

# Amateur Tape Recording

VIDEO & HI-FI

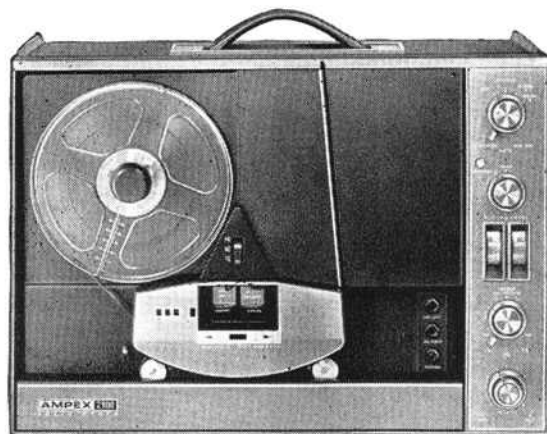
January 1967 Vol 8 No 6 2/6



**EN ROUTE FOR A PARIS SOUND HUNT—Page 22**

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# Amateur Tape Recording

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## EDITORIAL COMMENT

### BATR Contest '66

This year I was not among the distinguished panel of Judges of the British Amateur Tape Recording Contest for 1966, but I did attend the presentation of awards at the Criterion Hotel in London. Not all the winning entries were played during the presentation, although provision was made, for anyone who was interested, to hear all the prizewinning tapes. The total number of entries equalled those of the previous year, but after listening to some of them I felt that in many instances a higher standard could have been achieved in the quality of reproduction. Presentation was, on the whole, very good – in fact, the creative ability of the British tape recording enthusiast sometimes even surpasses that of the professional. This is indeed a good sign, especially with the likelihood of local broadcasting in this country, for here the keen amateur may well find an outlet for his talents. Hard and conscientious work deserves the appreciation of an audience for one's efforts.

### Technical Abbreviations

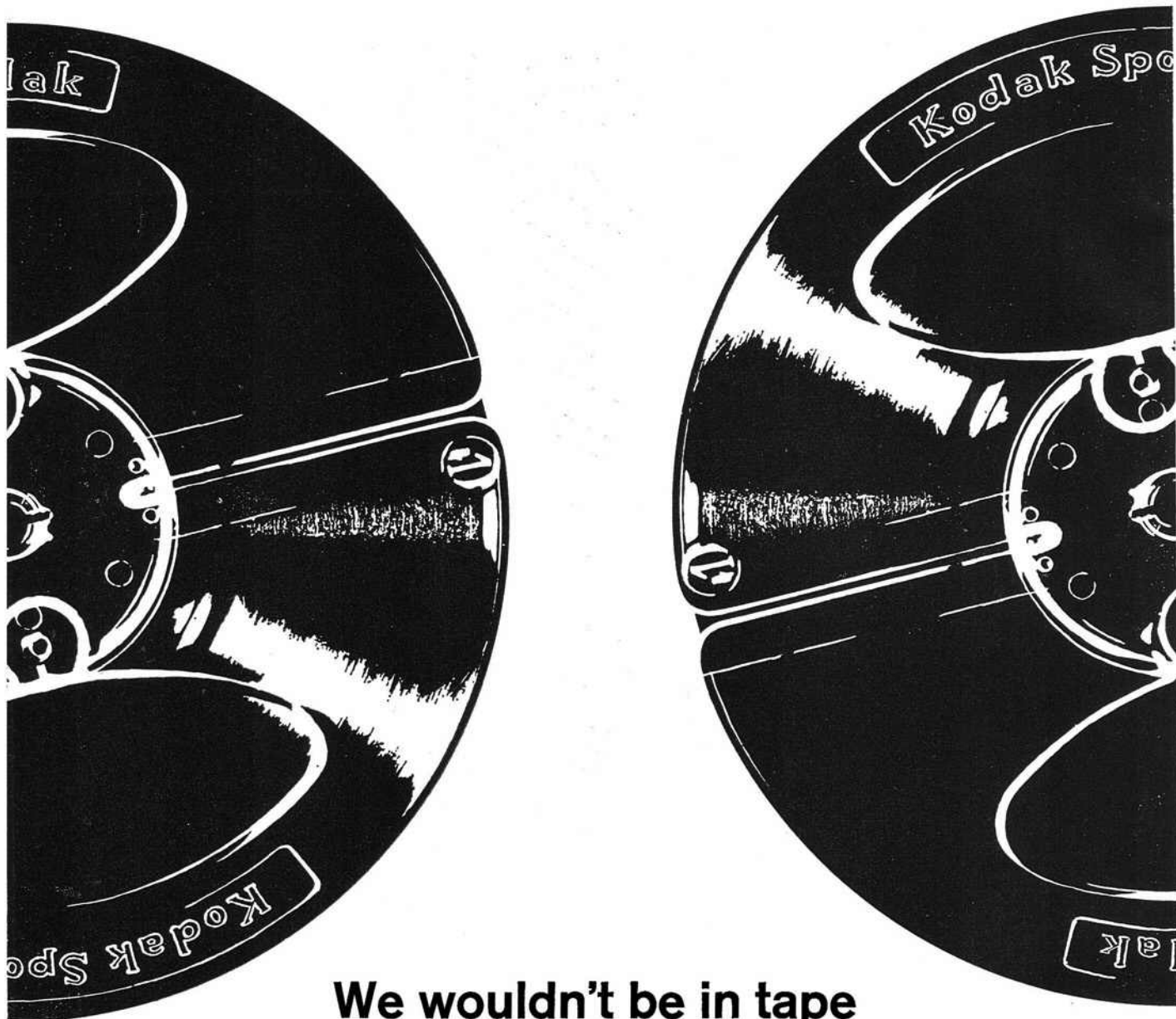
In this issue we are publishing a list of technical abbreviations commonly associated with tape recording, video and hi-fi. These have been carefully chosen with regard to clarity, meaning and presentation in print and will be used in all ATR Editorial features. There is, however, one abbreviation that is to be changed. This is 'cycles-per-second', which up until now has always been c/s or cps, the standard expression of radio, video or audio frequency. Cycles-per-second has been changed by International agreement to Hertz abbreviated to Hz. Frequency is now therefore expressed in Hz, so what would have been 'a frequency of 200c/s' is now 'a frequency of 200Hz'. A frequency of 10,000c/s, or as hitherto 10Kc/s, now becomes 10,000Hz or 10KHz. Millions of cycles, or Mega-cycles, now becomes Mega-Hertz or MHz. We hope that manufacturers will also be adopting this new internationally used abbreviation for expressing frequency.

### The New Year

Finally, may I take this opportunity of wishing all our readers a happy and prosperous New Year. Already there is promise of new things in sound recording and hi-fi. The prospects of video recording for the amateur are also exciting, as we will show you through the medium of this magazine during the coming months. FCJ

## FRONT COVER

Bob Danvers-Walker records the many signalling sounds that occur in the driver's cabin of the Silver Arrow express train which reaches speeds of over 100 mph between Paris and Le Touquet. There it links up with the British United Airways flight across the Channel to Gatwick Airport. (See *Paris on a Shoestring*, page 22.) The tape recorder used was a Uher 4000L-Report.



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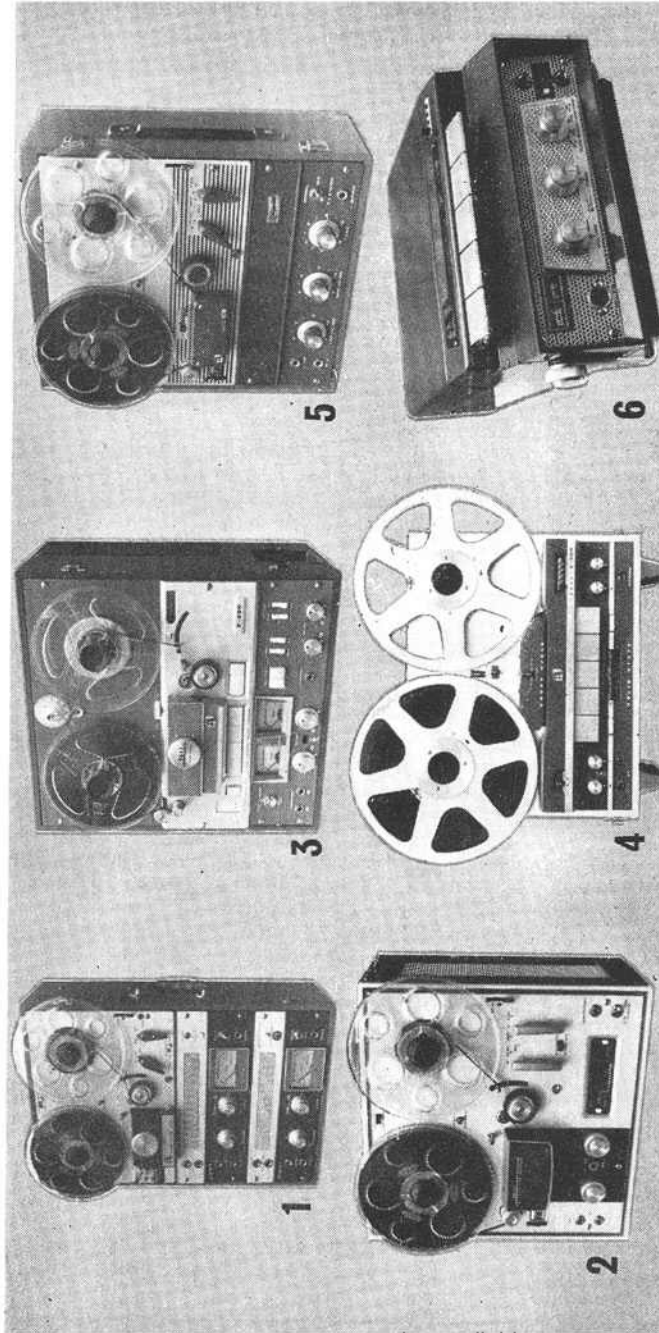
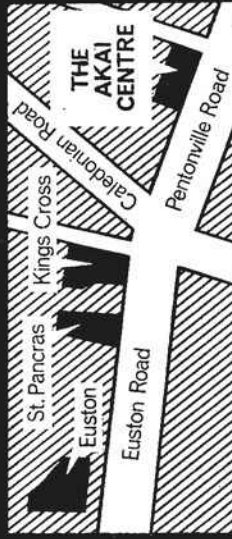
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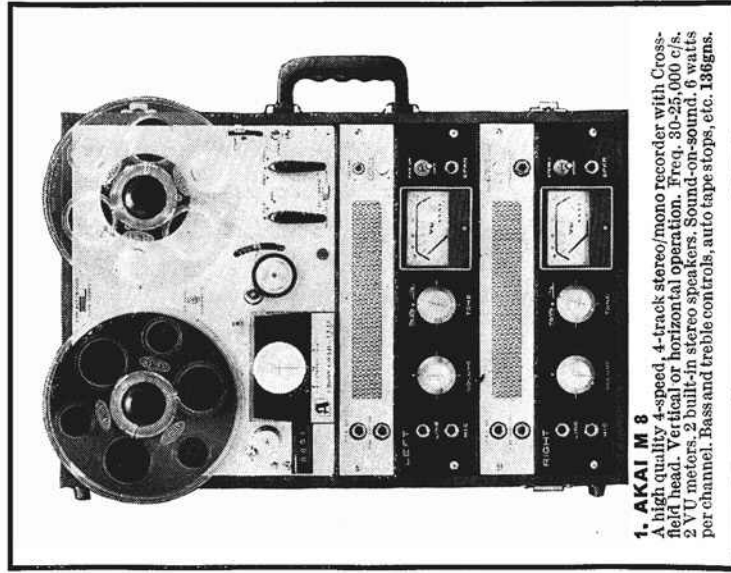
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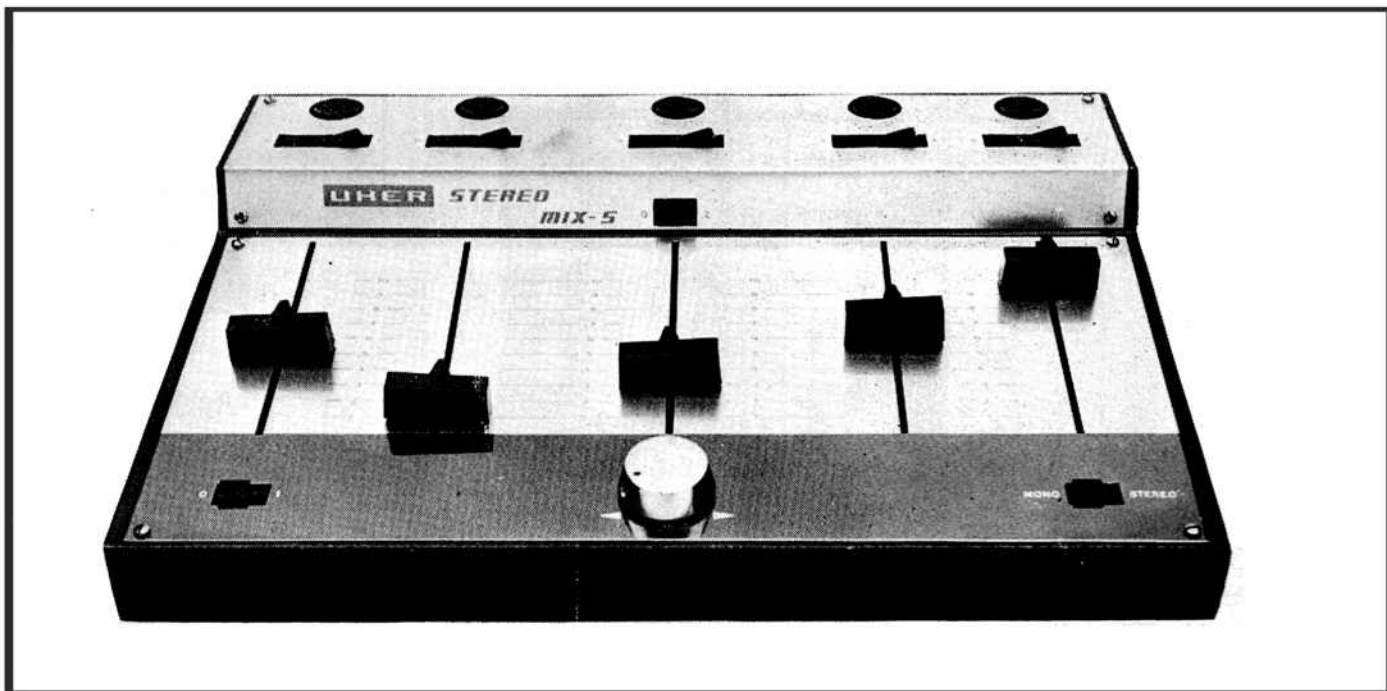


Fig. 1. General view of the mixer showing all controls. The DIN sockets are mounted at the rear. Plastic couplers are used to gang pairs of fader controls for stereo.

# ON TEST—THE UHER STEREO MIXER

by Gordon J. King

The art of creative tape recording eventually calls for the employment of a number of signal sources combined to a common circuit. Moreover, the levels of the various signals require a means not only of isolated adjustment but also of fading from zero to maximum tape modulation depth. A multi-channel mixer is required for this purpose, and preferably this should cater for a range of input impedances and sensitivities, allowing the mixing of microphone signals and also gram, radio and tape signals. The modern idiom is also towards two-channel stereo mixing.

All these features are provided by the Uher stereo mixer. This embodies five two-stage, isolated signal amplifiers using low-noise transistors. The two transistors in each amplifier are coupled via a variable attenuator, called a level control, and these controls (five of them) are in the form of coin-operated presets along the back of the control panel (see Fig. 1). Each of the five channels can also be switched on and off as required at the output, so that in the 'off' position that particular amplifier is completely disconnected from the combined output. This is an excellent idea for it means that the noise generated by those amplifiers not carrying signal is not present in the combined output circuit. The five switches performing this function are arranged in line just below the coin-operated level controls. They are toggle or 'rocker' type and both mechanically and electrically noise-free.

The source signals are thus applied direct to the first transistor of each amplifier, an arrangement which ensures the best possible signal/noise ratio. Fading up and down of the individual channels is accomplished by

slider-type controls on the mixer panel, and these controls are located at the output of each amplifier section.

## Inbuilt Tone Generator

Maximum dynamic range of the various signals is ensured by (a) the level controls or attenuators, as already described, and (b) an internal tone oscillator which can be switched on when setting up the mixer in conjunction with any tape recorder. The tone generator is then switched on, and this delivers a signal to the mixer output socket. Then adjust the recording level controls on the recorder until the level indicator shows maximum modulation. The generator is then switched off. The switch controlling this is in the centre of the side of the panel carrying the rocker switches and level controls.

There is also a slider type switch on the front right of the control panel for setting to 'mono' or 'stereo'. In the latter position, the test tone is fed into both A and B inputs of the tape recorder. This allows the mixer to be used stereo-wise and also allows the level controls of a stereo recorder to be set, relative to the recording level indicators, to a condition of balance. Once the recorder level controls have been thus set and balanced, the fader controls relating to the mixer channels in use are set to maximum and the associated level controls adjusted for full modulation on the recorder's level indicator. This gives the maximum dynamic range condition, and subsequent control of signal levels is handled exclusively by the fader controls.

The mixer operates from a small (i.e., Ever Ready PP3) 9 volt battery pack, and this is located in a clip inside the case, easily ac-

cessible by releasing one large screw in the centre of the bottom panel, allowing removal of the panel (see Fig. 2). The power is switched on and off by a slide switch located on the left of the control panel. The condition of the battery can be determined by switching on the tone generator with the mixer connected to a tape recorder, and as long as the oscillator functions, the battery is serviceable. Should the generator fail to work, then the battery needs replacing.

One other interesting control is located at the bottom centre of the control panel. This is a differential fader control wired between the stereo outputs beyond the amplifiers, and it serves to adjust a signal source progressively from one stereo channel to the other (i.e., fading one while increasing the other, in either direction, depending on which way the control is rotated from its centre position). This control, for instance, makes it possible to swing a mono signal source from one track gradually to the other track on a stereo recorder, and then, if required, back again. With the control at range centre, a stereo recorder can be fed equally on each channel with a mono signal.

## Inputs and Output

The mixer has fully-wired DIN input and output sockets. Of course, there is only one output socket, marked 'A' on the rear DIN socket panel. There are eight input sockets, numbered 1 to 8 to facilitate identification. The mixer is thus highly suitable for any machine which employs the DIN socket system. The output signal, derived from one or more input signals, is designed in level to suit the 'radio' input socket of any tape



recorder, the impedance being of the order of 20,000 ohms. This means that a stereo recorder, such as the Telefunken 204E, will accept the DIN terminated output, mono or stereo, at its 'radio' input, in spite of the fact that a pair of microphone input sockets are used (i.e., one for channel A and the other for channel B). Similarly, the mixer is suitable for the range of Uher recorders. It will be understood, of course, that the recorder's microphone input sockets are not normally used when the microphone signals are via the mixer. Though, as far as can be seen, there is no reason why extra microphones could not be connected to these.

It may be wondered why there are eight input sockets yet only five amplifier sections, five level controls and five faders. The reason for this is that the inputs to four of the amplifiers, apart from having separate sockets, are grouped in pairs, and each pair has an extra input socket wired for stereo, suitable for a stereo microphone. Thus, by connecting a stereo microphone to these two two-channel sockets, two two-channel stereo sources may be mixed and faded. When used like this, four amplifier sections are accommodated, and the fifth section can simultaneously be used to handle a mono signal. Alternatively, each amplifier-section may carry a mono signal, thereby giving five signal

channels in all.

The above reasoning accounts for seven inputs, and the eighth is evolved from the two separately matched and attenuated inputs to one of the amplifier sections. To recapitulate, two pairs of amplifiers each have three inputs – two individual and one for stereo, using the pair together, making six – while the remaining fifth amplifier has two individually tailored inputs, making up the eight.

#### Input Impedances

The impedances and sensitivities of the inputs are as follows: 1 and 6, 3Kohms at 0.1 to 27mV; 2 and 7 (these are the stereo ones) two times 47Kohms at 3.5 to 500mV or two times 1Mohm at 70mV to 1V; 3 and 8 as 1 and 6; 4 as 1 and 6 and 5, 47Kohms at 3.5 to 500mV or 1Mohm at 70mV to 10V. The wide sensitivity ranges are facilitated by the level presets between the two transistors of each amplifier section.

