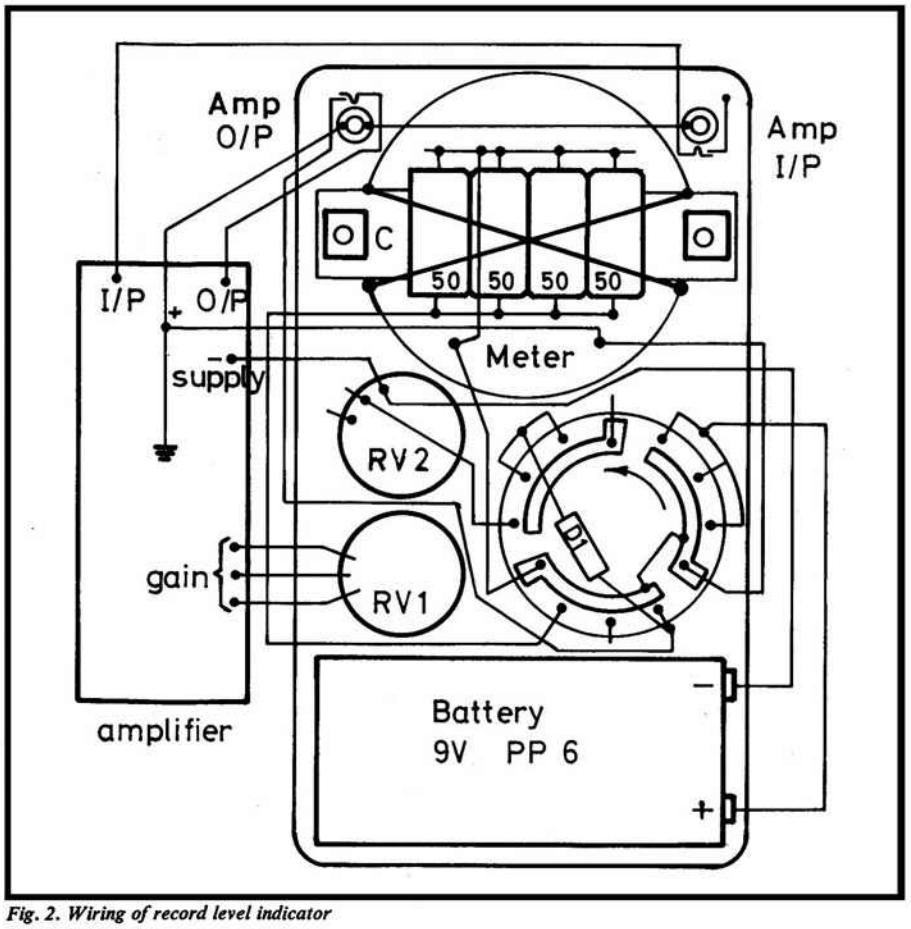


Fig. 2. Wiring of record level indicator

Calibration

Once the circuit wiring is complete, the unit must be tested and then calibrated. Testing should be carried out as follows:

(a) Set the function switch to *off*. Now move the unit vigorously and observe that the meter needle is sluggish and does not run hard against the stops. To observe the effect of movement without the meter protection switch, disconnect the battery, select the *slow* function and move the unit vigorously.
(b) Ensure that RV2 is set to its maximum and select the battery check function (*batt*). Where a battery is of a known 7 volts, reduce the resistor value until the needle coincides with the index mark. Where a new 9 volt battery is being used, set the needle to the point which would represent 9 volts. The reader will appreciate that it is most important that *batt* is never selected with RV2 set to a minimum, since

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SOUND SCENE

New Garrard Musicassette Deck

Garrard Engineering Limited – a member of the Plessey Components Group – is currently tooling for quantity production of the slide-in cassette mechanism (shown in Fig. 1) designed to meet the growing demand as many record companies have now adopted the new compact tape cassette system. When the cassette is inserted into the slot at the front the unit automatically starts, plays through the tape, stops, ejects the cassette and switches off.

The basic mechanism is compact and weighs only 27 oz. It can operate vertically or horizontally and is ideal for use in a car tape record player. Operation can be from 110/220 volts mains or from batteries.

Electronic Music Composer

Barry Gray, musical director of Century 21 Productions and composer of the famous *Thunderbirds* music, is shown in Fig 2 working with his EMI BTP4 studio tape recorder on his latest score. Barry Gray, born in Blackburn, studied musical composition under the Hungarian maestro, Matyas Seiber. He is one of this country's leading exponents of popular 12 tone music which he produces with the aid of an extensive tape library and two variable speed EMI playback machines. His scores for Century 21 are invariably coloured by the use of electronic instruments. The latest, for the new series *Captain Scarlet and the Mysterons* includes 2 harps, 3 electric guitars, glockenspiel, vibes, Hammond organ, transicord and an Ondes Martenot, the French originated ether-wave instrument, which the composer himself plays.

Grundig Schools Recording Contest

For the second year in succession the children of Class U4R of Boutcher Church of England Primary school, Grange Road, London, SE1 carried off the first prize in the Junior Section of the Schools' Tape Recording Contest sponsored by Grundig (GB) Limited. The winning tape told the story of *Jonah* and was made by the children with the help of the Deputy Headmaster, Mr Paul Ranger, as an extension of their Drama and English lessons. The prize, a Grundig C100 portable tape recorder, was presented in the School Hall on May 8th by the Divisional Inspector, Mrs Chetwynd in the presence of the School Governors and parents of the children who took part (Fig. 3).

Winners of the Senior Section and Overall Prize in the Grundig Schools' Tape Recording Contest, Brecon Secondary Modern Technical School received the Grundig Silver Challenge Cup and a Grundig TK120 tape recorder at a special function at the school on May 18th. The 10 minute tape, submitted by Mrs E. Gerrish, the Drama teacher, was based on the Pied Piper, the well known story by Robert Browning and was made by the 22 pupils of Middle School 1 (Fig. 4).

Fig. 1. The new Garrard Musicassette deck will operate from mains or batteries.

Fig. 3. Tina Ambler and Graham Moat, members of Class U4R of the Boucher C of E Primary School, receive their prize, a Grundig C100 tape recorder from Mrs Chetwynd, the Divisional Inspector. Tina and Graham both took part in making the winning tape in the Junior Section of the Grundig Schools' Tape Recording Contest.

Fig. 2. Electronic music composer Barry Gray at work with an EMI BTP4 studio recorder.

Fig. 4. Middle School I of Brecon Secondary Modern Technical School, winners of the Senior Section and the Overall Prize in the Grundig Schools' Tape Recording Contest, watch their form captain, Helen Chappell, receive the Grundig Silver Challenge Cup from Miss Brenda Marriott, Grundig's Publicity Manager. Mrs E. Gerrish, the Drama Teacher who submitted the winning tape, is seen on the right.

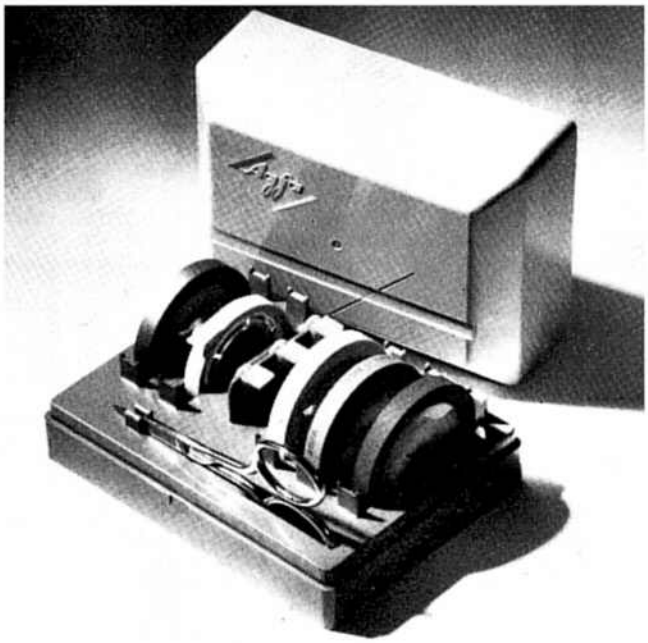


Fig. 5. New tape editing kit by Agfa.

Agfa Editing Kit

Recently announced by Agfa is a new practical editing kit, an attractive outfit containing red, green and white leader tape, adhesive tape, non-magnetic scissors, silver stop foil, tape clips. The lid of the container forms a tape splicing template. The new splicing kit is shown in Fig. 5, and is available from all Agfa dealers.

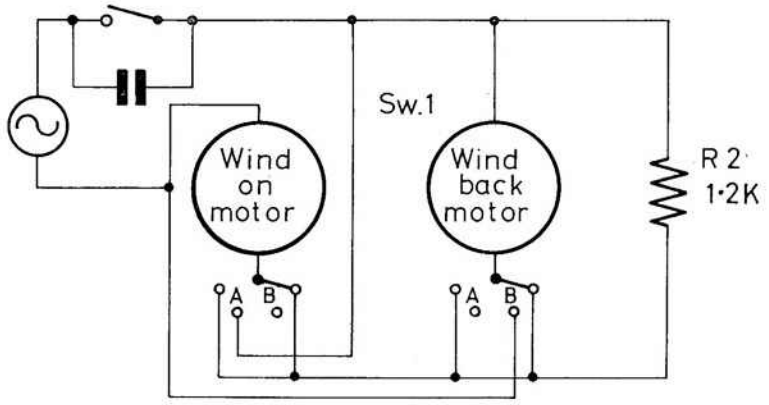
British Amateur Tape Recording Contest

In addition to the ten trophies, money and equipment prizes, there will be an extra trophy known as the Cotswold Trophy, which is to be awarded for the best tape recording sent in by a handicapped person. The Cotswold Trophy has been very kindly donated by the Cotswold Tape Recording Society in memory of their founder and President, the late Mr Eric Jones. Entry forms for the BATR Contest are available from the Secretary, 33, Fairlawnes, Maldon Road, Wallington, Surrey or from *ATR*, Haymarket Press Limited, 9, Harrow Road, London, W2.

VARIABLE SPEED SPOOLING

A useful aid to tape editing

by G. T. Rogers



Original circuit

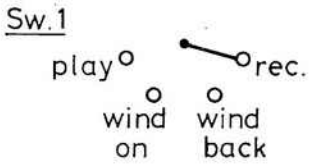


Fig. 1.

Tape editing, an art which can be undertaken at very little cost, can provide a very satisfactory and worthwhile experience for the owner of a tape recorder. For the non-creative recordist it may consist simply of joining together selected recordings of interest collected over the years. For the creative recordist however, tape editing means much more than this. He will wish to select the best of his many trial recordings and cut and splice these so as to obtain the desired effect in the finished programme. The number of splices involved may be many and the process is time consuming, but it is just as creative and enjoyable as making the original recordings.

Tape editing is therefore a very important part of making interesting tape recordings yet it is surprising to find a great many machines, even some of semi-professional calibre which are not adequately equipped. In this case editing can become a very difficult task requiring great technical skill and endless patience. One drawback on many machines is an inaccessibility of the replay head, making it difficult to mark the tape accurately. Another is that no manual free-wheeling is available when the machine is switched to fast wind and coupled to this the tape does not reproduce in this mode. This is essential so that the tape can be rocked back and forth over the replay head and the sound analysed to obtain an exact position for cutting betwen, say, adjacent single notes in music or two syllables in speech. An additional feature, which will be described in detail in this article, is a means of varying the fast spooling speed from full speed forward to full speed reverse. This facility, often found in professional equipment, has a definite advantage over the simpler manual free-wheeling facility sometimes encountered in domestic and semi-professional recorders, for in addition to moving the tape to and fro by hand to obtain the precise cutting point, the control will also enable the whole programme to be scanned and any part quickly located for editing in the usual way.

Variable speed spooling can be applied to many domestic and semi-professional machines which have separate motors to drive the reels. In the author's case the machine chosen in a Ferrograph 422U. This is a versatile instrument on which the replay head is easily accessible after lifting the hinged cover. It also offers manual free-wheeling when the main deck switch is turned to fast wind without starting the motors, and during this facility the machine plays back through the main amplifiers. Another feature reflecting careful thought in the design, is the inclusion of screw tappings on the deck in a convenient position to take a Bib tape splicer.

The original motor circuit of the 422U, together with the modified variable speed circuit which was suggested by Messrs Ferrograph, is shown in Fig. 1A. In the original circuit switch Sw.1 applies mains potential to either the wind-on motor (switch at A) or the wind-back motor (switch at B). These motors are designed so that a high driving torque is available when mains voltage is applied, and this is used during the short time necessary for high speed shuttling of tape from one spool to the other. The other positions of Sw.1 are used for record and playback and in these functions the motors are driven by a lower voltage via the resistor R_2 (1·2Kohms). This is so arranged that more power is applied to the wind-on motor and less to the wind-back motor. This means that a larger driving torque is available for the take-up spool and a smaller *back torque* maintained on the feed spool, which is necessary to pre-

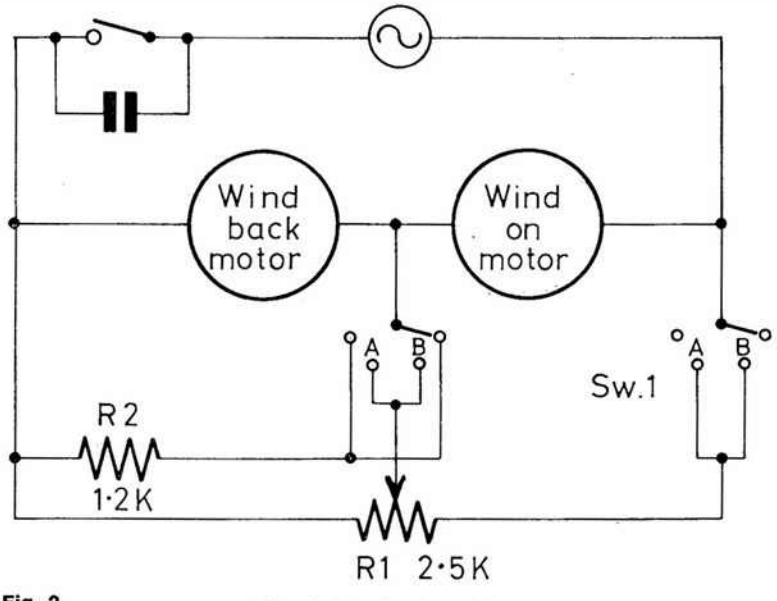


Fig. 2.

Modified circuit

vent spillage and to keep the correct tension on the tape during its transport from one spool to the other.

In the modified circuit (Fig. 1B) R_2 has the same function as in the original circuit, allowing a greater torque on the take-up spool than on the feed spool, during recording and playback. The two fast wind positions on Sw.1 however have been joined together and power is taken from a 2·5 Kohm 30 watt potentiometer R_1. Before going on to consider how this circuit works it will be useful at this stage to say something about the actual motors used to drive the spools.

Except in battery driven portables, the spool motors in modern tape recorders are generally of the single phase induction type which are efficient, robust and require little attention other than an occasional lubrication. The induction motor consists essentially of an outer fixed winding called the stator, and an inner moving coil called the rotor. Since there is a small air gap between the two coils there is no electrical connection between them; the energy is transferred entirely magnetically. The working of the motor depends on the production of a phase difference between the currents flowing in different parts of the stator so as to establish a *rotating magnetic field*. This phase difference can be accomplished for instance by means of a series capacitor in the stator winding.

