Amateur Tape Recording

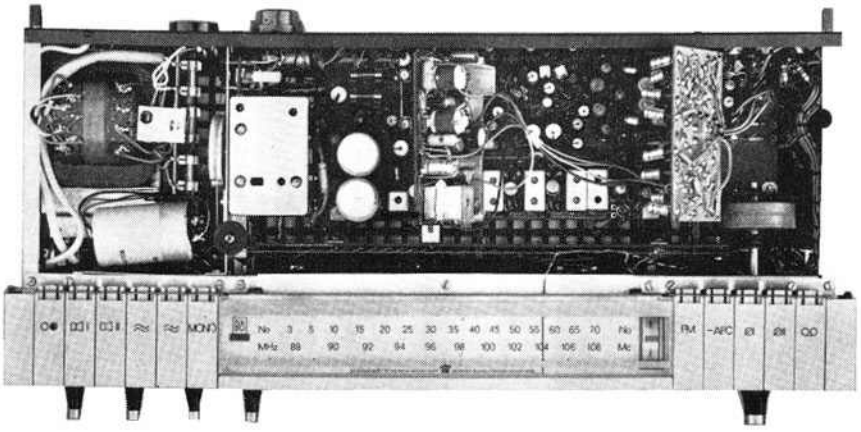
VIDEO&HI-FI

February 1967 Vol 8 No 7 2/6

ATR VISITS FERROGRAPH—Page 28

Bang & Olufsen–

for those who consider design and quality before price



This is what you would see under the elegant case of a Beomaster 1000K F.M. Tuner Amplifier. Solid state circuitry throughout, separate and hinged component panels, stereo decoder already fitted, and components of the highest quality and closest tolerance.

Notice too, the positive piano key mode selectors, which require only finger-tip pressure to operate, the long tuner scale for easier and more accurate station finding, fly wheel balanced tuning drive and large radicator type tuning indicator. This must be the most sophisticated high fidelity tuner amplifier available at such a modest price.

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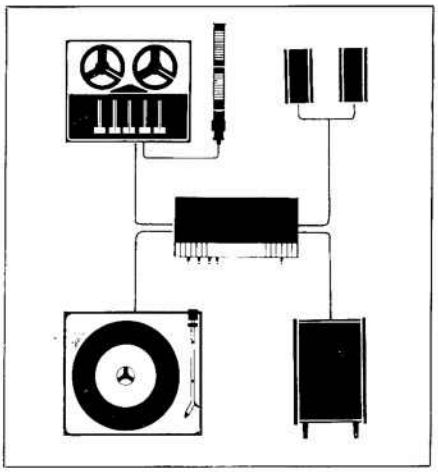

Bang & Olufsen's design theme continues throughout the whole range. For further information on Tape Recorders, Loudspeakers, Turntable units and accessories see your local B & O Dealer now or write for his name and our illustrated catalogue to:

Bang & Olufsen
U.K. Sales Division,
Eastbrook Road, Gloucester.
Telephone: Gloucester 21591

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Write for illustrated leaflet ATR12.

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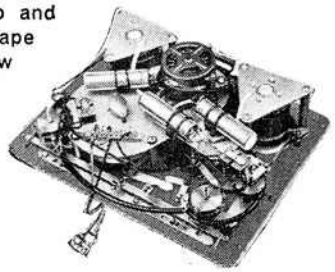

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A Winner

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Reel size	7" or smaller
Recording system	4-track stereophonic and monophonic
Frequency response	30-18,000 cps at 7½ ips (50-15,000 cps at 7½ ips±3db) 30-13,000 cps at 3¾ ips
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Flutter and wow	Less than 0.19% at 7½ ips Less than 0.25% at 3¾ ips
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Level indication	Two VU meters (calibrated to 0 VU at 12 db below saturation of tape)
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Input	Low impedance microphone inputs – transistorised (will accommodate any microphone from 250 ohm to 1 K ohm impedance) Sensitivity –68 db (0.3 mv) (2) High impedance auxiliary inputs Sensitivity –16 db (0.12 v) (2)
Output	Low impedance line outputs (2) Output level 0 db (0.775 v) External Speaker jacks (8 ohms) (2) Integrated Record/Playback Connector (1) Binaural monitor output (1) Output level 0 db (0.775 v)
Operating position	Either horizontal or vertical
Speaker	4 x 8" dynamic (2)
Power output	5 watts (x2)
Transistors	2SB381 (x6), 2SB382 (x2), 2SB383 (x2) 2SC297 (x1), 2SC298 (x4), 2SD64 (x6)
Weight	Approx. 34 lbs. 3 ozs.
Dimensions	21 5/16" (W) x 15 7/16" (D) x 7 7/8" (H)
Accessories	5" stereo recorded tape Empty 7" reel Microphone Model F-96 (2)

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Amateur Tape Recording

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Vol 8 Number 7 February 1967

EDITORIAL COMMENT

On page 11 you will find a questionnaire. Its purpose is manifold and it has been designed so that the information, which I hope you will provide, will enable me, as Editor of *ATR*, to continue to produce an informative magazine, but also to tailor it to your own specific demands. You may feel that some of the questions are rather personal, but please note that I do not ask for your name or address. Everyone who completes the questionnaire will therefore remain quite anonymous. It will take only a few minutes to fill in and no stamps are needed to return it to *ATR*. Your kind co-operation will be greatly appreciated and will, I am sure, prove advantageous to us all.

BBC Broadcast of Amateur Tapes

On 14 December the prize-winning tapes entered in the 1966 BBC Northern Region amateur tape recording competition were broadcast in the London Home Service. The competitors were originally asked to produce an imaginative interpretation of the theme '*Summer*' in order to demonstrate the great range of possibilities available with a modern lightweight portable tape recorder. The tapes were eventually judged by Douglas Brown, President of the Federation of British Tape Recording Clubs, David Scase, Director of Productions, Liverpool Playhouse, and Timothy Eckersley, Assistant Head of BBC Central Programme Operations. At last, it seems, someone has realized that amateurs can produce interesting recordings worthy of being broadcast, but we still need our own special programme in which tape recording topics and techniques as well as recordings of merit can be featured.

Walthamstow TRC goes Video – ATR Exclusive

Friday, 6 January 1967, is a date that will be remembered by members of the Walthamstow Tape Recording Club, for on this date they became the first tape club to stage a programme specially designed and produced for video recording. We are planning to publish a full-length report on this in the next (March) issue of *ATR*, but here is at least a brief outline. *Entire programme*, called *The Video Show*, sponsored by *ATR*. Produced by the Walthamstow Tape Recording Club and local dramatics personnel. *Video equipment* – Sony TCV2000 video recorder with zoom video camera and vision display. *Sound equipment* – (mostly supplied by *ATR* Editor) – microphones, mixers, sound replay and monitor amplifiers, etc. Don't miss the forthcoming exclusive *ATR* report on the scripting, production, recording and audience reaction to the screen reproduction. We have planned for video (see page 8). Now we have put our planning into practice!

FCJ

FRONT COVER

View of the tape recorder laboratory at the Ferrograph factory in South Shields.

PLANNING FOR VIDEO

F. C. Judd

It is time to consider the creative possibilities of video tape recording

'*On air in five seconds everyone – roll telecine – standby grams – three . . . two . . . one . . . up sound, vision*'.

Familiar instructions? In the studios of London's Rediffusion yes, but to us, the sound recording enthusiasts, the time has yet to come when we, too, will be using the more sophisticated commands required for television picture recording. That time is not far off. The December '66 issue of *ATR* dealt fairly extensively with the state of video recording for the amateur, but almost before the article was written Sony announced their domestic video equipment.

Working in close co-operation with Sony's UK distributors, *ATR* was able to have the entire outfit on loan and, as a result, publish a full technical test report on it in the same issue. Was this the breakthrough? Had video recording for amateurs really materialized at long last? Well, the tests on the Sony video recorder revealed a high standard of performance and, although this is at present expensive, many have already been sold to amateur enthusiasts.

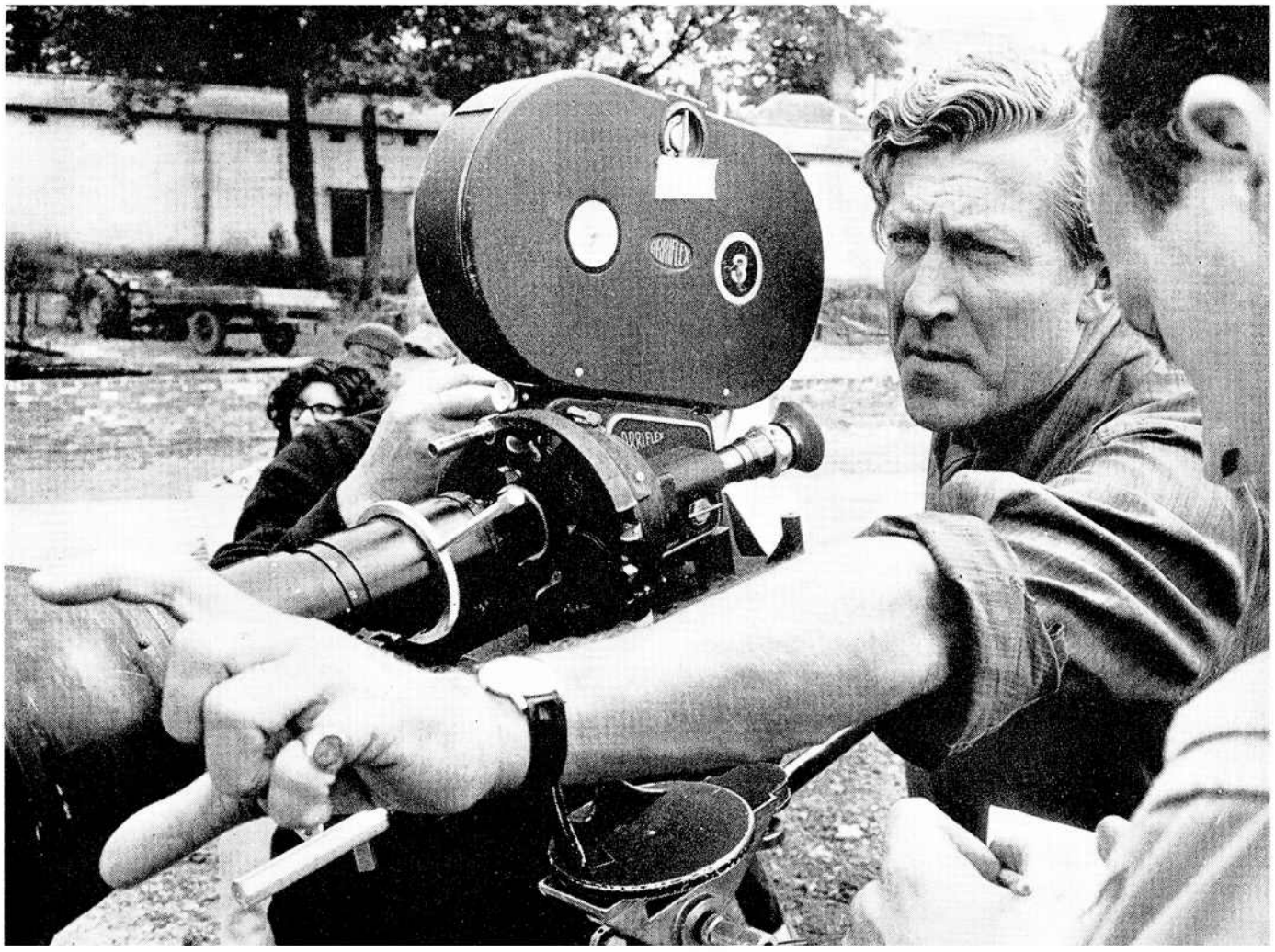
New Techniques

ATR therefore decided it was time to start looking into the creative possibilities of video tape recording, as well as maintain a close watch on technical developments. Quite obviously we cannot become experts on video recording overnight. First we must learn something of the technicalities and then make a close and careful study of the creative techniques – which are vastly different from those of sound and even from cinefilm with sound. So what better than first to turn to those who already have a wide experience of video, i.e. those engaged in video professionally. After all, many television programmes are video recorded and some are even planned and produced to fit in with the special requirements of video tape.

Those who take up video recording will have to become a combination of director, producer, cameraman and sound engineer. I speak now of producing worth-while recordings and not just of copying programmes from the tv. If your plays or documentaries, live shows or great epics of drama are to bear any resemblance to professional television, then you will need to become a lighting expert, an authority on costumes and think in terms of outside broadcasts, stage props, continuity and presentation. Don't forget that dedicated cinefilm enthusiasts emulate the professional film makers – ask any ardent cine club member – so why not do the same for television? Remember that television recording, like film, is only a means to an end. Only careful planning and production will make your video presentation a worth-while project and, let's face it, we shall probably find more audience enthusiasm for video recordings than we have at present for sound only recordings – provided they are well produced. So let's go over now to Rediffusion Television in London who have very kindly co-operated with *ATR* and myself for the purpose of this and other articles in which I shall be dealing with different aspects of creative television recording.

Directing for Television

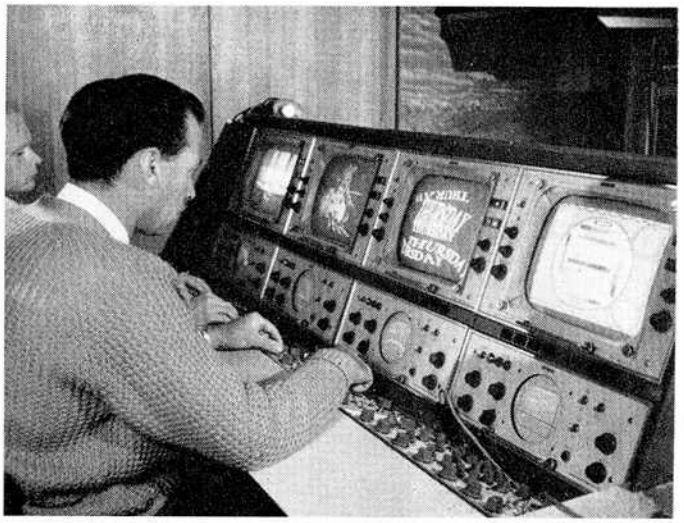
There are as many approaches as there are directors. Every television director will agree that his method is only one of many ways to present a programme, whether it is an outside broadcast, light entertainment, documentary or a play. Naturally, experience counts. From experience comes style and style has to be welded to the requirements of the programme concerned. Take a 1½ hour television play. The director likes a script which will set his imagination to work and help him to calculate a rough estimate



Rediffusion TV Director Cyril Coke on location for film inserts.

Vision mixing panel – Director Robert Stead (centre), vision mixer Paul Streather, production assistant Susan Miller.

Camera control room where the picture from each TV camera comes up on a separate display.



of its television impact. In his mind, he has already involved dozens of production and creative experts who are to work with him during the coming four weeks to make his conception reality. First there are the crews, the best and most appropriate for the job the director has in mind, for cameras, sound and lighting, the designers, the floor and stage managers must also suit the style of the programme. The director has a lot of pre-planning to get through, and with suggestions from the author already discussed, a rehearsal script is drawn up and studied. This script is also discussed in terms of cash, for every television programme has the budget it requires and the director should not need to exceed it. Filmed inserts and editing cost money, and so does background music, particularly if the director decides it has to be specially composed. The size and scope of his original conception of the play – in television terms – has to bear these considerations in mind.

Now comes the question of the cast. Heads down with the casting director as the actors and actresses are discussed. Artists are then contacted and although some may be available for work, others may be busy. A short list is finally compiled, the contracts are drawn up and a suitable place for them to start the rehearsals is booked. Meanwhile the designer has been hard at work on a 'ground plan' for the programme. When this has been produced, the director plots the moves of camera and cast, graphlike, on paper. He works out a camera script, showing camera positions, cues for sound effects and music, breaks for editing, and indicates filmed inserts.

A production assistant hands out the script to everyone concerned and makes sure that every detail from props to dressing rooms is being looked after. Before rehearsals can begin, plans have to be made with an attention to detail that won't eventually be caught out – for example, no make-up or props available at the required moment. The amount of studio time and facilities has to be drawn up, equipment booked, crews confirmed, schedules agreed.

Rehearsals

Finally the rehearsals begin with the first readings of the script. The director then comes to terms with the artists he has chosen and he must do this with sympathy and understanding and be prepared to change his earlier plans where necessary. For instance, cast and camera positions when plotted on the rehearsal room floor may miss the ideal mark of earlier theory. The director must be flexible to demands for change otherwise a camera might be where it shouldn't be, lighting might cast a doubtful shadow, an actor might speak and no one will hear. The lessons learned in the rehearsal room are typed out by the production assistant for inclusion in the camera script. Finally any filmed inserts are shot – on location if they are needed – and at last the production is ready for studio rehearsal. In the studio, speech, sound effects, music, props and settings are made to harmonize. Mistakes must be adjusted now, while there is still a chance. The director sends his instructions to the cast by way of the floor manager and to the crews through 'talk back'.

Finally comes the last couple of complete runs of the play prior to the real thing. The director hands his final notes to the cast and to the crews. There is little left he can do, except guide or warn, where necessary, through 'talk back'. The hectic planning dwindles to an ordered hush. In an hour or so, the 'writing will be on the wall' and the director will know if his one-in-a-thousand plan of weeks ago has stood up to public examination by millions of viewers.

So there you have it, straight from the mouth of the 'professional horse' – need I say more?

The Floor Manager (left) has the responsibility of maintaining order amongst the seemingly utter confusion of actors, cameras, microphones and stage props.