From the above it is clear that a very wide range of mono and stereo signals can be handled by the mixer and a very large combination of sources can be inter-related without trouble, but a certain amount of experience with the mixer and its socket connections is essential for the best results. The instruction booklet sets out various examples

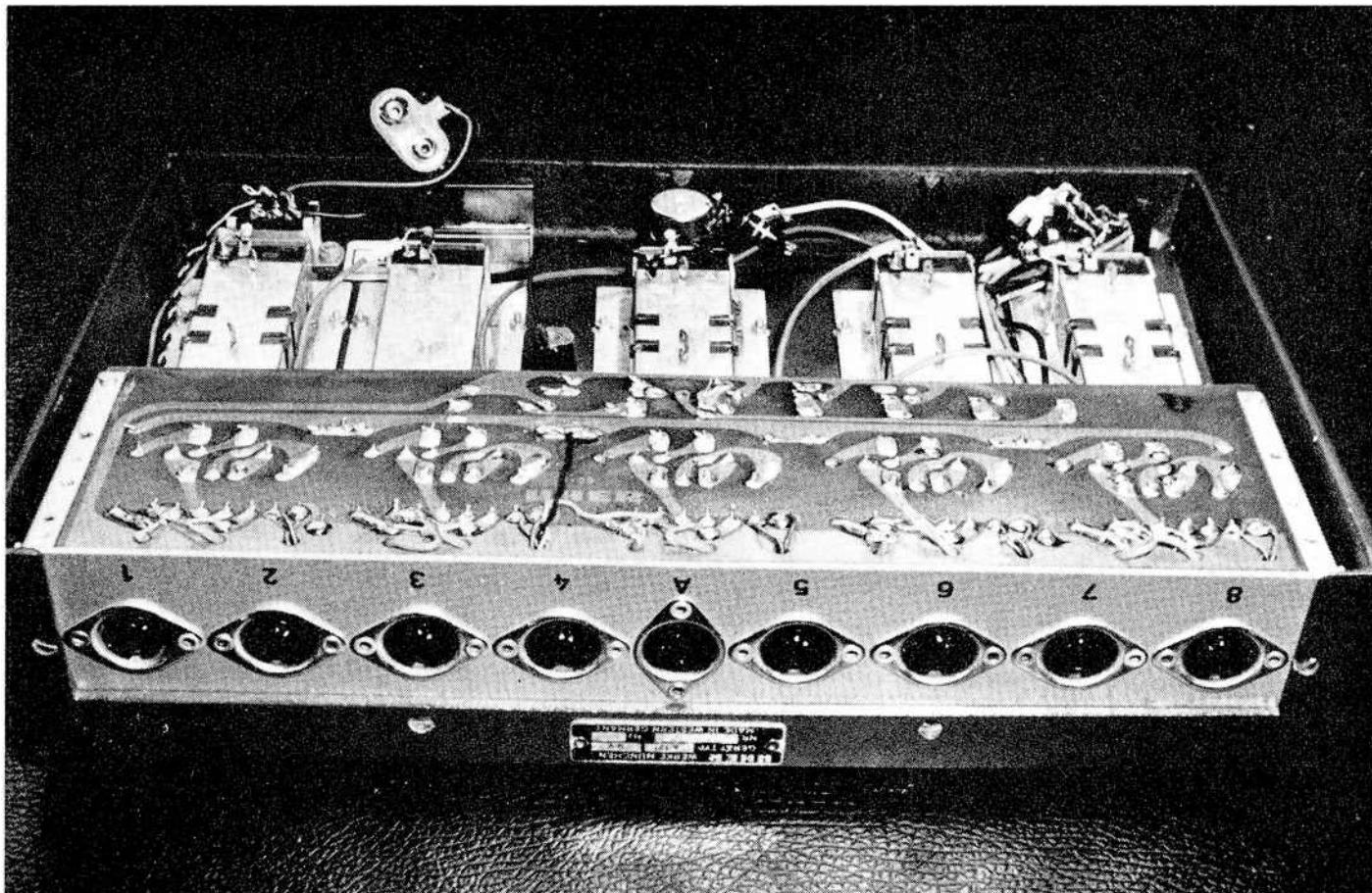
of operation, and there are many more possible combinations. The instructions are, however, poorly compiled and translated. This is a pity, since a mixer like this could have great appeal to creative recordists who are not always well versed in the technicalities.

The mixer was tested with a number of recorders and signal sources with extremely good results achieved in all cases. The rocker switches, as the maker says, are absolutely noise-free in all respects, and the faders work smoothly without electrical or mechanical noise. The transistor noise is well below trouble level, even with all channels switched in at one time and with level and fader controls at maximum. The tone oscillator sends out a nice note and this is really ideal for level setting. All in all, this is a very pleasant mixer to use and well worth its retail price of £45 10s 0d.

#### Maker's Specifications

*Frequency Range:* 20 to 20,000c/s, linear. *Dynamic Range:* 60dB. *Power Supply:* 9 volt battery pack. *Transistors:* 11 AC151s. *Output Impedance:* 20Kohms. *Output Impedance of Level Generator:* 200 ohms. *Mutual Level Interference:* better than 1dB. *Channel Separation:* 55dB. *Total Linear Distortion:* 0.5% max.

Fig. 2. Inside view with bottom cover removed showing position of the 9 volt battery pack location of DIN sockets.



## According to Graham Harris

# TAPE IS A WAY OF LIFE

Once upon a time a tape recorder was the status symbol of the rich. In BDDT (Before the Days of the Domestic Tape Recorder) a filthy-rich friend of mine commanded me to 'listen'! Having just ploughed through a borrowed copy of *Das Kapital* and therefore appreciating the potential utility of any commodity, I tolerated the imperialist's order and listened – and I've been listening ever since.

I can't say that I was immediately captivated by the sound that came from the status symbol. My rich friend said that it was 'the kids playing in the street'. It sounded more like a congested corner of hell during a penitence period. However, as it was also a time of personal impressions and multiple conversions – which is to say: 'I saw, I wanted, I acquired' – I cancelled any idea I had to subscribe to the local communist bloc, bought a tape recorder and donned the mantle of the idle rich.

Owning a tape recorder and using one, as any tapist knows, are two different aspects of one world. 'Ownership,' as my old Japanese master used to say, 'is like mustard. It decorates plate but is not necessarily used.' A tape recorder is expensive mustard, but it serves as a useful paradox. Using a tape recorder is an initiation to a way of life. A tapist begins to listen to sounds in a way that he's never listened before, until he comes to the point when his critical faculties are so well developed that he can set himself up as an audioanalyst.

As readers may have grasped from my earlier scribbles, I cannot take a photograph (35mm slide variety) without first considering the sound that will eventually accompany it on the screen. Where goes the camera, so goes the battery tape recorder. (Modern ATR proverb.) Because tape is a way of life – assuming that the premise is accepted – it is not necessarily a religious philosophy steeped in the worship of the great god *Aud*. However, the ceremony of setting up equipment to record some function has tended to resemble pagan rituals. During a particular recording of a 'Mayor-making service' I leapt from one machine to another, with earphones strangling my throat and sundry wires curled about my feet, performing a dance that – judging from the attention I was given – convinced the congregation in the back row that an ancient devil-throwing folk dance was in full throttle. On reflection, most recording sessions with which I have been involved have been scenes full of symbolic signs of mysticism to alien beholders. The wife of a taping friend of mine has confessed that she has been, on occasions, frightened to death with the performances given by her husband.



'Listen!'





tape programme in which his wife is participating, he conducts her as though he were Sir Thomas Beecham.

It isn't that a tapist differs in appearance from other people. His ears may twitch as though he were listening to voices. At dinner functions he may be seen to be fiddling beneath the table, eyes closed and ears cocked. In a crowded street he may be seen talking to his coat lapel. These are mere behaviour traits and not physical deformities. He might be misconstrued when he talks about his record head, throat mic, audio output and low resistance, but the number of tapists being locked up as public menaces is low – extremely low.

As a way of life, it cultivates an amazingly low ratio gap between luxury and necessity. The purchase of a new microphone is included in the list of essential household requisites before the wife realises that the time has come for a television licence renewal. If she has possibly regarded the tape recorder as a serious rival, she will, in time, learn to embrace this new life to the extent of finding polythene bags of assorted plugs at the bottom of her shopping basket and not batting an eyelid. There have been recorded instances of a wife at the ironing board including her husband's head in the sweep of her arm, as he follows the steaming iron in search of a new sound.

There is a great psychological impact to be acquired from this way of life. Like the tongues of Pavlov's dogs which dripped at the sound of a bell, tapists fingers will twitch as though turning knobs, at the sound of a crowd. I was once involved in a psychological experiment that should have been recorded in some thesis – except that the names of the subjects, the place and the equipment would have to be changed in order to prevent me from getting a thick ear. Before the days of plutocracy when I had only one recorder, I was inflicted with a gentleman – who shall be nameless – who had about a thousand slides of a chrysanthemum to which he intended to put a sound track. He owned a magnificent hunk of machinery, stereo-phony, the lot – he wasn't just filthy rich, he crawled with money. I didn't hold anything against this fellow or his money and equipment – or even chrysanthemums. But he just made one sound track after another and played the lot back to me with, it seemed, a malignant sense of sadistic pleasure. I must have heard a hundred variations of a theme of a chrysanthemum and, to put it politely, I was cheesed off. (I tried to tell him, but he had a hide like a rhinoceros and, contrary to what my friends say about me behind my back, I am too placid for words!) Finally he asked me to make the recording for him because he wasn't satisfied – for some unknown reason he had the idea that I was a specialist in these things. (I was writing science-fiction stories at the time and had not yet ventured into scripts for tape slide shows.) I put it to him that I didn't think for one minute I could do better – especially since his magnificent equipment put my cheap machine into the class of a dustbin lid. Unfortunately, he agreed. (Why he didn't purchase the BBC I don't know!) However, I had another friend who was the possessor of radios, transmitters and dialed façades. He also had a beard, which at that time was the characteristic of a qualified man or the trademark of a sailor. He was a sailor. I explained my inflection and together we devised a fiendish scheme.

My own tape recorder was deposited in the middle of my friend's radios and scattered

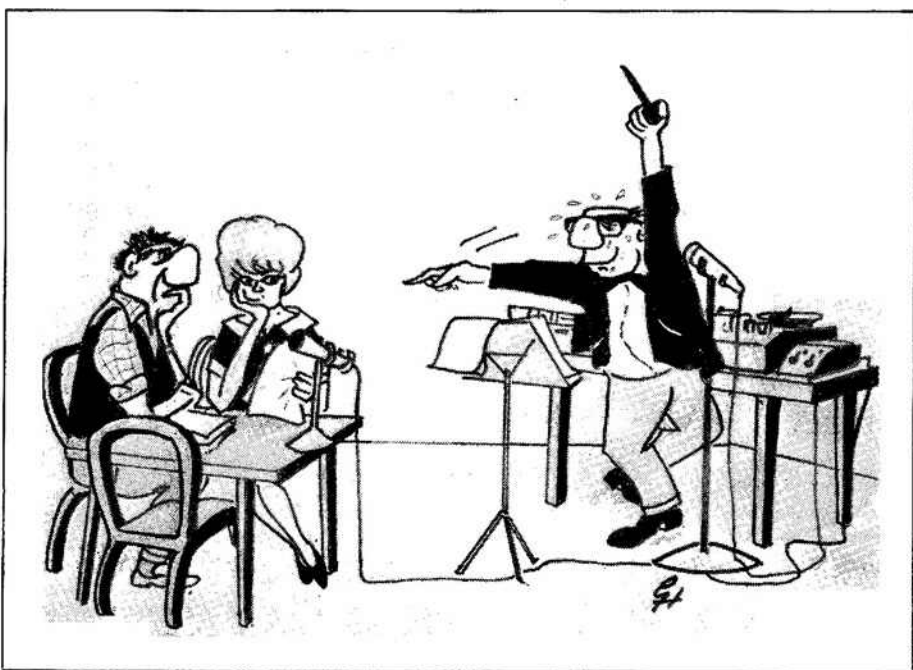


'... an ancient devil-throwing foot dance in full throttle.'

heaps of wire. A string of fairy lights was hung across the whole lot and four microphones placed in various positions about the room. The only objects connected to any electrical current were the fairy lights and my tape recorder. I learned later that a radio receiver was also plugged in somewhere. I introduced my naval friend as a key man in electronics and audiophony and explained to my rich friend that everything would be left in the 'expert's' hands. We sat this chap in a chair, measured him, moved the microphones a dozen times, carried out the counting tests with every move, and then switched on. The radio receiver hummed, the fairy lights blinked and the 'expert' leapt from dial to dial as this fellow talked.

Even I was impressed with show. The expert ranted on about 'the oscilloscopic resistant beam is at four DFB. You'll have to raise the HT up four degrees and watch the gebludenschaftenkreispillen valve!' The point is that my rich friend was also impressed, so much so that he walked away with a sound track that, as he confirmed some years later, was 'high-fidelity supremus' – whatever that meant. I have never been technically involved in this way of life – a blissful state of contentment due, I must confess, to a totally inadequate capacity to understand the simplest circuit diagram. The first time I opened a tape recorder I gave it a drop of oil, as per the booklet's instructions. The result – the dealer was seven quid better off. There does appear to be a strong feeling

*continued overleaf*



'Go and ask Sir Thomas for his autograph!'





# TAPE RECORD REVIEWS

by Russ Allen

**Pass in Review**, production directed by Bob Sharples. London Phase 4 Stereo LPL 74001. Manufactured by Ampex.

When asked for my dislikes in music, I have no hesitation in replying, 'brass bands and military bands'. So here I am, faced with a welter of military band music and all I can say is that it really thrilled me. They do say that all masculine hearts beat faster at the sound of marching music and I think this is true. Marches are a clever psychological trick that make the meekest among us stick out our chests and strut.

The recording is an obvious composite with crowd and troop noises. Some of it could have been recorded live at the Royal Tournament maybe, and/or the Trooping of the Colour – or it could have been entirely simulated in the studio. I would like to know how or which. How about telling us, Mr Sharples?

The idea behind the recording is a vast international review, starting with the British and *Rule Britannia*, then *Scotland the Brave* and so on through France, Australia, Germany, Russia, America, the Navy, the Air Force and Mexico, etc. (What happened to the Welsh?) Throughout the march-past we get the appropriately excited crowd noises, marching feet, vehicle sounds, jets screaming by overhead, and harness jingles. All very authentic except for one thing – how did the troops avoid treading on each other's heels? The grand finale is a two-hundred-strong massed band, including the Windsor Trumpets, playing the *Stars and Stripes*. Even I could scarce forbear to cheer.

A splendid and exciting album with copious sleeve notes to tell you what goes on.

**England's Greatest Hitmakers**. London LPM 70097. 4-Track Stereo 7½ ips

Don't take the list on the box back as the running order – it isn't – the openers are the Rolling Stones with, appropriately, *Surprise, Surprise*. Next is Kathy Kirby, a splendid Tom Jones, *Kiss, Kiss* and Mike Leander's Orchestra with *Sandstorm*, which seemed to have developed some wow. Unit Four plus Two play a very folksy *Woman from Liberia*, and Bern Elliot – *Forget Her*. Side two opens with the Bachelors – *Maureen*. Also the Zombies, Lulu and her Luvvers, not at her best, a very electronic Johnny Howard Band, and old-timer Billy Fury. Barrelhouse piano and tambourine in the group with a Miss, the Applejacks. Finally Dave Berry with full orchestra and choir, *He's with You*. The title of the tape could give rise to much heated discussion among pop fans in Tiles or the Cromwellian and I wonder who will buy it. Not the youngsters I'm sure. Apart from those who want something for swinging parties, this is a dodo. This doesn't mean that I don't like it; on the contrary, it is a good tape with a lot of fine sounds, but if you are a pop fan you'll know what I mean. If you're not and want to get a roughish idea of what it's all about, then you could get some idea from this album.

**The Great Bands**. Hamilton HLP 12142. 4-Track Stereo 7½ ips.

Here we have a typical case of sleeve note starvation. A most interesting collection of twelve typical American big bands of the 'forties – so interesting that I would like to know about them. Do they still exist? When was the track recorded? Who played the solos? What of the bandleaders – do they play anything? I don't think I'm over curious, but I think that good sleeve notes can often help to sell a tape. As it is, all you get on the box are the names of the bands and the tunes they play. You don't even get the playing order. I reckon I know a fairish amount on the subject, yet there are two bands here that I've never heard of. In case you'd like to know what I do know, I'll tell you.

Track one is the Bob Crosby Orchestra – yes, that's right, Bing's younger brother – playing *Honky Tonk Train Blues*, and it isn't the original Decca track. Dick Stabile's Orchestra plays *Tangerine* and the schmaltzy soprano saxophone solo is by Dick himself. Next is unmistakably Shep Fields and his Rippling Rhythm. Remember him? Louis Prima, who you may know as a husky-voiced singing trumpeter, a sort of pale Louis Armstrong, is represented with a sickly choir and organ doing *Chapel by the Sea* and all you get of Mr Prima is an occasional bar or two of trumpet fill-in. Ugh!

The great Jimmy Lunceford Band, which fostered so many of the greats of jazz, has *One for the Book* and Alvino Ray and his Hawaiian guitar performs a typical number, *On the Alamo*. Some very good tracks and one of them by Jack Kane, of whom I'd never heard, doing a very fine version of *Thanks for the Memory*.

One thing which is particularly apparent, the thuddy old bass sound they used to get in pre-tape recording days.

A grand bit of nostalgia and probably giggle-promoting for the youngsters if Dad tells them it's *real* music.

**The Baroque Beatles Book**. Music Tapes. EKTP 7306. 4-Track Stereo 7½ ips.

I would like to play this album to all those who say that pop tunes are a load of rubbish. Mind you, I am the first to agree that certain pop groups could take some of the classics and make them sound extremely trite.

Re-discovered and edited by Joshua Rifkin, the notes say, the Baroque Ensemble of the Merseyside Kammermusikgesellschaft, conducted by the said Joshua Rifkin do make with the Royal Beatleworkes Musicke in the manner of examples by the justly famed Messrs Handel, Telemann and Bach.

Though this is with tongue in cheek, *Last Night I said, Cantata for the Third Saturday after Shea Stadium* MBE 58000 is magnificently arranged and played by a true Baroque Ensemble, solo Klavierchord, chorus and soloists. Quite the most enjoyable track of all is the *Aria Help*, beautifully sung by tenor Harold Bienes, and special mention too for the

Canby Singers on *Please, Please Me* and the chorale *I'll be Back*. Oh! What a glorious joke this is, a really memorable tape. Whether you like pops or classical or both, you must get this tape. Heartily recommended, as they say.

**The Sound of Sight**. Music for experiment in imagination composed and conducted by Ray Martin. London Phase 4 Stereo Spectacular LPL 74040. 7½ ips.

Ray Martin indulges in a far too realistic leg-pull of film music. A splendid set of enclosed sleeve notes gives us the story line so that we may follow the audio picture closely. *Westorama* is the first and you'll swear you've seen it before – it's given the full Western treatment, Injuns an' all. *Destination Space* with actual Cape Canaveral recordings of countdown and capsule-to-ground conversations. *A Whale of a Tale* is an eighteenth-century sea epic with ocean and gulls. The music is marvellous and you can almost see the great ship gliding out to adventure and feel the spray on your face. Then the storm breaks and it had me shivering in my timbers, oops! sorry chair. I'd have liked it to have gone on for much longer.

*Cartoonik*, a jolly but not-so-good effort at a Donald Duck, ends side one. Side two opens with *Egyptian Epic*, an obvious MGM Wide Screen Colour job with all the ingredients of Super Track, luckily condensed to a couple of minutes instead of two hours. *Hoodnunit*, a private-eye-cops-and-robbers full of exciting typical big band jazz theme, with police car sirens, gun play, etc. Great stuff!

*Tearjerker* is the super-emotional drama and the trouble is, dammit, that even though I know it's a load of old mush, I always cry my eyes out. At least my beard soaks up the tears.

Finally to *Flagwaver* and the war game. Britain, France and America beat Germany. Gosh! That was a long time ago. Did we really win? Ray Martin must have enjoyed himself doing this little lot and I must confess that I enjoyed it too. So, I think, will you. Lots of fun.

**Broadway Spectacular**. Stanley Black conducting The London Festival Orchestra and Choir. London Phase 4 Stereo Spectacular. LPL 7471 7½ ips.

Very pleasant arrangements of American show tunes played the way Mr Black feels they would have been played in the show, to give us the true atmosphere. This he certainly does, capturing a lot of the excitement of a live show. Music comes from *Oklahoma*, *South Pacific*, *Hello Dolly*, *Funny Girl*, *Carousel* and *Music Man*.

Jolly music that makes a pleasant souvenir if you've seen the shows; and if you haven't, then you'll get some idea of what you missed. All the above tapes, from Transatlantic Music Tapes Ltd, are well boxed and attractively spooled with centre labels.

# SPEED VARIATIONS—THEIR CAUSE AND CURE

by Vivian Capel

Variations of speed are, without a doubt, one of the most annoying faults in a tape recorder. To some extent a degree of distortion can be accepted, some listeners tolerating a greater amount than others. A limited frequency range is likewise not unacceptable to many, often being deliberately restricted by turning down the tone controls. Speed variations, which can be easily detected, could otherwise mar an excellent tape recording.

The most common effect is the variation in pitch of the reproduced sounds. It is true that in some cases these variations can be masked by the nature of the recorded sound and hence go undetected. For example, with woodwind and stringed instruments the performers deliberately introduce a regular pitch variation to give a vibrato effect. When piano music is reproduced, however, any such defects can be instantly detected, and this really affords a good way of checking a tape recorder for such speed variations. The method is to record a single sustained piano note, say middle C, and to repeat it as it dies away so that a recording of several minutes is made, any speed variation soon becoming apparent on replay. Speed variations can be divided into three classes; wow, flutter and random irregularities, and we will deal with these classes in consecutive order. Wow is a regular speed variation of around 5 cycles per second or less. The effect sounds rather as though the sound is pulsating. Fortunately, it is comparatively easy to identify the source of this trouble.

## Drive System

We must first understand how the drive is imparted to the tape from the motor. One method using the idler wheel is illustrated in Fig. 1. The drive is transmitted from a capstan on the motor spindle to the rubber idler wheel and from thence to the rim of the fly-wheel. The top fly-wheel shaft is continued to form the tape drive capstan, contact between this and the tape being maintained by a rubber pressure wheel. The take-up spool is driven via a slipping clutch through a further idler wheel from the flywheel. Sometimes a belt is used in place of this second idler wheel and in others, belts are used in both cases. In some models (mostly of continental make) a single belt (from the motor) is used to drive both fly-wheel and take-up spool clutch wheel. There are other parts which come into play when the tape is rewound, but as these are out of operation during normal recording or playing, they cannot produce speed variations and so will not be considered here. However, it is as well to check that any such parts are not partially engaging when the recorder is in the normal play position.

motor to the drive capstan and pinch wheel could be responsible for speed variation. The drive to the take-up spool could also be at fault as any undue friction here would act as a brake on the fly-wheel. Before getting too involved with the inside of the recorder, check that the tape spools themselves are not rubbing against any part of the tape deck. This is a common cause of wow and can be due to a warped spool or to the turntables being too low, thereby allowing insufficient clearance between the spools and the deck.

## Diagnosis

Having made sure that the spools are well clear of the deck, the deck plate can be removed to reveal the fly-wheel and idler wheels or belts. The piano note recording is placed on the machine and switched on. Diagnosis now consists of trying to match the frequency of the wow with the speed of the various revolving drive wheels. It is as well to adopt a systematic approach, working from the motor and eliminating each wheel in turn until the culprit is found. Matching the speed can be aided by making a mark on the particular wheel. We may find, for example, that the idler wheel is revolving much faster than the reproduced wow, hence we check the fly-wheel. If this is revolving too fast we consider the pressure wheel; this is found to be matching the speed and so must be the culprit. The take-up spool idler wheel may be revolving at much the

same speed as the motor drive idler, so care must be taken in deciding which of these two may be the cause of the trouble. Having identified the trouble, the next step is to cure it. If the pressure or idler wheel are found to be at fault, these can usually be removed by first removing the circlip and then lifting off. First of all, the condition of the rubber should be examined. This should be firm yet resilient, but if it is soft and spongy it may be perished. On the other hand, excessive heat within the tape recorder can cause the rubber to harden. In either case the only cure is replacement.