The rotor winding is usually a short circuited coil and as soon as the stator supply is switched on, an emf is induced in the rotor causing a current to flow which tries to oppose the effect of the rotating field. The interaction of this current and the field makes the rotor begin to rotate. Its speed, though, can never actually catch up with that of the field since at 'synchronism' there would be no relative movement between the coil and the field axis and hence no induced voltage to produce the driving current. The difference in speed of the rotor and the rotating field is known as the 'slip' which may be in the order of 3% of the synchronous speed.

The speed of the rotor of any given induction motor depends on the supply *frequency* and on the number of poles in the stator, and not directly on the supply *voltage*. In practice however, the effect of reducing the voltage applied to the stator is to reduce the magnetic flux and hence the induced emf in the rotor. This makes the motor less efficient and less torque will be available to drive the reels against friction and back tension, the slip will be increased and the speed of the rotor will fall.

Reference to Fig. 2, the theoretical arrangement of the motors and the control potentiometer, will show how the modified circuit works. When the centre tap is at A, mains voltage will be applied to the wind-on motor and its speed will be maximum. Similarly the speed of the wind-back motor will be maximal when T is at B. However as the tap is slowly moved away from A the speed of the wind-on motor will slowly decrease and the back torque of the wind-back motor will gradually increase, until a point is reached when the torques on the two motors are equal and opposite and the speed of the tape will be zero. This is shown graphically in Fig. 3.

Assuming that the resistance R_b and R_o of the two motors and the loads on each

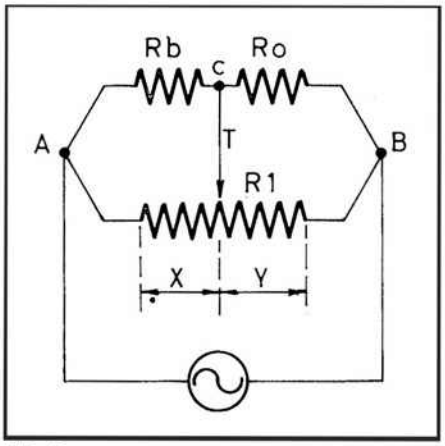


Fig. 3.

are identical the balance point will represent the condition when no current flows through the centre tap T. The motors are then energized by current flowing in series, along the path A-C-B, and this is at a low value determined by the combined resistances of the motors.

The theoretical balance point of the circuit is, if course, a characteristic of the familiar Wheatstone bridge, in which no current will flow through the centre tap when the ratio $R_b/R_o = X/Y$, where R_b and R_o are the resistances of the wind-back and wind-on motors respectively and $X + Y$ equals the resistance of the control potentiometer R_1. With two similar motors, where R_b and R_o are approximately equal, the balance point will exist when X is approximately equal to Y or when the control is at its half-way position.

At intermediate positions of the control, each motor will pull against the other and each will develop a torque which is related to the voltage tapped off from the control potentiometer and applied to its stator winding. The direction and speed of tape wind is therefore determined by the *relative torque* between the two motors and the load (the amount of tape on the spools) applied to each. As the torque of one motor decreases, the back torque or drag of the other increases which is an essential arrangement to prevent the tape looping when abrupt changes of speed occur.

The simplified diagram, Fig. 4 shows the relative torque between the motors at various positions of the control potentiometer. For example when the torque of the wind-on motor is reduced from maximum to the position A, by turning the control to C, the back torque on the wind-back motor (feed spool) will increase from zero to B. The balance point mentioned earlier is, of course, at X where the two curves intersect.

The power consumed by the control is the rate at which it uses up energy as it is converted into heat, as a result of 'free' electron collisions with the atoms while the current flows. For practical purposes the power rating of R_1 can be derived from the formula Power $= I \times V$ watts, or by Ohm's law, power $= I^2 \times R$ or V^2/R where I, V and R stand for the current, voltage and resistance respectively. Substituting the voltage applied to R_1 in the modified circuit, the power works out at $250^2 \times 1/2500 = 25$ watts. Allowing a suitable safety factor R_1 would require a rating of 30-35 watts.

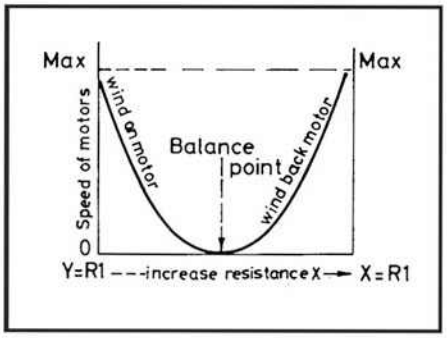


Fig. 4.

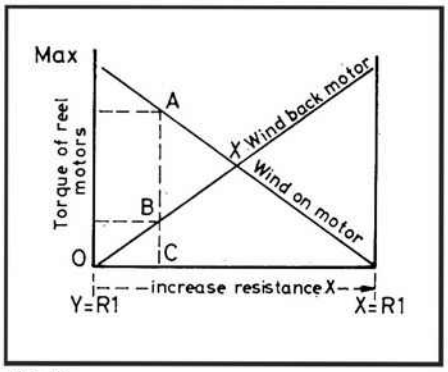


Fig. 5.

This rating assumes a current of 0·1 amps flowing in R_1. This is true when the circuit is balanced and no current flows through the centre tap T in Fig. 2 or when the tap is either at A or B. On the other hand, rather more than 0·1 amp will flow through the part AD of the potentiometer as illustrated in Fig. 5, when the centre tap is close to, but not actually at A. Suppose the motor winding draws 0·1 amp, then the current through AD will be near to 0·2 amp. In theory at least, this would require R_1 to have a rating of $0{\cdot}2 \times 0{\cdot}2 \times 2500 = 100$ watts using the $I^2 \times R$ formula. In practice though the control would be operated for the greater part of the time around the balance point and at A or B and the 30–35 watt rating given earlier is adequate.

Because of the heat dissipated and the restricted space inside the recorder cabinet, it will be found convenient to mount the potentiometer on a separate control panel situated on the left of the recorder. The necessary connections (mains voltage) can

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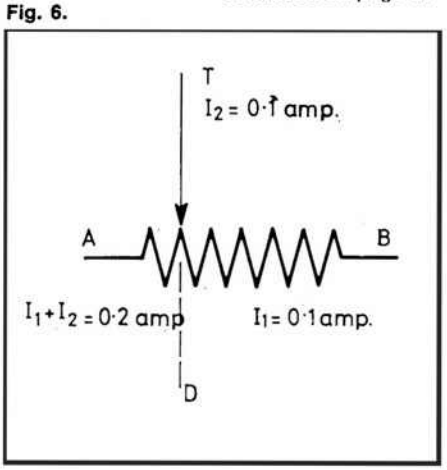
Fig. 6.



TAPE A HOLIDAY

The travails of a tape traveller. A vast amount of good material never gets used, complains Bob Danvers-Walker

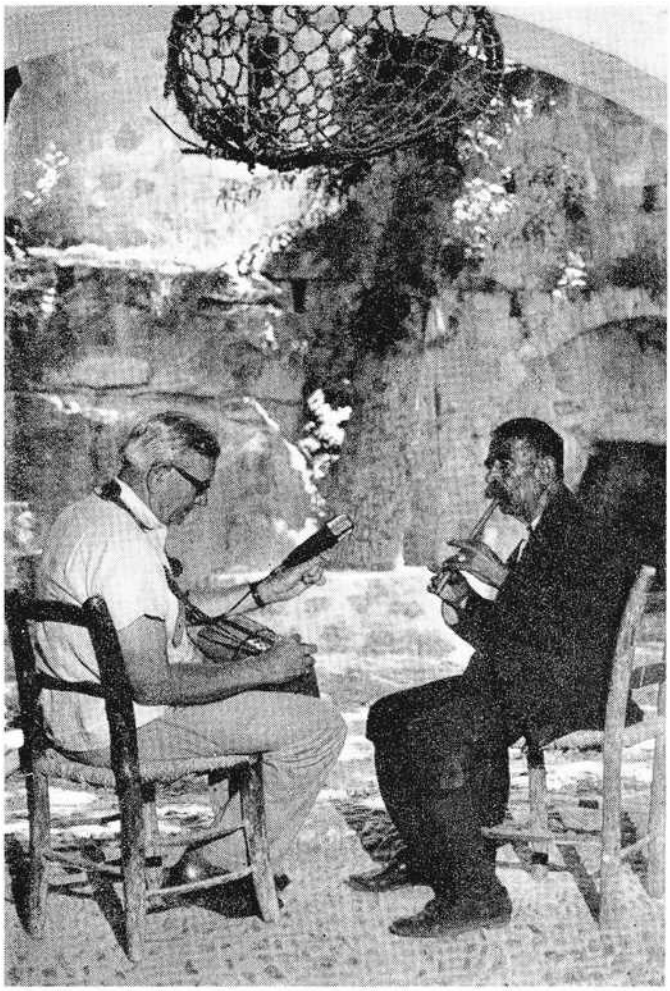
Music of Cyprus recorded in Kyrenia on the terrace of 'The Harbour House' owned by Judy Shirley, star of the BBC's famous wartime radio show Monday Night at Eight.

The last time I had a holiday – by that I mean a lazy, nothing-to-do, sun, sea and *lobster thermidore* fortnight away from work – would be, let me think now, back in the early fifties I would say. For the past fifteen years or so I have packed in more overseas travel every year than ever came my way when taking annual holidays, simply because a BBC radio producer, a travel film director, a TV programme chief or magazine editor gave me an assignment. And the first person to say 'half your luck, mate' should ask my wife or Editor Fred Judd what it's like being with me on a four or seven day tape recording mission. And what's more, as often as not I am also filming and gathering the ingredients for an article as well.

This business of holiday promotion is an exhausting business. I've seen more than one fatigued travel writer drive himself into the ground while his widely read feature describes some relaxing, soothing paradise in the Mediterranean. I just mention these facts because I'm just a little worried. As the Tape and Travel correspondent for *ATR* and knowing that you're a sound individual, I'm going to ask you whether you took your portable tape recorder with you on your holiday this year. If I may refer to people who are not professional travel writers and broadcasters as 'members of the lay public' then it's fair to say that they can mix their hobbies and holidays together quite successfully. But consider for a moment those who indulge certain hobbies professionally. Trigger-happy amateur photographers shoot off yards of film, golfers golf and fishermen fish and nobody thinks less of them. But let a professional photographer, golfer or piscatorial gent follow his calling when supposedly on vacation and you can hear the complaining wails of wives for miles. Well, you can understand it, I suppose. How would the husbands react if their wives who might be professional dress-makers, hair stylists or midwives spent the best part of their holidays running up frocks, trying out new coiffure creations on other guests in the hotel, or swotting up on obstetrics at the local hospitals? All right then.

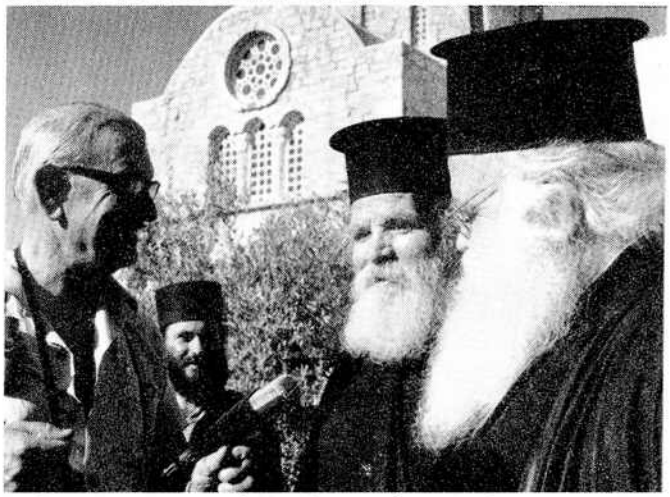
By the same logic the man or woman with the battery portable has brought it for one of three reasons: (1) For fun, because it's such a giggle to play around with a microphone on the beach and play pranks with your friends (sic); though those rather strange people from Wapping who sat at the next table never really saw the funny side when Mr X taped that time when the husband split the fried squid over his wife's sun suit. A recordist in this category may well have been an absolute riot with everyone (or nearly) and returns home refreshed with sand in his recorder head and not a care in the world. (2) With a set purpose in mind; to record for your Club or make a sound record of your holiday to play back reflectively and with some sense of personal pride. In which case this writer and this magazine will, to some extent, have been partly responsible since that's what we urge

Folk dances of Cyprus performed in Famagusta. This is a movement of the Sirtos Politicos, the Greek Handkerchief Dance.



Savas Filippos of Paphos, 70 years old and a shepherd flute player of great talent. He plays at musical festivals all over Cyprus.

In the Turkish sector in Nicosia Bob tries to persuade an old woman to record her street cry: she sells cherries.



Fathers Maximus and Stephanos chanted the Hymn of St Barnabas at the Monastery named after the most revered Saint in Cyprus.

our readers to do. But just between ourselves, back of my mind I can hear some wives saying to their spouses, 'Can't you just for once forget that wretched tape machine and remember we're on holiday?' And then there's (3), my category: Being told to go abroad somewhere, bring back good, interesting sound and construct a travel programme for broadcasting. In this case you start making contacts with travel agencies, airlines or shipping companies, national travel boards and, in some instances, Embassies or Consulates. You fix a week in the calendar, carry out research into the country's resorts, negotiate bookings, arrange facilities, draw up operational schedules. Then eventually, with a clean shirt, a toothbrush and razor in a carrier bag plus a mountain of technical gear draped all over you, you perspire your way to London Airport. From then on it's all GO.

Not that I don't enjoy belting around on location like the proverbial blue-tailed-fly from dawn to dusk. It's the weeks and mountains of work that emerge out of the assignments that bear down heavily. And the ulcer-making tensions that set in when your production which you really feel is a nice programme gets slashed to pieces by a producer or editor whose highest words of praise are grunted remarks like 'Suppose it'll go over all right' or, if he's in a happy frame of mind, 'Not bad – could have been better'.

So now glance through the photographs I had taken during a sound gathering assignment in Cyprus last June. Come next January or February in *Holiday Hour* an eight-day dash around the island visiting Famagusta, Kyrenia, Larnaca, Limassol, Salamis, the Mount Olympus villages around Troodos and Aphrodite's birthplace near Paphos will emerge as a twelve minute spot tight-packed with the sun-soaked sounds of International speed boat racing, the rasping of cicadas in olive groves, the soft notes of a shepherd's flute, the music of Asia Minor played on the Outi and the Darbouka, the street cries of Turk and Greek Cypriots (in their respective localities) selling Airani (a goat milk yoghourt), or cheese and olive puddings from their hand carts. Why is it that so much good stuff will have to be left unheard, crowded out by the dictates of programme planners who obviously know their job but to me are nothing but a body of faceless ogres bent upon spoiling everything I do. Anybody want to buy a persecution complex?

I won't be able to include that lovely hymn sung by the Monks in the Monastery of St Barnabas, or the sound of the village fathers playing a kind of backgammon called *Trik Trak* under the Tree of Idleness at Bellapais – and all because *they* are giving me twelve minutes and not a second more. That's when the red mist comes over me. Why not cut the show with a knife and fork I say (heatedly to myself) and fill up another hour with pop! Slash, Cut, Prune and Hack. That's all they think of when I come back with my lovely travel tapes. Eight days I've spent working like a slave – even going without meals so as to cram in as much taping as possible. All that money spent, all that energy burned up, all that time expended – all for 720 seconds of air time. If a day went by and I hadn't got two or three good recordings I'd lie in bed half the night worrying. At 5.30 or 6 o'clock the next morning I'd be up and off to capture sounds in the vegetable market or tape the waking sounds coming from a sleepy village roused by the swirling house martins that live beneath the eaves of cottages. The bleating of moufflon and Damascus goats I once taped at dawn. But then, ask any writer or broadcaster and he'll tell you the same thing. In film making too there's a very true saying that there's better stuff on the cutting room floor than ever got into the production. So there it is: and I wouldn't miss a moment of it. No sooner am I back from one assignment than I'm half way through planning the next. As I said to my wife, it's nice to be back to have drinkable tap water once more. I never did like that notice on a hotel door which read ... 'The running water in this room is drinkable. The Manager personally passes it'.