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AMATEUR TAPE RECORDING

HAYMARKET PRESS LTD

9 HARROW ROAD

LONDON W2

FOLD & TUCK IN FOLD 2

WE NEED YOUR HELP . . .

The more we know about our readers, the easier it is for us to give you exactly the magazine you want. Please help us to help you – by filling in and returning this form. It doesn't require a stamp.

Some of the questions might seem to be rather personal but they will certainly help to complete the picture and please remember that, as your name and address are **not** included, anonymity is in fact preserved.

Assessing your interests, requirements and tastes – your likes and dislikes – will enable us to plan *ATR* even more efficiently for your special needs.

Most of the questions require merely a tick in the appropriate box. You will see where a written answer is called for.

We look forward to hearing from as many readers as possible, and to reading what **you** have to say about **your** magazine. F. C. Judd

1st FOLD HERE

Your town and county.....

How many tape recorders do you own? .....

Which makes and types?

.....

.....

continued overleaf

Age 16–24☐ 25–34☐ 35–44☐ 45–64☐ 65 and over☐

Male ☐ **Female** ☐

Occupation .....

Income Under £950 ☐ £950–1250 ☐
£1250–1750 ☐ Over £1750 ☐

▲ Please start here

continued from previous page

What other equipment and accessories do you own? (*Tick the appropriate boxes.*)
Extra microphone(s) ☐ Mixer ☐
Amplifier ☐ Loudspeaker ☐
Splicer ☐ Echo unit ☐
Synchronizer ☐ Radio tuner ☐
Record player/transcription unit ☐
Other equipment.....

.....

Do you favour: Half-track ☐ Quarter-track ☐
Mono ☐ Stereo ☐

Do you like or dislike the following features *in this issue*:
Planning for Video (page 8) .....
What's New in Stereo? (page 13) .....
Tape Recording is Fascinating (page 14) .....
Is the Law an Ass? (page 15) .....
Tape Club News (page 16) .....
Sound Scene (page 18) .....
Bob Danvers-Walker's article (page 22) .....
Battery-driven Tape Deck (page 24) .....
Tape Recorders in the Making (page 28) .....
Review – Reslo Microphones (page 31) .....
Things You Say (page 32).....
Tape Recorder Servicing (page 34) .....
On Test – Ferguson 3214 (page 36) .....
Test Report – SME Series 2 Pick-up (page 39) .....
Tape Directory (page 44) .....
Test Report – Jordan-Watts Loudspeakers (page 47) .....

Please say how you consider any features you **dislike** could be **improved** .....

.....

.....

What do you normally read **first** in each issue? – apart from the contents list .....

Is there any aspect of tape recording or hi-fi which you feel is insufficiently covered in *ATR*?

.....

.....

.....

Roughly how much per year do you spend on tape recording and hi-fi? (Remember not only basic equipment but accessories, tape, discs, books, magazines, travelling, club subscriptions, etc.) £.....

On which do you spend more? Tape recording ☐ Hi-fi ☐

How do the following points influence your choice of new equipment? (Rank them from 1 to 4 in *your* order of importance.)
High quality performance ☐
Low price ☐
Guarantee ☐
Good after-sales service ☐

Who or what do you consult for information about equipment currently available on the market? Rate these sources 1 to 6 in *your* order of preference:
Friends' advice ☐
Editorial features, eg test reports, in *ATR* ☐
Advertisements in *ATR* ☐
Other audio and tape magazines ☐
Dealers' advice ☐
Other advertising ☐

What are your other major hobbies apart from tape recording or hi-fi? .....

.....

Which audio and tape magazines do you read regularly?

.....

.....

How often do you buy *ATR*?
regularly by subscription? ☐
every month from newsagent/bookstall? ☐
every other month? ☐
less frequently? ☐

How many other people usually read *your* copy of *ATR*? (Include your family, club associates, etc., if appropriate.)
.....

Do you have any difficulty in obtaining *ATR*?
Yes ☐ No ☐

Do you usually buy – well-known brands of tape? ☐
– cheaper or cut-price tape? ☐

Do you also buy – pre-recorded tapes? ☐
– discs? ☐

Are you a member of a tape club? Yes ☐ No ☐

Do you tapespond with other people – regularly? ☐
occasionally? ☐
never? ☐

Do you construct some of your own equipment or accessories?
Yes ☐ No ☐

WHAT'S NEW IN STEREO?

A. Campbell Gifford reviews some recent pre-recorded stereo tapes

During 1966 more pre-recorded stereo tapes than ever before have become available in Great Britain, including the 3¾ ips 4-track stereo tapes from the USA, 1⅞ ips music cassettes from Europe and even 4-track stereo tapes that play for 3 hours – also from the USA. Unfortunately relatively few dealers really took to the idea of the expensive reel-to-reel issues at 75*s* and above, preferring to concentrate on the 40*s* music cassettes, thus leaving the serious music lover to fend for himself by picking up snippets of information from magazines, here and there.

Despite its price, the longer playing tape is more popular on both sides of the Atlantic and for this reason Epic produced *Dvorak's Symphonies* 7, 8 *and* 9 (*New World*) all on one 3¾ ips 4-track tape which sells at around £5. Although I cannot imagine myself wanting to sit down and listen to all three symphonies at one session, I have to admit that the stereo effect is excellent and the performance among the best I've heard. One has come to expect such things from George Szell and the Cleveland Orchestra. The recording is most impressive with a rather better bass response than is usually found on 3¾ ips dubbings. This tape (*Epic E3C*848) is the equivalent of three LP discs and represents outstandingly good value.

The Columbia issue (CBS here) of Eugene Ormandy, the Philadelphia Orchestra and Mason Jones (horn) provides a treat which will not be forgotten: *Mozart's Horn Concertos Nos* 1, 2, 3 *and* 4. When you listen to these works played on the modern valved horn it is difficult to imagine them having been written for and performed upon the old-fashioned valveless horn. On this recording the horn player, Mason Jones, is the first desk horn player in the orchestra. He plays with remarkable ease, clean delicious tone throughout and, what is more, the cadenzas are his own composition. The accompaniment has an almost feline lightness and the sound is just right all the time. Over 52 minutes of sheer delight, if you like horn playing.

On the lighter side there was a tape which did not reach shops beyond the Edgware Road. This featured the piano playing of Juan Garcia Esquivel, who is not quite so well known here as he deserves to be. I suppose, in the States, he's about the 'Vice-President' of the cocktail music purveyors. His piano style is pure Carmen Cavallaro, full of fancy, rather pointless arpeggios, but these little embellishments in no way overshadow the fact that the music has been well arranged and very competently performed by Mr Esquivel and the orchestra, which lamentably remains un-named. *Malaguena*, for instance, opens with a harpsichord solo with string accompaniment. *Poinciana* is slightly reminiscent of Les Baxter's *Quiet Village*. Yes, I think it was the best cocktail music I heard during 1966. *RCA FTP* 1324 at 75*s*.

An awful lot of people I know are interested in organ – straight not Wurlitzerized. RCA have been generous with Carl Weinrich who late in 1966 combined with Arthur Feidler and the Feidler Sinfonietta to record *Mozart's Sonatas for Organ and Orchestra.* On *RCA FTC* 3008 they gave us the lot and very good too. Playing, stereo effects and overall sound are excellent and if your speakers will handle it, you can really hear the low register. Power Biggs on *CBS MQ*799 does a similar thing. The music is basically the same – *Mozart's Epistle Sonatas*, all composed for performances in the Cathedral at Salzburg. Real 'organphiles' will notice the subtle but important differences between these two tapes. Carl Weinrich plays these sonatas in just the

continued on page 17

TAPE RECORDING IS FASCINATING

Words of encouragement to the newcomer by H. Ibbotson

What is the attraction that makes the enthusiast so attached to his recorder? It cannot be the value of the actual machine, for this can be cheap or expensive and the interest is still present even if the machine is one of the cheapest types! Could it be that a collection of musical recordings can easily be built up for the initial expense of blank tape? No! I do not think that is the answer, though undoubtedly this can give many hours of pleasure. Perhaps the most likely explanation is the ease with which the everyday sounds of normal life can be captured and stored for future reference. However, whatever the reason, there is no denying that the tape recorder holds a fascination for those who care to explore the possibilities behind this creation of modern science.

Looking back to the time when I bought my first recorder, I cannot, even now, explain exactly why I was drawn to the hobby. I must admit that at first I regarded the tape recorder as a rather expensive toy, and it was not until I saw a copy of *Amateur Tape Recording* that I began to see why so many adults became devoted to this pastime.

My first machine was something of a let-down. True, it was only cheap, costing £18 18*s* 0*d*; even so, one does expect a certain amount of pleasure and service for such an expenditure, but that machine lasted exactly three weeks, then the motor packed up. After repair – which fortunately was free – another month's life was obtained before the motor gave up for the second time. This was the last straw, so to speak. I sent the darned thing back and tried again with a different model. The second machine proved reliable and paved the way to a fascinating hobby which grows with each passing day and each attempt to record something live and new.

Having tried recording from the radio and the voices of friends, interest was beginning to flag, when I came across a book in the local library (*Tape Recording for Everyone, by F. C. Judd*). The spark was re-kindled! Interest grew once more. Here were recording ideas in plenty, and, in particular, names and addresses of tape clubs. But the one that caught my attention most was the address of 'World Tape Pals', so out came the pen and paper and off went to a letter to Dallas, Texas, USA. Now, thanks to the author of that book, I am a very delighted member of World Tape Pals, with tape friends in Sweden and the United States after only three months membership,

Tapesponding

Tapesponding must be one of the most interesting aspects of tape recording. Imagine, the voice of a friend you have never seen, is with you in your own home, sharing your interests. A true and lasting friendship can grow through the medium of your tape recorder. Here is the finest way of learning geography, languages, everyday life of people in distant countries, and a host of other subjects.

Quite apart from the benefits of tapesponding, membership of World Tape Pals brings other pleasures too, as I soon discovered. A news sheet issued free every two months keeps one up to date on all activities, while separate sections within the club cater for stamp collectors, cine and slide photographers, or if you fancy reading for the blind, well, you can do that too. Maybe you fancy joining in with a round robin, all a part of the service to members. Personally, I rather like the idea of the tape library which literally stocks hundreds of master tapes on a variety of subjects. For instance, if your interest lies in a study of the old West, you have no shortage of programmes. The story of the Cowboy is told by a real Cowboy. The Life of Billy the Kid is fully covered by three tape programmes which include an interview with a man who claims to be the notorious Kid. Nor are the Indians overlooked. A tape in my collection – dubbed from the original – deals with the life of the American Indian from way back in pre-history up to the present day, and very interesting it is too! Yet another tape in my collection brings vividly to life the fauna of the Everglade swamps, and one listens with pleasure while a naturalist unfolds the story of night in the Florida Everglades.

All these interesting and varied programmes are entirely free to members of World Tapes for Education, the only cost involved to the member being the supply of sufficient blank tape to cover the programme and return postage, which, after all, is surely not too much to ask!

New Friends

There was a time – before the recorder came on the scene – when life could be so mundane, but now things are so very different. Each day holds a fresh promise of good times. The postman rarely passes by these days. Yesterday my friend from Panama dropped in for a chat! Last week another friend from New Zealand had a talk to me. Tomorrow I think I will call on yet another friend in Sweden for a chat and perhaps hear some Swedish music.

Am I a millionaire? Can I afford to board a plane just when I feel the urge? Indeed no! Quite the reverse. Yet I can still enjoy these things through the medium of my tape recorder. Distance is no object to contact with old friends. How nice to hear a strange, new voice greeting one as a friend, and to feel that friendship grows closer with each recorded tape that makes the voice more familiar. Have a chat, enjoy a good joke and laugh, or perhaps lend a sympathetic ear, and share in trouble told in confidence. Your recorder gives *you* the opportunity to understand your brothers and sisters of other lands. If you have the machine then, for the price of a message tape and postage, life can acquire a new meaning. Get out that recorder and *live*.

IS THE LAW AN ASS?

A legal note for tape recordists by a barrister

Most people who own tape recording machines use them to record broadcast programmes and also to copy commercial discs. In so doing they regularly break the law. In some cases they don't know what the law is, and in other cases they do but they think the law is an ass. Well, is it?

The object of the law is primarily to protect authors and composers who have produced creative works. It also protects record manufacturers who may have spent a lot of money in making a recording of an expensive pop group or a large symphony orchestra, and artists who receive a fee for broadcasting or for recording by a record company, but not for being re-recorded by others. In addition, the BBC and the Independent Television Authority have a copyright in their broadcast programmes.

Let us look at each in turn. First of all authors and composers. Under the Copyright Act, 1956, they are given certain monopoly rights enabling them to restrict the use of their works by others. For example, they alone can authorize publication or the right to perform in public. A further example, not so well known, is that they can restrict the right to 'reproduce' which includes the right to make a record of any sort, and this, of course, is why it is usually an infringement of the composer's right to make a tape recording of his music without his permission.

The cases when it is *not* an infringement to record a copyright work are very few. Some people think that all is well if the recording made is used only for private purposes. *Legally this is not so.* One instance where recording *is* permitted is if the use of the recording is confined to what the Act calls 'fair dealing for the purposes of research or private study'. This might well cover the activities of a musicologist, or indeed of any student of serious music or jazz, but it obviously doesn't cover the tape recordist who records off the air for entertainment purposes.

Another instance of authorized recording relates to education. The Act provides that literary, dramatic, musical and artistic works (but not commercial gramophone records) may be recorded if the recording is made by a teacher or pupil in the course of instruction. Schools can then use the recording for playing to an audience of teachers or pupils (but not parents or guardians) as part of the school activities.

The restrictions can also be overcome by applying for a licence to a central body called the Mechanical Copyright Protection Society which acts for the great majority of owners of recording rights. This Society, following up an arrangement made by it with the Federation of British Tape Recording Clubs, will normally grant an annual licence to cover recording of *most works under its control* for use for private exhibition in homes, in amateur tape and cine clubs for the benefit of other recording enthusiasts, or in national and local amateur competitions. The annual payment is 10*s* to make *sound only* recordings, or £2 10*s* 0*d* to make recordings which are synchronized with film or filmstrip or slides, or £5 to make synchronized recordings for use on a home television tape recorder. The licence in no case covers the right to re-record a commercial gramophone record. The manufacturers of commercial gramophone records, have had their rights protected in this country ever since 1912. Their right to prevent unauthorized copying is absolute, i.e. any sort of re-recording of a commercial disc, whether by taping a disc borrowed from a local public library, or from a friend, or indirectly by taping a broadcast programme containing commercial records such as *Pick of the Pops* on Sunday afternoon, infringes their rights, *no matter how private the subsequent use of the tape may be.* Even if only used for research and private study such recording would still infringe the rights of the gramophone company, though for the reasons given above it would not infringe the rights of the composer of the music on the record. Artists have the right under the Performers' Protection Acts of 1958 and 1963 to prevent unauthorized recording of their perform-

continued on page 17

tape club news

Some of you may have wondered why the final league positions for 1966/7 were not published in last month's issue. The main reason for this is that yours truly wanted to save them for this month and bow out with a flourish. For this is my last month as Club News Editor, and taking over next month will be Miss Isabelle Tournor. I'm sure you will join me in wishing her all the best in her new job, and if she makes as many friends through it as I have done, I know she will enjoy every minute of it (even the late-night slogging over the typewriter!). KC

Bath

As a result of the recent AGM of the Bath Sound Recording Society, the club secretary is Mr C. J. Griffee of 26 Court Farm Road, Wilsbridge, near Bristol. Chairman is Mr C. R. F. Herbert; treasurer is Mr A. H. Tregale; programme director Mr J. Fishlock; and hospital representative Mr B. Davies.

Most of the club's efforts during the past year have gone into the preparation and relaying of programmes for the Bath Hospital Broadcast Society, and over 200 hours of programme have been recorded. Outstanding events in the year include the recording of the *Cardiff Tattoo* and a number of church services, providing PA installation for hospital fetes (despite severe opposition from the weather), and the relaying of Somerset County Cricket Match commentaries on games played locally, and five special concerts specially for hospital patients. Celebrities interviewed for the programmes have included The Barron Knights, Hattie Jacques, Harry Corbett and Sooty, Manfred Mann, Ralph Wightman, The Bachelors, and The Seekers.

Club meetings in future will be held on the Monday prior to the second and fourth Wednesday in the month.

Derby

Two members of the Derby TR Club, John Smith and Peter Milner, combined forces to produce a two-part comedy adventure production in the regular series *All Your Own*, with the 'hero' somewhere in Russia at the end of part one. Members are looking forward with interest to part two.

The subject of the monthly competition was *A Haunted House*, and to give the right atmosphere members judged entries in darkness. As a result, Alf Stanway was placed first with Arthur Jeffries second and Martin Stanway third.

At the club's annual dinner and social evening, Chairman Ernest Flecknoe spoke of the very friendly atmosphere at club meetings, where people from all walks of life were united in a common interest. An open night, which should provide an added increase in membership, has been planned for 3 March in the Becket Rooms, Becket Street, Derby. Mr Flecknoe also presented the club competition Champion's Cup for the past year to Arthur Jeffries.

Doncaster

Members of the Doncaster and District TR Club were particularly impressed with a demonstration by the club's technical adviser, R. Broome, dealing with microphones ranging from the Post Office carbon to the modern condenser. Examples of condenser recordings were supplied by Mr Mick Plant of Leeds.

Regular newsletter nights – a monthly ritual when members listen to news from other clubs – have continued to be a popular part of the club programme.

The club's first tape competition was judged by members of the Leeds TRC and Mr Alf Huckle was the winner with his recording of a bonfire with commentary by a small boy. The second prize was won by the club's studio manager, Ron Brackenbury, with a Jack Jackson-type spy story.