Another cause of trouble is a flat spot somewhere on the circumference of the idler wheel. This often gives rise to a slight knocking noise as well as speed variations. More often than not it is due to the recorder being left standing for some considerable time with the idler wheel pressed against its driving surface in the one position. Providing the rubber is in good condition it can be cured in most cases by simply letting the recorder run for several hours. Oily deposits on the rim can also cause trouble so the driving surface should be well cleaned with a piece of rag dipped in methylated spirit. Do not forget to clean the surface it drives too, as this also will leave a similar deposit on the idler wheel after engaging with it. The spindle and the inside of the wheel can be cleaned again with spirit, oiled sparingly and then refitted. Make sure that the retaining circlip does not foul against the wheel.

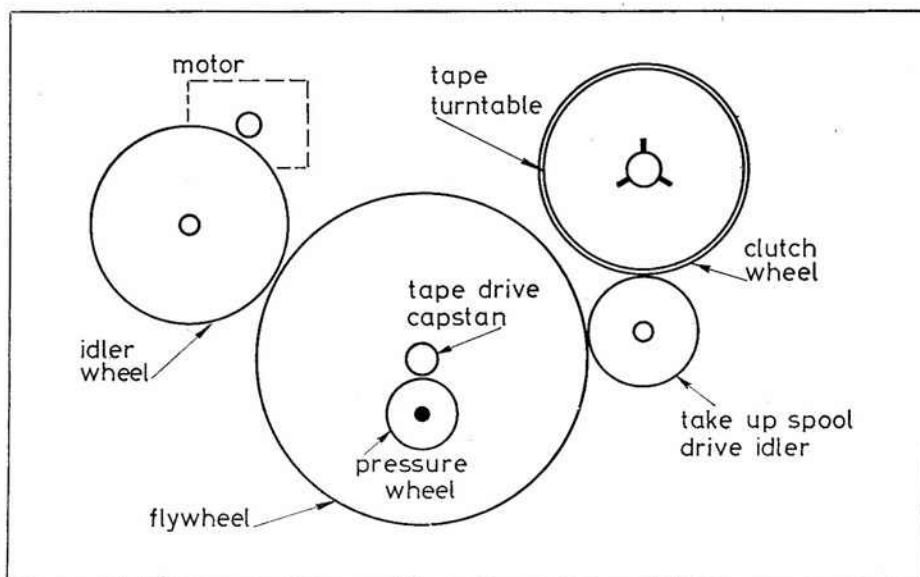


Fig. 1. Common drive system using idler wheels.





# TAPE RECORDER SERVICING PART XIII

This month Gordon J. King investigates recording levels and cross-field recording



We have already shown how the hf bias and the erase signal can be measured in terms of signal voltage across a series-connected resistor and then translated into signal current and have also shown how the strength of the hf bias to the recording head can be adjusted for optimum results. An earlier article detailed the effects that varying the bias signal amplitude (and frequency) can have on the recording. Among other factors, it will be recalled that the amount of treble recorded on the tape tends to fall as the amplitude of the bias signal is increased. This adverse effect has of recent months been minimized by a biasing technique known as cross-field recording, but before we investigate this, let us look first at the subject of recording current.

The strength of the signal recorded on the tape is governed by the strength of the magnetic field produced by the signal across the gap of the recording head. The magnetic field across the gap causes the oxide particles on the plastic tape to become magnetized in the pattern of the signal. Clearly, just how much magnetism is imparted must depend on the strength of the magnetic field producing it. There comes a time, however, when any further increase in magnetic field will fail to increase the strength of tape magnetism. This happens when the tape is so-called *saturated*, meaning that its oxide particles just cannot handle any more magnetism. The oxide particles are then fully magnetized.

Now, the magnetic field produced across the gap of the recording head is itself governed by the strength of the signal current passing through the head winding. The greater the current, the greater the magnetic field. Again, this is subjected to limitations in terms of saturation of the head pole pieces, head signal losses, recording amplifier capabilities and so forth. If the recording current is increased, therefore, the depth of recording will increase to a point where distortion will start to rise fairly rapidly, and this distortion could be caused by tape saturation alone, by head saturation or overload or by amplifier overload. However, the design of the recording section of a tape recorder is such that the amplifier is capable of delivering sufficient signal current fully to saturate the tape before it runs into overload or before the head saturates or overloads. The critical factor is thus tape saturation.

In practice, this can only be related to recording signal current in the head winding for an average tape. The recording signal current, though, will depend on the impedance of the

head winding; the lower the impedance, the higher the signal current necessary to create a signal field of sufficient intensity to saturate the tape. The strength of the bias signal applied to the recording head also influences the magnetic field across the gap of the head, as we have already seen. Several variables are thus involved.

From the aspect of the signal/magnetic field transfer, the nature of the tape, the efficiency and impedance of the head and the strength of the hf bias all have to be taken into account. Even then, there are difficulties, for there is no clear-cut demarcation between normal recording levels and tape saturation levels. The transfer distortion at levels well below tape saturation is very small, but at recording levels approaching saturation the distortion tends to rise fairly sharply, and this represents the only subjective demarcation available.

The recording level indicator tells us when the recording current is rising to a level towards tape saturation. We know that if we record consistently above 0dB or the red mark on the indicator we shall produce a recording containing a greater level of distortion than a similar recording made with the indicator peaking below the critical mark, assuming that the level indicator is set up reasonably accurately.

In practice, it often follows that by recording at an even lower level, the recorded distortion will be even smaller; but we are then troubled by an abnormally high background noise (i.e., impaired signal/noise ratio). Thus, there

is not much point in endeavouring to keep the transfer distortion at a very low level by under-recording when this advantage is outweighed by noise. Further, the recording and playback amplifiers are themselves going to add to the distortion, so even if the noise problem could be resolved, there would still be little point in recording at very low-level for the sole purpose of minimizing transfer distortion.

The recording level indicator provides an objective appraisal of when distortion due to tape saturation is likely to occur or, at least, when the recording current in the head winding is approaching the level that is likely to saturate the 'average' tape.

## Measuring Recording Signal Current

This means that the recording level indicator must be closely geared to the recording signal current in the head winding. Many recorders feature a preset adjustment for controlling the sensitivity of the indicator, and this is set

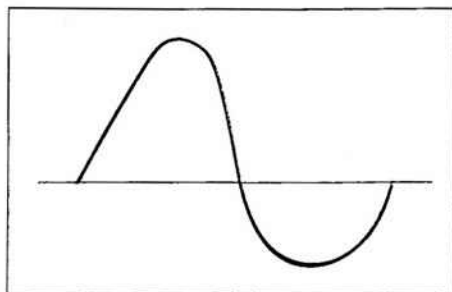


Fig. 1. Harmonic distortion of a sine-wave.

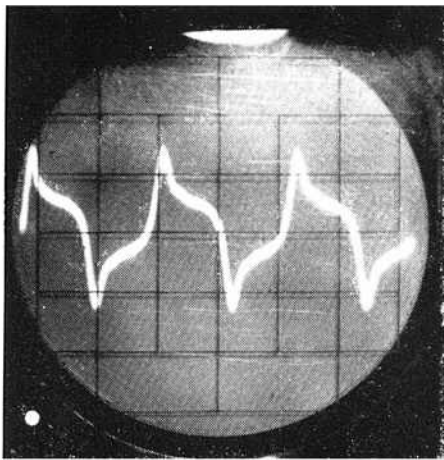


Fig. 2. Display of severe saturation distortion.

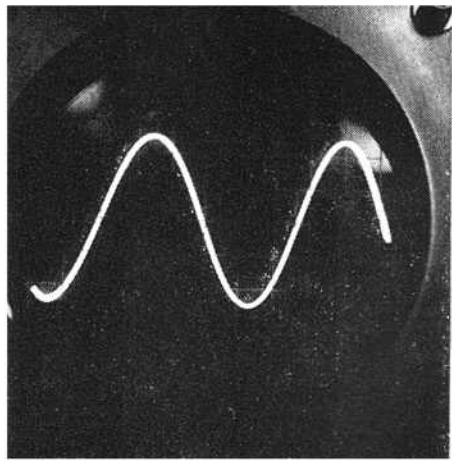


Fig. 3. The sine-wave signal used to record the tape producing the distortion in Fig. 2.



for peak indication when the recording signal current in the head winding approaches that required for tape saturation. This signal current information is sometimes given in the instrument's service manual, and it is related to a specific hf bias current and average type of tape.

The recording head winding current can be measured as detailed last time for bias current by introducing a low-value resistor in series with the winding and measuring the signal voltage across this at (usually) 1,000c/s. It should be remembered, of course, that treble boost is often applied during recording as an artifice for combating treble losses that occur in the head and in the transference of the 'signal' from the head to the tape.

The recording current in a high-impedance head may range from about 30μA to 100μA, from 60μA to 200μA in a medium impedance head and from 300μA to 1mA in a low-impedance head, depending on the nature of the tape and the bias current.

If no actual values for recording signal current are given, it is possible to make several test recordings with the tape to be used, at a fixed bias current value and at various recording levels, then monitoring these each in turn on an oscilloscope. A pure sine-wave signal at 1,000c/s should be used to make the recordings, and on playback it will be obvious when the saturation point is being approached as the waveform will progressively deviate from a pure sine-wave, passing into heavy distortion when the tape is really saturated.

The levels of input signal applied for each recording should be carefully noted and identified on playback, and the level just prior to noticeable distortion on the trace should be reapplied after the playback tests. At this level of input signal, the level indicator preset should be adjusted to the peak recording indication, again at 1,000c/s, of course. Second-harmonic distortion gradually becomes noticeable on the trace when the recording signal level results in the tape approaching saturation, and this is shown by one half cycle of the sine-wave being more rounded than the other half cycle, as shown in Fig. 1. For the very best results, of course, one should ensure that the very minimum of distortion occurs even at peak recording level, but if one goes too far this way the signal/noise performance will be impaired, as already mentioned.

Really severe saturation distortion is shown in Fig. 2, while Fig. 3 shows the sine-wave nature of the input signal which made the recording in the first place. It will be recalled that the hf bias signal is applied to the recording head together with the recording signal to linearize the transfer characteristic. Unfortunately, this signal has the effect of attenuating the higher order (treble) signals due to partial erasure, and it is essentially for this reason that the top frequency recorded is in the order of 2,000c/s per one inch per second tape velocity. Thus, 3½ ips gives an average treble characteristic of about 7,500c/s while stepping up to 7½ ips lifts the treble to around the 15,000c/s mark, assuming good tape recorder design.

### Cross-field Recording

Fairly recently introduced by Akai is a new technique called cross-field recording which permits the recording of frequencies as high as 7,000c/s at a tape velocity of one inch per

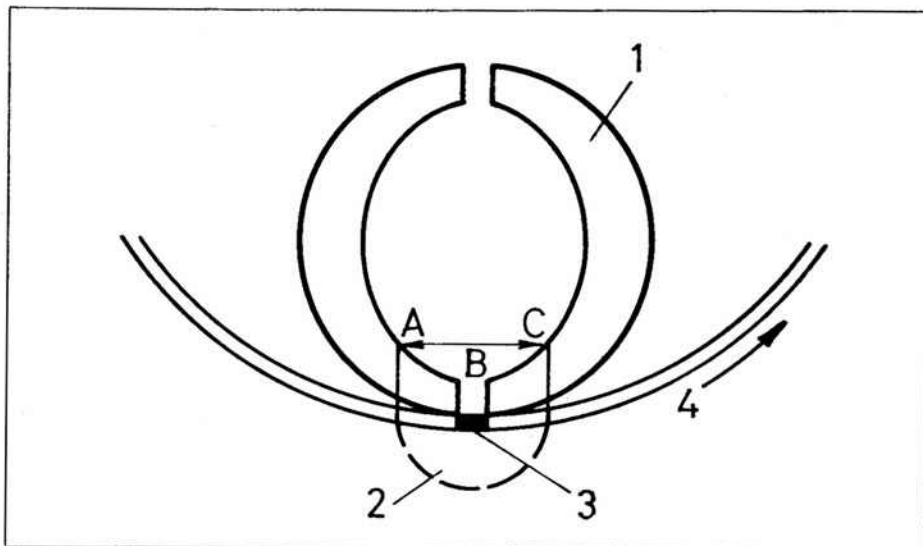


Fig. 4. Conventional recording head system.

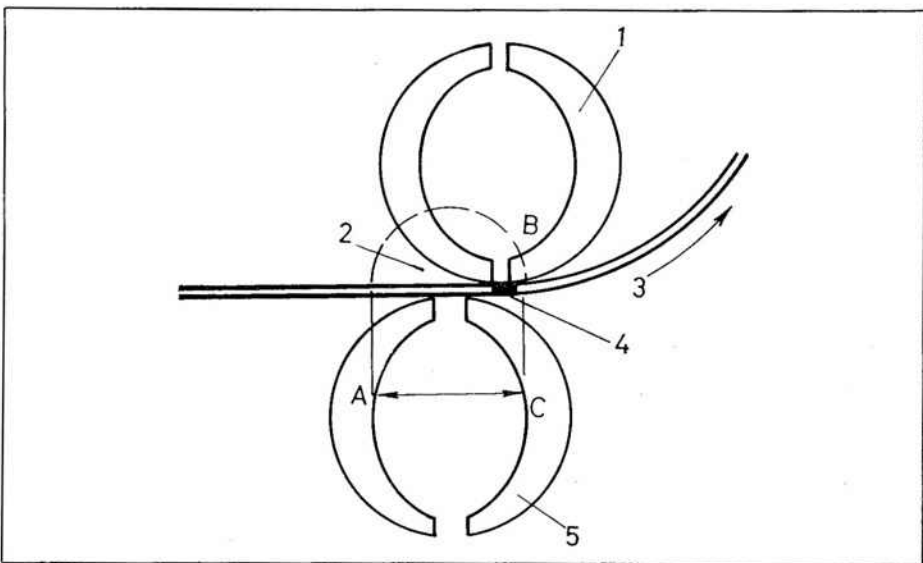


Fig. 5. Cross-field head system.

second. This means that a treble response as high as 26,000c/s becomes possible at 3½ ips, while at 7½ ips signals up to 52,000c/s can be recorded. Indeed, controlled laboratory tests have produced recordings up to 10,000c/s at 1 ips and there is reason to believe that even at this low speed the recorded signals go as high as 30,000c/s. Looking into the future, and considering the latter figure, video signals up in the 1,500,000c/s mark could thus be recorded at a tape velocity of 50 ips, which is by no means excessive for linear video tape recording.

Fig. 4 shows at 1 a section of a conventional recording head. Here the tape is pre-magnetized at point A by the bias field 2 to reduce noise, but because of this high-frequency components of the recorded signal at point B, recorded by the signal field 3, tend to be subjected to erasure effects, thereby causing attenuation of the tape 'signal'. These erasure effects are caused by the bias field embracing the area between points B and C, the field as a whole extending between points A and C. The tape direction is indicated by 4. Now, the cross-field system uses an ordinary recording head plus a second head to the winding of which is applied the bias signal. The arrangement is shown in Fig. 5. Here 1

is the signal head, 2 the bias field, 3 the direction of tape travel, 4 the signal field and 5 the bias head. The two heads are mounted in opposition with slightly offset centres. This means that the tape is pre-magnetized between points A and C, while the actual recording takes place at point B. Thus the recorded 'signal' is totally free of prevailing bias fields and it is retained on the tape without the losses resulting from the conventional system. Moreover, the bias magnitude and frequency can be adjusted almost solely on the merits of the signal, and not as a compromise as is often the case with the conventional system.

The Akai cross-field recorders provide a treble response up to 13,000c/s at the very low speed of 1½ ips; but it must be remembered that this low speed tends to exaggerate drop-outs on the tape and any minor shortcomings which would possibly pass unnoticed at the higher speeds; for low-speed hi-fi applications, therefore, the best possible quality tape must be employed.

Next month the recording level indicator will be examined in detail and this will be followed by hum problems associated with tape recording, showing how basic servicing can be applied to minimize them.

# SOUND SCENE

## News from HMV

Among the new series by HMV is the 2210 four-track, two-speed tape recorder shown in Fig. 1 which retails at 36 guineas. Four-track recording allows up to twelve hours' playing time and this recorder features two speeds,  $1\frac{7}{8}$  and  $3\frac{3}{4}$  ips. Piano keys provide easy, positive action. Provision is also made for tape inching in either direction to facilitate editing. A pause control is included on the tape deck and on the microphone. Other features include: auto-stop, straight-through amplifiers and sockets for external connection. Accessories – microphone, tape and leads. The cabinet is finished in walnut-veneer and has a detachable lid. Frequency response is given as 60–6000c/s at  $1\frac{7}{8}$  ips and 60–10,000c/s at  $3\frac{3}{4}$  ips. Further details and brochure from British Radio Corporation Limited, 284 Southbury Road, Enfield, Middlesex.



Fig. 1. The HMV 2210 four-track two-speed tape recorder.

## Marconiphone – New Releases

From the same distributors, British Radio Corporation, comes the new Marconiphone series including the Model 4210, a three-speed four-track machine with seven inch spools. This one incorporates mixing facilities, record level meter and two-way tape inching. Frequency response at  $7\frac{1}{2}$  ips is 40–18,000c/s and the amplifier will deliver 3 watts of audio. Other features are interlocking controls, auto-stop, straight through amplifier, signal monitoring and pause controls on deck and microphone. There is also provision for external amplifier and speaker connections. The Marconiphone Model 4210 retails at 45 guineas and is shown in Fig. 2.

## Latest Models from Ampex

A new series of professional quality stereo tape recorders for home use, featuring bi-directional recording and sound mixing in addition to automatic reversing and threading, has been announced by Ampex. The new top class Ampex 2100 series is designed to record and play in both directions, providing up to four hours of high quality stereo recording without changing reels. The 2100 series also incorporates the highly successful automatic reversing and simplified threading features previously introduced with the Ampex 2000 series.

Solid state electronics, VU meters, three-speed operation and dual capstan drive are other features. A fourth head has been included permitting bi-directional recording. A single jack stereophone plug is top mounted for easy access. Sound mixing is possible with the 2100 series in the monaural mode. Two sound sources may be recorded on a single monaural channel simultaneously. These may be two stereo channels from tuner or gram, two microphones, or a combination of one microphone and one tuner or gram input. The 2100 series is available internationally in three models: model 2153, an uncased deck with stereo pre-amplifiers, model 2163 portable recorder with stereo pre-amplifier and power amplifiers, complete with one Ampex 2001 dynamic microphone and dustcover and model 2165-3, same as 2163 but with oiled walnut case. This is shown in Fig. 3. Full details and specifications of all these models can be obtained from Ampex

## Dynatron Model Features Multiplay

Featuring complete multiplay, the new STR1 tape recorder from Dynatron Radio Limited shown in Fig. 4 is a four-track stereophonic recorder with all transistor circuitry. The STR1 incorporates a dual channel record playback amplifier with individual level controls and meters which, in conjunction with separate record and playback heads, provide complete multiplay facilities. The three-speed tape transport mechanism incorporates a large capstan flywheel driven by a 'Papst' system motor and the deck will accommodate 7 inch reels and utilizes a relay controlled, end of tape, automatic stop. The recorder is supplied with a 7 inch reel of tape, spare reel, and moving coil microphone. The STR1 has tape speeds of  $7\frac{1}{2}$  ips,  $3\frac{3}{4}$  ips and  $1\frac{7}{8}$  ips, and a frequency, of 50–18,000c/s, 5–10,000c/s, and 30–6,000c/s. Other features are programme indicator, four digit counter, and a push-button system which parallels both amplifier channels. Controls include separate bass and treble push buttons and track transfer for multiplay recording and mixing. The retail price is 79 guineas, complete with accessories. Further details from Dynatron Radio Limited, St. Peter's Road, Furze Platt, Maidenhead, Berks.

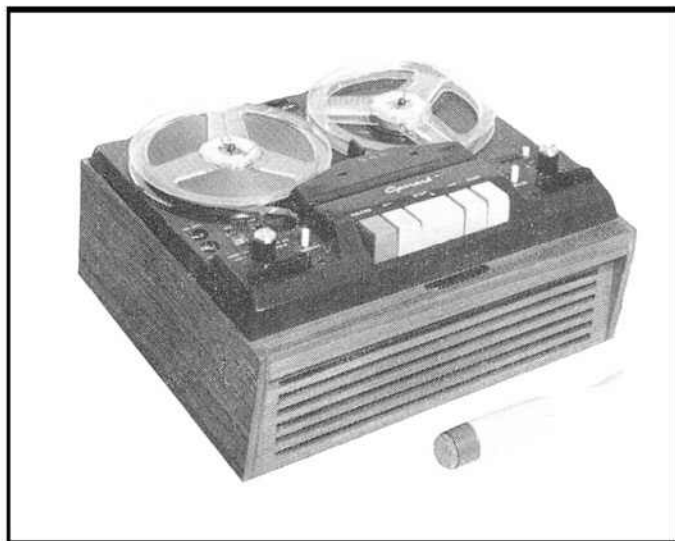
## The Elizabethan LZ612

The new LZ612 tape recorder shown in Fig. 5 by Elizabethan Electronics Limited is claimed to be unique in its design and has an output approaching 6 watts. This is possible only because of the 'vertical' design which allows a larger, more powerful and more effective speaker to be employed. Another feature which will commend it is the simplicity of operation and tape change through the new cassette type deck. Weighing only 18 lb and battery or mains operated, it is fully portable and can be taken on holidays, picnics or simply into the garden at home. The LZ612 retails at 45 guineas and features independent mixing and tone controls and is completely transistorized. No details are given concerning the tape speed or of the type of tape cassette used. Further details are, however, available from Elizabethan Electronics Limited, Crow Lane, Romford, Essex.





*Fig. 2. The Marconiphone 4210 incorporates mixing facilities and is a three-speed, four-track machine.*



*Fig. 4. The Dynatron STR1, a new tape recorder with multi-play facilities.*



*Fig. 3. One of the new Ampex 2100 series which features automatic tape loading and reverse run operation.*



*Fig. 5. The Elizabethan LZ612, a new cassette recorder.*

## **EIGHT-TRACK STEREO COMES TO BRITAIN**

What began in and is now setting industry standards for the United States is already spreading to other corners of the world. Eight-track tape cartridge players are scheduled to go into local production in Canada, Mexico, Argentina and Venezuela in the first half of 1967. A number of Japanese firms are well advanced with such instruments, with initial production scheduled within a few months. Now for the first time eight-track stereo will make its appearance in this country.