TAPE CLUB NEWS

News from the Federation

There was quite a good attendance at the AGM and a number of members took the opportunity to use their proxy voting rights. There were no fresh nominations and the 1966 Council was again put into office. One major decision was taken: to change the title to FEDERATION OF BRITISH TAPE RECORDISTS AND CLUBS. This brings in the associate members but leaves the well-known symbol and initials unchanged.

All keen amateur recording enthusiasts must know Cyril Rex-Hassan as the Director of the International Audio Festival and Fair, and since 1964 as the hard-working Chairman of the BATRC Committee. They may not know of the amount of effort and support, both practical and financial. that he has put into this task, or of his 'behind the scenes' backing of the amateur tape recordist whenever possible. It was in appreciation of this that the Federation Council recently invited him to become their first Vice President. He warmly accepted and now all wish Mr Rex-Hassan a long and enjoyable term of office.

Southend Teenagers' Recording Society

Since the club's last report was published in *ATR*, they have achieved a tremendous amount under their enthusiastic president, 16-year-old Terry Mendoza (seen holding mic in photograph).

A wealth of interviews with famous celebrities have been recorded for the society's hospital broadcast programmes including Rawicz and Landauer, Dave Allen, Pete Murray and Elsie and Doris Waters. The most distinguished interviewee to date has been the Rt. Hon. Dr Horace King JP, Speaker of the House of Commons. Copies of most of these interviews have been given to the local junior Toc H broadcast unit for their fortnightly programmes.

The society was called upon to provide background period music at the Kingsway Theatre, Hadleigh for their *Night at the Gaieties* in aid of charity. They also had a large team of members taping at various strategic positions around the theatre. The subsequent six hours of recording were condensed in a busy editing session to a one hour programme which was broadcast by Toc H to the five local hospitals.

Gary Miller has been appointed editor of the new club newsletter *Vibration* and David Riebald has taken over the task of technician of the interviewing team.

The society have recently started a new monthly competition in which members have to provide 5 *minute Masterpieces* which are judged by the whole society; the winners of each month are entered for the finals at the end of the year to find the STRS Tape of the Year. The winner of the first contest was D. Riebold with his entry – a doctored version of the *William Tell Overture* (with apologies to Rossini), complete with pistol shots, chipmunk duets, tuneful gurglings and impromptu drumming all made on a Robuk Rk4. Viv Fisher was winner of the second contest with his *Madvertisements*, a light look at how misleading TV commercials can be.

Terry Mendoza has gained his Silver Duke of Edinburgh Award with Sound Appreciation as one of the sections and is now working for the Gold Medal.

The scripting team of STRS, Ray Butler and Ian Fagelson, have now gained professional status through the club although they are only 15 years old! They had some portions of their comedy script accepted by the BBC in the radio show, *I'm Sorry, I'll Read That Again*.

The society turned out in force to record the Morris Dancing in the Pedestrian Precinct of Southend High Street; part of the National Folk Week celebrations.

During half-term, the first two of a new series of 20 minute *Tickled Pink* programmes for Radio Barnsley were recorded, using the Brenell Mk 5 recorder. Photographer Anthony Green must be thanked for his excellent job as principal DJ.

A team of three, including Michael Brown the newest member, took along some equipment to the Palace Theatre a fortnight ago to supplement the Palaces' panatrope for the Westcliff Drama Group's production *You Can't Take It With You*. In addition to sound effects they supplied period music on 78's to link scenes and give atmosphere. Another recording team has been to record the repertoire of a local classical trio, *Frank Sawyers Concert Party* to be made into a practice disc. Among the pieces recorded were *Sempre Libre* from *Traviata* and *Dells Song* from *Tales of Hoffman*.

Details of membership from the President, **Terry Mendoza, 28 Hall Park Avenue, Westcliff-on-Sea, Essex.**

Members of the Southend Teenagers' Recording Society.

The Moment of Truth!

How interested are members in using their equipment, especially for creating tapes? This was the half-yearly competition *Advertisement for the Coventry Tape Recording Club*. Alas, only four people managed to produce a tape on this subject. They were Bill Preston, Peter Warden, Cyril Stanley, and Roy Renolds. Bill gave details of some of the club's activities while Peter's tape asked if people were interested in meeting others or wanted an interesting hobby. This was interspersed with very short musical interludes. In contrast, Cyril's tape was much more ambitious, indeed more of a programme than an advertisement. The final tape and ultimate winner was entered by Roy. Roy is a past master in making these tapes (perhaps this is one reason why others don't enter a tape!). He has a brand of humour which he successfully transfers on to tape, giving a true but humorous theme for his winning tape. After the judging, a lengthy and interesting discussion took place. Nowadays members don't mind voicing their opinions about tapes heard and the entrants welcome these down-to-earth comments.

Ken Preston and Peter Warden went along with a portable to record the voice of Mr Harry Threadgold who at 97 is the oldest Freeman in the City of Coventry. After a brief problem with the machine, the interview took place with Peter acting as interviewer and Ken at the controls. As Mr Threadgold is almost totally deaf, the interviewer had to shout very loudly making the operator's job extremely difficult. However, Ken overcame this problem magnificently and the club were able to look back on the days of the 1890's.

Further information from the Secretary, **Mr K. W. Preston, 42 Four Pounds Avenue, Coventry.**

Natural History Visit

At the invitation of Mr H. G. Hurrell, the naturalist, author and broadcaster, a party of members from the **South Devon TRC** and friends spent a very pleasant evening at his residence at South Brent. Recording of a talking raven (with a near human voice) and a seal playing a mouth organ, toy piano and bells, were some of the unusual sounds captured on tape. A complete entertainment show was presented by the seal who carries out instructions from Mr Hurrel in three languages – English, French and Gaelic. Unexpected entertainment was provided when a swarm of bees was spotted and duly 'captured' with the help of members W. R. Owen and H. Heal who are both bee-keepers.

Members are busy preparing for a variety of amateur tape recording contests including three sponsored by the club itself. These are the *Stockman Cup Competition, The PPC Trophy Contest* and the *'Silver Spoon' Trophy*. The committee are now finalizing details of next seasons meeting and details are available from **The Hon. Secretary, Gordon Furneaux, 45 Kenwyn Road, Ellacombe, Torquay.**

Visit from Leicester Club

Gordon Routh of the **Rugby TRC** was responsible for the very excellent programme presented to visiting members of the Leicester Club recently. He started by talking about the synchronization of sound (tape) with cine film and then presented his quiz tape which was won by John Moule, Leicester secretary, with one of his lady members taking the runner up's prize. Gordon's film lasted about 30-45 minutes and depicted Malta as he saw it when serving there with the Army from 1959 to 1961. It was only during the last six months of his stay that he acquired a cine camera and viewers were quickly transported from the Central to that Mediterrannean island in the sun. As Gordon concluded, 'The Maltese, like the rest of us, like to sit in the sunshine and do nothing!'

Mr Dutson introduced Leicester's tape entitled *Rewinds of 1966*. These extracts from their activities last year gave an indication of how active this club has been and how likely they are to take the *ATR*

Challenge Cup next year.
Secretary of the Rugby Club is **Mrs Janet Clarke, 11 Craven Road, Rugby.**

New Equipment

Despite the warm weather and other summer attractions, **Barrow Soundtrack Club** unanimously agreed to continue weekly meetings at their studio. In fact, two new members were welcomed during the season. They joined at a particularly interesting meeting when Secretary Ron Duxbury was demonstrating the club's latest acquisition on the technical side: a Brennel Mark 5. Members had decided some months ago that the club needed a tape recorder to be kept permanently in the studio for use by any member at any time. After the success of the Spring Jumble Sale which realized a profit of £42, all members had been looking for an appropriate tape recorder and are very pleased at the choice made.

Proceeds from a summer jumble sale have been earmarked for club librarian John Duxbury to construct a portable plug box capable of being used on any plug point. This is essential when members visit other organizations to play back documentaries, sound magazine programmes and so on.

A successful drama night was presented by the club's three lady members and ladies from the Ulverston Outsiders Drama Group. A comedy sketch was recorded as well as satirical 'commercials' which had been written by club member Brian Rayner. These will be used in the club's weekly programmes at Ostley House for the Blind.

Mrs J. Rayner, Press Officer, will be glad to supply further details of the club. Her address is **123 Abbey Road, Barrow-in-Furness, Lancs.**

New Members

As the result of an appeal through Club News, the **Newcastle and District TRC** have now welcomed their first lady member. The presence of other prospective members has swelled summer attendance figures to an all time high.

The latest edition of the club's sound magazine *Sound-A-Bout* was the longest to date and probably the best. Encouragingly, many more members' contributions were received than usual.

Another session of the always popular tape sketches was held. Secretary Ron Turner remarks that while not exactly dramatic masterpieces, the sketches have the virtues of encouraging use of the microphone and drawing in many of the members as well as providing great entertainment.

The most interesting evening from a practical standpoint was attributed to Chairman Malcolm Hill when he knocked up a mains unit for a battery portable from scratch in about 90 minutes – and it worked without a hitch! A programme of excursions was also planned for July and August, ranging as far north as Alnwick Castle and as far south as York. To complete the summer 'break', the club has a round robin circulating.

More information about the club from **R. Turner, Secretary, 43 Richmond Street, Gateshead 8. Co Durham.**

Visit to Generating Station

Members of the **Derby TRC** recently visited the Electricity Generating Station at Willington. Originally it was hoped to make recordings for a future documentary, but the East Midlands Electricity Board would not allow this so members had to be content with just an interesting evening.

A later meeting was well attended considering the glorious sunshine outside. Martin Stanway, who at 17 is one of the younger members, presented a taped programme in the series *All your Own*, which included two humorous sketches, a dash of music and an interview with Cliff Richard. The competition, *A Driving Lesson*, was won by Dennis Land and Alf Stanway completed the evening with a talk called *Microphones* in which he described the different types and their characteristics.

Members are now sporting the lapel badges supplied by the Midlands Association of Tape Recording Clubs. More information about the club can be obtained from **A. F. Stanway, 8 Midland Road, Derby.**

Sound Hunt

A recent meeting of the **Brighton TRC** had a broad and interesting theme: *Brighton's Night Life*. This meeting took the form of a sound hunt to obtain recordings to illustrate the theme. In this respect it was not very successful but a number of interesting local sounds were found including a Jazz band, amusement arcades, bus and railway stations, a chiming clock (one of the few left in the Brighton area), and a racing cycle meeting at Preston Park.

Other meetings have included microphone demonstrations and production of a story combined with sound effects on tape.

Mr Robert Gunnel, station manager of BBC's Radio Brighton, arranged to visit the club to discuss the implications of local radio to club members but at the time of going to press, results of this meeting were not available.

The Hon. Secretary of the Brighton Club is **K. Upton, 47 Kingsley Road, Brighton.**

From the BBC

Over a thousand tape enthusiasts sent up for the rules of this year's tape recording competition run by the BBC North from Manchester. And that should mean that the man who handles the competition, John Ecclestone, will do some pretty big business with the GPO any minute now. The competition, on the theme *On the Move*, closes 30 September 1967.

THE BIG SOUND

PHILIPS STEREO CASSETTE RECORDER NOW COMPLETE WITH TWO HI-FI LOUDSPEAKER BOXES AT BIG SAVING

Philips Stereo Cassette Recorder EL3312 now comes complete with two GL559 High Fidelity loudspeaker boxes for super sound . . . *big* sound! Plus a highly sensitive stereo microphone, demonstration cassette, library rack and direct recording/playback leads. At a greatly reduced price of only 55 gns. Nowhere else can you get so superb a stereo recording and playback combination, beautifully styled in selected teak veneers, at so low a price. The loudspeaker boxes are completely separate from the recorder itself, so you can position them permanently for optimum stereo effect. And the three units look so superb that you can leave them on view, right in the living room.

The EL3312 is small but powerful

Philips Cassette system has eliminated the need for large space-wasting equipment. That's why it's called the 'Compact Cassette' system! You can easily fit the EL3312 and its speakers into existing bookshelves. Yet the sound output is out of all proportion to the size—powerful proof of Philips skill in micro-miniaturisation.

Compact Cassettes

To make recordings, mono or stereo, just snap-in a Philips Compact Cassette. Two sizes are available—C60 (60 minutes) at 17/6 and C90 (90 minutes) at 25/-. An anti-erasure device safeguards valuable recordings.

Hundreds of Musicassettes

You can playback your own recordings. Or snap-in any of the hundreds of Musicassettes now in the shops. LP Musicassettes cost 40/- each. EP Musicassettes cost 14/6. All Musicassettes are stereo recordings, but will give full reproduction using mono cassette equipment.

Learn it all. For full colour brochure post this coupon to: **Philips Electrical Ltd., Tape Recorder Dept., Century House, Shaftesbury Avenue, London, WC2.**

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PHILIPS **PHILIPS**

TEST REPORT GRUNDIG HI-FI STEREO AMPLIFIER SV40M

by Peter Knight

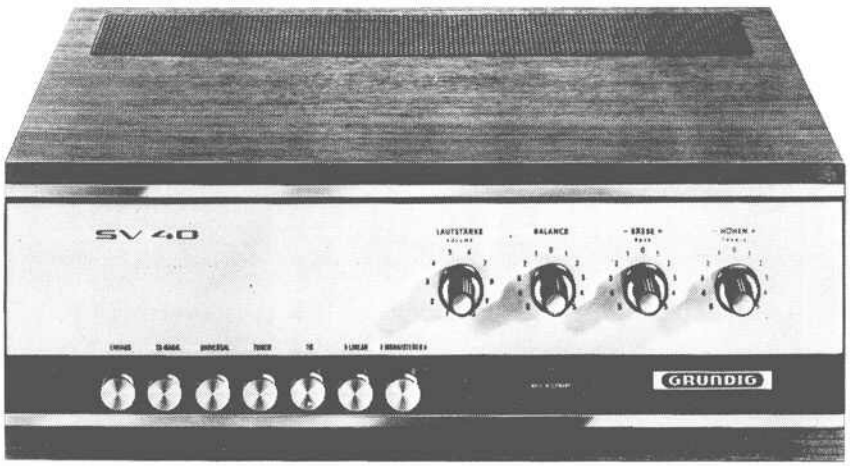


Fig. 1. General appearance of amplifier.

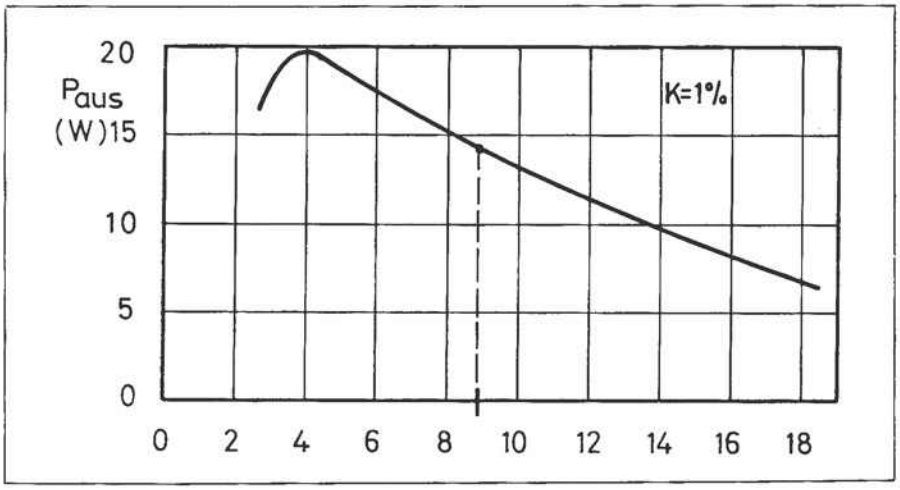


Fig. 2. Showing how power output falls with increasing load resistance.