London

A popular item in the programme of the London TRC was the playback of the winning tapes in the 1966 BATR contest, followed by discussion and comment on the tapes and playback of additional tapes brought along by club members.

At the club's annual film evening the members of the Edgware Cine Society supplied the films and Ken and Dorothy Blake supplied the necessary equipment.

Norwich

Members of the Norwich TRS have also had an opportunity of listening to the winning tape in the 1966 BATR contest. At the meeting prior to this, members heard the club tape, *Sounds Interesting*, which gives details of recording in general and the club's activities in particular.

The next big meeting will be taken up with an auction of all sorts of odds and ends of unwanted equipment. Ten per cent of the money realized by the auction will be paid into club funds.

South Devon

A party of members of the South Devon TRC took a look behind the scenes at Westward television studios, Plymouth, recently. They were lucky in getting two engineers, Mr K. Lloyd and Mr B. Warner, to explain the various equipment and answer the visitors' many questions.

A few days later members visited a local cinema which has recently had the latest Italian sound/film equipment installed. Here they were able to sample some of the six-channel stereo soundtrack from *The Sound of Music*. Three-speaker systems were employed behind the screen and fourteen ambient speakers around the cinema provided special effects.

Southall

Southall TRC recently held its sixth AGM at which John Weed, Arnold Highcazony and Ted Lyon were re-elected chairman, secretary and treasurer, respectively. In his review of the past year, the chairman pointed out that once again the Southall Show had been the highlight of the year and much work had been put in by all members towards making it a success.

During the 'Any Other Business' section of the agenda it was suggested that the club should broaden its activities by including demonstrations of hi-fi equipment and record recitals in its programmes.

Meetings are held every Monday evening at Talbot Road School, Talbot Road, Southall, and commence at 7.30 pm. Further details can be obtained from the secretary at 101 Roseville Road, Hayes, Middlesex.

An *ATR* reader, Mr D. Dansey, writes that there is a need for a club in his area and as a result he is starting the **Archway Tape and Cine Club**. He proposes to hold meetings on alternate Wednesday evenings and interested readers are asked to contact Mr Dansey at 788 Holloway Road, London N19.

LEAGUE CHAMPIONSHIP

1	Rugby	142
2	Thornton Heath	130
3	Leicester	101
4	Leeds	98
5	Derby	94
6	Brighton	80
7	N London	74
8	Coventry	61
9	S Devon B-TRAC	57
10	London	54
11	Doncaster	49
12	Montrose	47
13	Norwich	44
14	ITACS	38
15	Radio Scotland	37
16	Friern Barnet Great Yarmouth	33
17	Newcastle	31
18	Reading	30
19	Southend	29
20	Merseyside	24
21	Furness	23
22	W Middlesex	22
23	Ferrograph Owners	20
24	Park	18
25	Bournemouth	15
26	South Reach	13
27	Bromley Dublin Harvey School Walthamstow	12
28	Dartford	10
29	Boston Redbridge Millom	8
30	CSD	6
31	Barrow CTRI Ipswich Middleton Northern Overseas Students Solent Tape Link Teip Gael Southampton University Uxbridge Warwick and Leamington WTP WWTT	4
32	DDB Sound	2

WHAT'S NEW IN STEREO?

continued from page 13

order he fancies and observes all the repeats, but his sound is not quite so big and bold as Power Biggs. Carl Weinrich plays his part on the organ of the General Theological Seminary in New York City, the instrument is a relatively large modern baroque style Holtkamp, whereas Power Biggs' performance is on the Mozartian-period organ in the Stadtpfarrkirche, Eisenstadt. Personally, I go for the Carl Weinrich, largely because I have the original set of Power Biggs and the Feidler Sinfonietta of years ago on an old set of RCA 78s.

One final note, this time of piano. Ravel's *Gaspard de la Nuit*, Chopin's *Scherzo No* 4 *Op* 54 and *Nocturne No* 17 *Op* 62 and Debussy's *L'Isle Joyeuse* played by Vladimir Ashkenazy, who first came into my life at a provincial concert hall on the night President Kennedy was shot. He came on after the interval and played some Chopin as a 'tribute to the passing of a great man'. He was not so well known then and a little overshadowed by our own John Ogdon, with whom he nearly shared the prize in a piano competition in Moscow. At that time I felt he was a pianist of whom I should hear a great deal more. Well, here is an Ashkenazy *tour de force* with a flash of magic. Here we have, without a doubt, a magical stereo recording of a piano, fascinating for its wonderful pianissimo passages. This coupled with the playing of a pianist who demonstrates his mastery of his instrument with limpidly eloquent Chopin and sparkling Debussy. This to me is the finest piano recital I have ever heard on tape. Yet I am told that it was offered to over 180 dealers in this country and only three bought! *London LCL*80176 at 75*s*.

All the tapes mentioned in this article can be obtained through leading dealers, to order, or from Teletape Ltd, 33 *Edgware Road, London W2, or Transatlantic Music Tapes (Distributors) Ltd,* 36 *High Street, Salisbury, Wilts.*

IS THE LAW AN ASS?

continued from page 15

ances, and this applies to performers of all sorts – musicians, actors, or even speakers provided that in the latter case they are using a script or text of some sort, as opposed to speaking impromptu. The Acts would thus apply, for example, to a clergyman reading prayers, but not to people taking part in interviews or discussions. It is, however, a defence under these Acts if the recording has been made 'for the private and domestic use' of the person making it, but this does not legally enable him to give or even lend the tape to his friends and still less, of course, to have it processed by a recording firm.

Finally, the BBC and the ITA. They were given a copyright in their programmes by the 1956 Copyright Act which enables them, amongst other things, to prevent the recording of their programmes but only 'otherwise than for private purposes', a phrase which is slightly wider than the phrase 'private and domestic use' which is used for the performers. Because of this maze of restrictions, the BBC has made special arrangements with artists' unions and with commercial record companies to enable schools to record its schools broadcasts (but not other broadcasts) without getting all the special permissions which the law as described above would entail. The schools can only use their recordings for instructional purposes in class and they have to destroy them at the end of the school year or, in the case of radiovision programmes only, at the end of the third school year.

The fact is that the law as it stands is absurdly complicated. The use of varying phrases such as 'research and private study', 'private and domestic purposes' and 'private purposes' in different contexts means that the various bits of the law fit together badly. Of course the main objection is that, in practice, they are largely unenforceable. The law is not really an ass. In general it means well, even if it works badly. It is rather like a woman who wears clothes that don't fit and don't match, in order to show her respectability. *By courtesy of The British Broadcasting Corporation*

SOUND SCENE

First thing this month is an apology to Tannoy Products Ltd arising out of their letter which we publish below:
'Having carefully read your article (in the October issue), *Audio-view Takes a Look at Loudspeakers*, we feel that some of the information given would lead us into correspondence regarding our loudspeaker enclosures because you indicate that we are making a *Lancaster* with a 12 inch or 15 inch bass loudspeaker unit. This, of course, is not true. The Lancaster is fitted only with the *Monitor* range of dual concentric loudspeakers and is a full-range loudspeaker. We also feel that your readers should be aware that these enclosures are not necessarily suitable for units other than those of our manufacture. We are, however, prepared to supply free of charge constructional details of any of our enclosures other than the *Audio Metric* rectangular and corner GRF and the Guy R. Fountain *Autograph* enclosure, which are only supplied complete to owners of *Monitor* loudspeakers on receipt of the serial numbers.'
Tannoy Products Ltd, London SE27 **J. J. Bunt**
(Technical Representative)

Metrosound Accessories (Fig. 1)
A new display rack to be shown by most dealers contains a selection of all the well known Metrosound Audio and Tape Accessories, such as leader tape (four different colours), stop foil and splicing block, plus a number of entirely new products. These will be of extra special interest:
Metrosound spirit level. For use on turntables and for all levelling needs. A button-type spirit level that can be mounted permanently into desired position by fixing screws supplied. Retail price 6*s*.
Metroscale stylus balance. A unique idea from Metrosound giving positive and accurate stylus pressure readings. Retail price 7*s* 1*d*, incl. pt.
Metrosound lubrication kit. For tape recorders, transcription turntables and all mechanical and moving parts of machines of all types. Retail price 6*s*. All Metrosound products are presented in attractive 'bubble packs' complete with instructions.

Safe Electrical Connections
The Rendar *Safeblock* shown in Fig. 2 is an ingenious device which enables electrical equipment to be safely connected to the mains supply in seconds. Although it has been known to the electrical trade for some years, the device has not previously been available to the general public and it is certain that many people using tape recorders, projectors, amplifiers and test equipment will find it invaluable. For people engaged in testing electrical equipment in shops before sale, the Safebloc can save a great deal of time and send the customer away secure in the knowledge that his equipment is in working order.
Basically, the unit consists of a black plastic casing, into which may be wired a length of cable and a plug suited to the user's main supply socket. When the lid of the Safebloc is opened, three colour-coded spring clips are revealed in the base and a heavy-gauge fused bridging piece may be seen to be attached within the lid. The action of opening the lid automatically cuts off the supply of current and the appropriate wires connected to the electrical apparatus may then be inserted into the spring clips. Closing the lid completes the circuit and the apparatus is used normally.
The Safebloc is supplied complete with standard 5 amp cartridge fuse but, if this is replaced with a 13 amp fuse, greater loads may be carried. It can be fixed to a workbench or wall with the fixing screws provided or may be employed at the end of a trailing lead for utmost versatility. The Rendar Safebloc is available from Guildford Mail Order, 6 Leapale Road, Guildford, Surrey, at £2 7*s* 6*d* including postage and packing.

Fig. 1. The Metrosound Accessories display now to be found in most tape and hi-fi shops.

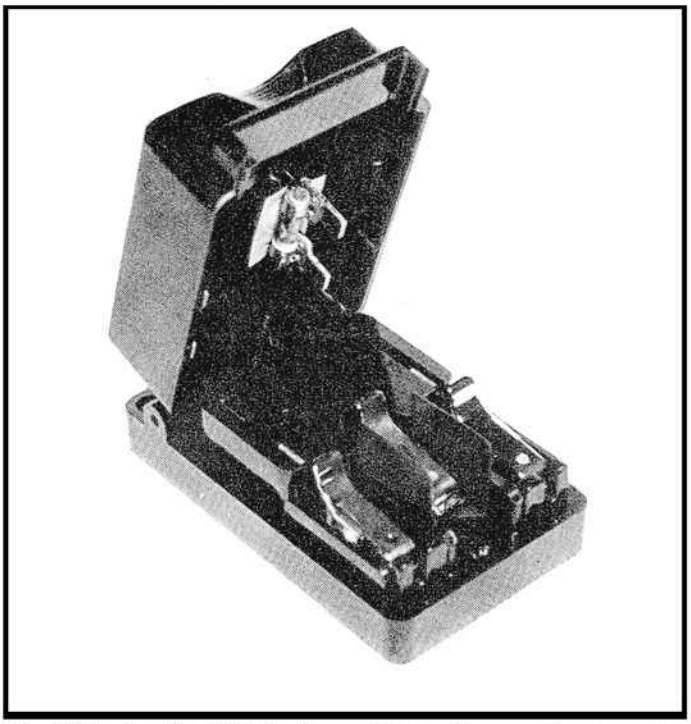


Fig. 2. The Rendar Safebloc for rapid but safe connections to mains supplies, etc.

New Truvox Tape Recorder
Truvox announce the release of a new model in their well-known Series 100 range of equipment – the Truvox Belgravia (Fig. 3). This is the first time that Truvox have given a name as well as a model number to a recorder and, following normal Truvox practice, the model will be available in two-track or four-track, the model numbers being respectively RB102 and RB104. The Truvox Belgravia features a solid wood, teak finish cabinet with slotted loudspeaker grill. The advanced electronics include solid state silicon all-transistor circuitry. The deck facilities offered by the Belgravia are identical to those available on the standard R102 and R104 recorders from the present series 100 range. The model is being primarily marketed for the man who requires the best achievements of modern design and at the same time wishes to enhance his home with a tape recorder that blends into any room setting. The retail price, complete with a 7 inch spool of tape and all other accessories, including a moving coil microphone, is 93 guineas. The price is the same for both models. Further details from Truvox Ltd, Neasden Lane, London NW10.

Fig. 3. The new Truvox Belgravia tape recorder is available for two- or four-track operation.

Fig. 4. New Synchrotape pack with free insurance cover for purchasers.

Free Insurance

Synchrotape users can get up to £25 free insurance cover against loss of their recording machine by theft or fire. Completely free to purchasers of 5, 5¾ and 7 inch reels in standard, long and double play grades, the nine available sizes of Synchrotape are now packed with full details of the scheme. Additionally, all Synchrotape boxes are 'Propathene' film sealed and further technical refinements are incorporated in the PVC base material and polished coatings. Fig. 4 shows the new Synchrotape 'free insurance' pack.

THE MANY MOODS OF

EMI

THE GREATEST RECORDING ORGANISATION IN THE WORLD

MUSICASSETTES

Cilla Black

SING ME A RAINBOW
Parlophone TC-PCS7004

George Martin

ON THE BEATLE TRACK
Parlophone TC-PCS3057

Frank Ifield

BORN FREE
Columbia TC-SCX3485

George Mitchell Minstrels

BIG BEN MINSTREL SHOW
Columbia TC-SCX3293

Michael Collins

MELODIES THAT WILL LIVE FOREVER
Columbia TC-SCX3411

Wout Steenhuis

SURFIN' WITH WOUT STEENHUIS
Columbia TS-SCX3585

TECHNICAL ABBREVIATIONS USED IN ATR

The following technical abbreviations will be used in all *ATR* Editorial as from this issue. Note the use of the now International abbreviation for frequency, i.e. Hertz—Hz.

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
μV	Microvolts, e.g. 100μV
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
μFd	Microfarads, e.g. 200μF (or 200mFd)
pFd	Picofarads, e.g. 10pFd
Ω	Omega (Greek symbol) used for 'ohms'
π	pi (Greek symbol)
dc	Direct current
ac	Alternating current
rms	Root-mean-square
mS	Milliseconds, e.g. 10mS
μS	Microseconds, e.g. 100μS
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

BOB DANVERS-WALKER

Sounds out British Rail

Tape recording on trains, ships and hovercraft

Take a look around the world and you'll find that some shipping companies are running airlines, underground systems have bus services, motor coach lines operate lake steamers and certain hydrofoil, helicopter and funicular services stem from managements which once ran tramways and cablecars. Perhaps future operators of monorails, escalators and moving pavements will emerge from a present-day manufacturer of pogo-sticks? But the ships, hovercraft and diesel-electric locomotives of British Rail are excitingly new and well worth recording.

Look at it this way. If in 1825 George Stephenson had had a tape recorder to capture the sound of the first railway (Stockton and Darlington colliery line) or designer Sir Charles Parsons the first turbine ship in 1894 (the *Turbinia* at Wallsend-on-Tyne, Northumberland) or Bleriot when he made the first cross-Channel flight by aeroplane in 1909, just imagine how valuable those tapes would have been today. By the same token a journey recorded aboard the latest cross-Channel car carrier will, when the Channel Tunnel is operating, have an historic value in time. And when, in the future, inter-planetary travel makes today's 'Deltic' diesels look as antiquated as Stephenson's 'Rocket' and hover-trains and hover-cars replace the rolling-stock and automobiles on planet Earth, then those recordings which I suggest you make now on the three 'prime movers' of British Rail could cause your great-great-grandchildren to think of you as a very forward-thinking and 'sound' ancestor.

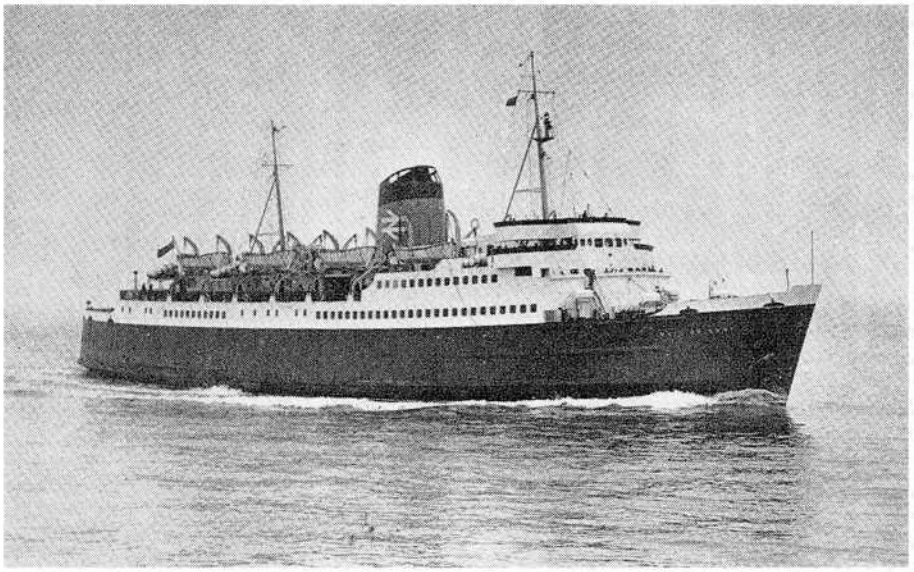
Fred Judd and I spent two very full days exploring the rolling, floating and hovering stock of BR operating between Waterloo – Southampton – Cowes and Victoria – Dover – Boulogne. We both carried Uher 4000 battery portables, four different microphones, Uher M.514, Beyer M.119, Sennheiser MD.421 and a Sennheiser MD.214 moving-coil, neck microphone 'camouflaged' in a brief case for experimental interviews – a new technique I have been exploring. The accompanying photographs and captions will give a fair idea of some of the locations where you could gather sound effects for a travelogue or library effects. A useful tip is to remember this: on outward journeys you will of course be on the alert to snatch every possible sound, but should you fail once or twice or lose a really choice sound, bear in mind that you will be covering the same ground on the way back. So use the outward trip as a reconnaissance and jot down a note in your log book for example, that sequence just outside X where the train travels at speed over a series of points before entering a tunnel. On the return you can be switched on and ready.