RCA Victor alone, which created the eight-track duplicating technique, has produced more than 2,000,000 tape cartridges and has more than 400 titles in its Stereo 8 catalogue. At least 70 other American record labels have introduced their own eight-track tapes and three industry leaders – RCA Victor, Capitol and Columbia – are offering eight-track cartridges exclusively.

The RCA Victor eight-track stereo cartridge player unit shown in the photograph will also be available here. This is the model MHC60, a compact modular deck unit designed to play through a stereo console, stereo table radio or stereo amplifier system. Further details from RCA Great Britain Ltd, Record Division, 36 Berkeley Square, London W1.



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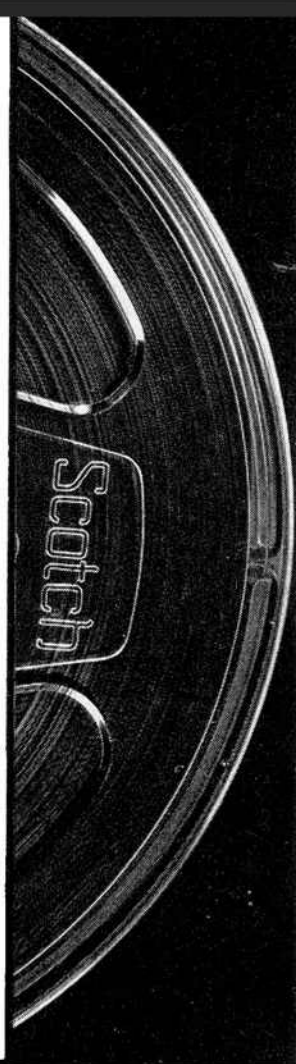


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# RECORDING IS OUR PLEASURE

by Yvonne van der Rest



Fig. 1. Studio control and recording booth in the railway carriage studio of the RIOP Foundation hospital broadcast service in Amsterdam.

*Whilst in Holland recently I came across a novel studio set-up for hospital broadcasting which is carried out by a group of enthusiasts under the title 'Stichting RIOP', which means 'Recording is our Pleasure Foundation'. Its history and work are similar to hospital broadcast services by clubs and groups in this country. It is their studio which is perhaps unusual, but I asked one of the members – who is also an announcer–Yvonne van der Rest, to write something for ATR about their programmes for hospital service. (Editor)*

The Stichting RIOP, Omroep voor Zieken (hospital broadcasting), was founded in February 1958 to provide programmes for patients in hospital and it all began in a living room with one tape recorder and a record player. Such was the demand for more tapes that new and larger premises had to be found and this time a 'garret room' (I hope my translation of this article is correct – Ed) was acquired. There was space here for small bands and various artists who contributed to the tapes of entertainment and news for the hospital patients. The problem of funds to run the service was solved by gifts from interested people and fund-raising 'fancy fairs'.

In 1964 the foundation managed to secure a railway carriage from the Dutch Railways which, with a lot of hard work, was transformed into a very roomy and efficient studio. It took volunteers eighteen months to strip the interior and build up the studio, which was put into service on 7 May 1966. Considerable help with suitable equipment came from trade organizations in Holland.

The 'staff' now consists of studio management, technicians and three female announcers, and programmes are produced for four Amsterdam hospitals. Every patient receives a printed programme and relatives can send in requests for records, etc. Twice a week 'RIOP collaborators' meet to discuss and produce the programmes. The work of programme production is carried out with great enthusiasm.

*Stichting RIOP, beste wensen en geluk voor 1967 van het redactie, Amateur Tape Recording.* FCJ



Fig. 2. The railway carriage studio is permanently 'berthed' in a railway siding in Amsterdam.

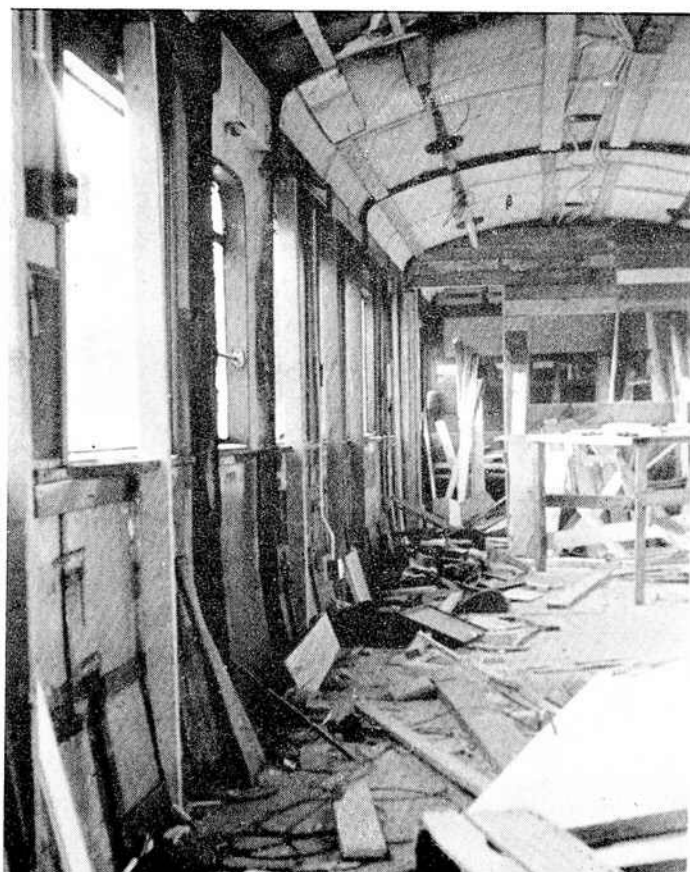
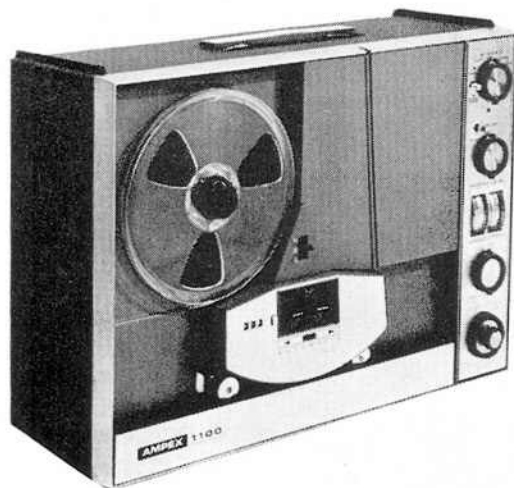


Fig. 3. The RIOP railway carriage studio under construction.

# REVIEW THE AMPEX 1150

by F. C. Judd



In all my experience of handling and using tape recorders and tape record/replay units, I have never come across any quite like the Ampex 1100 Series. There are actually three versions, more or less identical, and like the Model 1150 (the subject of this review) are tape record/replay units only. The other two are the 1160 and 1165, both of which are built into cabinets – the 1165 having a case with a walnut finish. (Note: the 1160 and 1165 units each have power output stages; the 1150 model therefore requires external amplifiers and loudspeakers. The other two require external speakers only.)

These units are, to say the least, unique and almost entirely automatic, but first you must read the very detailed instruction book *very* thoroughly. Then, having mastered the controls you can sit back and let this highly automated box of electronics do the work for you. For instance, to load up a four-track pre-recorded stereo tape, insert the leader in the slot on the right, press the appropriate button and the tape will play through to the end whereupon it will reverse itself (on direction) and play through the other two tracks. When the tape comes to the end, the drive mechanism will be switched off and the direction changeover system automatically re-set for the next tape. All that is required to do this is the recording of special low frequency signals at the end of side 1 of the tape – this facility is built into the recorder. By this means all your tapes can, in fact, be signal coded to automatically reverse. But the automation does not end there; the reverse direction signals can be recorded anywhere along a length of tape so one can replay a short piece backwards and forwards ad lib. I set up the system to play in both directions over about 12 inches of tape and left it running for quite a few hours. The electronics and the mechanism worked quite happily and without fault.

Another novel aspect of the automation is that for normal recording and playback usage (when the special right-hand spool is replaced with an ordinary one) the machine always re-sets itself for the correct direction of wind, re-

wind or record/replay. For example, if you play part of a tape (left to right) re-wind and to play again, the replay direction will automatically be re-set. Because of this, only one button has to be used for what would otherwise involve three separate functions.

## Technical Details

So much for the automation. The 1100 Series are, however, more than just electronic 'robots' capable of playing pre-recorded tapes backwards and forwards. These units do function as 'normal' tape recorders (except for the output stages and loudspeaker). The special spool, which is normally hidden by the slotted cover, can be removed (together with the cover) and an ordinary seven inch spool put on. The machine is then ready to function for recording, playing, re-winding and editing in the more conventional manner, except that the automatic direction re-set system still functions.

For general recording there are two microphone inputs, one for each channel (yes, I did forget to mention that this is a quarter-track stereo recorder), and similarly two high-level (radio) signal inputs. The microphone sockets are on the front panel. There are two high-level signal output sockets (one for each channel) each of which are preceded by ganged volume controls. The same controls come into operation for adjusting level when recording, but can be adjusted individually on playback or record. On playback both channels are 'tone controlled' or more correctly, have a variable control for playback treble boost or cut relative to the playback speed. Any small loss in upper frequency response can be compensated on replay.

The next control, above the twin VU type recording level meters, takes care of record/replay function and incorporates a safety lock against accidental recording over an already recorded tape. Above this is the 'automation' control which is used for recording the reverse coding signals on to a tape and/or selecting automatic re-run or 'repeat', i.e., playing

backwards and forwards over any length of tape.

The 1100 Series are all quarter-track stereo models and are for three speeds, namely  $7\frac{1}{2}$ ,  $3\frac{3}{4}$  and  $1\frac{1}{2}$  ips. Other deck features are a three-figure tape position indicator and an illuminated recording button (lights red when recording). Perhaps the most important feature is that the deck can be operated vertically or horizontally and so could stand on a bookshelf.

## Technical Performance

The Ampex 1100 Series were designed as 'hi-fi' recording and playing units and are fully transistorized (*solid state* is the American term used by Ampex). The performance specification quotes the frequency response as 50–15,000c/s  $\pm$  4dB at  $7\frac{1}{2}$  ips, and 50–7,500c/s  $\pm$  4dB at  $3\frac{3}{4}$  ips. The replay tone control provides a 6dB lift at 100c/s and a 10dB cut or lift at 10,000c/s. Wow and flutter are 0.15% at  $7\frac{1}{2}$  ips and 0.2% at  $3\frac{3}{4}$  ips. Speed accuracy comes out to within 2% at  $7\frac{1}{2}$  ips and 3% at  $3\frac{3}{4}$  ips. To quote from the Ampex Instruction Book:

*The tape recorder industry today is in a horsepower race and there is no standard procedure for obtaining and stating specifications. Therefore if you wish to compare Ampex specifications with those of any other competitor you must make sure that those specifications were obtained under similar conditions. Otherwise no valid conclusions or comparisons can be obtained. For this reason, Ampex has chosen not to show specifications of the 1100 Series at  $1\frac{1}{2}$  ips. The speed is not recommended for music recording. The Ampex 1100 Series out-performs any other recorder/player within its price range at  $1\frac{1}{2}$  ips. We invite your comparison. Ampex is proud of the specification of its tape recorders. Throughout the years Ampex tape recorders have set the pace for the industry and commanded the biggest in trade values. They will continue to do so.*

Well, there's nothing like being honest and I



think Ampex are to be congratulated on this. So I should therefore add that at the two higher recording speeds, namely 7½ and 3¾ ips, the performance is more than adequate for hi-fi. To refer to those about to throw bricks at my Editorial Comment in the November edition of *ATR*—how many quarter-track tape recorders will record faithfully at frequencies above 7,500c/s at 3¾ ips *without* excessive noise and distortion due to the high recording pre-emphasis. I used the Ampex 1150, as its quoted specifications intended it to be used and it far exceeded my expectations. Half the pre-recorded tapes I tried on it couldn't begin to do justice to the machine, even at 7½ ips, and I had it coupled to one of the finest hi-fi outfits on the market today. So much for its performance as a replay recorder. Now, what of recording? Most readers know of my multi-recording activity, so here, I thought, was a good test for signal to noise and recording performance. Let me explain that these Ampex units are not geared for multi-recording, i.e., track to track, so I used the 1150 in conjunction with a professional full-track machine. As I expected, the Ampex produced a good healthy recording after four or five dubbings without any build-up, hum or noise.

Finally, I must make it clear that this is a review and not a technical test report on what I consider a rather unique piece of hi-fi equipment. The Ampex 1150 or its sister models are not really intended for the creative enthusiast who would prefer a machine with mixing facilities, etc. They are, however, ideal for the hi-fi man who will want to do straight recording from music sources, play pre-recorded tapes and occasionally venture into the rather more sophisticated realms of the editing and splicing fraternity. For those who may be interested in either of the three 1100 models now available, the Ampex specification is given in a separate panel. Note no accessories such as tape or

## AMPEX 1150 PERFORMANCE SPECIFICATION

Overall frequency response	
Record/playback	7½ ips 50–15,000c/s ± 4dB 3¾ ips 50–7,500c/s ± 4dB.
Signal to Noise	
(from peak recording level)	7½ ips —46dB. 3¾ ips —43dB.
Tone Control Range	
	100c/s + 6dB 10,000c/s —10 to +10dB
Wow and Flutter	
	7½ ips 0.15%. 3¾ ips 0.2%
Fast wind time	
1,200 ft tape	160 seconds.
Line input impedance	High.
Microphone input impedance	High.
Line input level	0.2V to 2V max.
Microphone input level	3mV min to 30mV max.
Line output impedance	Low—less than 1Kohm.
Line output level	Max. 1V.

microphones are included with the 1100 series. The retail price of the 1150 model is £149 10s. Prices of the other units and further details can be obtained from Ampex (Great Britain) Ltd, Acre Road, Reading, Berks. F.C.J.

*Note: The model shown in the photograph is one of those supplied in a cabinet and includes power output stages. The 1150 model supplied for this review has an identical deck, but no cabinet.*

## WHERE NO BELLS RING by Joyce Rushen

For all of five miles taped bells can be heard ringing out from the long-ruined tower of a country church in East Anglia. Nothing so remarkable about this, in view of the increasing use of taped bells in churches, one would think. But whereas in many instances bells relayed from churches, particularly new ones, are frequently permanent installations in place of the traditional heavy and costly cast bells, these specific ones differ owing to being of a mobile nature and by serving a singular purpose apart from the unusual factors lurking behind their performance.

In point of fact, these bells represent wedding bells for brides, who, through the disuse of the original church bells, have long forgone a part of the ceremony of what is termed their *great day*. This privilege has, however, been restored through the ingenuity of a local tape-recording enthusiast, Mr R. West, who devotes the greater part of his spare time to this hobby.

A forthcoming fashionable wedding in the locality was faced with the prospect, as many others had been before, of a bell-less ceremony. The bride came up with the idea of taped bells, which caused Mr West to scratch his head and promise to figure something out. It proved, however, to be quite an undertaking.

Having obtained a disc recording of church bells and experimentally playing it through, it became obvious that he would have to eliminate the tolling bell at the beginning and at the end in order to synchronize the central 2½ minutes of chiming bells into a full half-hour wedding peal.

The task of making a continuously running recording took him

all of five hours to complete! But having interests centred in the relaying of public events, the setting up of an amplification system came easier to Mr West. He took the output from the tape recorder pre-amp into a hi-fi power amplifier with a maximum of 150 watts, enabling the use of 25 watts respectively for each of the four loudspeakers necessary for the relaying of the bells.

At the church the tape recorder and power amplifier were set up where the spare hassocks and surplices are normally stored. The four Grampian pressure units, bolted to four 48 inch flair horns, were wired and fixed to the highest point of the roof. Accurate timing by the bride together with the co-operation of the clergy made for a complete success. So successful that, following further bells for my wedding requests, Mr West now does a follow-up of recording the entire wedding service.

With the wedding imminent and on the final chime of the first peal of bells, he changes tapes, allowing a two-minute non-recording run, and then switches out the amplifiers and brings in the microphones to record the service. As this finishes, the recording and amplifier system is reversed for the second playing of the bells coinciding with the confetti and congratulations outside the church. Finally at home he edits the taped version of the ceremony, playing two minutes of the bells on each end of the record so that the delighted newly-weds can recapture all the intimate beauty and wonder of that ceremony with the wedding bells as well.

Next came the taping of bells for Sunday services, which incurred further adaptations and intermissions from the original disc

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# PARIS ON A SHOESTRING

## Bob Danvers-Walker gathers the ingredients for a tape and travel programme



*It's no rest cure, he says, 'if you want to do the job thoroughly and bring back sounds to illustrate a documentary on your trip'. I went along with BDW as photographer on this 48-hour trip to Paris which began with a very early morning departure from British United Airways air terminal at Victoria (I went to the wrong air terminal for a start) and bulldozed its way through to the grand finale – a ride on the locomotive footplate of the 100 mph crack French Silver Arrow express train on the return trip from Paris to Le Touquet. Working with BDW is certainly no rest cure – no time for sitting around, no time for meals – I practically lived on cups of French coffee, but we did come back with tape loads of recordings. BDW and I will be doing more of these exercises in which we hope to show you that tape and travel have lots of exciting and interesting things to offer (Editor).*

This is a poor man's guide to foreign travel. The lone wolf recordist or a party of tape club excursionists can have a long weekend in Paris for about the same cost of staying at an hotel at an English seaside resort. But you've got to box clever, as the saying goes. Travel agencies have several package-deal schemes worth considering, but the spending doesn't end with those 'all-in' prices – unless you make yourself a bit of a martyr. Mind you, I'll rough it with the best of 'em if it means good sound at the end of it.

How does a 'planned weekend in the French capital for £12 5s 0d' sound to you? According to a brochure handed out by the French Government Tourist Office, you get coach/air travel – London to Paris and return – including all port taxes, etc, and two nights' accommodation with continental breakfast at a good medium-grade hotel. So far, so good, but you've got to eat now and then. Meals in any capital city are not cheap, but there's nothing to prevent you from taking your own food – sandwiches and tinned stuff will keep you going. For a few francs you can buy a yard of crusty French bread, some *paté* and a bottle of wine and have a right good blow-out picnicking in the Bois de Boulogne. Apart from the creature comforts, the most important thing to remember is that if you want to return with some well-filled tapes, it entails much hard work, making every minute count and planning the days carefully in every detail and being alert all the time. Exciting sounds happen everywhere. Unless your microphone is at the ready and your recorder switched on and working in a second, it's no use – unless some visual indication triggers you off in time.

you may spend hours walking through the streets and it is very easy to roam around the shops like a tourist – looking at everything but not listening. If you find yourself doing this, dive into the nearest big store and snatch some 'concealed mic' conversation at a counter. At all costs keep working – time just flies by. A good tip for the language-shy who may find it difficult to get around is to spend Sunday afternoon on an organized coach tour of some of the sights. The courier's commentary will add a bit of colour. There are also the river boat cruises by the *Bateaux Mouches* on the Seine. You'll become goggle-eyed at all the lovely things to see, so be on your guard not to miss recording a snatch of the sounds of departure, the engine-room noise, the swish of the bow wave, the passing barges, the music over the PA and the bar-side chatter. Start each take with the digital counter set at zero so that any disappointing take can be run back and tape not wasted. Log every acceptable take and make notes as you go along. This is doubly difficult if you're on your own, but never rely on memory. For a few francs a *carnet* of tickets on the Métro gives you great mobility – a trip from one station to the next costing the same as a terminus to terminus run – and even includes changes from one line to another.

Fred Judd and I went by British United Airways London-Paris (Silver Arrow) rail/air service. I selected this because at £12 6s 0d return it provides fine opportunities to record French trains, and offers a most interesting run through the Somme from Le Touquet to the soundworthy Gare du Nord (a rail terminal is always good value). From my diary of the expedition, here are a few suggestions which I found worth taping on the way there and back:

1. The Public Address system at Gatwick Airport – Receptionist announcing the flight departure.
2. Airport activity as planes take off.
3. Boarding the aircraft – passengers mounting gangway and entering plane.
4. Voice of aircraft hostess over plane's intercom giving details of flight. End with sound of seat belt buckles being fastened.
5. Sounds of take-off and plane in steady flight. (Useful to put behind the narrative as a backing track.)
6. Public Address system at Le Touquet informing passengers of train departure.
7. Train pulling in at platform and then departing.
8. During the run use the concealed microphone dodge to ask questions of the refreshment attendant and ticket checker as they pass through. They'll speak English all right – funnier if they don't.
6. Train pulling in at Abbeville and Amiens.

Open the window and catch the station announcer's voice as coach passes the loud-speakers.

10. The 100 mph diesels are rock steady and the security signal bells sounding as the trains pass over contact points between the welded lines are interesting. Two different *Swanson* whistles are sounded at level crossings and when approaching stations.

Fred's camera has captured several novel ideas, but some of the sounds of Paris which were unaccompanied by photographs are worth a mention, such as the arrival of our *petits déjeuners* in the mornings. We found a useful trick to capture off-guard comments when the coffee and croissants were delivered to the bedroom was to conceal the recorder under the bedclothes, poking the microphone through the sheets at the end of the bed.

We stayed at a one-star hotel, located in the heart of the Paris west end in the *rue de Richlieu*, behind the Louvre Museum. A twin-bedded room with separate *cabinet de toilette* cost about 2 gns per night – all in, 28NF – and that includes the tax, service charge and *café complet* for two. *Les Halles*, the Convent Garden of Paris where the kerbside fruit and vegetable vendors operate, was just around the corner from our hotel. Shopping for the day's provisions is economical here. If it's raining, take them up to your room and have lunch there – many people do.

I am sure, thinking in terms of a club weekend, that a tour operator would be able to plan a three-day sound gathering operation by arranging an otherwise conventional all-in tour to cater for a fixed number of tape recordists. By this I mean that the itinerary would be so designed to include specifically soundworthy places in the coach tour. Camera enthusiasts are specially catered for, so why shouldn't tape recordists 'sound out' Paris? But, I repeat, unless someone does the planning, arranging and directing for you, you'll have a lot of work on your hands if you want to bring home the bacon.

I've made a study of cheap travel and having lived in France I know my way about. I had a two-weeks' holiday on the French Riviera for £50 for a BBC *Holiday Hour* programme by travelling there and back by scooter. Next season's tape and travel trend-setters will perhaps emerge from the increasing number of Channel swimmers.