Of fairly recent issue from the German house of Grundig, this fully transistorized stereo amplifier is designed to yield a continuous sine wave (rms) output of 15 watts per channel with a distortion content below ½% across 5 ohms. Music power is given as 20 watts per channel across the same value load.

Although somewhat bulkier than we have come to expect from recent transistor hi-fi amplifier development, the size is not so large as to prohibit placement upon a shelf or wall-furniture in accordance with the requirements of contemporary, domesticated hi-fi. The measurements, in fact, are about 16 × 11 × 6 inches – the shortest dimension being the height, as revealed in Fig. 1.

The circuits employ a total of 25 transistors, 15 semiconductor diodes and 2 rectifiers, and they work from a mains supply of 110/130V or 220/240V, 50 or 60Hz. Consumption is in the region of 20 watts quiescent, rising to about 80 watts under conditions of full drive; clearly indicating, therefore, that the power amplifier stages are biased for class B working – not by any means uncommon for this kind of amplifier.

It is very pleasant to look at. The front is finished in brushed aluminium with dark edging and the cabinet can be obtained in natural matt walnut or oiled teak. There are four main control knobs (calibrated) and seven push-buttons. The controls give *volume* (or loudness, as explained later), *balance*, *treble* and *bass*.

The press-buttons select the required input, matching with the input sockets, giving magnetic and ceramic pick-up, tuner, tape recorder or programme signals of similar level mono/stereo, mains on/off and linear/loudness action to the volume control. This latter button in its *linear* setting removes the frequency compensating components from the volume control, causing this to act linearly, as any ordinary volume control. In the other setting, however, compensation is applied to the control which mainly causes the bass response of the amplifier to rise as the setting of the volume control is reduced. A volume control with such characteristics is called *loudness control*.

When the mains on/off switch button is depressed, a small pilot light in the bottom left-hand corner of the front panel illuminates, indicating that the amplifier is energized.

All the sockets are located neatly at the rear of the amplifier and, of course, they are DIN type. They include four for programme signals, two for the loudspeakers and one carrying a mains supply for connecting to a record player, tuner etc.

The magnetic pick-up input has a sensitivity voltage of 3mV across 47Kohms and when this input is selected the signal passes through an equalizer tailored to CCIR. The Ceramic (or crystal) pick-up input is unequalized, of course, and has a sensitivity voltage of 200mV across 1M. Pick-ups like the Decca Deram require an interposing filter for the best bass output (usually a series resistor is sufficient). The inputs for both tape recorder and tuner have a sensitivity of 200mV across 470Kohms. The maximum inputs that can be applied are 100mV to the magnetic pick-up and 5V to the other ones. These represent a very good overload margin!

Dc-coupling is used almost completely from start to finish of the circuit, and this holds up the bass output to sub-bass frequencies. Indeed, substantial power is delivered at 10Hz. Although this goes towards a good

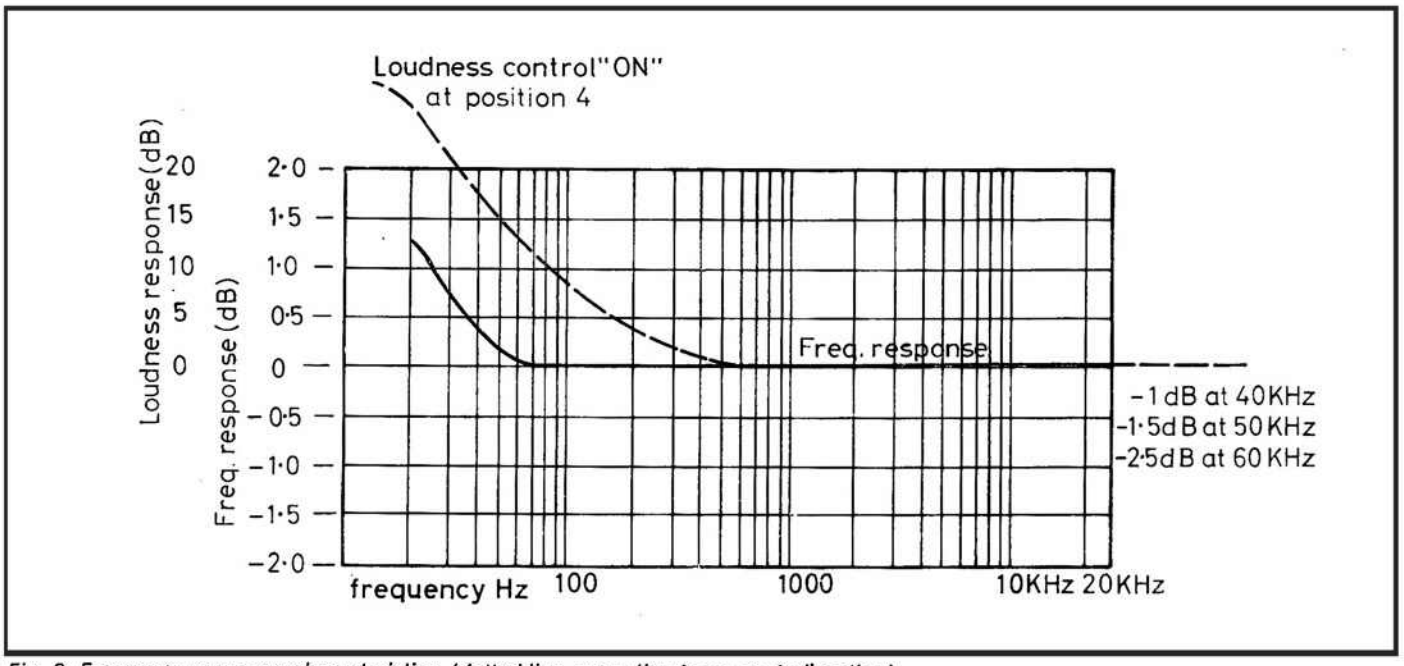


Fig. 3. Frequency response characteristics (dotted-line curve 'loudness control' action).

TEST REPORT—GRUNDIG HI-FI STEREO AMPLIFIER SV40M

continued

specification, the author is by no means happy about the response being kept up at such low (sub-audio) frequencies. After all, the lowest frequency likely to be reproduced is only about 16Hz, so why hold the power response almost wide open for lower frequencies?

This leads directly to two problems. One, sub-audio spurious signals, such as easily generated by crystal and ceramic pick-up cartridges from motor rumble and all kinds of forced vibration (indeed, the ceramic piezo effect is used in transducers to indicate pressure changes), can result in the reproduction being somewhat 'muddy' at depth and two, it makes transformer-coupling from the amplifier to the loudspeakers virtually impossible.

This is because at sub-audio frequencies the impedance reflected across the primary of a speaker matching transformer is pretty well zero ohms, and with such speaker loading the output transistors can 'blow up'. That is, if there is no fuss or other protection! This is a pity since the output impedance is only 5 ohms, anyway. True, Grundig make 5 ohm speakers for use with the amplifier, ensuring that its full power is delivered to them, but many enthusiasts already have 15 ohm systems which they would care to use should they purchase the SV40M, and many would immediately contemplate the use of a speaker matching transformer.

What happens to the power output with 15 ohms across the output load? This is shown in the curve (by Grundig) in Fig. 2. The power at this load is about 8 watts against 15 watts at just over 8 ohms. Full power is delivered at 4 ohms, and Grundig rate full output power as being available for impedances between 3 and 9 ohms. I am certain that if I had this amplifier I would install a high-pass filter and a matching transformer (of good design, of course) so that I was sure of all the available power being delivered to my 15 ohm speakers.

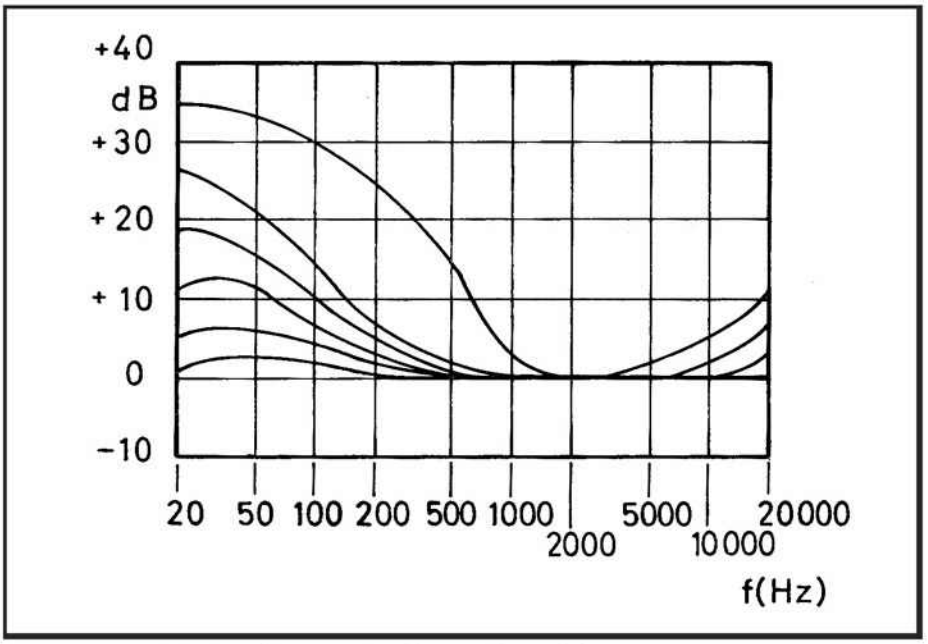


Fig. 4. Family of 'loudness' curves at various settings of the volume.

Another questionable feature, so far as the author is concerned, is the loudness control/linear press-button and associated networks. If one wants more bass when listening at low-level it is quite easy to apply with the bass control proper. According to the loudness contours, as we hear sounds from low to high frequencies at different intensities, by Fletcher and Munson, the treble should also be lifted by a smaller amount than the bass.

Frequency Response Test

A frequency response test was applied to the amplifier to get some idea of how the 'loudness' action was tailored. Fig. 3 shows the overall measured frequency response in full-line with the volume control linear and with the tone controls adjusted for the best possible square-wave reproduction at 1,000Hz (see later). The response, as will be seen, is flat within a fraction of a decibel from 50 to 20,000Hz; but even running 'linear' there was a tendency for the bass to rise from 50Hz downwards in frequency. At 10Hz the response was almost 1·5dB up! This could, however, be reduced by turning down the bass control from the desirable square-wave setting.

With the press-button to 'loudness' the bass response certainly lifts as shown by the broken-line curve. This was taken with the volume control set to position '4' on its calibration. The separate decibel scale shows that this rises well above 20dB at about 30Hz, and then upwards rapidly at

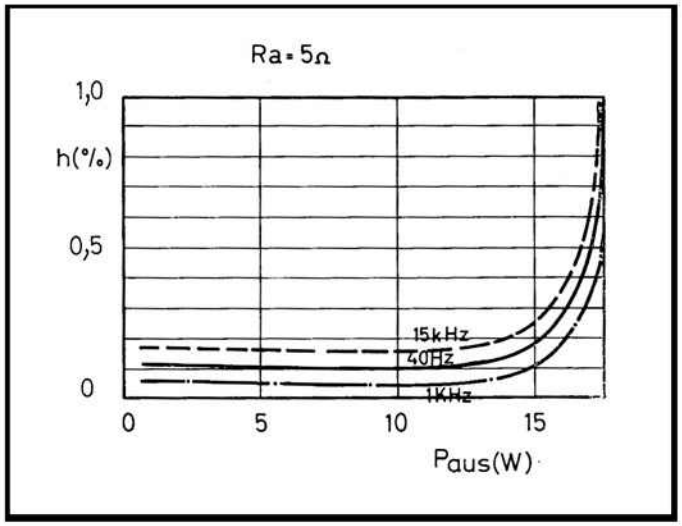


Fig. 5. Distortion curves.

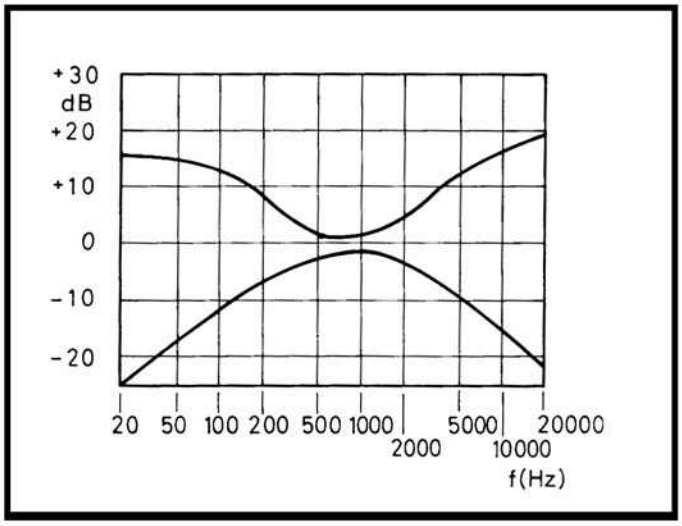
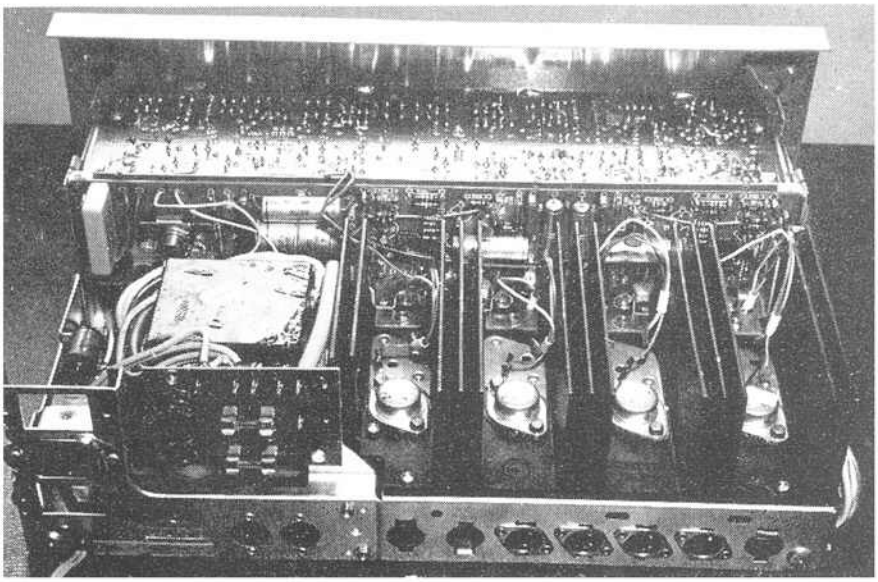
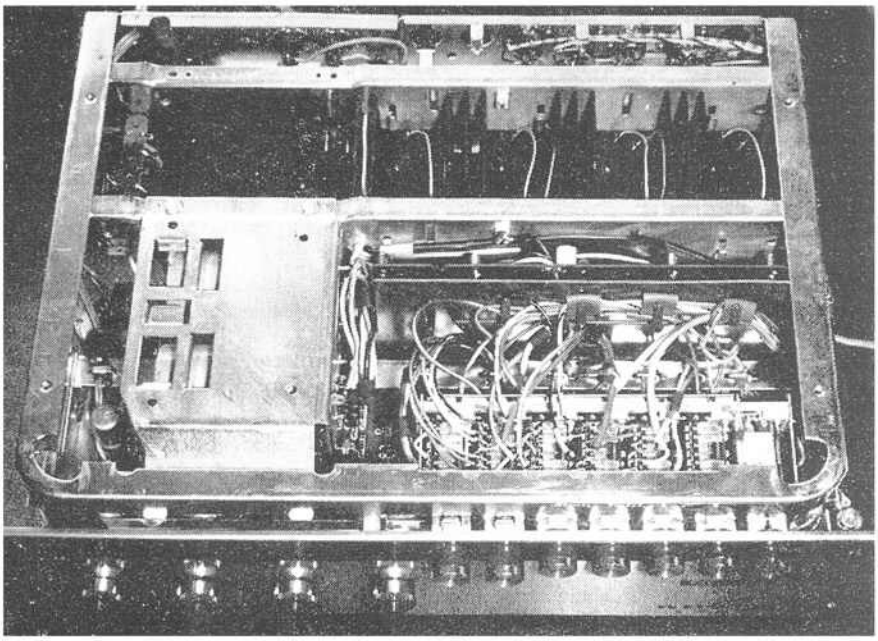


Fig. 6. Range of tone controls.