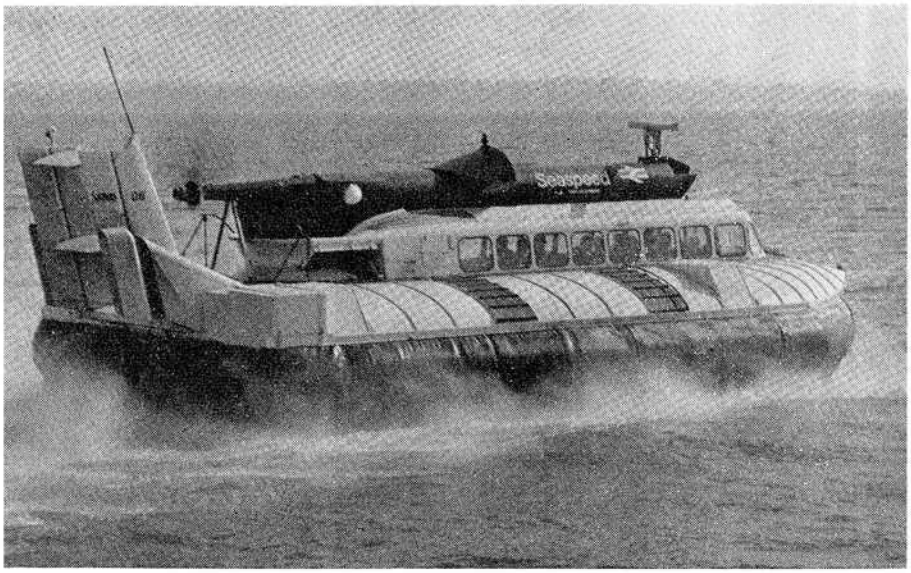
Programme building is usually more successful if all the sound ingredients are gathered first and later dubbed on to the master tape when the story has been written and the narrative recorded. An occasional eye-witness sequence in your own voice (if you're also narrating the story) recorded at the time will help to add a touch of actuality to the production, just as the voices of people met and interviewed give scope and interest to the travelogue. It's that casual comment or colourful phrase which you should always be on the lookout for. I found a most revealing one which I have used in the caption to the photo of the *Maid of Kent* picture. As the Master of the car carrier said: '*How many people realize that our railways have more sea-going vessels than any other shipping company in Britain.*' TR clubs should 'sound out' British Rail about their Mini-Tours, their City to City services and other travel facilities ashore and afloat which, at reasonable cost, can offer quite a lot. Here you have good sources for organized sound hunts. If contact is made with a BR official beforehand, special consideration and help will always be forthcoming. With every club member turning in tapes well-filled with sounds gathered on the excursion the club will be well stocked for a production to which all have contributed something. I speak from experience when I say that today's sounds are tomorrow's history. In my library I have the sound of the first 'Cushioncraft' made by the Britten-Norman organization at Bembridge on the Isle of Wight. I know it's unique because I was the only person to record it – and I was on it, a scarlet, flying-saucer-shaped 'ground effect machine' built to transport bananas from the plantations in the Cameroons.

Top left: The sound of a 12-cylinder, 3,300-hp Deltic *diesel at speed, its blaring horns and growling exhaust note creating the Doppler effect as it approaches and flashes by, is my idea of a dramatic sound with which to open a programme about 'the three prime movers of BR'.*

Top centre: Driver Walter Hawkins provides a few technical details about the Crompton diesel he drives before he takes the Southampton train out of Waterloo Station. The station announcer's voice from PA loudspeaker lent atmosphere to the interview.

Top right: The cross-Channel car carrier Maid of Kent *on the Dover–Boulogne run. In numbers of vessels, British Rail is the largest shipping company in the country. Cheap winter mini-*





tours at £18 return for a car and four passengers (also in summer, Monday–Thursday inclusive) make this a good bet for a sound-gathering excursion to the Continent.

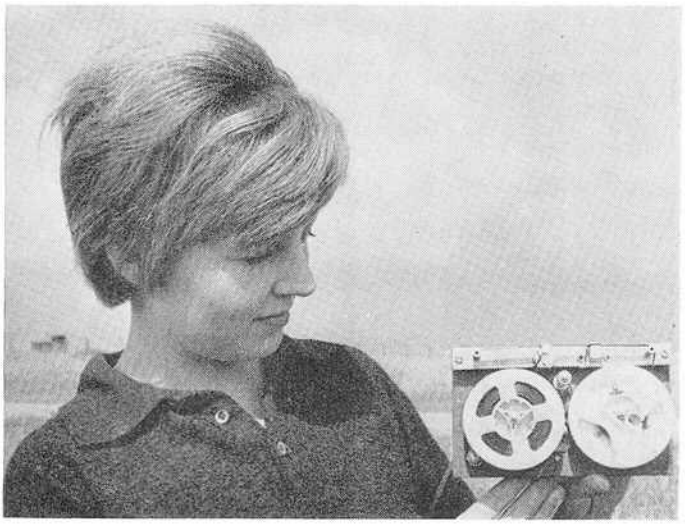
Centre left: Master of Maid of Kent *is Capt. James Giddy, who invited me on to the bridge. I was told that people with tape recorders bent upon a set purpose would receive the same consideration as those with cameras. A call at the Purser's office first is the proper thing to do if you want to seek a favour.*

Centre: By special permission of the Chief Engineer, the engine-room of the car carrier offered up its noise to the Sennheiser MD421 still wearing its wind gag after a quick descent from the deck where the cars had been on-loaded through the stern of the ship. The MD421 is a cardioid microphone with a built-in variable bass attenuator. It also has dual impedance.

Centre right: Travelling at 56 knots, the 38-seater Westland SRN6 Seaspeed *hovercraft crossing the Solent between Southampton and Cowes at an altitude of 4 feet. Return fare 30s. Most typical sound is arrival (or departure) of the craft as it comes in from the sea on to the ground at the Hoverport.*

Lower right: The pilot of the Seaspeed *is Commander Hermod Brenna-Lund, a Norwegian. The instrument panel shows air speed, propeller pitch and power turbine rpm indicators, fuel and oil gauges. Explaining the control of hover height and speed, the Commander claims the lowest altitude record – 6 inches.*

A BATTERY-DRIVEN TAPE DECK



by B. E. Wilkinson

The details that follow are the constructional steps for a battery-driven tape deck, built from low-cost and easily-available materials. No special techniques or tools are necessary, the deck being complete in that all necessary functions are provided. One dc motor is used to drive the take-up and supply spools directly. This type of drive may have certain disadvantages, but it is a mistake to think that wow and flutter are necessarily among them. It is easier and less costly to arrange than a capstan system and therefore found in inexpensive equipment where any speed fluctuation is due to the construction rather than the principle. The success of the drive depends on factors which are controllable, so that by careful adjustment and, in particular, accurate centre-finding, there is no reason why perfectly acceptable results cannot be obtained.

The most difficult problem was finding a simple and reliable method of applying the drive to the take-up spool during record and replay and switching it to the supply spool during the rewind function. It is usual with this type of drive to swing the motor into contact with the relevant spool or vice versa, but I felt that the drive could be simplified if I contrived to fix both motor and spool shafts firmly to the deck. The drive system finally adopted is shown in Fig. 1, which illustrates the layout of my deck. Perhaps I should point out at this stage that the layout should be regarded as a guide only and the reader may well prefer a deck of different size with different positions for the heads, guides, etc. The relative positions of the spools, however, are fixed by certain dimensions in the drive.

Two drums are shown, carried on shafts fixed to the deck. A rubber-tyred idler wheel is carried in a swinging arm which, mounted on the motor shaft, is shown engaging the take-up spool drum. Clockwise rotation of the motor shaft causes anti-clockwise rotation of the idler and clockwise rotation of the drum. A small wire spring carried in the swinging arm bears lightly against the motor shaft and the friction between shaft and spring tends to make the arm rotate in a clockwise direction. However, it can only move to a position where the idler engages the drum and so behaves as if it were spring-loaded, thus maintaining the engagement. If the polarity of the motor supply is now reversed, the shaft will turn in an anti-clockwise direction and this will cause the swinging arm to rotate until the idler engages the supply spool drum. This will then rotate anti-clockwise. By making the left-hand or supply spool drum smaller than the take-up drum, we make the rewind speed faster than on record or replay. If the take-up drum is twice the size of the supply drum, then the rewind speed will be twice the record or replay speed. It will be appreciated that this system provides *function* selection, i.e., the ability to switch from record/replay to rewind or vice versa. It is only necessary to reverse the direction of motor shaft rotation.

Construction

First one must choose a suitable motor and the variety of sizes available is considerable. A suitable unit, driven from 1·5 to 4·5 volts, will cost between five and ten shillings and is of the type intended for model work. The motor shown is cylindrical (1 inch diameter) and has a shaft diameter of 2·3mm (3/32 inch approx). The shaft length is 0·35 inch. The first photograph shows the assembled swinging arm on the motor shaft and Fig. 2 shows an exploded view of the arm. No dimensions are given as these depend on the size of the idler and motor shaft available. The idler is the basis of the arm and consists of a rubber-tyred wheel from a model motor car. Some care is required in selecting the wheel as the tyre must be of rubber (not plastic) to give a good friction drive and must not be ribbed or treaded; it must also have a metal hub with a fairly accurate centre. The wheel shown is 0·45 inch diameter including the tyre (see Fig. 3).

I used two small strips of mild steel to form the upper and lower plates of the arm, although brass would be suitable. There are three holes in the identical plates – those at the ends, drilled to clear 6BA and the central one to receive the motor shaft freely. The idler wheel should fit loosely over its rod, so that the central motor shaft hole lies directly over the edge of the tyre. It is important that the idler sideplay is sufficient to allow it to be pushed into contact with the motor shaft. Washers are used on each side of the idler to ensure freedom of rotation. The other 6BA rod is used to maintain the distance between the plates and also to carry the wire spring. This can be easily made from brass wire taken from a small safety pin. It will be seen that there is a small eye at one end and that the spring is V-shaped. Clearly it must be kept fairly small

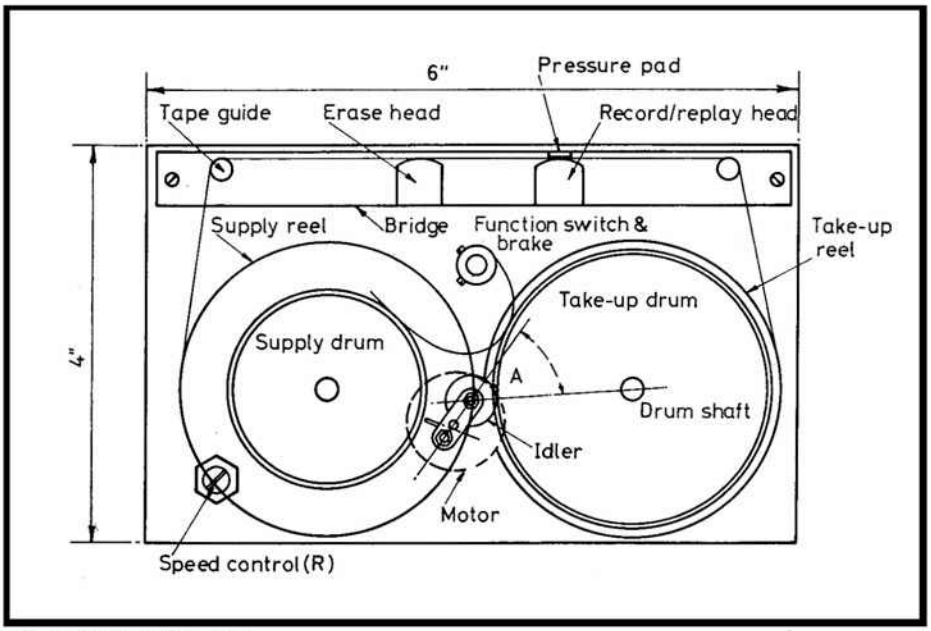


Fig. 1. Layout of the deck.

to avoid fouling the supply spool drum during record and replay (see Fig. 1).

To assemble the swinging arm, proceed as follows:

(a) Tin the lower ends of the 6BA rods and associated holes in the lower plate and solder the rods vertically in the plate. Run a 6BA nut down the rod which will carry the spring and solder lightly in position against the plate.

(b) Place a washer on the other rod, then the idler wheel and then another washer.

(c) Now position the brass wire spring on its rod and add a 6BA nut to hold the spring in position.

(d) Add 6BA nuts until the last nut is just above the level of the idler wheel on the other rod.

(e) Fit the upper plate, which will bear on the 6BA nut, allowing the wheel freedom on its rod.

(f) Run a single nut over the spring rod and tighten so that the plate is firmly held.

(g) Now run a nut over the idler rod until finger-tight against the upper plate. Fit a locknut and tighten.

(h) Saw off any excess 6BA rod.

The completed arm can now be positioned on the motor shaft, which should, of course, be long enough to pass through both plates. Spring pressure on the shaft must be light so that it should not be necessary to deflect the spring very much in order to pass the motor shaft through the plates. The 'clutch' effect of the spring can be checked by running the motor with the shaft vertical and the arm in position. The arm should spin with the shaft. Finger pressure is sufficient to stop the rotation. Under this condition, there should be virtually no reduction in motor speed.

The drums that are engaged by the idler and carry the spool platforms are made from plastic container lids. These are available in a great range of sizes and fortunately the most common sizes are, for our purpose, the most suitable. The take-up spool drum is approximately 3 inches in diameter, though there is no objection to a larger diameter. The supply drum is smaller for a reason already stated, but there are limitations. The spool centres cannot be less than 3 inches apart (3 inch spools) and if the supply drum is too small, the motor cannot be positioned so that the arm will swing to drive both spools. I used a supply drum of 2 inches in diameter. This does not allow a rewind speed much in excess of the record/replay speed, but the problem is solved by using a resistor in the record/replay circuit of the motor. Fig. 4 shows an elevation and exploded view of the take-up drum. It will be seen that the drum floats on a shaft, bolted to the deck. Having found a suitable drum, the first task is to locate the centre accurately. We want to find the centre in relation to the outer surface, since it is here that the idler will apply its drive, and the best way is to draw a circle of the same diameter on a piece of white paper, using a pair of compasses. The circle is then cut out and glued concentrically on the drum. A small pilot drill can then be used through the centre. Care should be taken when drilling as some plastics, although admirable for our purpose, tend to crack if drilled with too much pressure. The hole is then widened progressively to receive the threaded collar from an old potentiometer or wafer switch. When the collar is fixed in position with a nut, the drum can be placed on a $\frac{1}{4}$ inch shaft and spun to test the concentricity. If the drum is not quite true, the collar should be removed and the hole slightly enlarged. The collar is then replaced and, with the nut finger-tight, is moved about until the drum will spin concentrically. Now, the nut should be finally tightened.

A standard take-up spool is carried on a spool platform, which is mounted concentrically on the drum. Platforms can be made or obtained as spares for commercially-made machines. In either case, each platform consists of a disc with a central spigot. I used a 3 inch diameter mild steel disc as a platform and a short length of brass bar (approximately 3 inches in diameter) as a spigot. It was necessary to solder the spigot in the centre of the disc. The bar had a small hole running through it, so this was enlarged to clear 4BA. A 4BA hole was then drilled at the centre of the disc, which was then bolted to the spigot. Disc and spigot were soldered together. After the platform is thus completed, the bolt can be removed, but by soldering its head to the disc, the projecting thread can be used to carry a washer and nut. In this way, the spool can be locked to the platform without the need for blades on the spigot (Fig. 4a).

Mounting the platform on the drum requires some care as they must both be concentric. Fig. 4 shows how the platform is fitted to the drum by means of three 6BA bolts. Spacers are important to prevent the platform from 'bowing' and excessive strain from being put on the brittle plastic of the drum. In the unit shown, the spacers are slightly longer than the internal drum height, so that there is a small gap below the platform. The spacers used were taken from a dismantled wafer switch. To find the positions of the three holes in each part, it is best to scribe concentric circles of equal diameter on drum and platform. Having selected any point on the circumference, two further points 120° part are located. Accuracy is checked by joining up the points – the triangle formed should be equilateral. This is carried out for drum and platform, the parts then being bolted together with the nuts under the drum. This is necessary to prevent excess 6BA bolt from projecting into the spool. The bolt heads do, of course, project above the level of the platform, but lie between the 'spokes' of a positioned spool. If the drum/platform assembly is found on completion to be slightly eccentric, the three holes in the drum should be slightly enlarged so that some adjustment is available before final tightening up. The supply and take-up spool platforms and drums are identical in construction, although the supply drum is smaller. Fig. 5 shows this clearly. Each drum floats on a $\frac{1}{4}$ inch shaft which passes through the threaded collar and is fixed to the deck. Old potentiometer shafts are a good source of $\frac{1}{4}$ inch rod and the shafts can be identical in construction to the tape guides (Fig. 6) except that the groove is not formed.

Deck Construction

The reader may have noticed that although detail of the drive has been considered, little mention of the deck itself has been made. This is because the relative positions of the drum and motor shafts are fairly critical and cannot be determined until both drum and idler sizes are accurately known, i.e., only when the parts are complete. The deck should be stiff, although the choice of material is up to the reader. The deck shown is made of good grade hardboard and is very satisfactory. Whatever material the reader plans to use, however, I would recommend hardboard initially. When the necessary holes have been drilled in the correct positions, the deck can be used as a template for drilling the final deck. In this way, if drilling errors are made, it is only hardboard which has to be scrapped. The first task in making the deck is to decide the size and shape. My own layout (Fig. 1) is self-explanatory. The deck is rectangular and the spools are positioned symmetrically, allowing a space for the heads and guides. It will be noticed that the spools are set as close together as possible to keep the arrangement compact.