*Top left: Aboard the Le Touquet-Paris train, Bob logs the takes so far recorded.*

*Top centre: As the chimes ring from Notre Dame, Bob records part of the narrative about the Cathedral. The rest of the 'story' is post-synchronized.*

*Top right: Sunday morning in Les Halles and Bob finds plenty of recording material at the artichoke stall.*

*Centre left: One of the big Bateaux Mouches which ply the Seine on sightseeing cruises. Passengers lunch on deck beneath coloured umbrellas.*

*Centre right: Funicular cars travel up the steep slope leading to the Sacré Coeur Basilica on the heights of Montmartre.*

*Right: Clattering Métro trains have been replaced with quiet-running cars with rubber wheels. Be unobtrusive when recording in the Métro – there's a chance someone may object.*

*Far right: The pre-war buses with 'verandahs' on the back, a favoured perch for passengers, are still great fun to ride on. Note the lavatory-chain-type bell pull.*



# tape club news

## BIRMINGHAM

*Noise Abatement* is a somewhat unexpected title for a lecture to a tape club, but one under this heading was given to B-TRAC by Mr Beamont of the Birmingham Public Health Department. Noise problems in industry as well as those of a more domestic nature were explained and discussed. Equipment produced by Trevor Gilbert at a recent meeting proved to be a Leavers-Rich recorder and amplifying unit as used by the BBC. Trevor proceeded to give members a demonstration of the equipment which he had expertly converted from battery operation to mains and the difficulties he encountered in so doing made interesting listening. Richard Margoschis spoke to members about his approach to tape recording, demonstrating some of his winning tapes, one of which includes nearly 50 splices in a 12 inch section. Brian Arkinstall, an early member who has recently rejoined the club, presented a programme of his choice to the club. The club has entertained members from the Warwick and Leamington Club and has visited the Coventry Club.

## DERBY

The versatile lady members of the Derby TRC provided not only an excellent programme including some original compositions and a slide quiz, but also an overwhelming amount of delectable food for the interval. Further slides were seen at the following meeting when Derek Hill presented a programme of colour slides with taped commentary.

Members judged entries in the latest competition, *Cruising Down the River*. The winner was Dennis Land, whose tape was scripted by his wife, Mary. Second was Arthur Jeffries and third (in her first competition attempt) was Dorothy Barker. Chairman Ernie Flecknoe also announced arrangements for club members to record the full-scale production of the opera *Faust* at a local concert hall.

## ITACS

The International Tape and Cine Society recently celebrated its fourth birthday with an annual gathering of members from all parts. The club's monthly journal, *Tape and Cine Reel*, contains an 11-page report on this meeting, including a number of photographs. A do-it-yourself article on speaker cabinets is also featured.

## LEEDS

The Treasurer of the Leeds and District TRC recently gave a talk to members on an often neglected topic - *Wiring, plugs and cables*. His demonstration equipment included a portable vice and a soldering iron.

A number of Leeds members attended the Yorkshire Federation meeting, and this was followed by a club committee meeting to discuss the production of a Federation tape magazine.

Chris Eagle illustrated his talk on coupling high fidelity sound equipment with diagrams of five star earths and his Tandberg, Quad and Radford equipment.

The club members will act as hosts to the next Yorkshire Federation meeting in their club rooms on Sunday, 15 January at 2.30. Any club wishing to come should contact Bill Rowe at 34 Bristol Road, Leeds 7.

## LEICESTER

To show their appreciation of the facilities provided for them at Leicester Ambulance Station recently, members of the Leicester TRC readily agreed to record for the chief ambulance officer a lecture given by the surgeon in charge of Birmingham Accident Hospital. The talk, illustrated with films and slides, was entitled *Advances in First Aid* and the recording will be used in the training of ambulance crews.

When a local retailer gave club members a demonstration of Bang & Olufsen equipment, members were delighted when, in addition to bringing the Beocord 2000K de luxe, the Beomaster stereo amp tuner, the Beogram 1000 and the 'B' and 'S' type speakers, he also brought along the area representative of the B & O distributors, who kindly answered members' questions.

A visit to the BBC studios in Birmingham proved to be extremely interesting, and members are grateful for the consideration shown by all the BBC staff.

## LONDON

*London Leader* is the title of the new publication which replaces the one-sheet newsletter of the London TRC. The first issue contains details of the club's ninth AGM.

## NEWCASTLE

During recent weeks members of the Newcastle and District TRC have embarked on a *Tale of the Supernatural* from the story by Edgar Allan Poe. Ron Stevens was chosen as narrator because of the quality of his voice, and although he had not seen the story before, he launched into the narration in great style and completed it with only two takes. This was followed by a discussion of the sound effects to be used to heighten the drama, and how to obtain them.

Members enjoyed a demonstration of new equipment by a local dealer, Messrs Richley & Freeman, who provided a large variety of recorders and gadgets for club members' inspection.

## NORTH LONDON

*One-man Band* was the description given to David Barker and his tape-recorder by members of the North London Tape and Hi-Fi Club. David entertained the club with a multi-track recording he had made of himself playing the guitar and piano, singing and adding his own vocal bass accompaniment. A second interesting tape featured David just singing *boom boom boom* played at different speeds and multi-tracked.

Cutting versus dubbing was featured in a club programme at which members were divided into teams. Each team was given a sound track of the visit to the Royal Mint and, using separate rooms, were asked to produce a 15-minute commentary of the visit, one by splicing and the other by dubbing. Team number two, led by John Wilson, finished the dubbed tape first, but there was no time to hear the result. Team number one, led by Ron Goodwin, was unable to finish the spliced tape but this was completed at a later meeting and the results played back and compared.

## READING

A new slant was added to this year's entries of holiday tape and slide shows at the recent competition held by the Reading Cine and Tape Recording Society. Instead of appearing in the form of a general travelogue, most entries highlighted one particular event or aspect of the holiday. The most

topical and moving item was submitted by new member Devora Wiseman. Entitled *Wales - a dedication*, her programme accompanied by suitable poems showed various parts of Wales including Aberfan at the time of the tragedy. The Spanish background and mood of the Canary Islands were captured by Malcolm Shiffrin; Henry Chaney's programme on France concentrated on French architecture; and Doug and Rita Noyes captured the scenes of the local bull games in the Rhone delta.

## RUGBY

A request for tapes of holidays by the Rugby TRS did not produce as many entries as had been hoped for, but Bill Long produced an excellent tape of a hovercraft trip and the Bannister family recalled mackerel fishing in Wales.

Members of the Spencer Dallington camera club judged the annual tape contest on gambling with Athur Harding, a member of both societies, acting as compere. Winner was Mrs Dorothy Key, with John Bannister, Bill Long, Tom Reader and Mrs Martin as runners-up. Mrs Key was then presented with the Len Stephens Trophy.

On the lighter side, members and friends enjoyed an evening out at a local cinema to see *The Sound of Music*.

## SOUTH DEVON

*A new look at electronic music* was the title of a recorded lecture by Mr F. C. Judd, editor of *ATR*, played to members of the South Devon TRC. Specially prepared for the club, the tape included many examples of electronic music composed by Mr Judd for television and films, multi-track recordings and electronic organ music. Following this, club president Mr D. W. Aldous demonstrated some of the latest cassette recorders and tape records to be introduced to this country, discussing their advantages and disadvantages and comparing the two different systems presently on the market.

Tape and slide programmes of holidays featured again in *Holiday Highlights* presented by C. J. Block.

## THORNTON HEATH

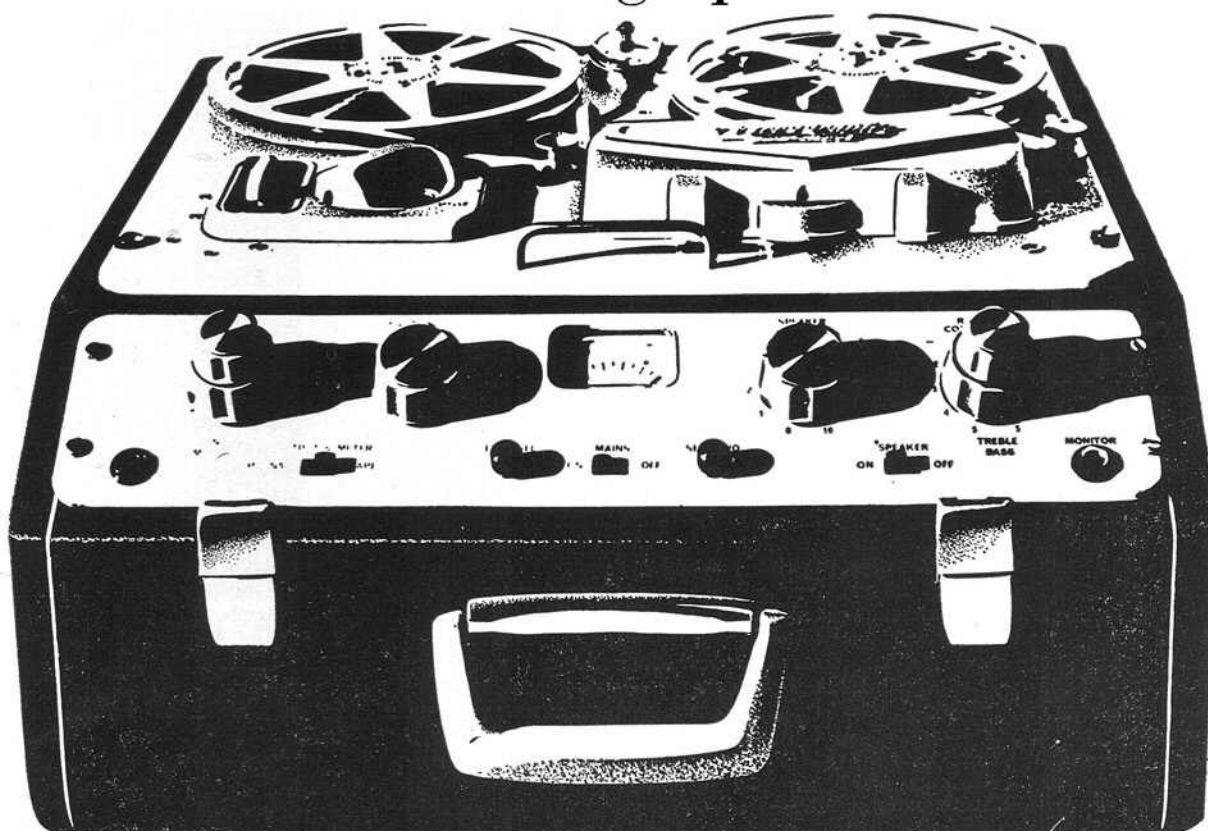
The final monthly competition (a tape of your own choice) of the Thornton Heath TRC was won by new junior member, 14-year-old Robert Prizeman, with a most professional documentary on the Combined Cadet Force - voted to be quite up to BBC standards. Second was Mr Mitchell with a recording of a medium's spirit guide actually speaking during a seance. Alan Brown came third with a recording of a beery character singing in the old music-hall style. Alan Brown is now the proud owner of £100 (that is, if he hasn't already spent it on more equipment), and a trophy for his success in the BATR contest. His winning tape has also been broadcast on the BBC Overseas service.

In spite of the club's 'no outside demonstrators' rule, Robert Prizeman did bring along his music master, who turned out to be none other than David Squibbs, BBC's Music Man, who gave club members a great deal of information on hurried editing and splicing.

## UNIVERSITY OF SOUTHAMPTON

I understand from Mr G. Potter of 3 Tranby Road, Itchen, Southampton, that a tape club has been started at Southampton University. At the first meeting of the club, which will be known as Soton University Tape Recorder Society, the officers of the committee were elected as follows: Mr G. Potter, President; Mr D. Argent, Deputy President; Mr P. Norton, Secretary; Mr B. Gaydon, Treasurer. Other committee members include Miss J. Popejoy, Mr J. Rogers and Mr D. Mullins. All prospective members will be welcomed and are invited to contact Mr Potter.

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THE INCOMPARABLE TAPE RECORDER

# THE FEDERATION OF BRITISH TAPE RECORDING CLUBS

This country has always been unique in the amateur tape recording field, in that the Club movement got away to a good start fairly early and few other countries can boast so many tape recording clubs. Early in 1957 John Amphlett invited all the clubs then in being to a meeting in the Leofric Hotel in Coventry. This meeting was presided over by the Mayor of Coventry, and during the many discussions which took place it was decided that a *Federation of British Tape Recording Clubs* should be formed and thus FBTRC came into being. Its main object was to represent, at a national level, the tape recording club movement and to encourage the interchange of ideas and information between existing clubs and to encourage and assist in the formation of new clubs.

For the first two years of its life FBTRC concentrated upon making itself known to the industry and the BBC; in fact to any organization serving amateur recordists, however indirectly. To this end it soon affiliated itself to the *International Federation of Sound Hunters (FICS)* which itself had only been founded the previous year. Thus it now represented British amateur recordists' interests on an international level and was able to enter British tapes (usually from the British Amateur Tape Recording Contest winners) in the wider International Recording Contest (CIMES). In 1960 FBTRC was the host in this country for the annual Congress and Contest, a task it again undertook in 1965 with marked success. In the years between, the Contest has been held in various capitals from Berlin to Lausanne and FBTRC has always sent a team of delegates and judges. From each of these Contests the Federation has brought back copies of all the winning and runner-up tapes which have gone into its unique Sound Archives and become available to all amateurs in this country.

It was soon realized that regular communication between the various club members and the central organization was an essential part of its function and the FBTRC quarterly Bulletin was born. After going through various difficulties in production and mailing, and filling the editorship, the Bulletin has settled down to a regular production in a special loose-leaf cover, personal to each member, and containing many items of general and specialist interest, illustrations and advertisements for its trade Associate Members. Clubs receive one bound copy and spare copies for distribution to members.

Early in 1964 the Federation began to receive requests from individual recordists asking whether they could become affiliated to the national body. After consideration a Class of Associate Membership was formed for those who, whilst not wishing to become involved in a tape recording club as such, certainly wanted to belong to some central organization. This Membership class has proved increasingly popular and is doubling its numbers annually. Quite a number of Associate Members join a club later, but usually continue their individual membership in order to receive their mailing direct. About a year later, it was decided to make this Associate Membership available to English-speaking recordists, wherever they might be temporarily

domiciled and the Federation can now boast of members in South Africa, Kenya, Singapore, Belgium, Aden and, surprisingly enough, a growing number in the United States where the tape club as such has not really become very popular.

The Federation's Sound Archives have always been available to anyone interested but at the end of 1965 it was decided to classify the ever-growing store of interesting and valuable tape recordings dating back to the British and International Contests of 1956. This catalogue, now some 25 quarto pages in size and added to quarterly, is issued to all subscribing members and the service of dubbings has proved very popular indeed. In the year since the catalogue was first issued, some 1,000 items, in programmes of the members' own request, have been sent out and there has been nothing but praise for the interest of the recordings and the quality of the dubbings. The service is not restricted to FBTRC members; for a small dubbing fee and a charge of 10s 6d for the Sound Archives Catalogue (with a two-year free amendment and additions service) non-members may use the Archives freely. It is of interest to note that it is in great demand from those amateurs who organize tape magazine services for the blind and disabled. Apart from the Contest-winning tapes which form the bulk of the Archives, a growing section of interesting items donated by members has been added, including live recordings and light and classical music tapes with no copyright problems attached.

It is the Federation's proud claim that the services it offers to its members are restricted only by the limits of time and energy available to its corps of keen amateur volunteer committee members upon whom all the work must fall. Every day brings requests in the post ranging from aspiring taperspondents anxious

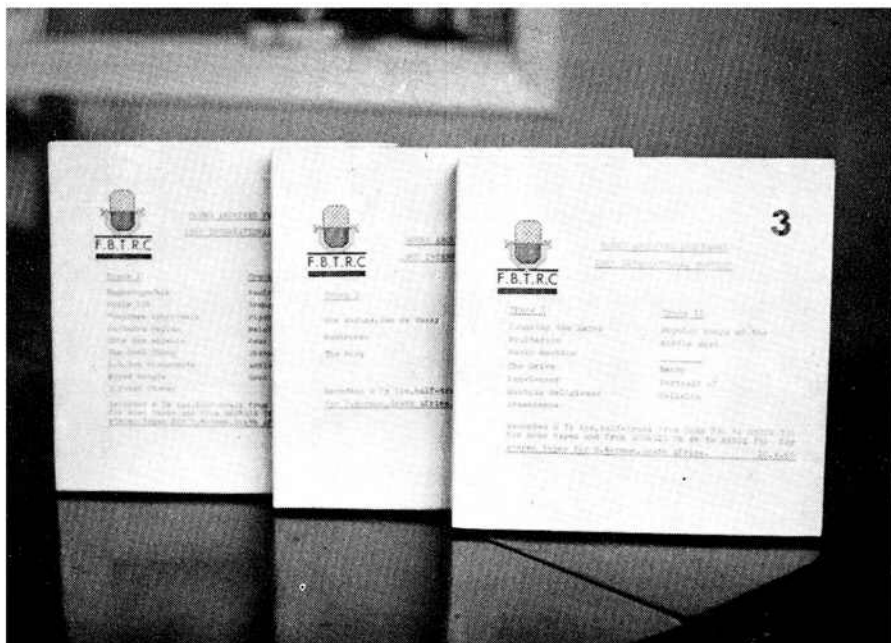
to contact fresh fields, to heart-rending appeals for recordings of sound effects for tape-slide shows or amateur dramatic performances. Schools, too, are especially catered for, and where the distance is not too great a personal visit from a committee member of FBTRC can often start a junior recording group off on the right foot and obtain help for them from the industry.

The copyright problem is of urgent and continuing concern to the Federation who, some time ago, was able to negotiate an agreement with MCPS giving its members special terms and some relief from the concern most amateur recordists feel upon this vexed question. The problem still remains, however, and very active steps are being taken to find a satisfactory solution to the muddle which exists regarding copyright and the amateur.

The Federation's relationship with industry and with the British Broadcasting Corporation, as well as with a number of the Educational Authorities concerned with audio methods of teaching, is now on a mutually co-operative basis and consultations are not infrequent. The larger the membership of a nationally representative body the easier it is for the views of its members to be put before those most able to help. This is one good reason for the Federation's earnest desire to bring its existence and objects to the notice of as many as possible of those people concerned with amateur tape recording.

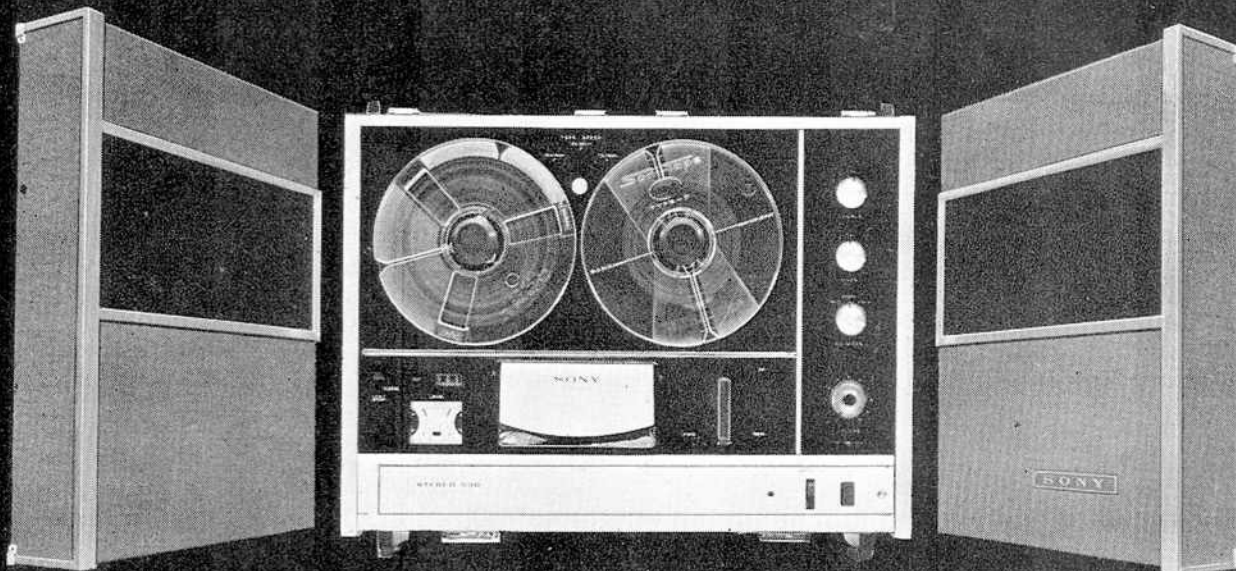
Enquiries regarding membership, or any other matters should be addressed to The Press Officer, FBTRC, 33, Fairlawnes, Maldon Road, Wallington, Surrey.

Annual subscriptions from 1 January, 1967: Club Membership £3 3s 0d; MCPS Licence £1 10s 0d; Associate Membership £1 1s 0d; MCPS Licence 5s 0d. NB: MCPS cover is optional and the whole fee goes to MCPS, nothing being retained by FBTRC.





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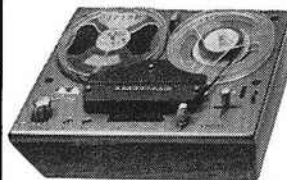
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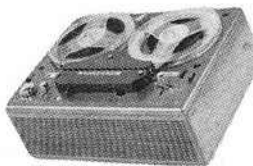


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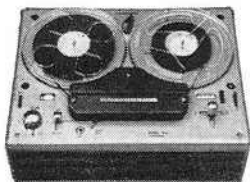
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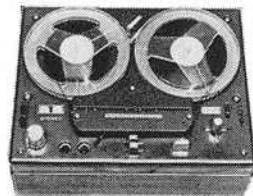
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## TEST REPORT A GOLDRING TRIAD

by Peter Knight



Fig. 1. The Goldring G99 transcription turntable.

This group of three comprises the Goldring G99 transcription unit, the Goldring-Lenco P77 transcription arm and the very latest Goldring CS91/E stereo ceramic cartridge. These items were tested in the Goldring cabinet, Model C99, the whole forming a very useful record playing system.

The motor unit, arm and cartridge are pictured separately in Figs. 1, 2 and 3, while some idea of the complete system accommodated in the C99 cabinet is shown in Fig. 4, but here arm Type G65 is fitted – not the P77. The complete system as described is not cheap, as would be expected, since it is truly hi-fi. The cost in total, including purchase tax, is £70 17s 4d, made up as follows. The motor £22 5s 6d. The arm £30 7s 9d. The cartridge £7 8s 6d, and the cabinet £10 15s 11d.