Fig. 7. Right: Top view with case removed, showing output transistors.

Fig. 8. Below right: Underneath view, showing press-button switching and heat-sinks.





lower frequencies. Fig. 4 shows a family of 'loudness' curves at various settings of the volume control. This shows a bass rise of 35dB at 20Hz at one setting of the volume control and lifts also at the treble end.

Power Output Test

With the mains tapping set to 240V and a supply of 240V 50Hz applied, the amplifier was set up for a power output test at 1,000Hz. Carefully loaded to 8 ohms, each channel of the sample amplifier delivered 13 watts rms to wave-form clipping level. *This power was maintained within a fraction of a decibel from 20 to 20,000Hz.* Indeed, the power was only about half down at 60,000 Hz! This is a very good power specification. The extension on the frequency response curve (Fig. 3) shows how the response holds up towards the rf spectrum!

Distortion at full-power was below about 0·5% over the audio spectrum, and both channels behave more or less equally. Breakthrough from the active to the inactive channel under test was about 200 times voltage-wise (ie, 46dB). Distortion curves are given in Fig. 5.

The best square-wave display was obtained with the bass at +1 and the treble at −1 at 1,000Hz repetition frequency. From the calibrated zeroes on the tone controls, a 50 Hz input gave from −15dB to +16½dB on the bass control and a 10,000Hz input from −18dB to +16½dB on the treble control. This shows very good balance of the tone controls, as borne out by the square-wave test. The range of the tone controls is given in Fig. 6.

There is little point in showing here the nature of the square-wave displays, since these are text-book perfect at both 100Hz and 1,000Hz. Even at 5,000Hz there was only a very slight trace of rounding at the corners, but this is to be expected with such a wide treble passband. This amplifier, in fact, almost certainly has one of the best

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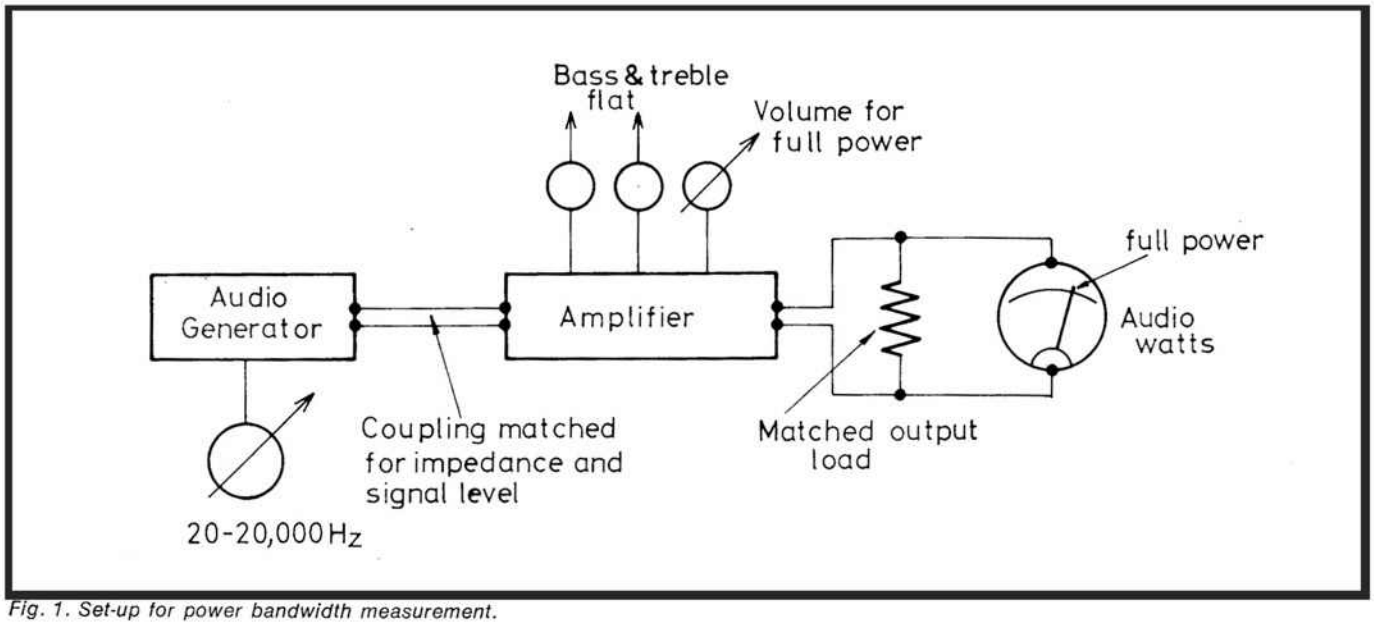

Fig. 1. Set-up for power bandwidth measurement.

AUDIO BANDWIDTH

by Gordon J. King

Audio bandwidth defines the lower and upper frequency limits within which all audio equipment must operate. This article however, is concerned mainly with amplifiers. An amplifier with a bandwidth (or frequency range) of, say, 20 to 20,000Hz would pass and amplify all frequencies within that range. A perfect amplifier would amplify signals of all the frequencies of equal level and most hi-fi amplifiers are virtually perfect in this sense. There might be undulations in amplification over the spectrum, but these would be very small indeed in an amplifier classified as 'hi-fi'.

Magnetic pick-up equalization and the tone controls are purposely designed to cut and lift certain frequencies as required by the programme signals, the loudspeakers and the acoustic environment, but these circuits are in addition to the basic 'flat' amplifier characteristics. Thus, the basic amplifier is designed for the flattest possible audio bandwidth, while the equalization and tone controls provide for controlled modification to this response.

Power Bandwidth

Right at the start it is just as well for us to understand the difference between frequency response (or signal bandwidth) and power bandwidth. A hi-fi amplifier, of course, is designed to deliver *audio power* to the loudspeakers, and the power response or *power* bandwidth is measured by feeding a pure sine wave signal into an unequalized input and then monitoring the actual power delivered to a purely resistive load connected in place of the loudspeaker across the output terminals, as shown in Fig. 1.

For this measurement it must be possible to swing the input signal over the audio spectrum from, say, 20 to 20,000Hz while maintaining a constant signal level. This means that if the level is set initially at 100mV then 100mV must be applied to the amplifier at *all* frequencies over the spectrum. Further, the signal generator must match into the input load, and if the amplifier at that particular input is stated as being 100Kohms, then the signal generator must have a matching resistance.

The power bandwidth is often referred to 1,000Hz at full power. This means that an amplifier rated at 15 watts would first be adjusted in small steps from 20 to 20,000Hz the loudspeaker terminals. The tone controls would also have to be set at zero at this stage, so there is no boost or cut on treble or bass. With the same level of input signal, the input generator would next be adjusted in small steps from 20 to 20,000Hz and at each step the power delivered to the output load would be measured. This would allow us to plot a power response curve like that shown in Fig. 2.

There is still one important factor that has not been taken into account, namely, distortion. Hi-fi amplifiers are specified as having a total maximum distortion content at full power output, and it is rather important when checking the specifications to ensure that the distortion does not rise above this level. Thus, apart from monitoring the output power, the distortion at the output also needs to be measured with a wave analyser or distortion factor meter.

An oscilloscope can be used instead to monitor the waveform, and any deformation of the pure sine wave input signal is a sure sign that the amplifier is adding spurious signals in the form of distortion. With a good 'scope it is possible to measure the distortion on the waveform; but it is not easily possible to measure the very small (less than 1%) distortions produced by hi-fi amplifiers in this manner.

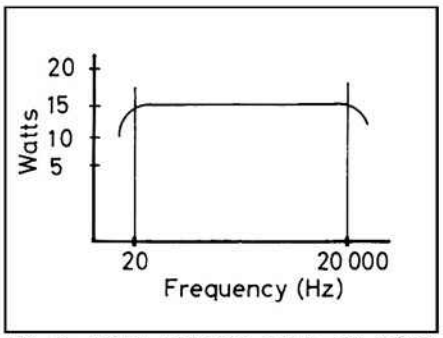

Fig. 2. Power response curve not taking distortion into account.

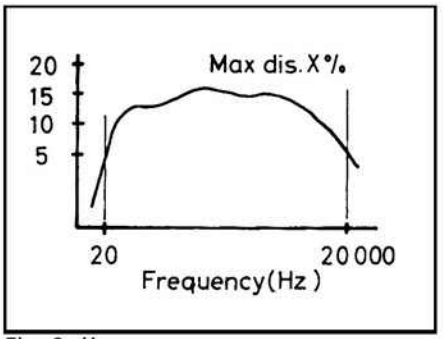

Fig. 3. How a power response curve may look if geared to a maximum distortion figure.

Returning to our power response curve in Fig. 2, the power revealed over the entire audio spectrum should be delivered without the total distortion contribution rising above

the specified value. Sadly, many amplifier specifications simply state 'total distortion less than (say) 0·5%', while they really mean '... less than 0·5% at 1,000Hz'. Test conducted by the author have shown that while the distortion specification has been adequately met at 1,000Hz, there is a tendency for it to rise outside the specification towards the bandwidth extremes at full power. Transformer-less transistor amplifiers would seem to hold a specified distortion factor over the whole spectrum, while not-too-expensive valve types give increasing distortion at the bass and treble ends, governed by the goodness of the output transformer and negative feedback circuitry. Anyway, we are diverting a bit from the general theme.

Frequency Response

So much, then, for power bandwidth, but how does frequency response differ from this? Well, firstly, the frequency response does not take in the distortion aspect of the power test, for the response check is made well below the full power output of the amplifier. If one makes a power bandwidth test, for instance, for a given distortion content over the entire spectrum, a curve something like that shown in Fig. 3 may be obtained. This curve does not mean that the amplifier cannot deliver full power at all frequencies, it simply shows that the power has to be reduced at bass and treble frequencies to keep the distortion here at the specified level.

A frequency response characteristic does not embrace this factor because the amplifier is driven nowhere near full power during the measurements. Indeed, a 15 watt amplifier may be delivering less than a watt when a frequency response check is made. Often, however, the power amplifier section is excluded from the frequency response characteristic, and this means that the signal *voltage* delivered by the pre-amplifier or control unit sections is being referred to. The input is applied as for power bandwidth measurement (Fig. 1) and a valve-voltmeter is used to monitor the level of the output signal over the audio spectrum. A decibel scale on the meter makes for easy plotting of the response characteristic, for while the power bandwidth is frequently plotted against power (watts) the frequency response is frequency plotted against output voltage or variations in output voltage given in decibels. Fig. 4 shows a typical frequency response curve.

How it Sounds

The foregoing has explained the 'mechanics', so to speak, of audio bandwidth and we must now consider its subjective effect. That is, how it affects the listener.

The whole spectrum of sounds which we hear range from about 16Hz (the lowest frequency of a large organ – 16·4Hz) to 16,000Hz (transient noises produced, for instance, by the clapping of hands!). All musical instruments produce fundamental tones and also overtones which are harmonic components of the fundamentals. A large organ has the largest range of all, extending from about 16·4 to 8,500Hz on fundamentals and going up to about 14,000Hz on overtones.

On the other hand, the tympani has about the shortest fundamental range, from about 100Hz to 2,000Hz with overtones spreading

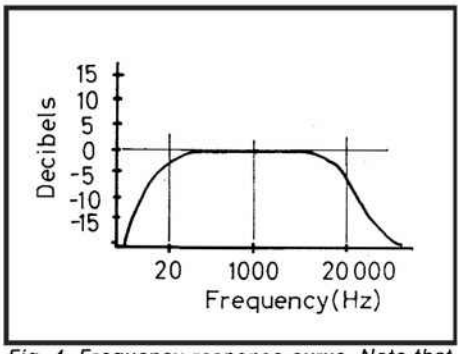

Fig. 4. Frequency response curve. Note that frequency here is plotted against signal output in decibels, as distinct from audio power in figs. 2 and 3.

up to about 3,000Hz. The triangle produces noises from a little over 2,000 to almost 16,000Hz, while speech has frequencies from about 200 to 10,000Hz.

From all this, therefore, it would appear that provided our amplifier has a power bandwith from about 16 to 16,000Hz it would be adequately suitable for the fidelity reproduction of all normal sounds in nature and their overtones. On this basis one might well wonder why hi-fi amplifiers are designed for and made with responses going up to at least 20,000Hz. It may also be argued that people past middle-age can rarely hear sounds above about 14,000 or 15,000Hz (sometimes not as high as this, even) so why should they bother about their amplifiers reproducing treble towards 20,000Hz and beyond?

The answer is not a simple one, and it is related to the fact that music and ordinary sounds have characteristics in addition to pure sine wave components. Before we go on, however, it is just as well to illustrate this subjective bandwidth aspect of sound reproduction. Let us suppose that we check the hearing of a person who is appreciative of music by using an audio generator feeding into a very high-quality amplifier and loudspeaker with a known output up to at least 20,000Hz. The exercise is progressively to increase the frequency of the signal until the listener indicates that he can no longer hear anything.

Let us further suppose that this person has a cut-off at 14,000Hz, and that after the frequency test he is asked to listen to some very high quality music by way of the amplifier just mentioned. He is then asked again to listen to the same music but this time with a filter in the amplifier arranged to pass 14,000Hz but severely to attenuate all frequencies above this. He will most definitely react to the filtered test, and his impression will be that of reduced technical quality, reduced musical attack and so forth. This person, then, who cannot hear sounds above 14,000Hz, is distinctly sensitive to frequency supression in the amplifier which cuts off the output above 14,000Hz!

The elementary reason for this is that a large part of music is composed of steep, rapidly occurring wavefronts (transients), produced by harmonic components of the fundamental frequencies of the various instruments. Cutting the higher frequency components has the effect of spoiling the desirable steepness of the wavefronts as well as reducing the overall amplitude of the sound. Since transients are responsible for the 'attack' attributable to music, destroying these in a way that impairs the corresponding accelerations of the wavefronts is obvious equally to persons with and without extended frequency hearing.

There is another aspect of this, and that is the wider the bandwidth of an amplifier, the faster it will pass through high-frequency signals. Conversely, then, an amplifier of restricted bandwidth will tend to slow down or delay signals of higher frequency more than signals of lower frequency. Now, transient and steep wavefronts in music are of this characteristic shape because they are made up of the fundamental frequency plus many odd- and even-numbered harmonic components in particular phase relationship.