Having selected the positions of the spool centres, the next step is to describe two circles representing the drums. The motor shaft position is found by laying the completed swinging arm on the deck in the cleft formed by the drum circles. Using a nail or a piece of wire through the motor shaft hole, a position is easily found where the arm can be swung into contact with either drum. This is shown in Fig. 1 as the angle A. The angle should lie in the 45°–60° range and at this stage it is sufficient to find the motor shaft position where the condition can be obtained approximately. Once the motor and drum shaft positions have been determined, the necessary holes can be drilled. To provide some adjustment for the drive, the drum shaft holes are elongated so that the drums can be moved slightly with respect to the motor. Motor fixing depends on the size and type of the motor which is mounted under the deck with the shaft projecting through. I found that since the shaft was fairly short, it was necessary to pass part of the motor body through a 1 inch diameter hole in the deck. To fix the motor, I used a metal strap made from a jubilee clip (Fig. 7). The length is arranged so that with the motor held firmly there is still a gap between the end tabs, which carry the 6BA nut and bolt. The strap is positioned around the motor and bears on the underside of the deck. A holding-down bolt passes through the deck and secures the strap by means of the holding-down bar and a 6BA nut. This method of securing the motor is perfectly satisfactory.

Initial Testing

At this stage of construction, the drive can be tested. The drums are mounted on their shafts, with washers to reduce friction and adjust the height so that the idler engages about halfway up the drum height. A temporary switch should be connected up so that the motor can be reversed and the arrangement supplied from a battery. When driving, the idler should wedge itself between motor shaft and drum and the drive should be positive enough to lock if the drum is forcibly stopped. If the drive seems to slip or falter under load, the drum shaft should be moved away from the motor shaft. Care has to be taken not to move it too far, or any sudden increase in load may cause the idler to pass between the shaft and drum. If this happens during record or replay, the arm will swing into contact with the supply drum and rotate it so that tape is spilled. If this occurs during rewind, tape will be spilled from the take-up spool. Adjustment of the drum shafts should be all that is necessary to get the drive functioning satisfactorily. Then the drum shaft nuts can be finally tightened.

The speed of the drive in record and replay is controlled by the variable resistor R in the motor circuit. Since the resistor can reduce the tape speed to zero, it is important to ensure

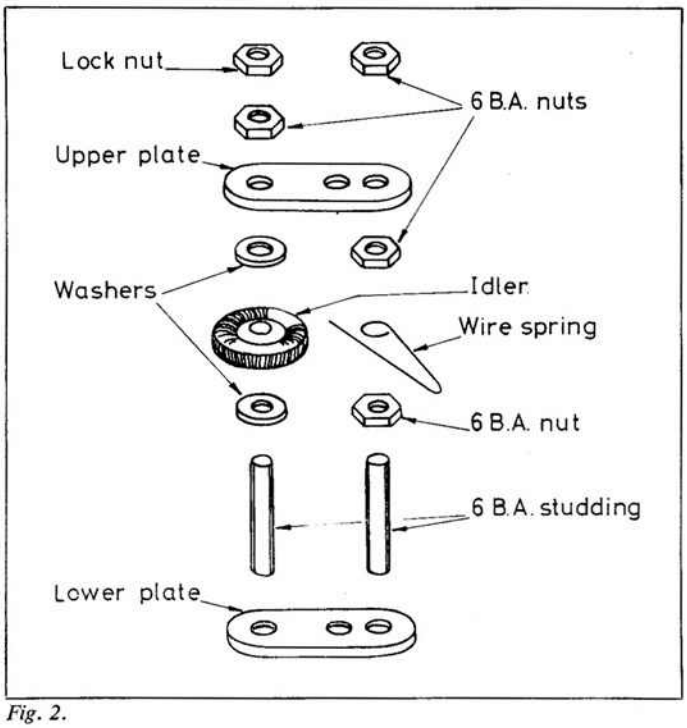


Fig. 2.

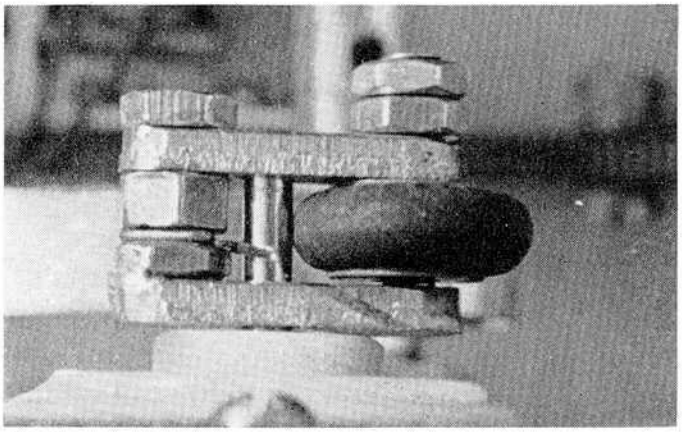


Fig. 3.

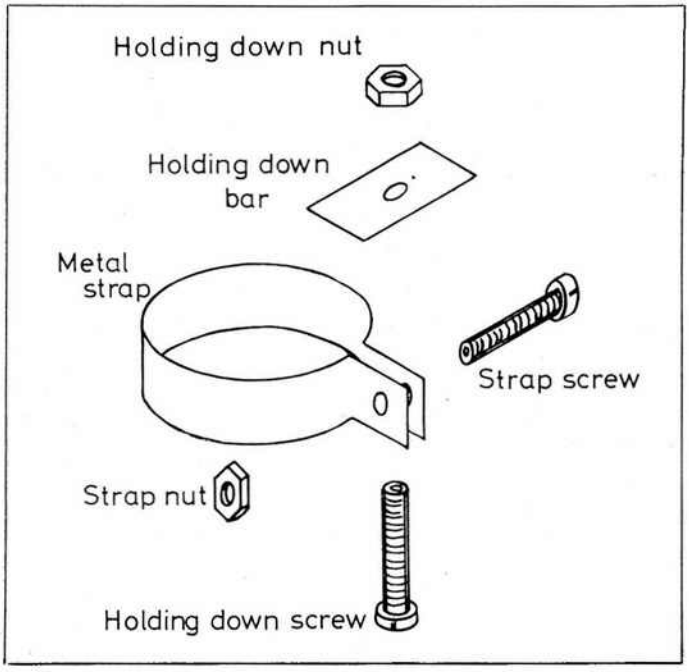


Fig. 7.

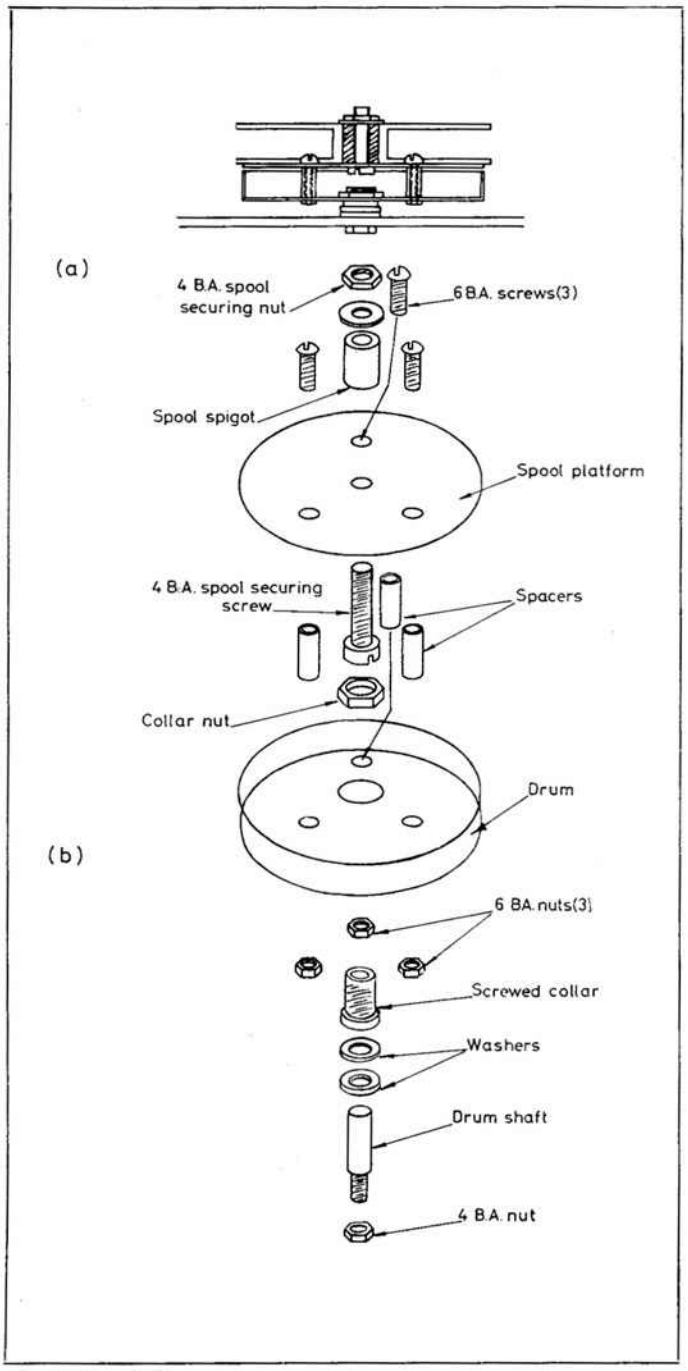


Fig. 4 (a) and (b).

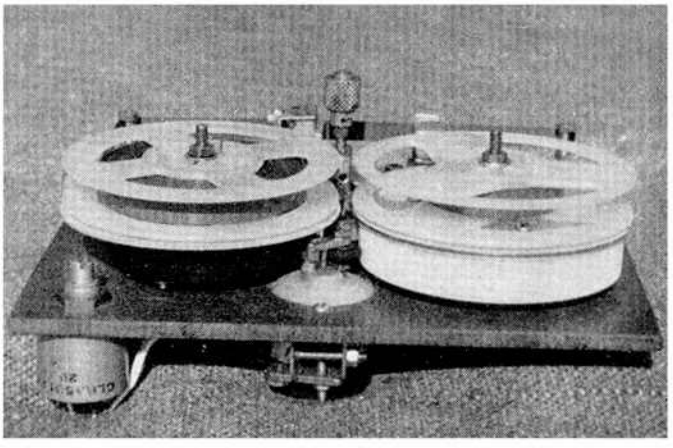


Fig. 5.

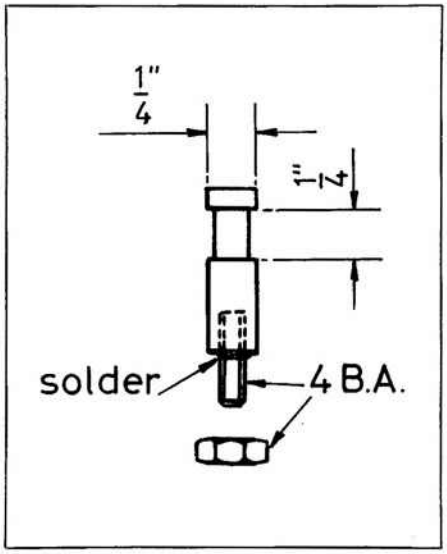


Fig. 6.

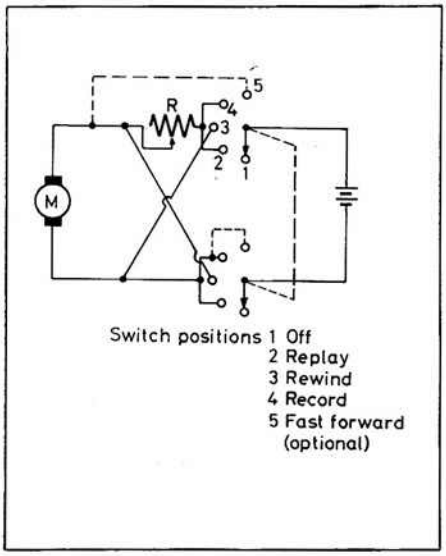


Fig. 8.

Fig. 2. Exploded view of idler wheel arm.

Fig. 3. Assembly of idler wheel arm.

Fig. 4. Drum and platform assembly: (a) elevation; (b) exploded.

Fig. 5. View of drums and drive.

Fig. 6. Detail of tape guides.

Fig. 7. Method of mounting the motor.

Fig. 8. Control circuit for motor.

that the maximum speed is fast enough to give acceptable reproduction. The motor I used was supplied with useful specification which stated that the normal operating speed was approximately 6,000 rev/min. Since the driving shaft is 2·3mm ($\frac{3}{32}$ inches approx) diameter and the take-up drum is very nearly 3 inches in diameter, the speed reduction is $3 \div \frac{3}{32}$ or 32. Assuming this to be roughly 30, then the spool speed will be 6,000/30 or 200 rev/min. The hub diameter is about 1·25 inches and the spool diameter 3 inches, so that the maximum initial and final tape speeds are $5\pi \times 200/40 \times 60 \simeq 4\pi \simeq 12$ in/sec and $3\pi \times 200/60 = 10\pi \simeq 30$ in/sec respectively. In practice, due to loading, the motor speed is less than that specified, but, even assuming a 50% reduction, the tape speed is well in excess of an acceptable value and any suitable tape speed between this and zero can be selected using the resistor.

It has already been stated that function selection is electrical, involving the reversal of the motor supply polarity. This is effected by using a four- or five-position rotary switch in the motor circuit (Fig. 8). The switch consists of two wipers on the rotor, moving over four or five (shown) contacts on the stator. The first contact is not connected and represents the *off* position. Contacts 2 and 4 are connected together and, with the variable resistor R, form the circuit for replay and record respectively. At contact 3, the supply polarity is reversed for the rewind function and R is omitted: this ensures that rewind is always at full speed. Where a four-position switch is used, no fast forward function is provided, but in Fig. 8 I have shown a five-position unit with circuitry for fast forward function shown by dotted lines. Here, the drive is as for replay and record, but R is omitted to ensure full speed, though this will be less than rewind because the take-up drum is the larger. The deck shown in Fig. 5 is fitted with a five-position switch, but is not wired for fast forward. The reader may consider that the sequence of functions is not the most convenient and he can rearrange them if he wishes. It will become evident, however, that there is only one switch position which can be used for the *off function*. R should be low in value – less than 100 ohms, to give fine speed adjustment, but larger values can be used. The potentiometer shown is 0–250 ohms and about one quarter of the available shaft rotation is used.

It will be appreciated that when the motor is not driving – i.e., when the selected function is *off* – both drums will be free and any movement of the deck will cause tape to spill off the spools. To overcome this, a simple brake is carried by the shaft of the rotary function switch and engages both drums in the *off* position. The switch is mounted as shown in Fig. 1. The shaft position is not critical, but it should be nearer to the take-up than the supply drum. The brake itself is a strip of tinplate, bent double to increase stiffness and wound into a spiral, the inner end being soldered to a collar. This is part of a coupling used to link $\frac{1}{4}$ inch shafts and retains its set screws. I found the best way to fit the brake is to solder the tinplate strip tangentially to the collar and then mount the collar on the switch shaft. The strip can now be gradually bent to the spiral which will, in one position, engage both drums. It should now be obvious that *off* must be at the furthest anti-clockwise position of the switch, so that in all other functions the brake is not applied. To secure the collar in the correct position, the function switch is set to *off* and the collar moved anti-clockwise until the brake engages. The set screws are then tightened. Brake pressure need not be sufficient to lock the drums, but simply to prevent rotation. A knob is necessary on the shaft of the function switch and it will be found that a narrow one will be required to avoid fouling the spools.

Tape Heads and Guides

The mechanism of a tape deck is generally arranged so that only the spool platforms project above the deck; the heads and guides are thus fitted directly to the deck at the height of the tape. Owing to the height of the drums, however, the heads and guides must be raised so as to be level with the tape on the spools. The deck is shown fitted with a bridge which carries heads and guides. Made of mild steel bar, 6 inches long and about $\frac{1}{8}$ inch thick, the bridge is mounted by means of 4BA bolts, one at each end. Each bolt carries three nuts, one to secure the bridge against the bolt head and the other two to lock the bolt to the deck. The height of the bridge is thus adjustable by varying the position of these two deck nuts.

The positions for the tape guides are not critical, two are used and are situated on the bridge. I fitted one at each end to allow plenty of space for mounting the heads. Each guide is made of $\frac{1}{4}$ inch rod (brass or mild steel). The tape groove is slightly over $\frac{1}{4}$ inch long and is cut as follows (see Fig. 6):

(a) Mark the groove with a scriber or sharp point.

(b) Secure the bar in the chuck of a hand drill and then mount the drill in a vice.

(c) Turn the drill, holding a hacksaw against the groove marks, until two thin slots are cut; these should not be very deep.

(d) Turn the drill, holding a file against the metal between the slots so that the tape groove is formed.

In this way, quite a satisfactory groove can be turned without the use of a lathe. The guide is secured to the tape deck by means of a short length of 4BA threaded rod (cut from a bolt), which is soldered into a short hole drilled up the base of the guide (Fig. 6). Apart from the length of the groove, the only important dimension of the guide is its height to the lower edge of the groove. This represents the height of the tape above the bridge and should be determined from the height of the head pole faces. It is difficult to be specific about this as the height obviously varies from head to head, as does the method of mounting the head. However, if the guide height is made greater than the pole face height, then the head can be adjusted vertically by adding shims.