### The Cartridge

The ideal of putting a ceramic cartridge into such a high quality arm seemed at first to be a bit of a waste! But this was certainly very much disproved. The CS91/E cartridge is most definitely something different in the field of ceramic cartridges. Its price may be a pointer in this respect, for the straight CS90 is more modestly priced at £4 19s 0d, including purchase tax, and this itself is a fair cartridge in the line of ceramics. Thus, the 'E' has an extra £2 9s 0d worth of something!

This cartridge features an elliptical stylus. These are not so easily made as the spherical-tip versions and so cost more. Its compliance is better than the straight '90', running at  $12 \times 10^{-6}$  cm/dyne, as distinct from  $8 \times 10^{-6}$ . It also tracks (in a good arm, such as the P77) down to 1 gramme and up to 3, while the straight '90' can only be taken down to about 2 grammes with safety, but up to 5. Finally, the 'E' delivers 20mV across 1 to 2 megohms, while the straight '90' steps up the piezo electricity to 50mV at the same recording depth. Both models give a flat output from 30 to 20,000c/s (see Fig. 5) when loaded across about 2 megohms, and the channel separation on stereo is 20dB at 1,000c/s, dropping to 10dB at 10,000c/s. This latter is quite good, as some piezo cartridges have virtually no separation at the high treble end.

Like all good ceramic cartridges, the CS91/E will give a velocity output when loaded to about 50Kohms. This means that the output can then be applied direct to a magnetic pick-up amplifier input, equalized to RIAA, without further ado. How well this works, though, depends very much on the value of capacitance of the ceramic element, on the actual value of the load resistor in the amplifier and on any mechanical tailoring of the cartridge required to secure its flat response when high-loaded (i.e., to 2M). To combat these problems, some ceramic cartridge makers stipulate the use of critically-valued resistive/

capacitive padding networks between the pick-up and the equalized input of the amplifier, even though this is loaded to around the 100Kohms to 50Kohms mark.

Indeed, by connecting some ceramics direct to the magnetic input, the results can be very poor, so something has to be done. Goldring suggest very simple networks to correct the output voltage to suit the amplifier, but nothing elaborate, and in many cases the pick-up could be connected direct to the amplifier without any padding. The author has always felt that the best way to load any ceramic is across 2 megohms, without equalization, of course, for the cartridges are mostly tailored for optimum response under this condition. The CS91/E requires an amplifier with a sensitivity of between 40 and 100mV (flat), across a 2 megohm load, to get the best of this condition. Loading across 1 megohm causes a 5dB drop in output around the 70c/s mark, progressively falling to this from about 500c/s.

The cartridge was tested on several amplifiers (valve and transistor) with known discs at both high (unequalized) and low (equalized) inputs, and extremely good results were obtained under all conditions. It was virtually impossible to tell subjectively whether the cartridge was working into a high or low load, but extremely critical listening called for a very small degree of tone control compensation in the latter condition. Some piezo pick-ups have a distinctive sound. A little less smooth than magnetics (depending upon price range etc.), but it can be said in all sincerity that the CS91/E delivers signals

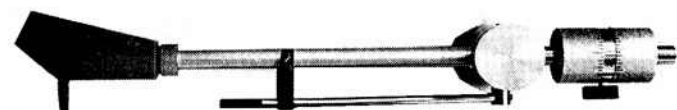


Fig. 2. The Goldring-Lenco P77 transcription pick-up arm.



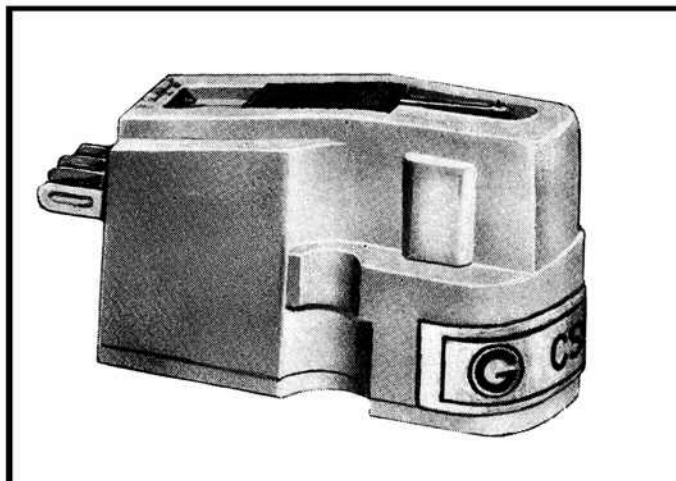


Fig. 3. The Goldring CS91/E stereo ceramic cartridge.



Fig. 4. The complete 'Triad' system by Goldring.

## TEST REPORT—A GOLDRING TRIAD *continued*

that are very close to those expected from good magnetic cartridges. The output is perfectly smooth and the cartridge was found to handle all kinds of music extremely well, including really wide-range organ material.

It was also noticed that the cartridge catered very well with mono discs with the A and B outputs paralleled. Even though there is no such thing (in this country, anyway) as a compatible record, here in the CS91/E we have a compatible cartridge. For medium quality applications, though, the straight '90' with the spherical stylus would probably serve well. The effective mass at the stylus tip is said to be less than 1 milligramme, and this is borne out by its ability to track at 1 gramme. The cartridge was tested exclusively in the P77 arm, and tracking was easily possible down to this value.

### The Arm

This arm is a masterpiece of engineering, developed by Swiss engineers, yet has the appearance of simplicity. It is designed to be pre-balanced in all planes. To facilitate balancing when a head is changed, for instance, the balancing adjustments are finely calibrated. This means that it is possible to balance out after any head change simply by 'dialling' the numbers previously obtained. With the head correctly positioned, the balancing adjustments are manipulated in the order given in the instruction booklet until the arm on its main bearing can be set to rest in two horizontal and two vertical positions. A counter-weight at the end of the arm is also adjusted to balance out the head and arm weight, since the tracking force is applied separately by means of a spiral spring system.

Balancing adjustments are made with the arm removed from its pedestal base, and although they are not particularly difficult to handle once the general idea has been gleaned, some repetition is required to secure optimum balance with the chosen cartridge. A note is then made of the dial settings. The adjustments consist of a knurled wheel mounted on the counter-weight which controls its movement a little up or down the end of the arm in slow-motion, and two rotating drums which constitute the body of the counter-weight. These drums enclose the functional weights, which are mounted and geared so as to provide an adjustable eccentric distribution of weight at the end of the arm, thereby serving to balance the arm and head in all planes. Downward or tracking pressure is applied by rotating a calibrated disc on top of the rotating body or spindle of the arm. This is from 0.5 to 8 grammes. The spindle is mounted in a pedestal base and is calibrated for height adjustment. The wiring from the pick-up is contained within a screening can below the pedestal base, and is easily handled. The makers say that when the arm is correctly balanced it will track a record in almost any position, vertically if required, juke-

box fashion! The motor failed to work correctly at this abnormal angle, but perfect tracking at 2 grammes was possible in an almost vertical position, and there is little doubt that it would have tracked inverted if the turntable unit would have allowed it!

The cartridge shell is of the plug-in variety and although it looks rather on the 'massive' side it has little weight and is resonant-free. It will accommodate any cartridge with standard 0.5-in. centres, and the cartridge mounting plate is adjustable to minimize the tracking error. Rather than adjusting the cartridge to provide the optimum overhang, some arms in the quality class have an arrangement whereby the pivot position can be adjusted.

The bearing is virtually 'frictionless' with no trace of play, and the hydraulically damped positioning and lowering device enables the stylus to be lowered exactly where required in the groove. The damped positioning feature is very useful since it avoids the arm swinging slightly as it is being lowered. The if resonance is governed, of course, by the compliance of the cartridge, and with a cartridge of compliance  $5 \times 10^{-6}$  cms/dyne it falls at about 10c/s, but it will be below this when cartridges of greater compliance are used. Nevertheless, with the CS91/E, which has 12 compliance units (i.e.,  $12 \times 10^{-6}$ ), no trouble was experienced with disc ripple.

### Transcription Unit

The G99 transcription unit is a progressive development of the earlier GL60 and the 'domestic' GL56 before that. It is a remarkably neat unit with the turntable top flush with the top of the control panel. The turntable speed is infinitely variable over the range of 30 to 80 rpm and from 15 to 18 rpm, and is adjusted by a rotary knob on the left of the control panel. This operates a mechanism which moves the idler wheel that couples the motor to the underside of the turntable along a conical shaft on the motor. The drive ratio between the motor and the turntable is thus continuously adjustable.

The speed control knob is roughly calibrated at 78, 45, 33 and 16 rpm and the accurate speed is determined by means of a built-in neon-lit stroboscope. This works off the turntable and is viewed through a small window in the centre of the control panel (see Fig. 1). There are three stroboscopic bands on the turntable corresponding to the three main speeds.

The idea is to set the speed adjusting knob approximately to the calibration corresponding to the record, and then very slowly turn the knob one way or the other until the pips of the stroboscope appear to be stationary when viewed through the neon-lit window. One has to be careful that the correct stroboscopic band is selected, especially between the 33 and 45 rpm speeds, but with practice one would soon identify the band corresponding to the required speed.

The turntable is really massive, weighing 8 lb, with plenty of mass in the centre for stability and plenty round the periphery for maximum inertia, the latter to iron out any irregularity in motion. The motor is switched on and off by two push-buttons on the right of the control panel, and in the 'on' position a red indicator (as well as the strobo' neon) on the control panel lights up. The idler drive is disengaged in the 'off' position to avoid the development of flats, and some idea of the turntable flywheel effect and bearing efficiency can be gleaned by the fact that it takes a full one minute ten seconds for the turntable to cease rotating from 33 rpm from the time that the 'off' button is depressed.

In spite of the high inertia, however, the turntable soon picks up to full speed on depressing the 'on' button. The inertia effect must, though, be taken into account when finely adjusting the turntable speed with the control knob, for there is a little delay after moving the knob for the turntable to settle down to its new speed. The turntable is die-cast from zinc alloy and is, therefore, non-magnetic, which means that it has no effect on even the most sensitive of magnetic cartridges. It is fitted with a thick rubber mat moulded at the top to have minimal contact with the surface of the disc.

The hum field at the top of the turntable is insignificant and there is very little stray magnetic field from the motor. This motor is a powerful, four-pole constant velocity type, matching the high inertia turntable very well.

The sample motor unit tested was virtually noiseless when running and rumble was totally insignificant. Even with the pick-up stylus resting on a sounding box placed on the control panel, rumble was still below amplifier noise level when at full gain and full bass boost! Indeed, acoustic feedback developed under this condition before any trace of motor noise could be detected below amplifier noise.

Wow and flutter effects were just not present when tested subjectively on an organ record with sustained notes — a record which is very quick in revealing even the smallest of motor irregularities. Here, then, is a record playing system of the highest possible order, and one that can be thoroughly recommended to even the most critical enthusiast.

#### Manufacturer's Specifications

**CS91/E Cartridge:** Frequency response: 30 to 20,000c/s. Output per channel at 1kc/cm/sec: 20mV. Channel separation: 20dB at 1,000c/s and 10dB at 10,000c/s. Recommended load: 1 to 2 megohms (suitable also for equalized inputs loaded low). Tracking weight: 1 to 3 grammes. Compliance:  $12 \times 10^{-6}$  cm/dyne. Effective tip mass: less than 1 mg. Stylus (replaceable): elliptical. Mounting: Standard 0.5 inch centres or single hole.

**PTT Arm:** Overall length: 13 inches. Diameter of pedestal: 1.34 inches. Overall height: 5.9 inches (including screening can). Max height adjustment: 1.18 inches. Tracking length: 8.27 inches. Stylus overhang: 0.67 inches. Max adjustment of stylus position: 0.39 inches. Off-set angle: 23 degrees 12'. Tracking error:  $\pm 0.8$  degrees. Length cable: 43 inches. LF resonance with 5 compliance unit cartridge: 10c/s.

**G99 Transcription Unit:** Supply: ac mains 200/250V 50c/s. Motor: 4-pole constant velocity, 15W. Speed: Continuously variable over four speeds. Turntable: 8 lb non-magnetic. Speed control: Neon-lit stroboscope. Speed variation: Less than 1% for 13% mains voltage change.

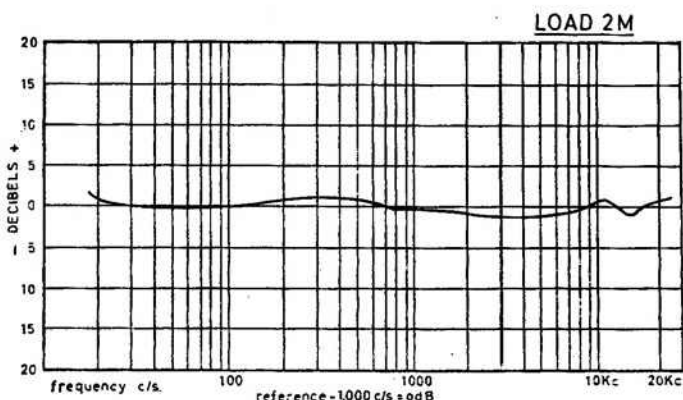
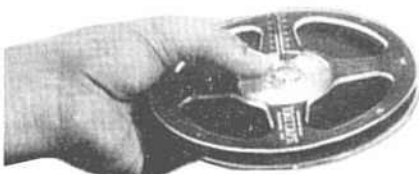


Fig. 5. Frequency response of the CS91/E ceramic cartridge (see text).

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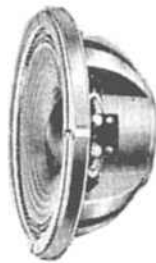
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# DESIGN FOR A LOUDSPEAKER ENCLOSURE



Fig. 1. The Axiette 8 speaker unit by Goodmans Industries Ltd.

We are often asked by readers for loudspeaker enclosure designs of which there are very many – enough, in fact, to fill the whole of this magazine – plus. Few readers may know, however, that enclosure designs for all sizes and combinations of loudspeakers are available for the asking from the majority of loudspeaker manufacturers. Most of our requests have been for a single-unit system not too expensive, not too difficult to build but capable of providing hi-fi sound.

We have chosen one which complies with these points and which will not only do full justice to any hi-fi system, but which can also be used as an efficient external speaker to almost any tape recorder having a suitable output impedance. Our choice is the Axiette 8, a very recent model by Goodmans Industries employing a plastic terminated diaphragm and aluminium drive coil (Fig. 1). The Axiette 8 requires an enclosure of only 3000 cubic inches and will handle power outputs up to 6 watts. Frequency range with one of the enclosure designs given is approximately 40 to 15,000c/s. The impedance of the Axiette 8 is 15–16 ohms, which is suitable for most hi-fi amplifiers and tape recorders with nominal 15-ohm outputs.

The Axiette 8 speaker unit retails at £5 5s 0d plus 18s 6d purchase tax, but if you need that little extra response at the higher frequencies then use the Twinaxiette 8. This is also a 15 ohm unit but has twin diaphragms and an extension of response up to 18,000c/s. The Twinaxiette retails at £5 19s 0d plus 21s purchase tax.

## Enclosures

There are two enclosures and either are suitable for the speaker units mentioned. One is a rectangular type, the dimensions, etc., of which are given in Fig. 2, and the other a corner reflex model as in Fig. 3. These enclosures should be constructed exactly to the dimensions given and built from timber or chipboard not less than  $\frac{3}{4}$  inch thick. The interiors must be lined with 1 inch thick wadding except, of course, the speaker and reflex apertures. The enclosure can be finished with veneer or stained and polished and the whole front covered with suitable material of fairly loose weave. Those who are interested in building speakers for the larger power outputs should write to Goodmans Industries Limited, Axion Works, Wembley, Middlesex, who will send, free of charge, their booklet of speaker units and enclosure designs from which the two given in this article were chosen.

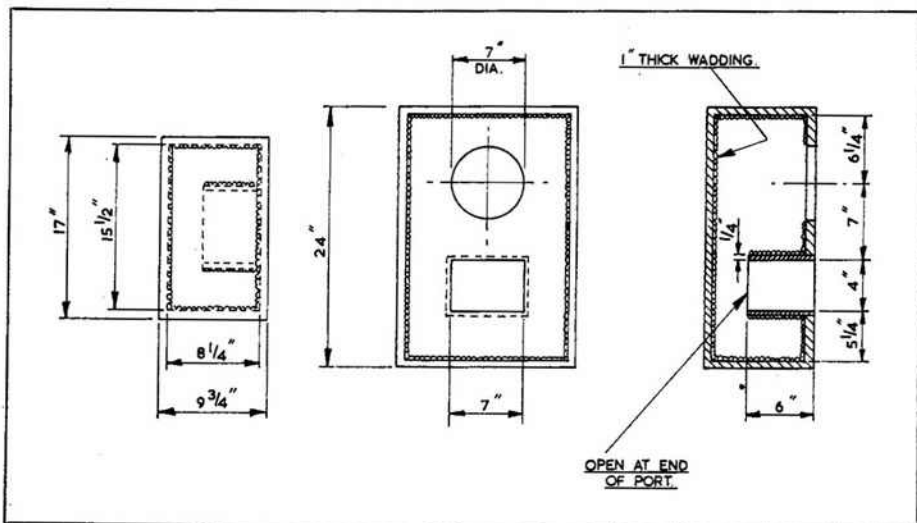


Fig. 2. Design details for a rectangular reflex enclosure.

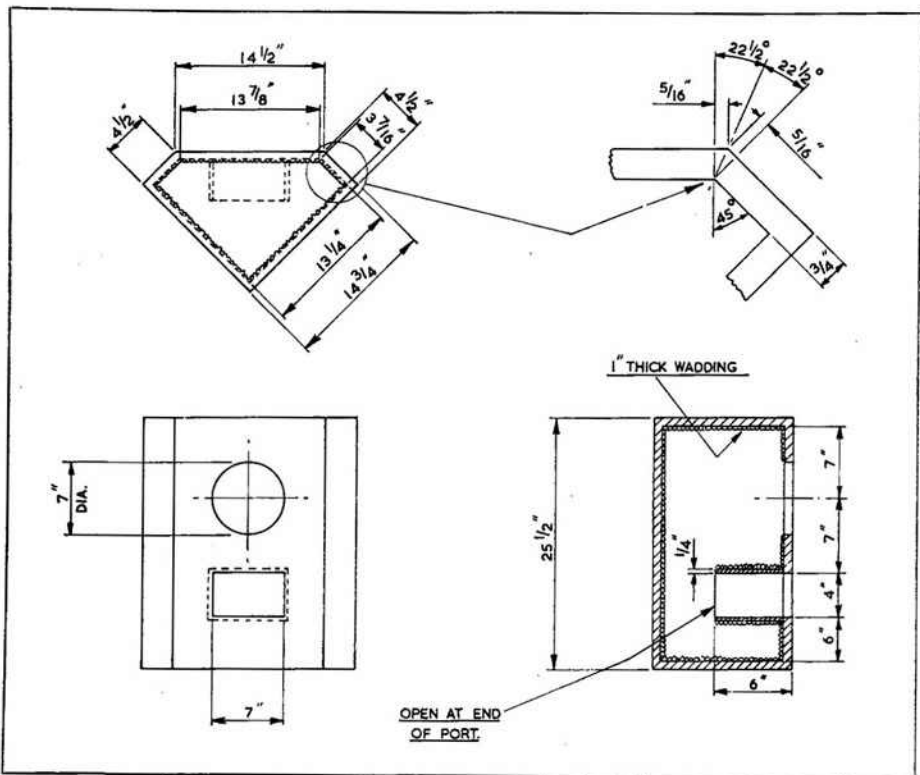


Fig. 3. Design details for a corner reflex enclosure.

# MATCHING — CIRCUITS, PLUGS AND SOCKETS

by Peter Knight

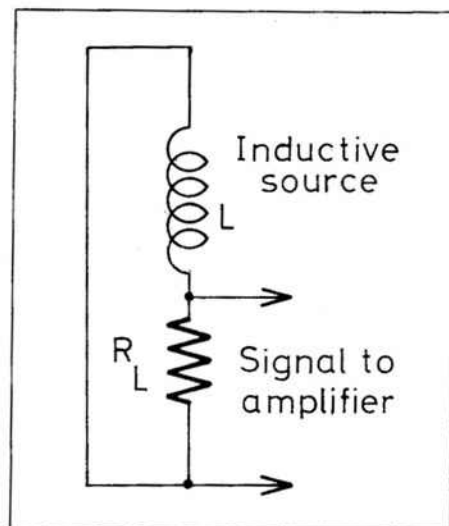


Fig. 1. Basic equivalent circuit of inductive source across resistive load.

One does not venture far into the arts of hi-fi and tape recording before being confronted with problems of matching one circuit or piece of equipment to another, plugs on the leads of accessories that fail to fit the sockets of the main equipment and sockets on new equipment that differ from the plugs connected to the existing equipment. This article deals with problems such as these but looks first at the problem of matching.

Let us take a pick-up — magnetic type first — and see how this is matched to a hi-fi amplifier or tape recorder. We have two factors to consider: one, the load resistance or impedance stipulated by the manufacturer across which his pick-up should be connected and, two, the strength or level of signal across this load delivered by the pick-up. These are the two basic parameters that the matching has to satisfy. Now, an amplifier has reciprocal characteristics at its pick-up input socket. That is, it has a specified value of load resistance (or impedance) and a specified sensitivity. The problem, then, is to ensure a good match from the pick-up to the amplifier.

As an example, take a pick-up whose recommended load or termination as it is sometimes called is 50,000 ohms and whose output when so terminated is 1.2mV/cm/sec. The output voltage, incidentally, is often expressed this way so far as magnetic pick-ups are concerned. It means that for each 1 cm/sec. velocity of the stylus, the output signal is

1.2mV. Thus, with a recorded velocity of, say, 3 cm/sec. the output would be three times 1.2mV, or 3.6mV.

## Voltage Sensitivity

To handle such a pick-up the amplifier sensitivity at the magnetic pick-up input should not be less than about four times the pick-up's output as specified above. This means that the amplifier should be capable of accepting a magnetic pick-up on a circuit with a sensitivity of not less than 5mV with an input load of 50,000 ohms. So connected, our example pick-up would work very well indeed.

Let us suppose that our hi-fi amplifier or tape recorder pick-up input does not have such high sensitivity. Say its input sensitivity is 50mV. This implies that a signal of 50mV is required fully to drive the amplifier so that it will deliver full output with the least distortion. Well, since the average output of the pick-up (a music recording, for example) is only 5mV the amplifier would not be fully driven. It would be necessary to turn the volume control to an abnormally high setting and this would bring up the background noises generated in the amplifier, such as mains hum and valve or transistor hiss. The signal/noise ratio would be poor.