Thus, an amplifier of restricted bandwith will pass through the lower frequency signals making up this steep wavefront with less delay than the higher frequency signals. This means that the various component signals fail to come together at the output of the amplifier in the phase relationship in which they were created. The signals might well be present, of course, but since the phasing or timing is altered the nature of the wavefront will be altered from that of the original signal. This aspect of things is particularly important in stereo reproduction.

The low-frequency end of the spectrum is far less important, for it is only rarely that one desires to reproduce the big pipe of an organ at full power. A full-power response down to about 20Hz is a sign of a good amplifier and, indeed, a response below this is not always desirable, for it is at such sub-audio frequencies that disturbances like motor rumble and pick-up arm resonances fall. The best amplifiers thus feature a high-pass filter which produces a gradual cut-off at about 20Hz or a little higher.

This is particularly important so far as transistor amplifiers are concerned, especially if a transformer is necessary to match from a low output impedance to 15 ohms or thereabouts to work the existing hi-fi loudspeakers. Transistor amplifiers tend to supply a constant-voltage output signal. This means that the power rises progressively as the value of the load is reduced. Optimum power may occur, say, at 5 ohms, and while a 15 ohm loudspeaker would work from such a load, the amplifier would fail to be fully loaded for power.

In this event one contemplates the use of a loudspeaker matching transformer. This is quite in order, but if the transformer is inefficient below 20Hz (and many of them are), the amplifier would be 'looking' into a load substantially below 5 ohms (depending upon the loss value) and if the amplifier is delivering power at these sub-audio frequencies the transistors could be overloaded, resulting either in their failure or the blowing of a fuse or some other protection device.

A high-pass filter would overcome these difficulties, so why keep an amplifier channel wide-open for spurious rumble and resonance signals, anyway? It is surprising just how much unwanted sub-audio signals are produced by ceramic pick-ups. They are no good to man or beast.

SONY research makes the difference

MODEL TC350 - FEATURES

4 track stereophonic and monophonic recording and playback ☐ Precision solid state circuitry comprising independent recording amplifiers and playback preamplifiers ☐ Professional 3 head system ☐ Sound on sound recording ☐ Language/music training facilities ☐ Vertical and horizontal operation ☐ All idler beltless tape driving mechanism ☐ Two tape speeds ($7\frac{1}{2}$ and $3\frac{3}{4}$ ips) ☐ 7″ reel capacity ☐ automatic shut-off switch ☐ head-set monitor jack ☐ pause control ☐ digital tape index counter ☐ two VU meters ☐ integrated record/playback connector

SPECIFICATIONS:

Power requirements: 50W, 100, 110, 117, 125, 220, 240V, 50/60 c/s AC.
Reel: 7″ or smaller.
Tape speed: $7\frac{1}{2}$ and $3\frac{3}{4}$ ips. with automatic equalization change.
Recording system: 4-track stereophonic or monophonic.
Frequency response: 30–20,000 c/s at $7\frac{1}{2}$ ips. ± 3 db 50–15,000 c/s at $7\frac{1}{2}$ ips. 30–14,000 c/s at $3\frac{3}{4}$ ips.
Signal-to-noise ratio: Better than 50 db.
Wow and flutter: Less than 0.17% RMS at $7\frac{1}{2}$ ips. Less than 0.25% RMS at $3\frac{3}{4}$ ips.
Harmonic distortion: Less than 3% at 0 db line ouput.
Level indication: Two VU meters.
Record : NAB standard.
Playback: calibrated to 0 db line output.

Recording time:

	4-track stereo	4-track monophonic
1,200′ tape $7\frac{1}{2}$ ips.	1 hr.	2 hrs.
$3\frac{3}{4}$ ips.	2 hrs.	4 hrs.
1,800′ tape $7\frac{1}{2}$ ips.	$1\frac{1}{2}$ hrs.	3 hrs.
$3\frac{3}{4}$ ips.	3 hrs.	6 hrs.

Fast forward and rewind time: Within 4 min. (1,200′ tape).
Input: Microphone
Sensitivity: – 72 db (0.19mV)
Impedance: low (will accommodate any microphone from 250–1K ohm impedance).
Auxiliary
Sensitivity: — 22 db (0.06 V).
Impedance: approx. 100K ohms.
Integrated record/playback connector.
Sensitivity: — 42 db (6.15 mV).
Impedance: approx. 100K ohms.
Output:
Line
Output level: 0 db (0.775V).
Impedance: optimum load impedance 100K ohms.
Binaural monitor
Output level: — 1 db (0.692V).
Impedance: accommodates 10K ohm head-set.
Integrated record/playback connector
Output level: 0 db (0.775V).
Impedance: optimum load impedance 500K ohms.
Head: Recording RP 30—2902.
Playback PP 30—4202N.
Erase EF 18—2902H.
Transistor: 2SC402 x 18, 2SB381 x 2, 2SC291 x 1.
Diode: IT22A x 2, 5G-D x 2.
Dimensions: $15\frac{3}{4}$(W) x $6\frac{5}{16}$(H) x 13″(D).
Weight: Approx. 17 lbs. 3 ozs.
Accessories: Empty 7″ reel. Connection cord. Capstan. Pinch roller. Reel cap.

Recommended retail price **75 Gns.**

Sony offer the finest range of tape recorders from the battery portable TC 900 to the studio quality 777.
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Eastbrook Road, Gloucester.
Tel: Gloucester 21591.
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70-71 Welbeck Street, London, W.1.
Tel: 01-486 2143

SONY®
RESEARCH MAKES THE DIFFERENCE

AUDIOVIEW

Hi-Fi

New Bang and Olufsen loudspeakers

The B & O Beovox 1000 shown in Fig. 1 is a medium-sized bookshelf pressure chamber loudspeaker 18⅞ × 9½ × 7½ inches. designed for either vertical or horizontal operation and fitted with two loudspeakers units, one bass and one high frequency. The power handling capacity is 10 watts rms. The output impedance is 4 ohms and the unit is available in either Teak or Rosewood finish. The retail price is 17 guineas including £2 15*s* 9*d* purchase tax.

The second of the new B & O speakers is the Beovox 5000 shown in Fig. 2 and is designed to fulfil the requirements called for by the truly critical audio enthusiast. This loudspeaker is capable of handling the high power available from modern large amplifiers at low impedance and is small enough as to be complementary to modern furnishing requirements.

The Beovox 5000 contains seven drive units. These are a 12 inch diameter bass unit with a resonant frequency of 20-24Hz, two 5 inch diameter mid-frequency units and four 2 inch tweeter units in line source form. Variable attenuators are provided for the mid and high frequency units with a crossover network at 800Hz – between bass and middle and 5KHz between the middle and high frequency loudspeakers. The dimensions of the Beovox are 28¾ × 18½ × 12¾ inches. The weight is 50 lb. The retail price is 49 guineas (no purchase tax).

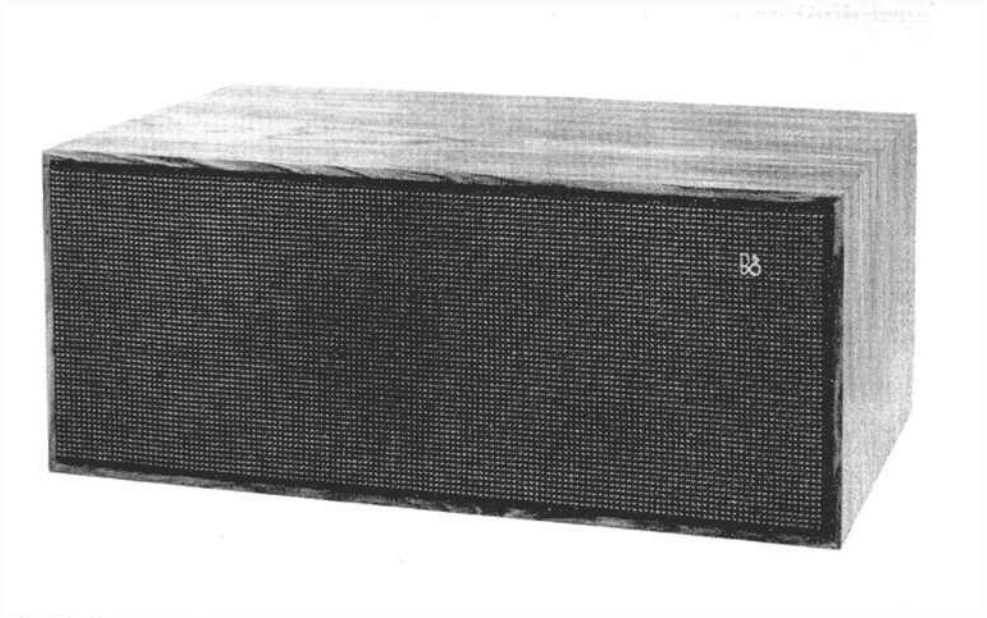

Fig. 1. The Bang and Olufsen 'Beovox' 1000 bookshelf pressure chamber loudspeaker.

New BBC VHF Sound Service

The vhf Sound Service from the BBC Relay Station at Maddybenny Moor between Coleraine and Portrush, Northern Ireland is now in operation. The three sound programmes will be transmitted on vhf horizontally polarized on the following frequencies:

Northern Ireland Home Service 93·1 MHz, Light Programme 88·7 MHz, Third Network 90·9 MHz.

The area served from Maddybenny Moor includes Coleraine, Portrush and most of Portstewart.

Stereo Booster

A high gain low noise pre-amplifier known as the 'Stereo Booster' has been announced by Holdings Audio Centre, Mincing Lane, Darwen Street, Blackburn, Lancs. It is simply connected by plugging the aerial lead into the input socket and by connecting the output from the booster to the aerial socket of an FM tuner. Power is provided by internal battery or mains. The stereo booster will increase the strength of FM reception and is peaked for maximum gain on the Third programme. Due to its high gain it will appreciably improve results on mono or stereo where the limiting factor has been a lack of gain in the FM tuner. The stereo booster complete with battery is available at £3 18*s* 0*d*. Price of mains operated unit available from Holdings Limited at the above address.

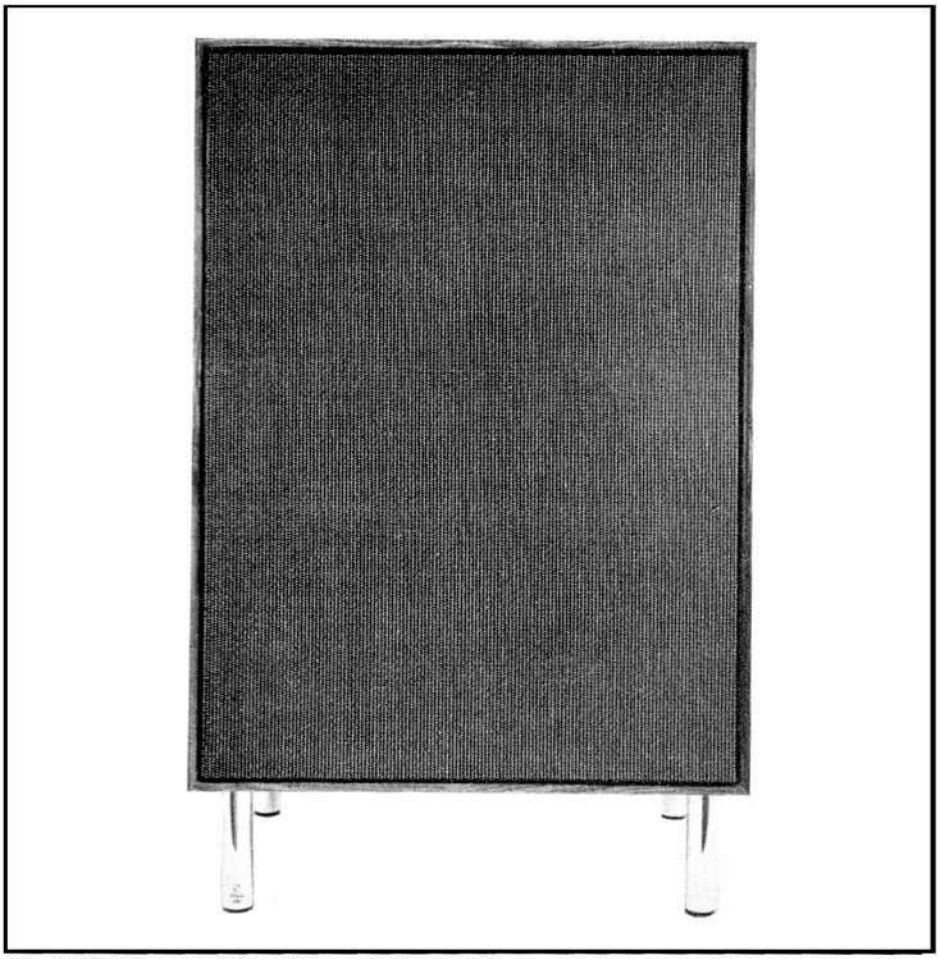

Fig. 2. The 'Beovox' 5000 hi-fi loudspeaker contains no less than seven separate speaker units.

A TO Z IN AUDIO AND VIDEO

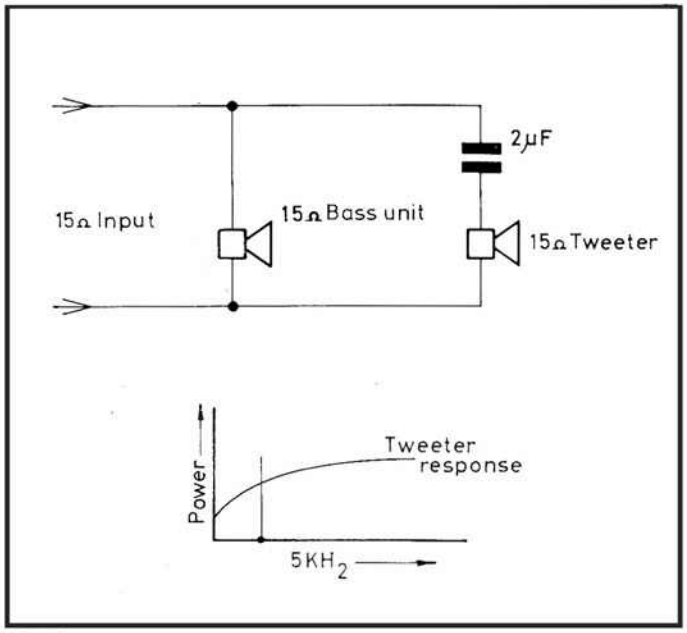

Fig. 1.

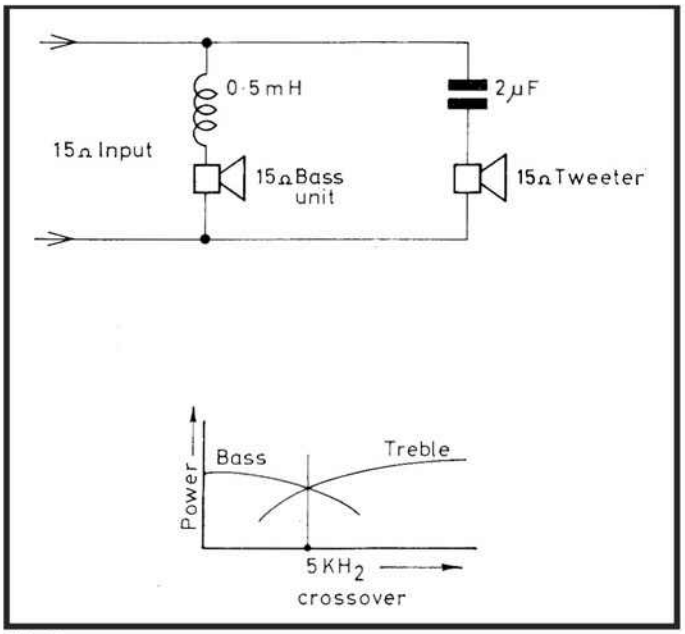

Fig. 2.