The deck carries two heads – record/replay and erase – the positions being such that any point on the tape passes the erase head first during the record and replay functions. The head positions are not critical along the length of the bridge, but should be located carefully along the width. I found the best method of locating head position was to fit the guides to the bridge and position a strip of tape across them, secured with adhesive tape in tension. The erase head is now positioned so that the tape is pressing against the pole faces. The tape should make contact with as little area of head as possible so that the contact pressure at the gap (force due to tape tension/area of tape contact) is as great as possible. The deflection of the tape path from a straight line, therefore,

continued on page 54

TAPE RECORDERS IN THE MAKING

FERROGRAPH

The tape recorder industry is still quite a young one, in this country at least, and one of the very few manufacturers who have been in this industry from the beginning is the Ferrograph Company. Seventeen years ago they made their first tape decks for the Admiralty, who very soon required complete instruments designed and produced to the same standard of precision engineering.

The origin of the Ferrograph Company, however, began in 1919 when two engineers, J. G. Wright and T. G. Weaire, began producing precision assemblies and components for 'wireless'. By 1922, they became leading manufacturers of high quality parts such as coil holders, rheostats, valve holders, and later of high-grade wireless test instruments. The production of the first *Wearite* tape decks and tape recorders (Fig. 1) created such a large demand that the Ferrograph Company was formed for the production of tape recording equipment. From the very beginning, however, a choice had to be made as to whether the new company should abide by the dictates of fashion with chrome-plated, push-button tape recorders designed to catch the eye, or stick to the precision engineering policy inherited from Wright and Weaire. I feel that the somewhat technical and almost clinical appearance of Ferrograph tape recorders underlines the well-designed mechanics and electronics beneath the deck, and one phrase I have often heard applied to Ferrograph machines is 'built like a battleship'. Whilst touring the South Shields factory I was shown vintage models such as their 2A which had been returned for service and checking and which would go out again with the performance restored to its original specification.

Production

There are approximately 400 employees in the South Shields factory where, aside from the familiar 'domesticated' Ferrographs, special recorders are made for the Services, for language laboratories, universities and even for use in fire stations. What is most unusual about Ferrograph is their own manufacture of practically every component used in their tape recorders from hand-made control knobs to tape heads. In fact, everything in a Ferrograph is well and truly 'British Made'. Around the factory can be found mu-metal processing equipment, a stove enamelling bay, machine tool rooms, an electroplating plant, coil winders, and even a carpenter's shop which produces special wooden cases for some service machines and the teak ends for the latest domesticated models.

From the first stages of production to the final packing a rigid inspection system is always in operation. Individual components are checked before and after being assembled in decks, amplifiers and power units, etc., which themselves are tested and matched before they finally emerge as complete tape recorders.

Final Testing

When production is completed every tape recorder now undergoes some 40 different tests concerned with circuit continuity, voltage tests, mechanical functions and performance, head alignment, hum and noise level checks, recording bias level, distortion factor measurement, frequency response, wow and flutter and even mechanical vibration testing. This wide range of performance and alignment checks involves no less than four hours' work

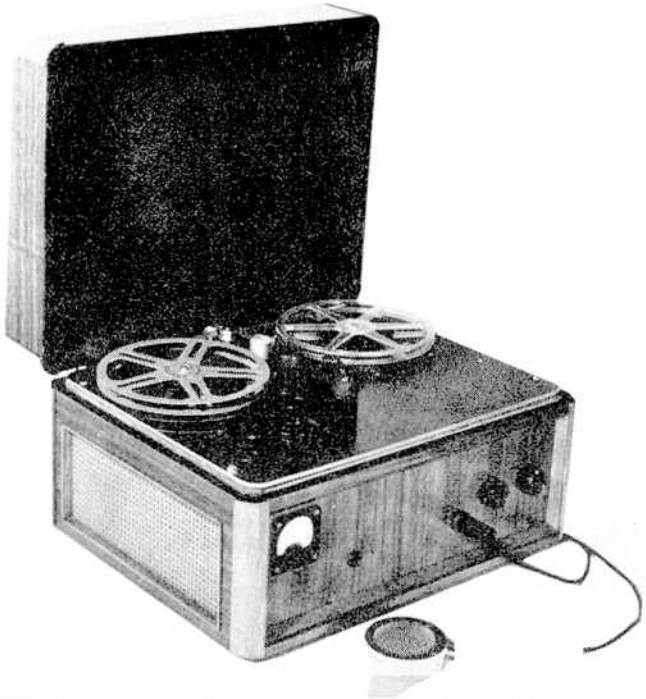


Fig. 1. One of the first Ferrograph tape recorders (circa 1948).

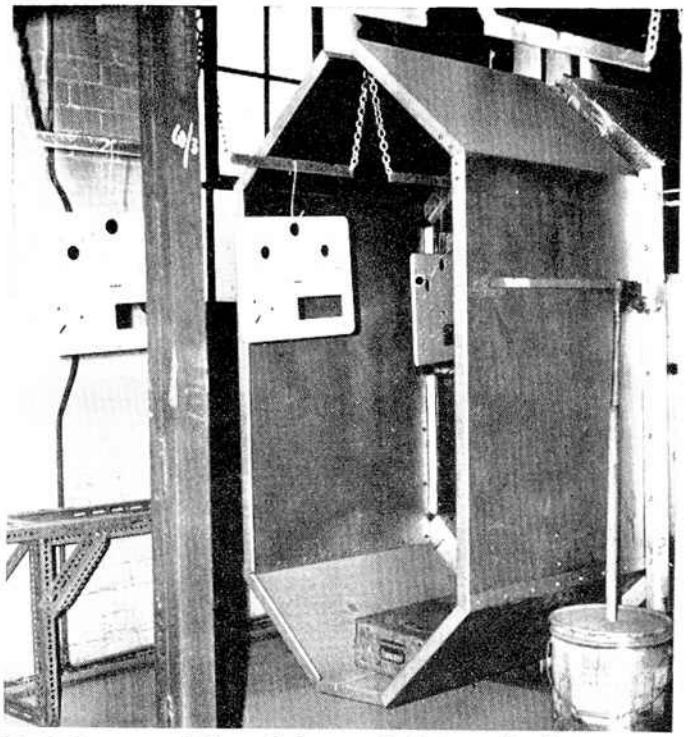


Fig. 2. Stove enamelled tape decks enter the drying and hardening ovens.

Fig. 3. The ATR Editor inspects a capstan flywheel and the machine which produces them.

on every individual tape recorder, the results of which are entered on a production card attached to the recorder.

The most final of all the tests are carried out in a special department where first the wow and flutter percentage is checked and simultaneously pen recorded on to a graph. Then follows the 'B and K' frequency response check – this also being automatically pen recorded. This is an 'off tape' frequency response test and shows the overall record through the playback performance. Ferrograph models such as the 633 which I reviewed recently are actually despatched complete with their pen recorded wow and flutter and frequency response charts and a final test certificate.

Finally, after spending almost an entire day touring the stately home of Ferrograph, I came to the conclusion that their advertising tag *Incomparable Ferrograph* is more than justified. And one other point too; although Ferrograph tape recorders are used 'professionally' by broadcasting and television authorities and by studios, the company do not claim 'professional' performance. Perhaps they are too modest or too honest, I don't know which, but you can rest assured that the performance of every Ferrograph tape recorder is also incomparable. FCJ

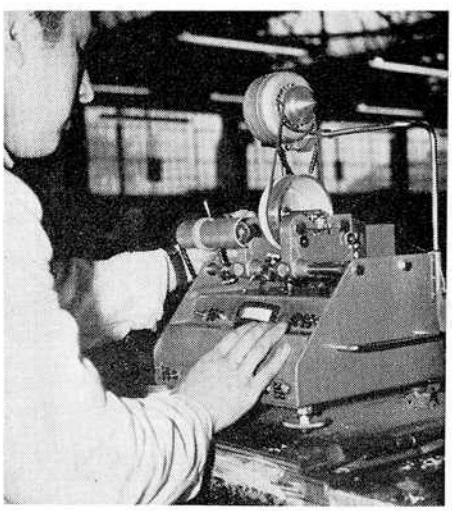


Fig. 4. A special instrument is employed to check accuracy and dynamically balance the flywheels for the deck drive mechanism.

Fig. 5. A Ferrograph-produced machine for grinding recording and erase head faces. Ferrograph are one of the very few tape recorder manufacturers who produce their own record, replay and erase heads.

Fig. 6. Final stage in the assembly and wiring of a Ferrograph tape deck.

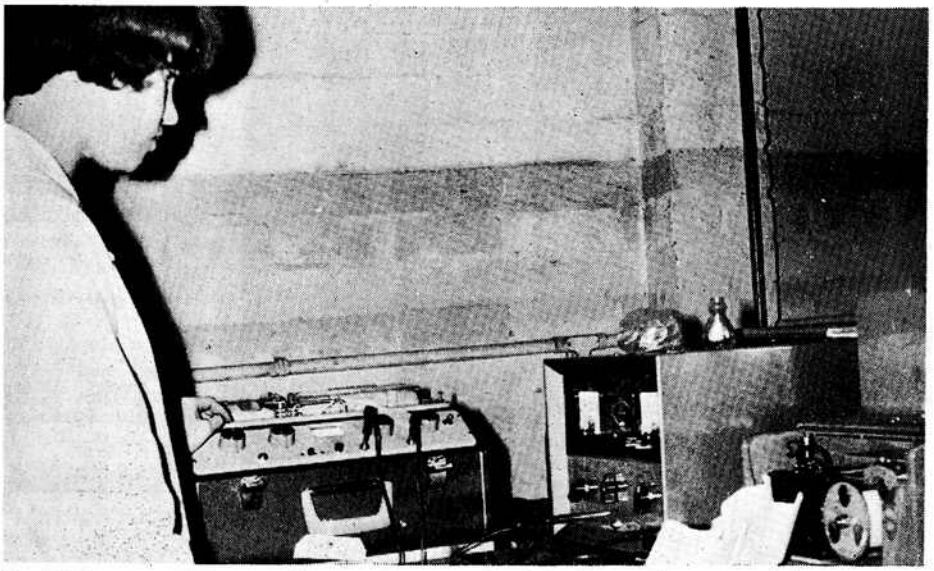


Fig. 7. The wow and flutter performance is measured and simultaneously pen recorded.

TAPE RECORDERS IN THE MAKING

FERROGRAPH

continued

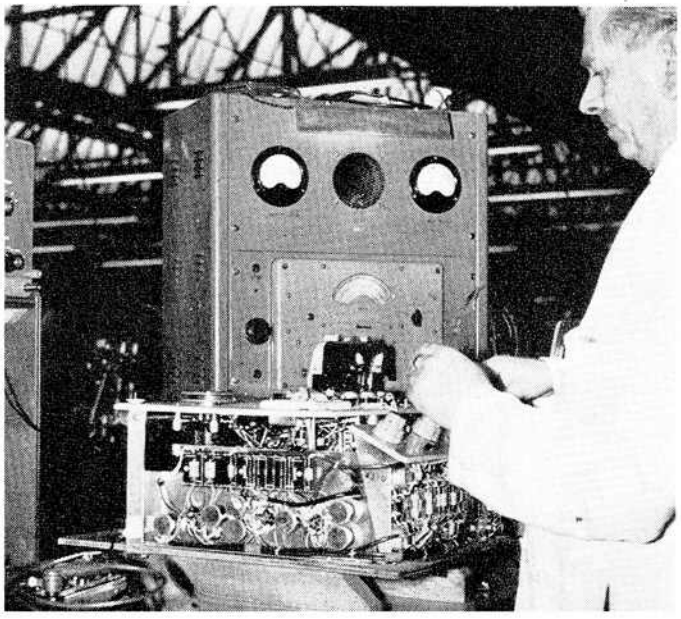


Fig. 8. Preliminary alignment and circuit tests begin immediately a tap recorder leaves the production assembly lines.

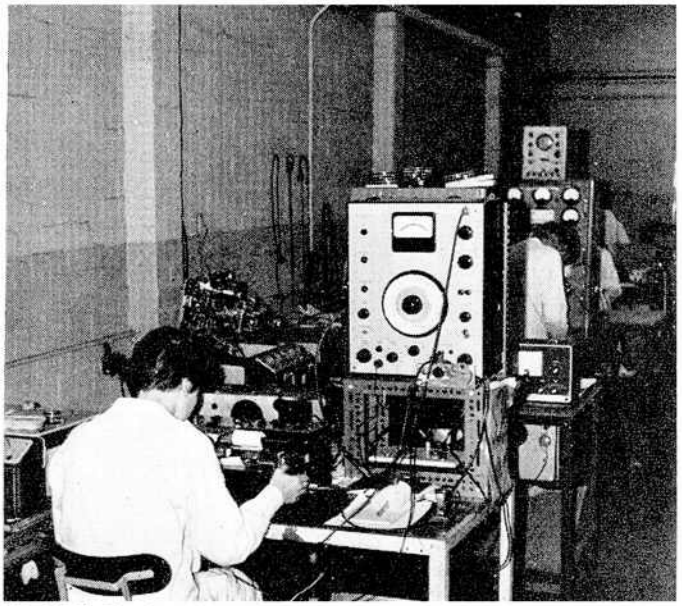


Fig. 9. The Bruel and Kjaer automatic frequency response equipment records the audio response of a tape recorder over the range 20–20,000 Hz.

REVIEW RESLO MICROPHONES

Fig. 1. The Reslo type VRT miniature broadcasting ribbon microphone.

Fig. 2. The Reslo type EC1 cardioid dynamic microphone.

The Reslo Type VRT

This microphone is a special version of the well-known Reslo Type RB and is called the *Broadcasting Miniature Ribbon-type VRT.* It has, in fact, been specially developed to meet the very high standards demanded by broadcasting authorities such as the BBC. This microphone, as shown in Fig. 1 is highly recommended to advanced amateur recordists and for professional studio use. It is available with alternative impedances, namely 300 ohms for studio use (VRT/M) and 30–50 ohms for the more popular low-impedance applications (VRT/L).

The ribbon element, consisting of a moulded plastic frame to which the ribbon is secured, is mounted on the magnet assembly suspended in the main frame by four foam rubber pads. The ribbon is placed in the front shell (the label side) and only the minimum possible internal protective shields are provided. The line matching transformers, which bring the ultra low impedance of the ribbon up to 300 or 30–50 ohms respectively, are mounted within the connecting socket below the microphone hinge. The microphone can therefore be connected via a long screened balanced microphone cable to a suitable low-impedance input socket or to a high-impedance input via a matching transformer-type LTU1. This is dealt with later.

The response of the VRT microphone is checked to within 2dB over the entire frequency range as given in the specification below. Each microphone is supplied with a special padded hardwood instrument case and is supplied complete with 18 ft of cable, plug connector and a set of five alternative mounting adaptors. An eight-page instruction book deals extensively with installation and usage. Since this microphone has a response extending well into the low-frequency range, close speaking or singing can produce unpleasant effects. To offset this, special acoustic pads are provided which can easily be fitted within the microphone shell. As the makers quite rightly point out in the instruction book, this is a professional microphone and must be treated accordingly. Owners should obey the instructions regarding handling and storage, etc. Although this microphone is a precision-made instrument and strongly made, it should definitely not be bounced around the floor! The performance of Reslo microphones is already too well known to need our confirmation. We can only say that if you require a really high-grade microphone with a broadcast studio performance, then, as our recent use of one has shown, this is it. The Reslo VRT/M and VRT/L Miniature Broadcasting ribbon microphones retail at £17 17*s* 0*d* and are manufactured by Reslo Sound Ltd. Further details can be obtained from their sales office at 24 Upper Brook Street, London W1. The technical specifications are included below.

Technical Specification – *Reslo Type VRT Microphone*

Frequency response: Smoothly maintained over the range 30 Hz to 16,000 Hz – 2dB at 40 Hz+ 2dB at 16KHz referred to the level at 1,000Hz.

Sensitivity: 81dB below 1 volt/dyne/cm² (300 ohms impedance).

Polar response: Nominal figure of 8. This may be modified as required.

Main ribbon resonance: The average main resonance of the VRT ribbon assembly is at 55Hz and this is maintained in production ±5Hz.

Dimensions: From top of frame to swivel screw: 2⅝ inches (66·7 mm). Frame width: 1⅛ inches (38·1 mm).

T-base swivel screw to the plug connector: 2⅜ inches (60·3 mm).

Weight: Head only 9 oz (0·255Kg).

Finish: Satin chrome overall. Alternative finishes to special order.

Construction: Head, mounted for tilting as Reslo RB series, on 'T' (tubular) base fitted with Reslo T.C. socket connector. Maximum angle of tilt from vertical, 45 degrees, rear direction only.

Connecting cable set: Six yards of screened and twisted PVC sheathed cable supplied and connected to mounting plug.

The Reslo Cardioid Dynamic Microphone (Fig. 2)

This is known as the type EC1 and is a dynamic microphone with a cardioid polar response. It has been introduced by Reslo Sound Ltd as an 'entertainment' microphone and is similar to the Reslo type CPD which, like the EC1, employs a miniaturized insert. The insert is mounted at the rounded end of a lightweight cylindrical case and is secured in position by a special domed front cap which provides mechanical protection and allows acoustic energy to be distributed on both sides of the diaphragm. The impedance is 30 to 50 ohms so that a matching unit is required for use with high-impedance inputs (see details of LTU1 unit given below). The overall result is a smooth wide frequency response over the range 50 to 17,000 Hz. The microphone responds excellently to transients and is therefore highly suited to music recording. When used for close speaking or singing it should be used with an amplifier having provision for bass cut. An on/off switch is included (mounted on the case) together with a special clip-on stand connector. Reslo also provide an acoustic hood which can be used for close speaking, etc. The clip-on stand connector allows the microphone to be quickly detached from the stand for hand use.