What is the solution to this problem? An extra booster or pick-up amplifier could be used between the pick-up and the amplifier

input, but this would have to be very carefully designed to have a wide frequency response, correct input and output loads and low noise generation. A low-noise transistor amplifier may solve the problem, but the best plan would be to obtain a pick-up more suitable for the amplifier.

Now let us suppose that the pick-up delivers 50mV from a record while the amplifier's pick-up sensitivity is 5mV. In this case the pick-up would tend to overload the amplifier. In operation, only a very small setting would be required on the volume control for full output, and since the early stages of the amplifier would be carrying an abnormally large signal, the distortion would be higher than it should be. The solution to this problem lies in the use of an *attenuator network* — with suitable input and output loads — between the pick-up and the amplifier.

## Resistance and Impedance

So far we have considered only signal voltage at the source and sensitivity voltage at the amplifier input. What about load resistance and impedance and how do these affect the matching? Firstly, let us clear the air about resistance and impedance. Resistance implies *pure resistance*, such as the nature of resistance in a length of wire, in a resistor and so forth. Impedance, also measured in ohms, implies the effect of signal current or ac (i.e., alternating current). For instance, if

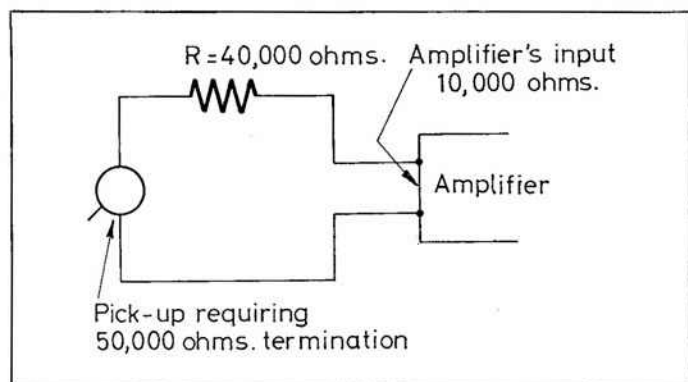


Fig. 2. The pick-up termination may be stepped up by adding series resistance ( $R$ ).

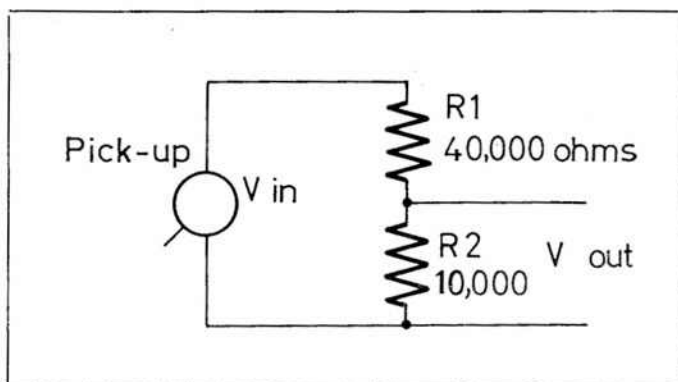


Fig. 3. When Fig. 2 is adapted, an attenuation effect results as this simple circuit shows. Note:  $V_{out} = \frac{V_{in} \times R_2}{R_1 + R_2}$ .

we have a circuit composed of pure resistance along with inductance and/or capacitance, then we have a path that will impede the flow of signal current.

Indeed, such a path may well block dc but will pass ac. A capacitor, for instance, will do just that, while an inductor (coil of wire, choke, transformer winding) may have a high dc resistance (due to the pure resistance of the wire) and a relatively low impedance. Basically, therefore, impedance can be looked upon as 'ac resistance' whose value is influenced not only by the value of inductance or capacitance (or both) in the circuit but also by the frequency of the signal current. The elementary laws are that the impedance of a capacitive circuit falls as the frequency rises, while the impedance of an inductive circuit rises as the frequency rises. It is assumed, of course, that the circuit also contains resistance. The effect on current in a hybrid circuit depends on the individual values of the resistance, capacitance and inductance, as well as on the frequency of the signal current. However, there is no need for us to get into really deep water for the purpose of understanding this article.

Now, the recommended load or termination given by the manufacturer of a pick-up microphone, etc., relates to pure dc. The impedance of the source may also be given. The termination across the input sockets of a tape recorder, hi-fi amplifier and other associated equipment is also (generally) assumed to be pure resistance. Thus, provided the resistance (in ohms) of the pick-up input circuit of the amplifier is near to that of load required by the pick-up, and the voltage and sensitivity aspects are satisfied, then all is well. It is worth noting that the majority of magnetic pick-ups require a 50,000 ohm (or near) load and this has been provided, by the majority of amplifier makers, across the magnetic pick-up socket.

#### Effects of Changing Load

What happens if the termination across the magnetic pick-up differs from that recommended? Well, since this sort of pick-up is predominantly inductive, we get a change in frequency characteristics. Fig. 1 gives the equivalent pick-up and input circuit of the amplifier. Here  $L$  is the inductance of the pick-up and  $R_L$  is the input resistance (load) across the amplifier socket.  $R_L$  has been selected by the maker to provide the best frequency characteristic and to 'swamp' the effect of  $L$ .

If we reduce  $R_L$ , we get an effect rather like reducing the bottom leg in a potential-divider.  $L$ , of course, can be assumed as an 'ac resistance' (in ohms), while  $R_L$  is pure resistance in ohms.  $L$ , remember, increases in value (in ohms, that is) with increase in frequency, while  $R_L$  is unaffected by frequency. This means that as the frequency of the signal rises, the potential-divider effect changes so that the top arm increases in value. Most of the signal voltage is then developed across the top and a correspondingly reducing value develops across the bottom arm. Since the voltage here is the signal voltage to the amplifier, it follows that the signal voltage applied to the amplifier circuit falls as the frequency rises. Thus, by reducing  $R_L$ , the output of the magnetic pick-up falls as the frequency rises. Conversely, an emphasized treble response would arise from the use of a too high value  $R_L$ .

There are side effects from this in terms of output voltage. The output is given relative to a specific load value. If this is reduced, the average output will almost certainly fall below the specified value. This in turn may mean that the amplifier cannot be fully driven, resulting in poor signal/noise performance, as with an amplifier of sensitivity voltage above that of the source voltage. If the load is somewhat above the value specified, then the source voltage may rise (on the average) above that in the specifications.

So much, then, for the impedance - or frequency-sensitive - aspect of matching. The thing to remember here is that, although we sometimes talk of output impedance, input impedance and so on, the load does not necessarily have to equal the impedance of the source, but it has to match, as far as possible, the source's recommended termination. For instance, one well-known magnetic pick-up has an impedance of 3,000 ohms at 400c/s, yet the recommended load or termination resistance is 50,000 ohms. This value is based on achieving a correct output characteristic at specified output voltage.

With magnetic pick-ups, of course, equalization is required in the amplifier to compensate for the rising output with rising frequency, which is a characteristic of all magnetic devices. However, this is not really a matching problem as such.

#### Simple Matching Artifices

Let us now suppose that we have an equalized pick-up socket on our amplifier which repre-

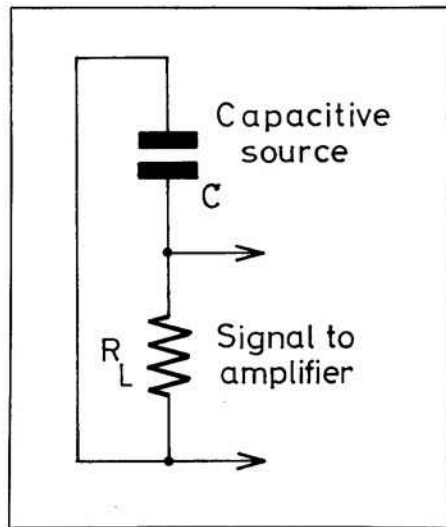


Fig. 5. Basic equivalent circuit of capacitance source across resistive load.

sents an input load of 1 megohm, while the pick-up we wish to use requires a termination load of 50,000 ohms. The quickest way out of this one is simply to parallel the amplifier input with a 50,000 ohm resistor (or near value). We would then, in effect, be putting a resistance of 50,000 ohms in parallel with the amplifier's input resistance of 1,000,000 ohms. The pick-up would then 'see' a resistance a little below 50,000 ohms, and would thus match correctly.

Normally, an amplifier does not bother much if its input is connected across a resistor which is substantially below its input resistance. That is, from the frequency response aspect. It must be remembered, though, that the sensitivity voltage of the amplifier may be based specifically on its designed-for input resistance, and if this is reduced (by connecting a lower value resistor in parallel, for instance) the sensitivity voltage may increase, making the input across the lower resistance less sensitive.

On the other hand, if the amplifier's input is, say, 10,000 ohms and we wish to connect a pick-up requiring a termination of 50,000 ohms we have to add resistance in series with the circuit, as shown in Fig. 2. Here the 40,000 ohm resistance adds to the 10,000 ohms input resistance of the amplifier so that the pick-up 'sees' 50,000 ohms. This is all very well so far as the pick-up itself is concerned, but the extra 40,000 ohms of series resistance forms a potential-divider with the amplifier's input resistance, so that the voltage received by the amplifier ( $V_{out}$ ) is somewhat below that delivered by the pick-up ( $V_{in}$ ). This is shown in Fig. 3. Actually, the output voltage is equal to  $V_{in} \times R_2 / R_1 + R_2$ . Putting figures to this expression, therefore, and assuming that the pick-up delivers, say, 5mV, we find that  $V_{out}$  in Fig. 3 is 1mV. The circuit acts, therefore, as an attenuator, and while it may be suitable for reducing the voltage of a source delivering an output far in excess of the amplifier's sensitivity voltage, it is not a good device to have in a low-level pick-up circuit. The best plan would be to have the input resistance of the amplifier increased from 10,000 ohms to a value more suitable for the required termination of the pick-up. If the termination resistance differs considerably from the amplifier's input resistance and attenuation is purposely needed between the

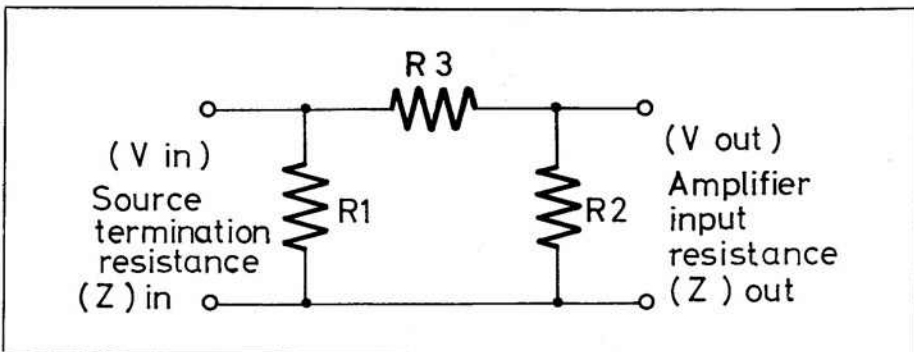


Fig. 4. A pi-attenuator which can also be used for matching (see text). Note:  $R_3 = Z \left( \frac{K^2 - 1}{2K} \right)$

$$R_1 = R_2 \text{ (when } Z_{in} = Z_{out} \text{)} = Z \left( \frac{K + 1}{K - 1} \right) \text{ where } K = \frac{V_{in}}{V_{out}}$$



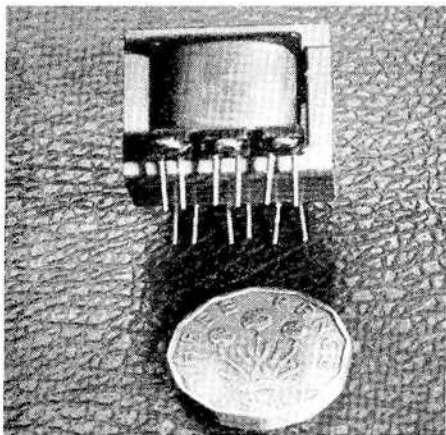


Fig. 6. Miniature microphone transformer of the type that may be contained within the microphone casing.

continued from page 35

source and the input, a *pi*-attenuator, which can also match input and output, may be desirable. Such a device, shown basically in Fig. 4, is sometimes necessary with transistor amplifiers to avoid undue disturbances to the input frequency response. The circuit in Fig. 4 can be made suitable for a balance circuit. In this case  $R_3$  is divided by two and an additional element of the same value incorporated in the bottom line, between  $R_1$  and  $R_2$ , to match  $R_3$  in the top line.

### Capacitive Sources

So far we have seen how matching can affect inductive sources. How about capacitive sources, such as crystal pick-ups and microphones? Well, the equivalent circuit can be shown basically as in Fig. 5. This is the same as that in Fig. 1 but with capacitance  $C$  instead of inductance  $L$ . Capacitive sources are also designed to work with a specific termination resistance, and to get a flat output, the termination is generally in the order of 2 megohms.

If  $R_L$  is below this value the output to the amplifier tends to rise with increase in frequency (the bass fall), while an increase in bass output will result if the termination is substantially higher than 2 megohms. This is because the ohms value (impedance or – more accurately – reactance) of  $C$  falls as the frequency increases (the opposite to  $L$ ).  $R_L$  remains the same, of course, so we get a varying potential-divider effect again, with more signal voltage developed across  $R_L$  as the ohms value of  $C$  falls.

Indeed, this property is often exploited with crystal and ceramic pick-ups to allow the cartridge to be connected direct to an input that is equalized for a magnetic pick-up. When a capacitive source is loaded to an input well below 2 megohms (say, 50,000 ohms), the output rises with frequency at an average of about 4dB/octave, which is the same as the output from a magnetic pick-up. This is useful to know when it is required to run a ceramic or crystal pick-up into an equalized input of a tape recorder.

The matching of capacitive sources to resistive inputs follows similar rules to those already expounded, but the output from such sources (piezo electricity) is generally greater than from magnetic sources, so the sensitivity of the amplifier's input need not be so

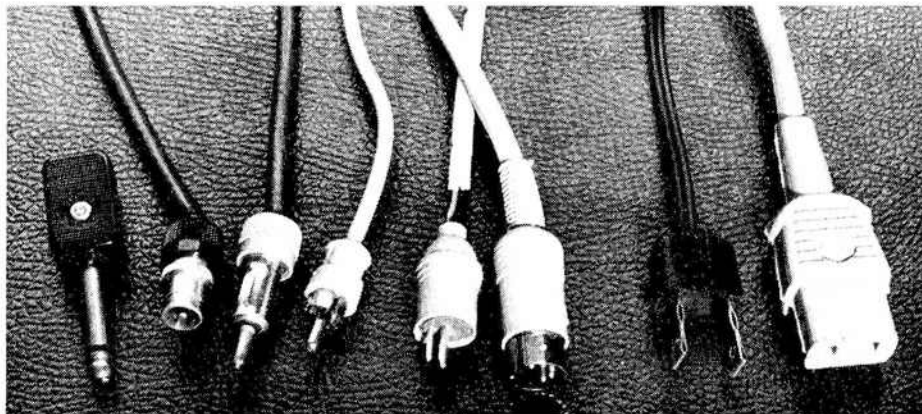


Fig. 7. Range of plugs (left to right): ordinary jack, co-axial, alternative co-axial for audio and vhf radio signals, phono, DIN non-reversible speaker, DIN signal (described in text), American mains, continental mains.

high and there is greater scope for the type of matching that results in signal attenuation.

### Microphone Matching

In the main, we have so far considered pick-ups, but the same general rules also apply to microphones. Magnetic units (moving-coil and ribbon, for instance) have only a small value of  $L$  and so the frequency response is less affected by different value terminations. Nevertheless, a termination as close as possible to that stipulated by the maker should be used wherever possible. But one need not be too much of a purist in this respect.

If the microphone input resistance of the amplifier is, say, 1,000 ohms, it would generally be quite in order to connect to this microphones with quoted impedances of from 100 to 200 ohms upwards to 1,000 ohms and in practice a little above in some cases. The chief aspect is that microphones with small impedance values usually deliver less signal to the amplifier than those with higher values. It is possible – though it would never be done – to connect a 100 ohm microphone to a 100,000 ohm amplifier input. Very little output would result, however, because a 100 ohm microphone would rarely give sufficient signal to drive a 100,000 ohm input circuit. If one wants to run a 100 ohm microphone to a 100,000 ohm input, then a step-up transformer is used. This transforms the 100 ohms of the microphone to 100,000 ohms of the amplifier provided the correct turns ratio is used. The turns ratio is calculated by find-

ing the square-root of the amplifier resistance divided by the microphone impedance. In the above example, we have 100,000 ohms divided by 100 ohms. This works out to 1,000, the square-root of which is a little less than 33. Thus the transformer would have a turns ratio of about 33-to-1.

A transformer also steps up the signal voltage (and steps the current down in proportion) by the value of its step-up turns ratio. The example transformer, then, would step up the microphone signal voltage by 33 times and make it of a level suitable for the 100,000 ohms input.

Crystal and ceramic microphones must always be loaded across a resistance of 1 to 2 megohms. Lower value terminations will impair the bass response. It is not really feasible to run these through a transformer (step-down) to a low amplifier resistance. The snag with high impedance is that the circuit can pick up noise and mains hum. This makes it difficult to run long microphone leads. In any event, the lead should be screened, and as more capacitance is added by the screening across the circuit, so the microphone output voltage drops. One solution lies in the use of a transistor matching device, the input of which accepts the capacitive source without bass cutting (high impedance), while the output is across a relatively low impedance which matches the low impedance microphone input of the amplifier or recorder. The amplifier/booster should be located close to the microphone, and the low impedance output lead taken to the amplifier.

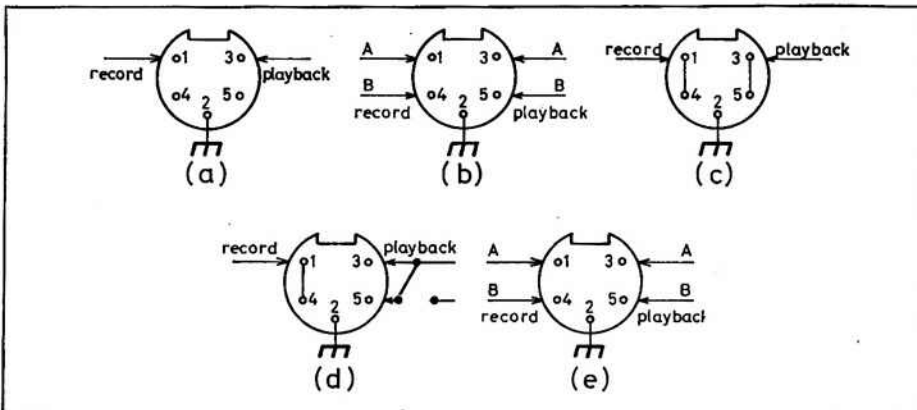


Fig. 8. DIN connections (a) and (b) mono and stereo sockets respectively; (c), (d) and (e) plug connections for mono and stereo (see text).

Long leads can then be satisfactorily employed.

Capacitor microphones have built-in amplifiers and matching devices so that the output is low impedance at fairly high output. Some inherently low impedance moving-coil and ribbon microphones have a high impedance output – to match crystal and ceramic inputs – by reason of a very small step-up transformer being fitted in their housing. Such a transformer is shown in Fig. 6.

### Plugs and Sockets

Now about plugs and sockets. Fig. 7 shows a range of plugs now in current use. Most of these are very well known and need no mention. That which causes most problems, however, is the DIN plug, the third from the right. The DIN socket is found on the majority of imported machines and amplifiers, and is really a very satisfactory arrangement, especially on stereo equipment where two inputs and two outputs (two pairs of A and B channels) are adopted. One DIN socket/plug can handle all these circuits. Fig. 8 shows the basic DIN connections, at (a) and (b) the mono and stereo sockets (fitted to recorders, radio receivers and amplifiers) respectively and at (c), (d) and (e) the partnering plugs. The plugs and sockets are all the same, of course, only their connections differ, but a common factor will be seen in Fig. 8.

Schemes (c) and (d) are used, for instance, with a mono recorder and (e) with a stereo model. The difference between (c) and (d) is that (c) calls for a disconnection between sockets 3 and 5 under certain conditions to avoid the paralleling of the two circuits. This is taken care of in (d) by the switch incorporated in the circuit or socket, as the case may be, but with this scheme the capacitance of the playback leads should not exceed 150pF to avoid treble loss. A and B in the diagrams correspond to the left and right channels respectively. The DIN documents are very formidable and it is possible to deal only briefly upon the subject here; however, it is hoped that Fig. 8 will help solve some of the problems that arise.

### About Speaker Matching

Finally, a word about speaker matching. Some enthusiasts are worried about their transistor amplifiers not being correctly loaded to 15 ohm speakers, and a repeated query is 'should I use a matching transformer?' Generally speaking, it is perfectly in order to connect a 15 ohm speaker system to a lower impedance speaker output of a transistor amplifier. Preferably, a network of units should be arranged to give the output impedance stipulated by the amplifier maker. If this is not possible, a 15 ohm system will not damage the amplifier but full power and the minimum distortion will not be obtained; however, it may well be virtually impossible to determine this subjectively!

Indeed, there may be more distortion by introducing a transformer to step up, say, an 8 ohm output to 15 ohms to match an existing speaker system. Personally I would rather use a direct connection – although mismatched – rather than a transformer. It is well worth noting, however, that speaker makers are now producing units of lower impedance specifically for absolute matching to transistor amplifiers.

# THE THINGS YOU SAY

### Postal Delays

Nottingham is approximately sixty miles from Burton Latimer, a matter of an hour and a half's drive in a fast car but by post somewhat longer. A tape posted to me on 4 June, informing me of an intended visit on the following weekend, arrived on 4 October, a little late. A tape posted to me on 3 August in Maitland, NSW, Australia, arrived on 7 August. Although a little more expensive, it would have been much quicker for my Nottingham friend to have sent my tape to me via Australia. This unfortunately is not an isolated incident, as many of my business letters from this same town have been quite long-winded in arriving. Burton Latimer, Northants. A. J. Link

### Appreciation from 'Down Under'

Thanks very much for your wonderful article of *What's Top of the Pops, Pop* – in the June issue of *ATR*. David Lazell deserves the biggest and best medal available. I remember when as a kid about 13 or so some other great pretenders and myself used to collect some 78s from our houses, then trot off to the corner grass square and listen to these records. That was only 17 years ago! We were fans of people like Guy Mitchell, Les Paul and Mary Ford, Joe Stafford, Woody Herman, Louis Armstrong, Spike Jones, Bing Crosby, Perry Como and even Bill Haley. It would be wonderful to hear these again. Best wishes and keep on with your good work, mate.