Continental Plugs and Sockets

'Continental' is the term sometimes given to DIN plugs and sockets because they were first widely used in Europe for the various connections to and from audio amplifiers, microphones, tape recorders and so forth. They are now being adopted much more extensively in Great Britain and also on British-made audio equipment.

The 'standard' DIN plug/socket features six connectors, giving a maximum of two-channel (stereo) in and two-channel out with 'earths'. Often though, some of the connectors are not used, in which case the plugs and sockets are minus certain connectors although positions for them are present on the plug/socket moulding.

DIN plugs and sockets are also used for loudspeaker connections, but these differ from those described above. There are also DIN mains supply plugs and sockets.

Crossover Networks

This is a passive network comprising reactive components, like capacitors and/or inductors, designed to channel the bass frequencies into the bass or 'woofer' speaker unit, the treble frequencies into the high-frequency unit or 'tweeter' and, sometimes, the middle frequencies into a third, mid-range speaker unit. The three units are often integral to the common loudspeaker enclosure, giving the speaker system as a whole. A common circuit from the speaker terminals on the amplifier feeds audio power into the speaker system, and the signals are 'split' therein as described. A very simple crossover scheme is shown in Fig. 1. This uses just a capacitor feeding the tweeter, and as the impedance (or reactance) of a capacitor decreases as the frequency of the signal increases, so the power fed into the tweeter rises at the rate of about 6dB/octave, as the response curve shows. This has the disadvantage that the bass unit receives treble as well as bass and mid-frequencies, but this is overcome by the addition of an inductor, shown in Fig. 2. The inductor, in the bass unit circuit, has a reactance which increases as the signal frequency increases. so that the power fed to the bass unit tails off as the frequency rises, as shown by the accompanying curve. The component values shown give a crossover at about 5KHz.

For a greater rate of crossover, an inductor is sometimes connected across the tweeter and a capacitor across the bass unit of the basic circuit shown in Fig. 2. A popular quarter-section series crossover network with components values providing a 1KHz crossover is shown in Fig. 3.

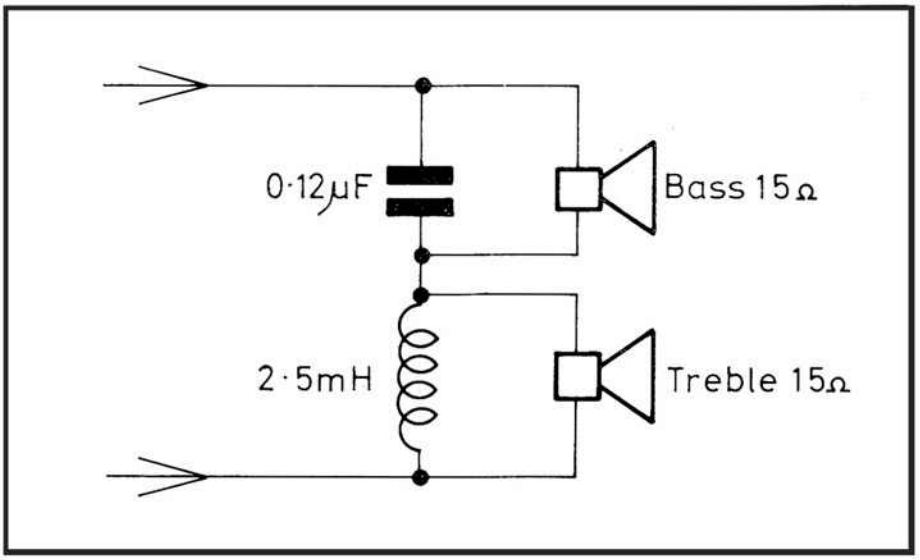

Fig. 3.

Crosstalk

This is the term given to signal breakthrough from one channel into another, adjacent channel. It is commonly used to illustrate the performance of a stereo circuit or stereo equipment and then the crosstalk value is often given in decibels. For example, if the A (left) channel of a stereo amplifier is energized, while the B (right) channel is operative but not carrying signal, the ratio of A signal in the B channel is the crosstalk value. If the crosstalk signal voltage is, say, 100 times below that of the main signal, then the crosstalk performance is pretty good, being 40dB.

The crosstalk of stereo pick-up cartridges is appraised similarly over the frequency

spectrum. Earlier crystal and ceramic cartridges tended to have progressively poor crosstalk performance with frequency increase towards the treble end of the spectrum. Magnetic pick-ups were (and often still are) better in this respect, but there have been vast improvements in crosstalk relative to ceramic cartridges over the last few years.

Cross-track Recording
This facility is found on certain makes of tape recorder which feature two separate heads, recording and playback channels. The idea is first to record on one track with one head etc, then to record on the second track while mixing with this signal the output from the head, simultaneously replaying the first track recorded. In this way it is possible to make multiple recordings of the same instrument or voice.
For instance, if a musical instrument is used to record a tune on the first track, this can then be played back and monitored in headphones at the same time as the mixed recording is being made on the second track. This is often done using the same instrument and tune but possibly a different musical part. The second track will then carry the 'mixed' recording.
The process can be repeated by recording the mixed track upon the first track at the same time as new material is being added and so on, until background noise makes further superimposition technically undesirable.

Cueing
This is the art of locating important positions on the recorded tape for subsequent editing. Many machines carry digital counters operating from zero to 999 or 9999 (the former three-digit and the latter four-digit). A press-button or edge-type control allows rapid zero setting, and if zero is set at the start of a recording any particular place in the recording can be identified in terms of a number shown on the counter.
When two and four-tracks are used, however, care should be taken to identify the particular tracks relative to the counter numbers.
An alternative method is to employ marking tape at the points where subsequent identification will be required.

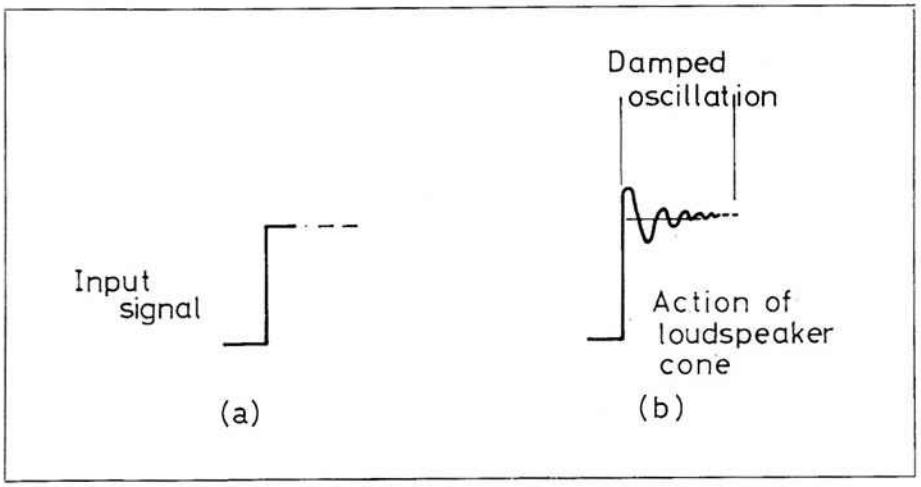

Fig. 4.

Cushion Effect
This term is sometimes used to describe the 'overload margin' provided by pentode and, to a smaller extent, tetrode amplifier valves. This 'cushioning' is the result of the gradual bends at the extremes of the characteristic curves.
With a triode valve the distortion rises very rapidly when the stage is overloaded, but the cushioning effect of pentodes and tetrodes gives a gradual increase in distortion towards the overload point. It should be noted, however, that the nature of the negative feedback may modify the degree of cushioning provided.

Damped Oscillations
This is the term given to any decaying oscillation. A typical example is a piano string. When this is struck by the hammer it commences to vibrate at the musical frequency set by the string. Initially the amplitude of vibration (or oscillation) is large and it gradually becomes smaller and smaller until oscillations cease. How long the oscillations take to cease depends on the degree of damping applied to the oscillating device (or electrical circuit). With a piano string damping can be applied with the soft pedal and removed with the loud pedal.
A loudspeaker cone can also exhibit damped oscillations when activated by a steep-fronted signal as at (a) in Fig. 4, (b) shows the oscillatory movement of an undamped loudspeaker cone. Damping is provided by voltage negative feedback which reduces the effective impedance as 'seen' by the loudspeaker without affecting the electrical coupling impedance. The ratio of these two impedances gives the *damping factor.*
Loudspeakers are also damped acoustically by tight coupling to air at all frequencies within the audio spectrum. This is achieved by the nature of the loudspeaker enclosure. Small loudspeaker systems work on the so-called 'infinite-baffle' principle where the inside of the cabinet is completely sealed from the outside air. The loudspeaker unit is designed with a small cone and large piston action, and this is 'cushioned' against the air trapped in the enclosure. The cone is thus damped acoustically as well as electrically at the amplifier output.

THINGS YOU SAY

Tape on TV?
Here is the opportunity to put 'creative tape recording' over to a wider public. Recently, on TV, a series has begun on photography. This is transmitted at a late hour so that it can be digested by those who *want* to be interested in the hobby.
Perhaps a programme could be organized to show people all the things that could be done with tape, from beginners through to advanced. For instance, Bob Danvers-Walker's travelogue type articles in *ATR* are very helpful for the owner of the battery portable recorder, and adapting these articles for TV would be very interesting indeed. 'Tape on TV' would do no harm – it might even do some good!
London, W12 **J. Hone**

Praise for Brenell
It always appears that people are very eager to voice their complaints (rightly so) but very reluctant to praise, hence this letter.
I have just purchased a Brenell for my son, and everything was carried out in a most efficient and courteous manner.
On arrival a hinge on the deck was damaged. I wrote away for a replacement on Friday night, assuming that they were on a five day week. As Whit Monday intervened, they couldn't have received my letter until Tuesday morning at the earliest. The replacement arrived on Wednesday morning. How's that for service!
Gloucester **N. C. Browning**

Tapes for the Blind – an Appeal
I would like to tell you about a new service for the blind and handicapped tape recording enthusiast. This is *Tapes for the Blind.* The aim of this organization is to send out a Sound Magazine on tape each month, consisting of many interesting items such as interviews, music, documentaries, poetry, sound effects and any other material members may care to ask for.
Membership is free to all blind and handicapped people. The tapes last for approximately two hours duration and are two-track, mono/stereo at 3¾ ips. Anyone interested please contact the Club Secretary at 63 Ashton Road, Luton, Beds.
If any non-handicapped reader is interested in becoming a helper member, there is a subscription fee of 10*s* per year. A helper member is expected to send in from time to time any material which he, or she, may think would be of interest to our listeners. A helper member does not receive a copy of the *Sound Magazine*, but may participate in helping to produce it. All members are welcome to call and see us at the Studio if they care to and this can be arranged by contacting the Club Secretary.
We are also a registered charity and a small donation to our club funds would not be refused.
I would be happy to hear from any interested persons – a letter or a small tape – who wish for further details. **D. Beswick,**
Luton, Beds. **Chairman, Tapes for the Blind**
DDB Sound Studio's Club

What have the happiest Hi-Fi enthusiasts in common with the Fire, Police and Defence services...with theatrical producers and concert impressarios?

The Ferrograph

Ferrographs are unique in their combination of reliability, rugged construction and *fidelity of recording* . . . not for the first exciting months of ownership, but for year after year of faultless performance. Even so, we do not claim perfection, although we do believe that we have come nearest of all to the ideal. And the vast majority of Ferrograph users agree.

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Ferrograph

THE INCOMPARABLE TAPE RECORDER

INTRODUCTION TO TAPE RECORDING

continued from page 13

no more complex than operating a simple mono model. Any small unbalance in A and B recording levels can be corrected on replay by a *balance control*, giving a differential action of volume over the two channels. This is in addition to the ordinary volume control, and by turning the control to one side of centre more output is given from, say the A channel, while turning it the other side more is given from the B channel.

More elaborate machines, however, have separate A and B recording level controls and indicators, but it calls for some practice to set these up for optimum stereo recording. The best way is to place a sounding source at the centre point of the stereo microphone arrangement used and then adjust the A and B level controls until the A and B indicators have the same deflection.

So much, then, for the basic stereo idea. Next month we shall be dealing with connecting external equipment to tape recorders.

TEST REPORT GRUNDIG HI-FI STEREO AMPLIFIER SV40M

continued from page 29

rise-time performances I have ever seen. Each push-pull output transistor has its own driver transistor, a p-n-p for one and an n-p-n for the other, giving the required phase reversals. This really constitutes a complementary driver, and this is fed by three dc-coupled stages. The preamplifier and control unit section of each channel uses five transistors. Voltage stabilization is provided on some of the supply circuits and the amplifier generally features some rather interesting circuit arrangements, needing more space than here available to describe.

The power supply input is fully isolated by a mains transformer, and two bridge rectifier systems are adopted for obtaining the dc for the transistors. Fuse and diode protection is incorporated.

The amplifier is made in the best Grundig tradition, and readers familiar with Grundig tape recorders will know what this means. Fig. 7 gives a top view of the amplifier out of its cabinet, showing the output transistors – two in each channel – and Fig. 8 gives an underneath view. These show without doubt that Grundig have retained their engineering excellence from tape to true hi-fi.

In spite of my personal feelings about sub-audio power response and so-called loudness controls, the SV40M is an amplifier deserving of full marks. It is the highest of hi-fi and will certainly rank with the best of the solid-state audio of this generation.

Manufacturers' Specifications

Power Output: 2 × 20W music and 2 × 15W rms across 5 ohms. *Distortion:* less than 0·5% (intermodulation, less than 0·5% for full modulation using signals of 250 and 8,000Hz). *Power Bandwidth:* 10 to 50,000Hz for 1% distortion. *Frequency Response:* 20 to 20,000Hz ±1dB. *Signal/Noise Ratio:* 60dB relative to power output of 50mW and 85dB from the tuner input and 60dB from pick-up input relative to 15 watts. *Damping Factor:* 5/0·25 ohms, or factor of 20, equal to 2½dB. *Channel Separation:* Better than 46dB over audio range.

VARIABLE SPEED SPOOLING

continued from page 21

then be fed from the spare octal socket on the rear of the recorder to a three pin socket on the control panel.

Machines with a single motor to drive the capstan and spools always depend on some mechanical means such as a pulley and friction wheel clutch in order to engage and reverse the fast wind, and the modification described in this article is not possible. Reducing the voltage of the motor circuit of such a machine would tend to reduce the speed of tape wind, but the induction motor would not be reliable when running at the low speeds necessary, which would be far below that of the synchronous speed. When separate motors are employed, the pull from the other reel absorbs the excess torque and the voltage need not drop to such a low value. In any case when one motor is employed, the capstan would be affected by the control and the reverse wind lever would still have to be used. Similar problems exist with a two motor machine.

As mentioned earlier, it is essential for tape editing that the machine plays back through the amplifiers when it is switched to manual free-wheel. In the Ferrograph 422U there is a separate playback head and amplifier in circuit at all positions of the main function switch Sw.1. In some models however, such as the Ferrograph 5AN, it is necessary to modify the switch on the deck so that the head remains in circuit during the fast wind. This is very easily carried out (see the circuit diagram for the machine) but Messrs Ferrograph tell me that for some reason it tends to polarize the head slightly requiring the frequent use of a head defluxer. A better, but more expensive, way to adapt the 5AN would be to buy an additional replay monitor head and feed this into an equalized monitor amplifier.