Fig. 3. The Reslo line coupler and matching unit type LTU1 (low to high impedance).

Tests with this microphone showed it to have an exceptionally good bass response. Care must be taken to avoid close speaking without the use of acoustic resistance hood unless the microphone is used with an amplifier with bass cut. Sensitivity is such that a speaking distance of not less than two feet can be used without undue bass emphasis. This microphone is perhaps best recommended for indoor use and particularly for music recording. Its

specification is shown below and it retails at £18. Further details can be obtained from Reslo Sound: address as shown above.

Technical Specification of the Reslo Type EC1 Microphone

Frequency response: Smoothly maintained over the range of 50Hz to 17KHz −4dB at 100Hz and +8dB at 16KHz referred to the level at 1,000Hz.

Sensitivity: 88dB below 1 volt/dyne/cm² (30–50 ohms impedance).

Signal output: The average open circuit voltage generated by a male voice 6 inches (15·24 cm) from the front of the microphone in a dead room at normal conversation level. EC1/L=50–150 microvolts. EC1/M (600 ohms)=250–450 microvolts. EC1/H (Hl-Z) =2–4 millivolts. When the distance is reduced to 1 inch the output level increases approx. 10 times (20dB).

Polar response: Unidirectional, partially suppressed at the rear. Rear pickup −10 to 20dB over the range 200Hz to 15KHz.

Impedance values: Supplied in L, M, and H models. L=30–50 ohms, M=dual impedance 250 or 600 ohms, H=dual impedance, 'Hi-Z' (approx. 40Kohms) or 30–50 ohms. The M and H models incorporate miniature line transformers in the case.

Connections: From Reslo three-contact socket at end of case, low-impedance floating from earth and phased. High-impedance single-ended and phased. A.900 plug and flexible cable (6 yards) provided.

Finish: Fine-grain black shrivel enamelled tubular case, head and front cap matt 'silver'. Alternative finishes to special quantity order.

Dimensions: Overall length, including plug, 8½ inches (21·59 cm). Maximum diameter (head) 1$\frac{5}{8}$ inches (3·33 cm).

Weight: Head only EC1/L 6oz (0·17Kg).

Reslo Line Coupling Unit LTU1 (*Fig. 3*)

This line coupler or matching unit can be employed with either of the microphones mentioned in this review, i.e. the VRT or EC1. The LTU1 unit is designed for external use adjacent to the amplifier or tape recorder with which the microphone is to operate. It employs a magnetically screened transformer mounted in an enamel housing fitted at one end with a Reslo three-pin contact socket for the microphone line connections (plug provided). At the other end a short length of screened cable is terminated with a screened tip type jack plug. The nominal output impedance is 100,000 ohms and is therefore suitable for almost all high-impedance inputs to tape recorders, mixers and amplifiers. The input impedance is, of course, suitable for 30 to 50 ohm microphones. The price of the LTU1 unit is £4 12*s* 0*d* and further details can be obtained from Reslo Sound Ltd (address above). The full specification of the unit is given below.

Specification of the Reslo LTU1 Line Coupler

LTU1 line coupler, transformer magnetically shielded and fitted in circular metal case, three-pin plug balanced connections for low-impedance input, screened jack plug (tip and sleeve type) for high-impedance output.

Nominal input: 40 (15–50) ohms.

Nominal output: 100,000 ohms to valve grid.

Frequency response: ±1dB 50Hz to 15KHz.

Dimensions: Length 2¼ inches (5·71 cm), diameter 1½ inches (3·81 cm).

Weight: 10oz (0·283Kg).

Finish: Metal housing stove enamelled with polished chrome fittings.

THE THINGS YOU SAY

Each month the writers of the most interesting letters selected for publication on this page will receive a useful accessory to tape recording. Letters for this page should be addressed to *Things You Say, ATR, 9 Harrow Road, London W2.*

An open letter to all tape recording clubs from Bob Danvers-Walker

Local radio operation as laid down in the Government's White Paper is going to rely extensively on 'local bodies' for support. And this year local radio station managers are going to need all the public support they can find. Having had long experience in small radio station operation, I know only too well how difficult it is to find programme material to fill air time. There will be opportunity for tape recording clubs to be actively employed in the regions where the initial nine stations are to be located – and these should not be missed. I would hope that, *for providing entertainment*, tape recording clubs are better equipped than council offices, chambers of trade and commerce, universities and similar bodies, however praiseworthy their social and cultural efforts may be. It is *now* that club secretaries should get active and plan ahead.

Local radio means local participation; the many skilled men and women with tape recorders might well be actively employed both individually and co-operatively. Audience participation is extensively used on Manx Radio – Britain's only legally recognized commercial radio station. It is the homely touch that counts for more than the voices of officialdom. That station's success is the best example. If the 'new nine' on the mainland are going to succeed, then anyone with experience should begin to get geared up.

Clause 39 of the White Paper says: 'The government attach great importance to the need to ensure that the stations are local in character and not moulded to a common pattern imposed from the centre.' And Broadcasting Councils operating in co-operation with the BBC – the parent operators – 'will have the maximum possible voice in the direction and performance of these stations'. Responsible tape recording clubs should be represented on those councils.

London W5. **Bob Danvers-Walker**

See Editorial Comment in last month's ATR. *– Ed.*

Appreciation

I am a comparative novice at sound recording, having originally acquired my recorder as an aid to examination studies. May I appeal to you to publish an occasional article for the benefit of beginners who, because of financial or other reasons are only equipped with run-of-the-mill domestic tape recorders? I agree that stereo is the ultimate in sound reproduction and that some of your regular articles such as *Tape Recorder Servicing*, *Sound Scene* and constructional features cater for all groups of experience. However, there must be many of your readers who cannot afford the exotic machines featured so often in your columns. I realize that space is limited, but is it not possible on the assumption that today's beginners are tomorrow's enthusiasts, to have a feature for us – perhaps once every third issue.

I was introduced to *ATR* through reading the excellent book *Tape Recording for Everyone*, written by the Editor, F. C. Judd. Before reading this book I knew nothing about the subject, but the information and advice contained therein enabled me to avoid many pitfalls and as a result I obtained best value for my money when I purchased my machine. My first enquiries were made at a large local branch of a well-known electrical dealer but I found that the salesman's knowledge of tape recorders was even more limited than mine. I therefore followed the advice so often given in *ATR* and eventually purchased my machine from a dealer specializing in tape recorders. His advice, assistance and after-sales service cannot be faulted. In conclusion, many thanks to *ATR* for all the knowledge that, as a mere beginner, I have gained from your articles. There is not an issue from which I have not learned something new about this fascinating hobby.

Kingswood, Bristol **Harry Danks**

Special Editorial features for the newcomer are on the stocks (*Ed.*).

BATRC Tapes

I received a note, which was enclosed with my *British Amateur Tape Recording Contest* tape, which stated that my entry was a 'near miss'. This is very rewarding and has had the effect of renewing my enthusiasm for my hobby, but it does seem a shame that the various tape magazines could do no more than publish the list of actual winners, with absolutely no other details on how their tapes were able to gain a position above all others. After all, to me an amateur, the annual contest means more than mere prize money, yet when the Audio Fair time comes round, the news before and after the event seems almost endless.

We read about the annual recording contest quite some time before the closing date. Let's read a little more about it after the judging takes place and let us read how each of the winners built up their winning tape.

London W12 **John Hone**

The Federation of British Tape Recording Clubs make copies of winning tapes available to members (*Ed.*).

More readers' letters on page 54.

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TAPE RECORDER SERVICING PART XIV

This month Gordon J. King deals with recording level indicators

We have seen that the depth of recording on the tape is governed by the strength of the signal current in the winding of the recording head, and that too much signal causes tape saturation and heavy distortion on signal peaks. Too little signal can impair the signal/noise performance, giving high background noise and hiss. Recent articles in this series have also revealed ways of checking the head signal in terms of current or signal voltage developed across the head winding or across a resistor of known value connected in series with the winding and signal source.

However, this amounts to very little unless one has some way of knowing when the head current is approaching the level corresponding to tape saturation. This is the job of the recording level meter or indicator. The majority of most inexpensive machines feature some arrangement or other of this kind. Before proceeding, however, a word or two about so-called 'auto' machines would not be amiss. These machines embody an electronic device that adjusts the gain of the recording amplifier automatically, according to the strength of the programme signal, in such a manner that the recording head signal current never exceeds a level that would put the tape into saturation. These machines sometimes do not have either a recording level indicator or a recording level control. They do have certain shortcomings, especially in creative recording, but these will be discussed in a later article, both from the operational and technical aspects.

How well a tape recording sounds, therefore, is very much related to how well the recording level indicator is geared to the signal current in the recording head. Indicators usually have some marked reference level corresponding to a head current that will almost fully record the tape. When the indicator exceeds this reference mark, tape saturation is close at hand and the record distortion rises swiftly. The best quality recordings are made with the indicator peaking just below the reference mark. One has to take into account, however, the dynamic range of the programme material, otherwise the noise may be abnormally high on low-level sounds, and will require absolute peaking beyond the reference mark.

Clearly, although the recording section itself may be working correctly, badly distorted recordings could result from the recording level indicator failing to display a true measure of head current relative to its reference mark. For instance, the overall sensitivity of the indicator might fall due to a component or valve fault. This would mean that a head current corresponding to maximum tape modulation would fail to cause the indicator to reach its reference mark. Indeed, there may be only half normal deflection. The tendency would be to advance the recording level control to the indicator's reference.

Two things would then happen. One, the tape would be over-recorded and, two, the recording amplifier itself may be overloaded. In any event, the net result would be an excessive amount of tape distortion. This would be proved by playing the tape back on a different machine (i.e., to prove that the playback section of the machine on which the tape was made is not defective). One may eventually conclude that something is amiss with the level indicator when it is discovered that distortion-free recordings can be made with the level indicator peaking at some point below the reference mark.

Level Indicator Check

To check a suspect recording level indicator it is necessary to know the value of the signal current in the recording head corresponding to about 6dB or 12dB below tape saturation. This is often the recording head current upon which the indicator's reference mark is based. It is virtually impossible to discover this current value by trial and error methods but, fortunately, it is usually given in the service manual either as real signal current or as a signal voltage across a certain value resistor, as already mentioned.

The indicator's sensitivity can thus be checked by applying a fixed frequency input signal to the 'radio', 'mic' or other socket of the recorder and adjusting the signal level until the correct recording current is indicated on a meter connected to the head circuit (see last month's article for a full explanation of how this is done). The level indicator should then deflect to the 'full modulation' reference mark – or fairly close to it. The input signal should be in the order of 1,000Hz (1,000c/s), for this is the frequency at which tests of this kind are made. It will be understood, of course, that the level indicator monitors the signal current actually applied to the recording head via the recording amplifier. Some recording amplifiers are purposely tailored to give a rising treble response. The reason for this is to combat the hf losses by a rising (with frequency) head current.

Thus, assuming that the response of the level indicator circuit itself is reasonably flat, the meter will show an increase of recording level as the signal frequency is increased, in spite of the *level* of the signal at the input being held constant. However, at 1,000Hz treble lift will not have come into effect, so the indicator's deflection should not be synthetically boosted. Some recording level indicator circuits have a preset sensitivity adjustment. This makes it a simple matter to set the indicator to the correct reference mark when the levels have been adjusted for the corresponding head current. Less exacting machines, however, have the head signal coupled to the indicator through a network of fixed value components, these having been accurately worked out at the design stage to provide an 'average' current in the recording head (based on an 'average' tape, bias frequency and so forth). But it is not uncommon for the value of one or more of these to change as the machine ages, and upset the indicator's sensitivity, usually resulting in over-recording.

Stereo machines sometimes have a pair of level indicators which work independently from each channel. A quick sensitivity check with such machines can thus be made by applying a signal of the same level to each channel and then comparing the deflections of the two indicators with the recording level controls adjusted to coincide in each channel. Remember, though, that apparent lack of indicator sensitivity could be caused by fall-off in sensitivity of one of the stereo recording channels! Other machines use just one indicator and a switch allowing this to monitor the recording signal in the left- or right-hand channel separately but not together. Another arrangement is for the level indicator to 'read' the sum of the signals in the two stereo channels.

Over the years, a diversity of indicating devices have been used for showing recording

level, but the two types now mostly employed are the moving-coil meter movement and the magic-eye (or fluorescent indicator). The basic magic-eye was used as a tuning indicator in radio receivers and came in various forms, but it is not ideally suited to audio level indication since the overall degree of deflection is not very great and its illumination is poor.

Fluorescent Indicator

A development of this kind of indicator for tape recording level indicating applications is seen in the EM87. In this the fluorescent material is coated on a fairly large surface on the side of the glass envelope, and the internal electrodes are arranged so that two ribbons of green light deflect from each end towards the middle. The degree of deflection is governed by the level of the recording head current. These indicators have a good frequency response and deflect consistently at all frequencies over the audio spectrum, provided the circuits feeding them with signal have no frequency inhibitions.

Full recording level is indicated when either the two ribbons of light meet at the middle of the fluorescent screen or, alternatively, when they arrive at a strip of coloured transparent material affixed to the glass by the manufacturer of the tape recorder. A circuit in which the EM87 is used is given in Fig. 1. This is from the Fidelity Playmaster recorder. Here the signal *voltage* at the anode of the recording output valve is fed to the grid of the indicator through a resistor and capacitor. The capacitor blocks the dc voltage but is of too high a value to affect the frequency response, while the resistor, in conjunction with its partner connected between the grid and chassis, controls the amount of signal applied. The two resistors form a potential-divider network.

The capacitor across the chassis-connected resistor produces a time-constant effect, and the greater its value, the less the ribbons of light are affected by fluctuating signal. The indicator then 'reads' more of an average signal value, rather than signal peak. Without the capacitor, the ribbons tend continuously to quiver and this makes their edges ill-defined and hard to 'read'.

Fluorescent Indicator Faults

This kind of indicator, of course, is found only in the inexpensive type of machine. It cannot be very accurate, but the least it does is to reveal when the recording signal is of such a level that the tape is about to become overloaded. As the emission of the indicator falls, its sensitivity is affected, and this could well result in severe over-recording. Alteration in value of either of the resistors in the grid circuit would also affect the sensitivity, an increase in value of the upper one (2·7Mohm) reducing the sensitivity. Similar trouble in the lower one (to chassis) would increase the sensitivity, with a consequent tendency towards over-recording.

The voltage at the anode of the indicator valve influences the position of the ribbons of light on the fluorescent material. This voltage is fixed by the value chosen for the anode resistor, and if the value increases (thereby decreasing the anode voltage), the distance between the two ribbon strips will increase. A greater level of signal is then required to evoke the indication of full recording level, and this would saturate the tape. Better quality machines always employ meter-type indicators. These may be uncalibrated or calibrated in decibels, volume units (VU's) or percentage recording level. Uncalibrated meters have their scales divided into green and red (or white) sections. The green section indicates levels within the normal recording range, while the red section indicates levels corresponding to over-recording. The demarcation between the two sections represents the full recording level reference mark, and if the scale is calibrated this mark refers to OdB or 100% recording level. This kind of meter is often of the edge-reading variety, a typical example being shown in Fig. 2. The meter simply slips into a socket on the main deck assembly and is held firmly in position by the top plastic panel of the deck.

Decibel meters are generally calibrated down to about −20dB and up to +3dB, the −20dB indication corresponding to 10% recording level and the +3dB to a 40% overload. At this juncture, a word or two about the chief types of level indication – namely, the VU meter and the 'peak-programme meter' – would not be amiss. The VU meter is often found on American and imported models tailored initially for the US markets. Many British and European machines, on the other hand, favour the PPM. Essentially, the VU meter responds to loudness, while the PPM responds to peaks of the signal waveform. The VU meter may, therefore, be frequency compensated. This means that for a signal amplitude indication at one frequency, a different indication may result for the same signal amplitude but at a different frequency. The PPM, however, should give the same level indication irrespective of frequency as long as the signal amplitude remains constant.

Moreover, PPM's are often arranged to have a relatively fast rise-time and a slow decline. Thus, the meter will immediately respond to full amplitude of a signal of short duration and remain in that position for a period of time that will allow its easy reading, even though the signal has since returned to zero. In other words, the meter will continuously record only the maximum amplitude peaks of the programme material.

PPM meters are often the ones scaled in decibels, while VU meters are found with linearly calibrated scales, such as in percentage recording level. This means that low-level indication on a VU meter is relatively small compared with that on a logarithmically-scaled meter. Nevertheless, both types are perfectly adequate in practice, but some operators – especially professionals – may have a preference towards the PMP. This is the kind used by the BBC.

Next month we will take a look at some of the meter circuits, and see what faults can develop in them.