Thames, New Zealand.

Ray Wolf

### About Domesticated Sound

May I say congratulations to Peter Knight on his article *Quality Sound Reproduction* by

*Truvox* (*ATR*, October). As a *Truvox* user I found this particular section of your new series (*ATR Hi-Fi Supplement*) very interesting, especially for beginners (to whom of course this is aimed). Well done, Mr Knight, for cutting down on the technical jargon so that people can read and understand. A good article on good British equipment.

In conclusion I would like to back up Russ Allen's statement that the *Truvox* deck (having three motors) does get warm, but as he states (*ATR Tape Reviews*, October) in the upright model this is soon cleared up. (Mine is not the same model as Russ Allen's PD104, but the earlier R92.)

Newthorpe, Notts.

W. Medikin

### Typing Services

I wonder if I might be permitted a small space to hold out a ray of hope for overworked club secretaries everywhere who have longed for someone to help with the typing, but who could not afford professional services.

I have just completed arrangements with the headmistress of my local girls' school for the girls in her commercial department to act as secretaries for me. Her attitude is that this gives the girls a chance to do some real work as against repeated book exercises. This work is carried out without charge, although I have to provide all the stationery, and it is done to a very high standard. I mentioned this as a possible line of enquiry, since most girls' schools have some typing classes, and in return for an offer of help from the club, I'm sure that many headmistresses would act similarly.

B. Ashfold,

PRO, Worldwide Tapetalk

## MORE NEW FEATURES IN FEBRUARY ATR

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- \* Jordan-Watts Loudspeakers
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and many other topical articles plus news on Tape and Hi-Fi

# AUDIOVIEW LOOKS AT CABINETS FOR HI-FI



Fig. 1. The Design Furniture EQC81 cabinet with matching S33 loudspeaker enclosure.

Although the trend in hi-fi has recently been toward miniaturization – bookshelf loudspeakers, tape recorders, amplifiers, etc – many still prefer having all the equipment nicely stowed away in an elegant cabinet. There are basically two ways of housing a hi-fi system. One is to incorporate everything, including the loudspeaker, in one box, but this is not ideal for acoustical reasons. The other and most popular arrangement is to install the amplifiers, transcription unit and tape recorder in one cabinet, leaving the loudspeakers in separate enclosures so that they can be positioned with regard to stereo and other acoustic requirements. In answer to the latter requirements, Design Furniture recently ran a competition for the design of hi-fi cabinets and from this evolved their EQC18 system shown in Fig. 1. This will take an amplifier, tuner and record transcription unit and it retails at £25. The loudspeaker cabinets are not included in this price but are their type S33 enclosures.

For those who require space for a tape recorder as well as the rest of the equipment, Record Housing Ltd offer a range of cabinets from 44 guineas downwards. The *Longfellow* shown in Fig. 2 will take an amplifier, tuner, record transcription unit, tape recorder, tapes and records. They can also supply matching loudspeaker enclosures. From the same catalogue comes a somewhat different cabinet system known as *Scan Storage Units*. These are separate cabinets of equal size for a record unit, tape recorder, amplifier, etc., and can be purchased separately as the hi-fi system expands. An assembly of Scan Storage units is shown in Fig. 3.

A study of the catalogues sent to us by the various cabinet manufacturers showed that there is a wide range to choose from. Incidentally, for those who wish to construct their own, Heathkit offers three systems. Their *Malvern* cabinet, for instance, will accommodate a gram unit, tape deck, tuner and amplifier and retails at £18 1s 0d. With regard to choice, size and space, we advise writing to the manufacturers included in our list. Their catalogues contain all the details you will need such as finish, dimensions, available space for various kinds of equipment and information regarding suitable matching loudspeaker enclosures.

Here is a list of some of the cabinet manufacturers:

**Design Furniture Ltd**, Calthorpe Manor, Banbury, Oxfordshire.

**GKD Ltd**, 45 Crawley Green Road, Luton, Beds.

**Heathkit** – Manufactured by **Daystrom Ltd**, Bristol Road, Gloucester.

**Howland-West Ltd**, 11 Howland Mews, Howland Street, London W1.

**Imhofs**, 112-116 New Oxford Street, London WC1.

**Largs of Holborn**, 76-77 High Holborn, London WC1.

**Lewis Radio Company**, 100 Chase Side, Southgate, London N14.

**Musicraft Hi-Fi Centre**, 64 High Street, Hounslow.

**Record Housing**, Brook Road, Wood Green, London N22.

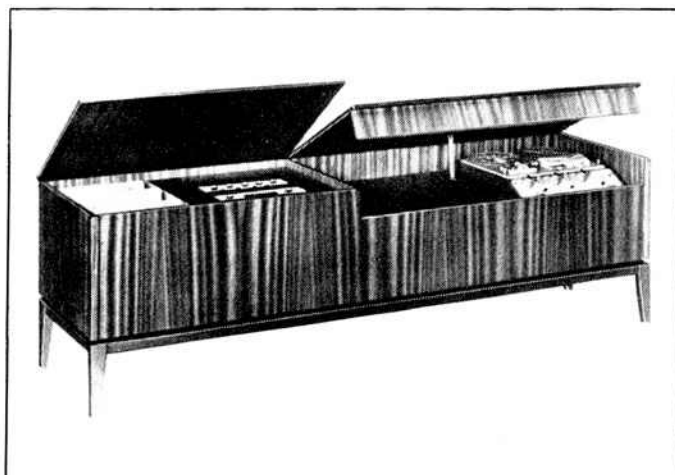


Fig. 2. The Record Housing Longfellow will accommodate amplifier, tuner, tape recorder, record transcription unit, tapes and records.

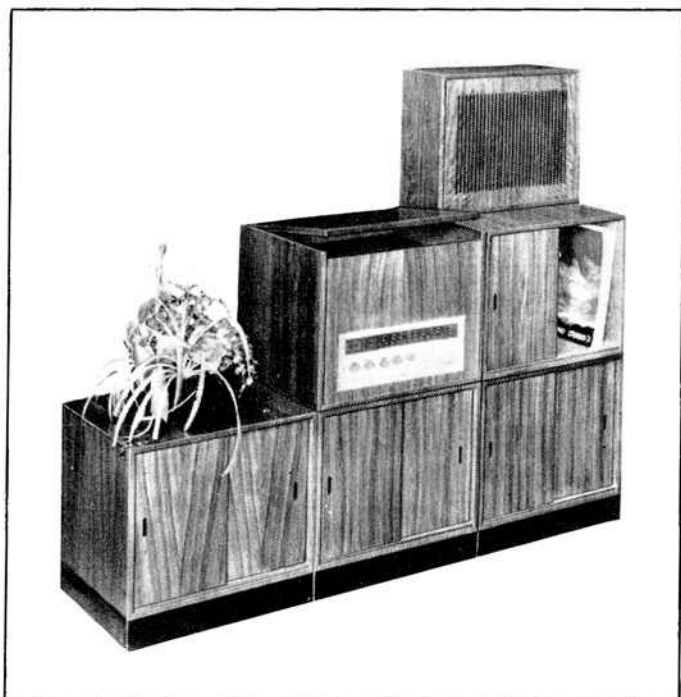


Fig. 3. The Scan Storage Units by Record Housing.



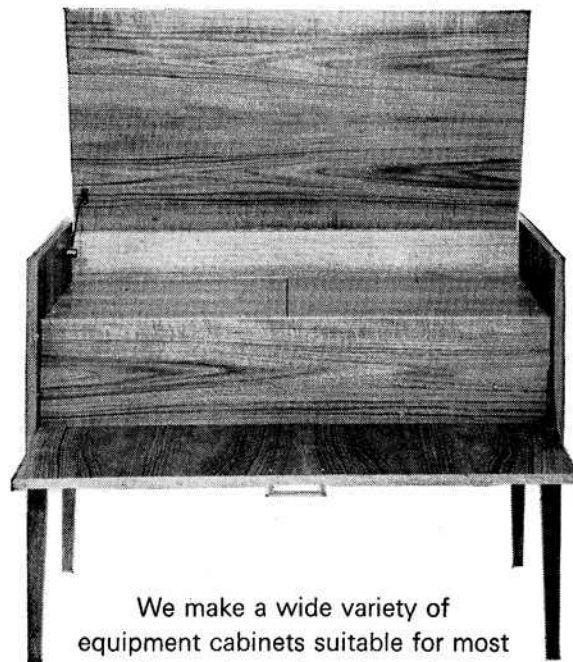
# TECHNICAL ABBREVIATIONS USED IN ATR

The following technical abbreviations will be used in all ATR Editorial as from the February issue. Note the use of the now International abbreviation for frequency, i.e. Hertz—Hz (see editorial comment on page 3).

AM	Amplitude modulation
FM	Frequency modulation
vhf	Very high frequency
uhf	Ultra high frequency
hf	High frequency
Hz	Cycles (Hertz) per second, e.g. 200Hz
KHz	Kilocycles (Kilo-Hertz) per second, e.g. 10KHz
MHz	Megacycles (Mega-Hertz) per second, e.g. 2MHz
dB	Decibels, e.g. 2dB
K	Kilo, as in Kohms, e.g. 47Kohms
M	Mega, as in Mohms, e.g. 2Mohms
V	Volts, e.g. 20V
mV	Millivolts, e.g. 10mV
$\mu$ V	Microvolts, e.g. 100 $\mu$ V
mA	Milliamps, e.g. 5mA
A	Amps, e.g. 4A
W	Watts, e.g. 10W
mW	Milliwatts, e.g. 500mW
ips	Inches per second, e.g. 7½ ips
F	Farads, e.g. 2F
$\mu$ Fd	Microfarads, e.g. 200 $\mu$ F (or 200mFd)
pFd	Picofarads, e.g. 10pFd
$\Omega$	Omega (Greek symbol) used for 'ohms'
$\pi$	pi (Greek symbol)
dc	Direct current
ac	Alternating current
rms	Root-mean-square
mS	Milliseconds, e.g. 10mS
$\mu$ S	Microseconds, e.g. 100 $\mu$ S
f	Frequency
R	Resistor, e.g. R1, R2, etc.
C	Capacitance (or capacitor), e.g. C1, C2, etc.
L	Inductance, e.g. L1, L2, etc.
VU	Volume level
afc	Automatic frequency control
avc	Automatic volume control
agc	Automatic gain control
atc	Automatic tuning control
rf	Radio frequency
vf	Video frequency
TV	Television

# You can't put a . . . . in here!

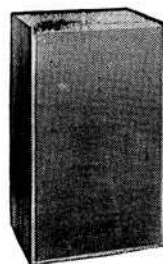
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Philips	8108	...	57/6
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Classified advertisements in 'Amateur Tape Recording' cost 1s per word, minimum 10s. Box Nos. 1s. 6d. extra. Advertisements and remittances should be sent to Classified Advertisement Department, ATR, 9 Harrow Road, London W2.

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Highest cash prices offered for good quality Tape Recorders, Hi-Fi Equipment and LP Records. REW Earlsfield Ltd, 266/8 Upper Tooting Road, London SW17. Tel BAL 9174. (TC)

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Charities are also being strangled by the credit squeeze and we need money to keep our service going. Readers of ATR - you have helped in the past. Please come to our rescue again by sending a cash donation to The Treasurer, Tape Programmes for the Blind, Marston Green, Warwickshire. (3/67)

You ought to send for a copy of 'Psychology and Whisper Teaching' to 1 York House, Huddersfield - 5s 9d post free. (6/67)

Pen friends wanted by many: all ages. SAE. Pen Society (T.74), Chorley, Lancs. (1/67)

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The perfect companion to ATR is 8mm Magazine - an unbeatable combination for the sound and cine enthusiast. 8mm tells you all you need to know on how to take cine films and where to look for subjects. Packed with news of the latest cine developments, unbiased test reports and hints on sound and cine. All for only 2s 6d a month, or special introductory subscription offer of 25s a year from Subscription Dept, 8mm, Haymarket Press Ltd, 9 Harrow Road, London W2.

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Tape Club members wishing to avail themselves of the special Club Subscription rate of 25s per annum should apply to their local Club Secretary. All Club orders must bear the Club Secretary's signature and be sent to the Subscription Department.



## WHERE NO BELLS RING

Continued from page 21

record including this time a recording of 2½-minute toll-in bell. Bookings soon came in for weddings and special Sunday services, such as Harvest Festival and Armistice Sunday, from other bell-less churches in the area. At some of these there is no suitable hidey-hole available for the tape recorder and amplifier so Mr West goes along in a fully equipped mobile caravan and operates from that in the churchyard.

Of course, some of these old churches are characteristically low, thatched buildings having no steeples whatever. One in particular from which he operates has never been known to have bells, not even the one bell sometimes erected in a framework covered with wooden casing outside the church. To acquire the height needed to obtain a satisfactory relaying, a twenty foot tower of steel interlocking-piping is erected, the loudspeakers are hoisted into position and the bells ring out!

Campanologists in the area show no antipathy towards this introduction of taped bells as there is really no intrusion into their specific field. In fact, the idea helps to promote interest in the old craft of bell ringing. Tape recording has taken on a new aspect for Mr West, who claims that his enterprise in recording church bells in this manner was recently featured by Independent Television. The inhabitants of the surrounding villages feel that the taped bells add something to the local country atmosphere and to some of the very old folk it seems almost magic that the eight beautiful bells from Thatcham Church in Berkshire can ring out over the fields of East Anglia.

J.R.



Alan Brown of Mitcham, Surrey, and a member of the Thornton Heath Tape Recording Club receives the EMI Challenge Cup and a cheque for £100 donated by EMI Tape Ltd.

### 1966 BATRC Awards

The Awards for the British Amateur Tape Recording Contest, 1966, were presented this year by Miss Josephine Douglas, well-known television producer of *Emergency Ward 10*, at the Criterion Hotel, Piccadilly, London. Among the winning tapes were some excellent examples of multi-track recording techniques – but none approached the ingenuity that went into the making of the 'Tape of the Year', an *Excerpt from Macbeth* by Alan Brown of Mitcham. This was the witches' cavern scene in which the competitor portrayed all the different speaking parts, the necessary pitch variation in the voices being produced by using slightly different replay speeds of the original recordings. These were copied as a whole at a common tape speed for the master tape. A highly dramatic backing of electronic and natural sound effects was also employed. Alan Brown is 20 years old and a member of the Thornton Heath Tape Recording Club.

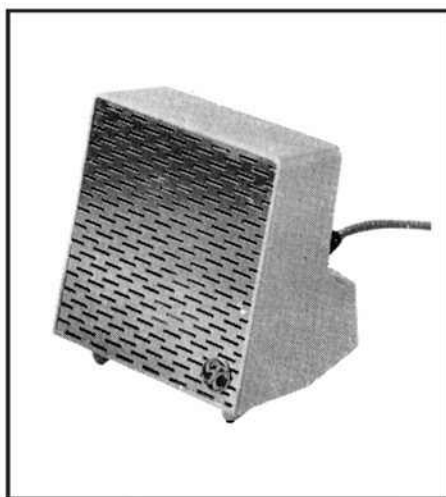
## REVIEW THE STC 4114 DYNAMIC MICROPHONE

It is not often that one comes across a low-priced microphone with a performance designed for tape recording. Electronics (STC) now market the STC 4114A and 4114B which are identical except for impedance. The 4114A is 200 ohms and the 4114B 80,000 ohms (high impedance) and they both retail at 32s 6d. In both mics the very effective frequency response is maintained between 100c/s and 800c/s with a rise in response at around 3,000c/s which compensates for deficiencies in slow-speed recording.

The sensitivity is quite high and even when the 200 ohm model was deliberately mismatched into a 25 ohm input there was still ample gain on close speaking. The 4114B high-impedance version has a built-in transformer which steps up the output to a nominal 'high impedance' and can therefore directly replace an ordinary crystal microphone. The low-impedance 200 ohm model 4114A is more

suitable for transistorized tape recorders, most of which have a microphone input impedance of around 200 ohms. The microphone unit is housed in a small, square, plastic case and can be hand held without too much transfer of handling noise. The polar response is omnidirectional, i.e., the microphone responds equally in all directions. Bearing in mind the extremely low price, this microphone performs very well. One could not reasonably expect it to have the smooth extended frequency response required for high quality music recordings which can only be found in microphones costing at least six times the price. It is only fair to say, therefore, that this microphone is not intended for high quality recording but is nevertheless excellent for speech. The low-frequency roll-off below 100c/s makes it very suitable for outdoor work such as interviews and general sound recording.

F.C.J.



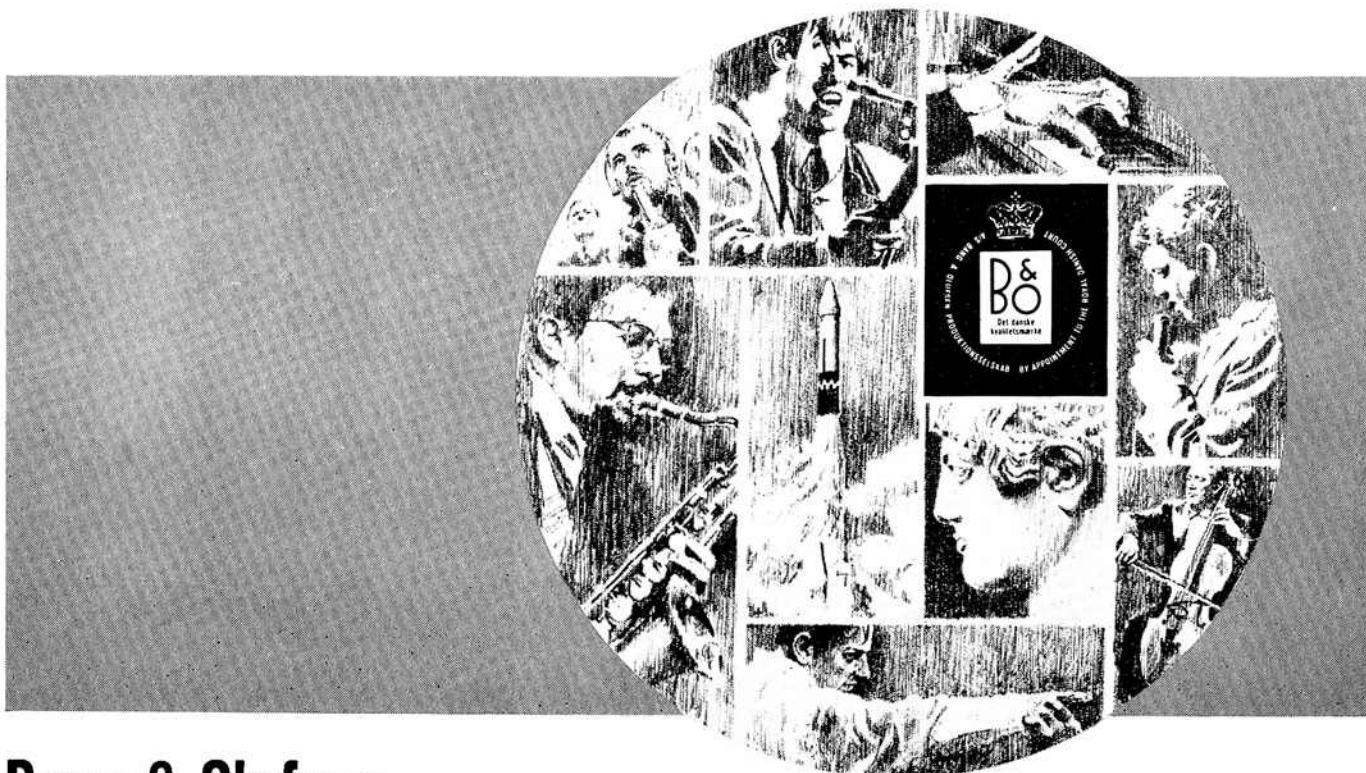
### ATR MICROPHONE DIRECTORY

42 In the December issue we stated that the following brands of microphones were manu-

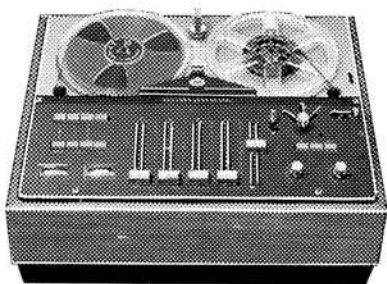
factured by the companies whose names and addresses in the UK were listed in the Microphone Directory. They are in fact imported and distributed in the UK by these Companies: AKG; Denham & Morley; Elpico-Geloso;

Sennheiser; Telefunken.

We regret that the price of the Bang & Olufsen BM5 Stereo Microphone was incorrectly shown as £60 5s 0d. In fact it costs only £23 2s 0d.



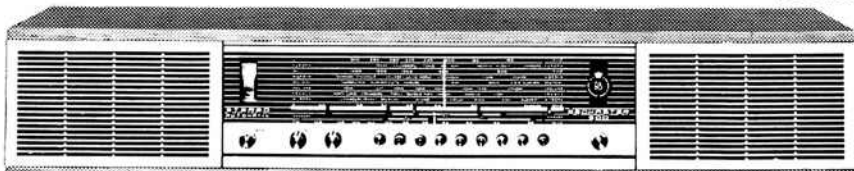
## Bang & Olufsen— for those who consider design and quality before price



BEOCORD 2000K. Outstanding semi-professional two track tape recorder. Built-in 4 way mixer section. 125 Gns. Portable version 129 Gns.



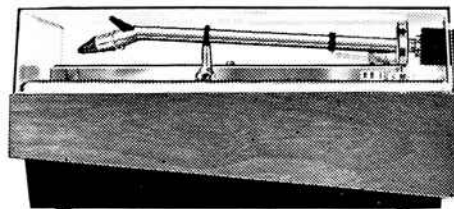
BEOVOX 'B' Type loudspeakers — optimum performance from small dimensions (11" x 5" x 10" approx.). 13 Gns.



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### B&O—Danish Design—Danish Craftsmanship



BEOGRAM 1000V. Stereo transcription turntable unit, mounted on suspended plinth with magnetic cartridge, lowering device and dust cover. 34 Gns.



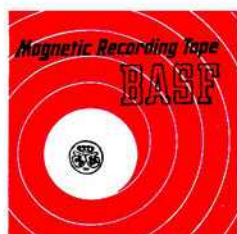
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