A RECORD LEVEL INDICATOR

continued from page 17

a heavy current will then pass through the meter. Because of this, RV2 should be wired so that clockwise movement of the shaft increases the meter reading. Therefore if RV2 shaft has been moved, it is always safe to rotate fully anti-clockwise and select *batt*. After RV2 has been set, put a paint splash on the shaft and collar. This will lightly fix the shaft and serve as an indication that it has not been moved. If the needle does not move in the required direction, but tries to move against the zero stop, reverse the meter connections.

(c) Plug in the microphone and select the *slow* function. Now increase the amplifier gain (RV1) until the ambient noise causes the needle to deflect. If, as in (b), the needle tries to move against the zero stop, reverse the diode connections.

(d) Select the *fast* function and check that the unit behaves as in (c), except that the meter needle is more 'lively'.

The above testing ensures that the circuit has been wired up correctly and is functioning. The record level indicator must now be calibrated against the recorder with which it will be used. It is therefore necessary to incorporate a scale under the indicator gain control RV1. The photograph shows the 270° sweep of the potentiometer divided into 5 positions. The scale under the tape recorder gain control is determined as follows:

(a) place the indicator and recorder microphones side by side and generate a loud and fairly constant sound (music is suitable) using a portable radio receiver (or other suitable sound source).

(b) set the level indicator gain to maximum (5) and the function switch to *slow*. Approach the microphones with the sound source – ie, the radio. Fix the microphone/radio distance when the meter needle is just passing the overload mark.

(c) now, without moving or adjusting the radio, make a number of short recordings, progressively increasing the recorder gain setting until the tape just overloads. At this point, mark the recorder gain as 5 under the knob.

(d) set the level indicator to 4 and repeat. Carry this out for settings of 3, 2 and 1.

In this way, a scale is built up for the gain setting of the recorder. To obtain satisfactory recordings the level indicator should first be set so that the meter does not overload and the recorder gain then set to the same figure. The reader should remember that for the level readings to be true, the recorder and indicator microphones must be used in the same relative positions as for the calibration. Furthermore, the system must be re-calibrated if either indicator or recorder are used with different microphones.

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MM3 Custom Music for 8mm 38 tracks include openings, closings, themes and effects. Ceremonial, mellow, finale, movie finale, holiday, travel, continental, birthday, wedding, pageantry, etc. Effects: crowd, dog, baby, seaside, thunderstorm, etc. Price £2 9*s* 6*d*.

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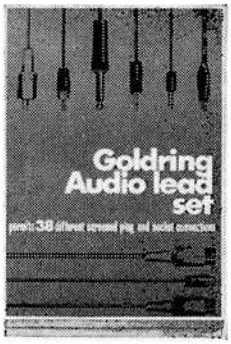

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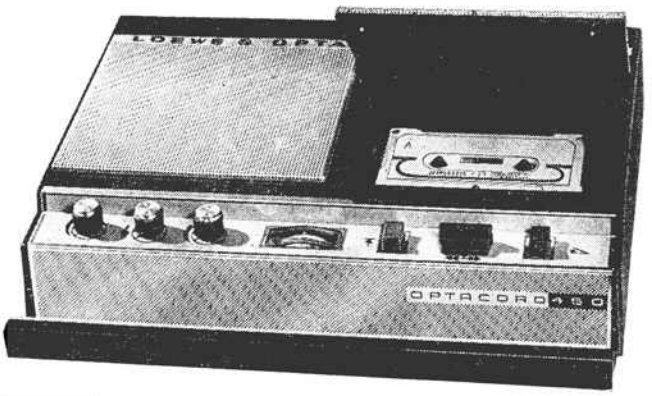

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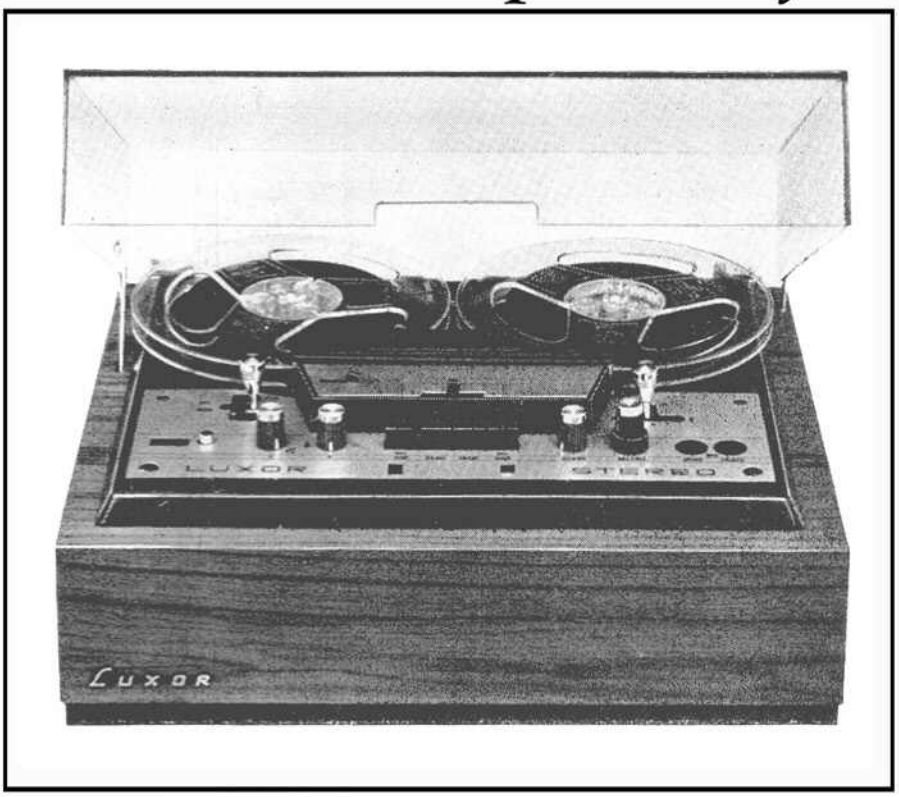

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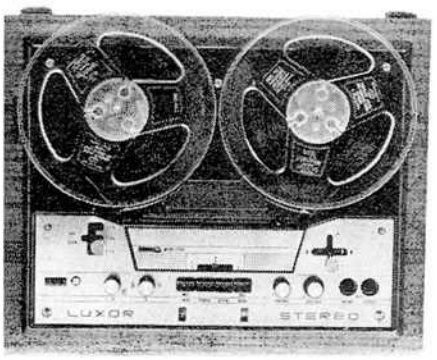

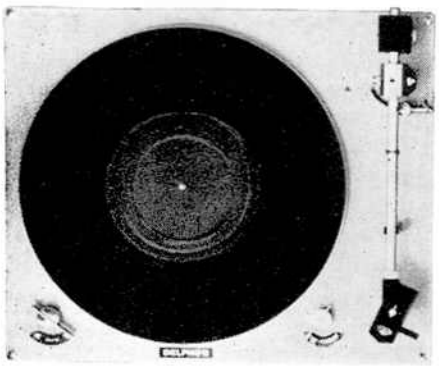

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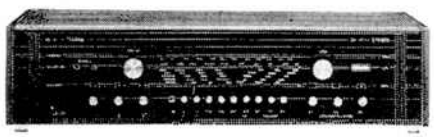

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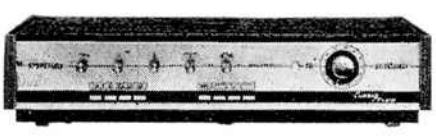

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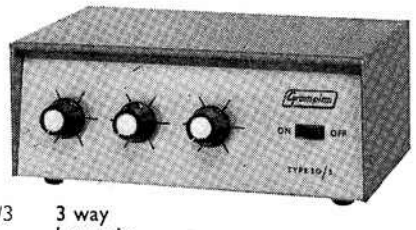
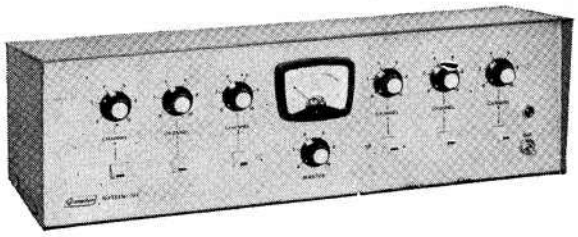


Type 20/3 3 way
low gain



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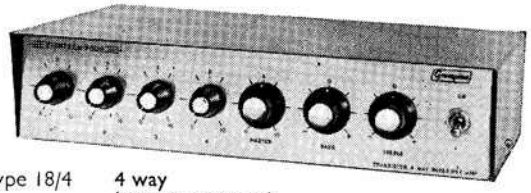
high gain



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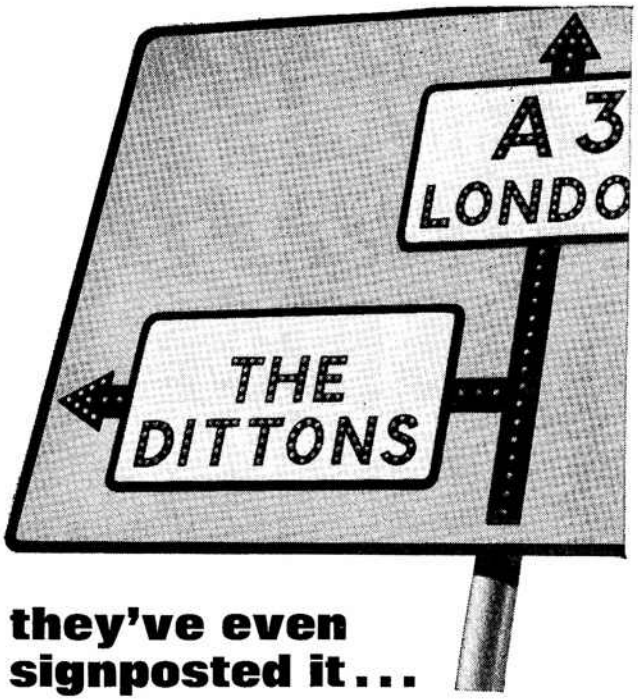

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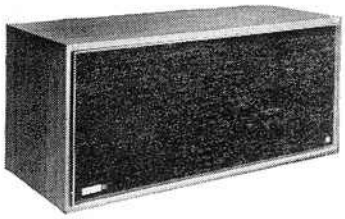

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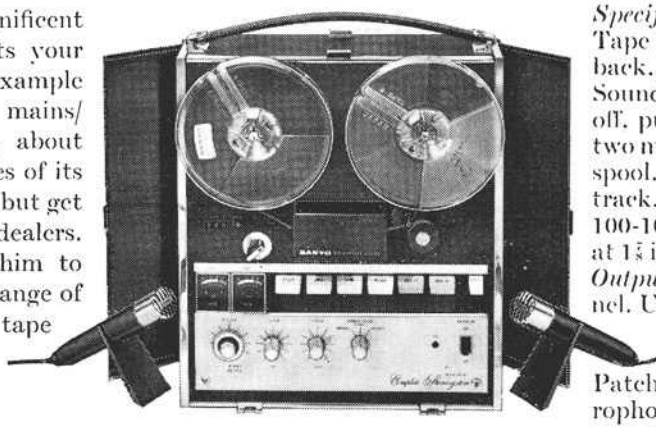
GD876

Sanyo puts you in the world class.

From Sanyo, a new range of magnificent hi-fidelity equipment that puts your sound in the world class. As an example the MR 151, Sanyo's splendid mains/battery stereo tape recorder, about 65 guineas. Some choice features of its specification are included here—but get the full story from your hi-fi dealers. And while you're there, ask him to demonstrate Sanyo's brilliant range of solid state tuner/amplifiers, tape decks, record players.



Specification: Mains/battery Stereo Tape Recorder. 4 tracks. Record/playback. Three speeds. Sound on sound. Sound with sound. Automatic shut-off. push button operation. including two microphones, spool of tape, empty spool. *Recording system:* AC bias 1/4 track. *Tape speed and recording time:* 100-10,000 c/s at $3\frac{3}{4}$ ips. 100-5,000 c/s at $1\frac{7}{8}$ ips. 100-2,500 c/s at $\frac{15}{16}$ ips ±3dB. *Output power:* Max. 800mW per channel. Undistorted 750 mW per channel. *Accessories:* Microphone x 2. 5" full tape x 1. Empty reel x 1. Patch cord x 2. Splicing tape x 1. Microphone stand x 2. Power cord x 1.

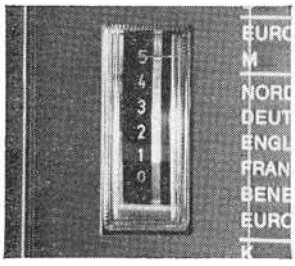
SANYO

RELIABILITY IS BUILT IN

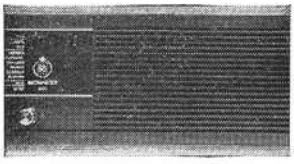
See Sanyo at any authorised dealer. For further information write to: J. W. Cowley, Sales Manager, Electronic Equipment Division, Marubeni-Iida Co. Ltd., 164 Clapham Park Road, London, S.W.4.

Bang & Olufsen

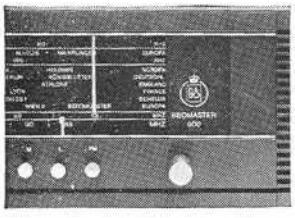
for those who consider design and quality before price



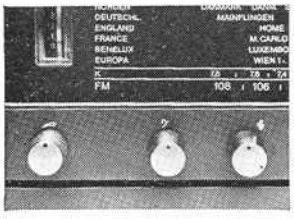
Calibrated Radicator, for absolute accuracy in station selection.



Balanced Pressure Chamber Loudspeaker enclosures, for optimum reproduction.

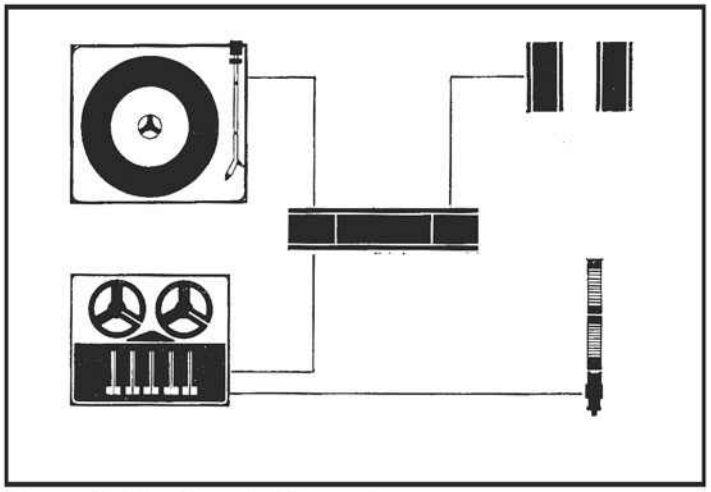


Duplex tuning indicator drive system with separate A.M. & F.M. cursors, push-button wavechange and mode selectors, for simplicity of operation.



Aurally compensated volume and wide range separate bass and treble controls for "personal quality" adjustment.

BEOMASTER 900k. 4 Waveband stereo table radio. Top audio specifications comparable to regular High Fidelity standards. Designed the Danish way with universal appeal and constructed in solid Teak or Rosewood. For those who wish to use separate loudspeakers the Beomaster 900 M is available.



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