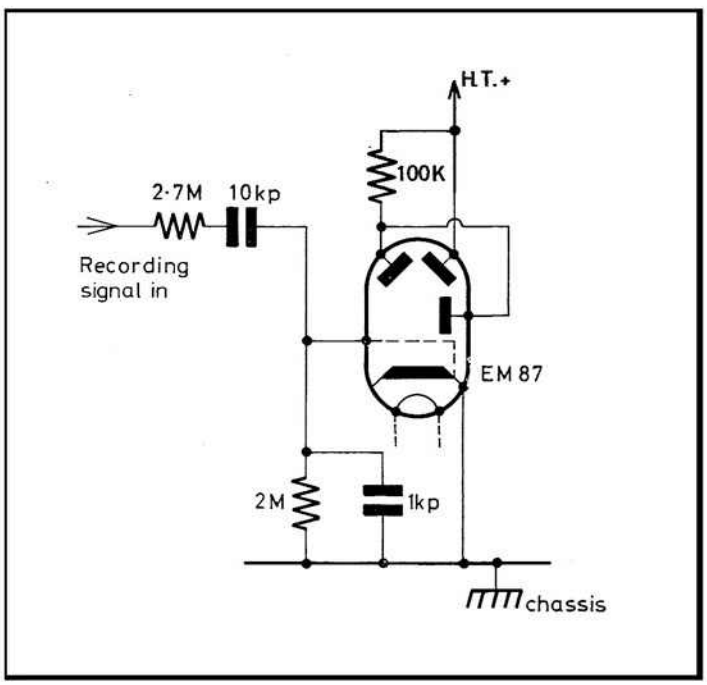
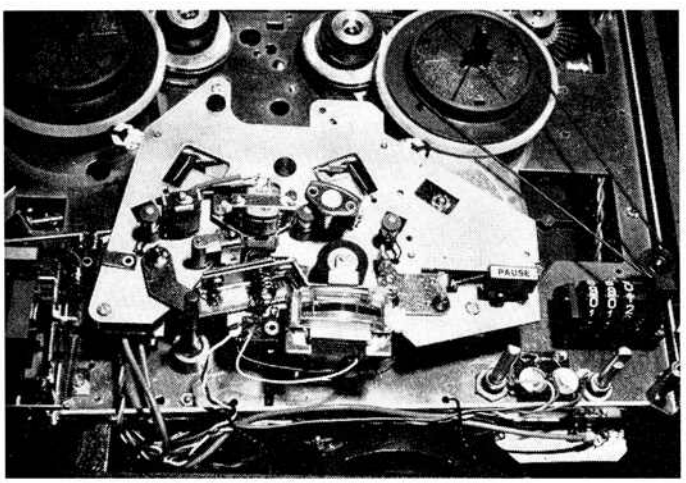


Fig. 1 (left). *Circuit diagram of the fluorescent type of recording level indicator using the EM87.*

Fig. 2 (below). *Showing the edge-type recording level meter fitted in a slot on the main deck assembly. This is held in position by the top, plastic cover of the deck. The main trouble of this type of movement is sticking of the pointer, and there is not a great deal that can be done to clear this trouble, apart from replacement.*



ON TEST – THE FERGUSON 3214

by Gordon J. King

The Ferguson Model 3214 is a quarter-track machine of remarkably good performance for its £46 4*s* 0*d* selling price – and this includes DIN-terminated cable, microphone with pull-down wire stand, a 7 inch spool of tape and an empty spool. It is a three-speed model, giving 1⅞, 3¾ and – most useful for better quality work – 7½ ips. Another good thing about it is its ability to handle up to 7 inch spools. It is a mono machine, but it has a wired DIN socket for taking a stereo accessory unit; this requires a second audio channel. The tape transport is press-key controlled, and the key-bank is conveniently situated on the right of the control panel (see Fig. 1). There are two keys for 're-wind', and each one for 'pause', 'play', 'record' and 'stop'. The record key contrasts red against the white main keys and the black stop key. The record key can be depressed to bring the amplifiers on to record without the tape being transported, and under this condition the amplifiers can be used independently of the tape action. Both the record and start keys have to be depressed to record on the tape (or erase a tape record). When this condition is programmed, the tape can be halted by depressing the pause key. The action here is a mechanical one which pulls the pressure roller away from the capstan. It is very effective and the key needs very little pressure to work it.

The same action can be incited by working the 'stop/play' slider switch on the microphone, but this time the mechanism is operated by an electro-magnet on the deck. This is a sort of remote control system and is very useful for dictation work and can be operated on either record and playback. An electro-magnetic-operated auto-stop facility is also provided. This is controlled by metal leader tape and functions during recording, playing or re-winding. The braking system is really efficient and pulls the tape up almost instantaneously without overshoot or spilling. It is also possible to operate the auto-stop system at any point in the tape by introducing metal leader tape at the required positions.

The electronics side of the recorder is under the control of four graduated knobs. These give mains on/off and tone (the latter on playback only), playback volume, pick-up input signal level for recording and recording level of microphone or 'radio' signal. The two last controls mentioned, therefore, can be used as a recording 'mixer pair'. Also on the control panel are a four-digit tape counter, a moving-coil recording level indicator, a pair of track selector buttons and the microphone input socket. This, incidentally, looks like a DIN socket but it isn't.

If the two track selector buttons are depressed simultaneously, the two head windings are connected in parallel so that on playback recordings on the two appropriate tracks will be heard together. This is useful for superimposition and for obtaining correctly balanced mono reproduction from a stereo tape record. Another useful attribute of the machine is the pick-up input channel with its own recording level control. This allows a pick-up to be connected direct to the machine for immediate translation to tape. There are two pick-up inputs (DIN sockets) at the rear of the case, PU1 suitable for pick-ups delivering nominally 75mV across a very high impedance (3·3M) and PU2 with an input sensitivity of 180mV into 200Kohms to 500Kohms. PU1 would normally be used with a crystal or ceramic pick-up. With a stereo pick-up the A and B (left and right) outputs would be connected in parallel for correct mono balance.

There are also DIN sockets for 'radio' in and out, for 'auxiliary' and for external loudspeaker. The 'radio' input sensitivity is 1·5mV into 68Kohms and the output signal 1V (max)

Fig. 1. Facing view of machine.

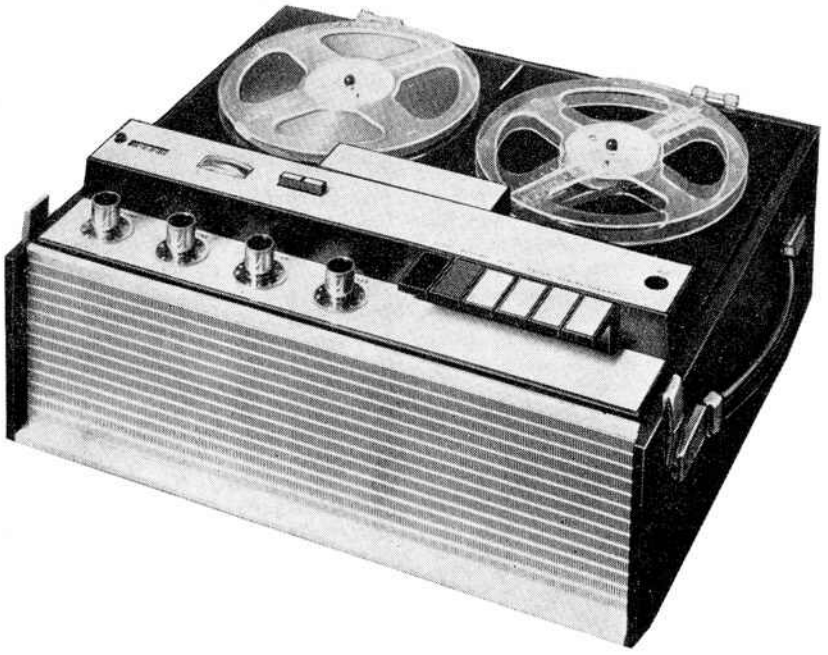
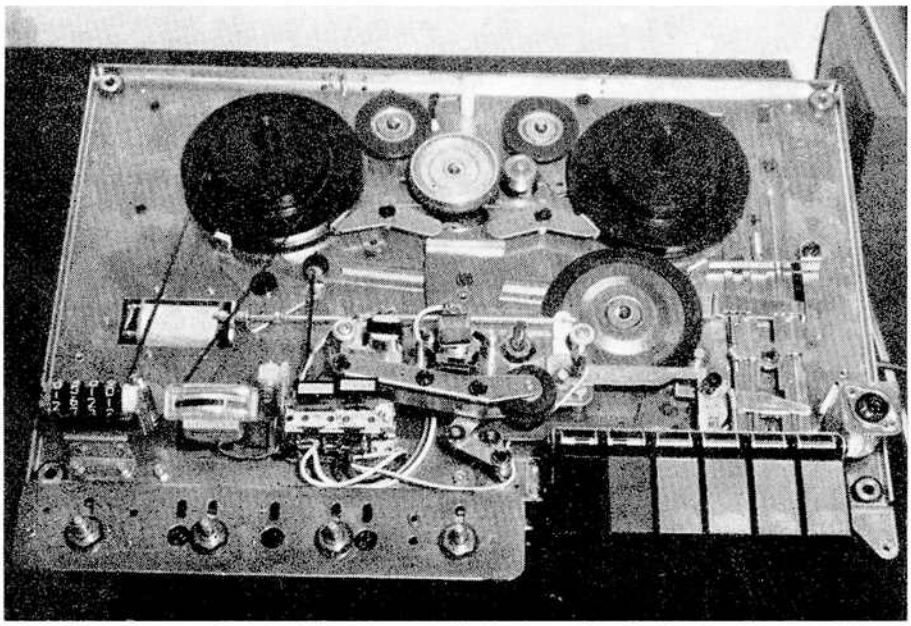


Fig. 2. Inside view, showing deck top.



across 22Kohms. Thus, the former will accept signals from a hi-fi amplifier, tuner, other tape recorder and so forth, while the latter signal is of sufficient level to drive the 'tape', 'radio' or 'aux' input of any hi-fi amplifier or second tape recorder. The external speaker output is 3 watts maximum across 3 ohms, and this is a two-way DIN socket. With the plug inserted one way both internal and external speakers are connected. Inserted the opposite way cuts out the internal speaker.

The 'aux' input is for accepting Ferguson accessories, such as remote 'pause' control, slide sync unit, stereo unit, second-track monitoring, etc. The versatility of this machine is very high and a great deal of thought must have been applied to these terminations. Outstanding features (in the reviewer's eyes) are the four-digit counter, the 'latch-on' pause control, the remote pause action, the powered 'aux' socket (there is 32V dc at 50mA between pins 1 and 3), the graduated controls (allowing immediate resetting) and the excellent braking.

Another interesting feature of the deck mechanism is the two-way 'tape inching' facility. This means that by applying initial pressure to the wind keys the tape can be 'inched' backwards or forwards for editing. Also to help with editing is a tape index. This allows the exact location of the recording head gap relative to an indexing mark on the head cover. For editing, the tape is lifted from the slot, rested on the head cover and then marked with a chinagraph pencil against the index. A small thing, perhaps, but mighty useful to the real enthusiast. Fig. 2 gives an idea of the solidness of the deck. The amplifier is partly integrated with the deck, and the recorder as a whole can easily be extracted from the cabinet for servicing. Printed circuit boards are employed.

A total of three valves is used (yes, only three!) and one of these (Mullard ECC82) is employed exclusively as a *push-pull* bias and erase oscillator. The other two valves are amplifiers. A triode-pentode (ECL86) gives a 3-watt output pentode and triode driver, while a double-triode (ECC83) gives a pair of low-noise cascaded stages for the head/microphone signals. Clicks are suppressed by two PY124 diodes, while a metal bridge rectifier delivers the ht voltage. Lt for the electro-magnet solenoid is provided by another bridge rectifier. Complete mains isolation is provided by a transformer.

The motor noise of the sample test model was a little high, but not obtrusively so, and resolved almost to nothingness on a solid, concrete floor. An overall response characteristic was obtained by feeding sine-wave audio into the 'radio' input, recording this at selected frequencies, at the same time keeping the signal amplitude constant over the spectrum. The signal amplitude of each frequency recorded was then measured at the 'radio' output using a calibrated valve millivoltmeter of known response. A curve was also made of the recording level meter deflection (in terms of percentage) at the constant amplitude input frequencies. The overall response is shown in full-line and the level indicator response in broken-line in Fig. 3. Note that these tests were made at 7½ ips tape velocity. This clearly shows a useful response from 20Hz to 20KHz, with a 5dB bass boost and a 5dB treble loss at spectrum extremes.

Distortion was found to be high up to about 150Hz but fell to a nominal 2.5% above this frequency (referred to 1V). The broken-line curve shows the normal technique of treble boosting during record to hold up the playback response. There is nothing wrong with this, of course, provided the signal/noise ratio is not too much impaired at the treble end, and this is certainly not the case with this machine. The overall signal/noise ratio at 7½ ips was approximately 46dB. It seems to your reviewer that the 40dB given in the maker's specification is under-rating the machine!

A tape was next recorded over the spectrum with sine-wave signals at a level of approximately −9dB. This was then played back at full volume and the output measured across the 3-ohm speaker outlet (correctly loaded). The results of this test are shown in the curve at Fig. 4. This provided a nominal output of about 1·3 watts (distortion a little above 6% at 1KHz). The effects of the bass-boosting can be seen by the output rising almost to 2·5 watts at the bass end of the curve. The output is expressed in watts on the right Y axis and in volts across 3 ohms on the left Y axis.

The recorder was also operated direct into a hi-fi loudspeaker (a Leak Sandwich speaker system was available at the time) with the internal speaker muted, and results were really good at inputs up to about 1 watt. Even better sound quality was obtained by feeding into a hi-fi amplifier from the 'radio' output of the recorder at low level. The quality was comparable to that obtained from a good FM transmission (using quality tape records on the recorder). Even recording from the hi-fi system and then playing back the tapes so recorded gave results which would not normally be expected from a complete machine in this modest price group.

Without any doubt, this is certainly a machine to be investigated for versatility, good domestic quality and even for use with a hi-fi amplifier system. On top of all this, the machine is good to look at. It 'looks' more expensive than its mere 44 *gns.*

Maker's specifications

Spool diameter: 7 inch maximum. *Tracks:* Four (with parallel track working). *Speeds:* 7½, 3¾ and 1⅞ ips. *Wow and flutter:* Better than 0·15%, 0·2% and 0·25% rms respectively at 7½, 3¾ and 1⅞ ips. *Frequency range:* 40Hz to 18Hz at 7½ ips, to 14KHz at 3¾ ips and to 7KHz at 1⅞ ips. *Signal noise ratio:* 40dB unweighted. *Tape position indicator:* Four digit, press-button zero reset. *Recording level indicator:* Moving-coil type with transistor rectifier system. *Output into elliptical speaker:* 3 watts at 3 ohms. *Power supply:* 200 to 250V 50Hz mains, taking 60 watts. *Wind time:* 1,800 ft of tape in 20 seconds. *Sockets:* External speaker: with facility for switching out internal speaker, giving 3W across 3 ohms. Radio input sensitivity 1·5mV across 68Khoms. Radio output: 1V across 22 ohms PU1 input: Sensitivity 75mV across 3·3M. PU2 input: Sensitivity 180mV across 200 to 500Kohms.

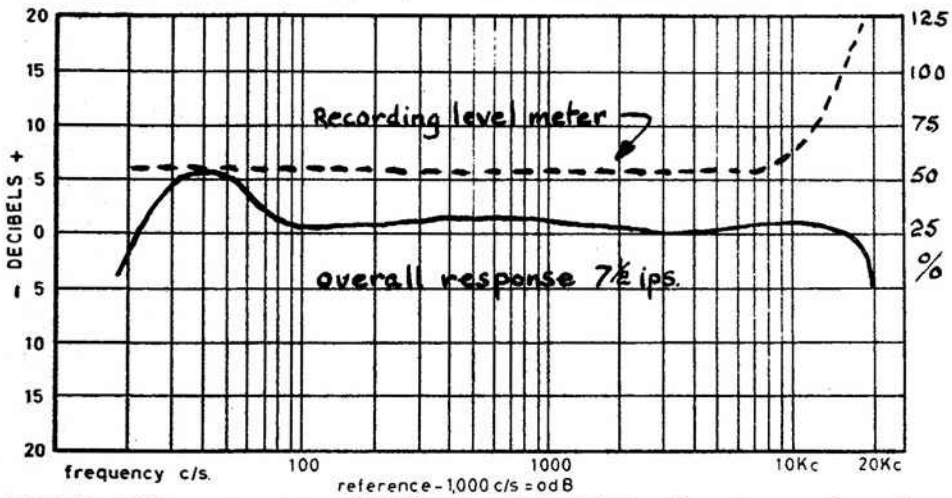


Fig. 3. Overall frequency response. Solid line: input/output. Broken line: response of recording level indicator.

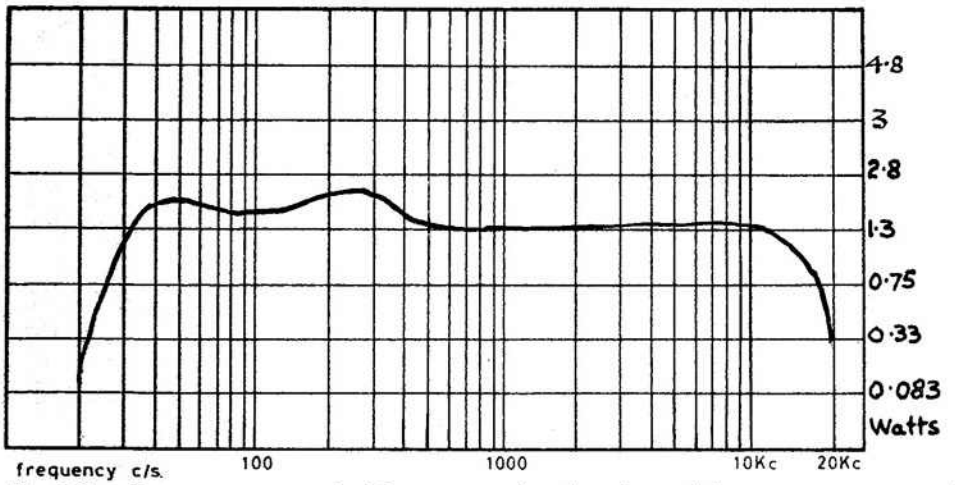
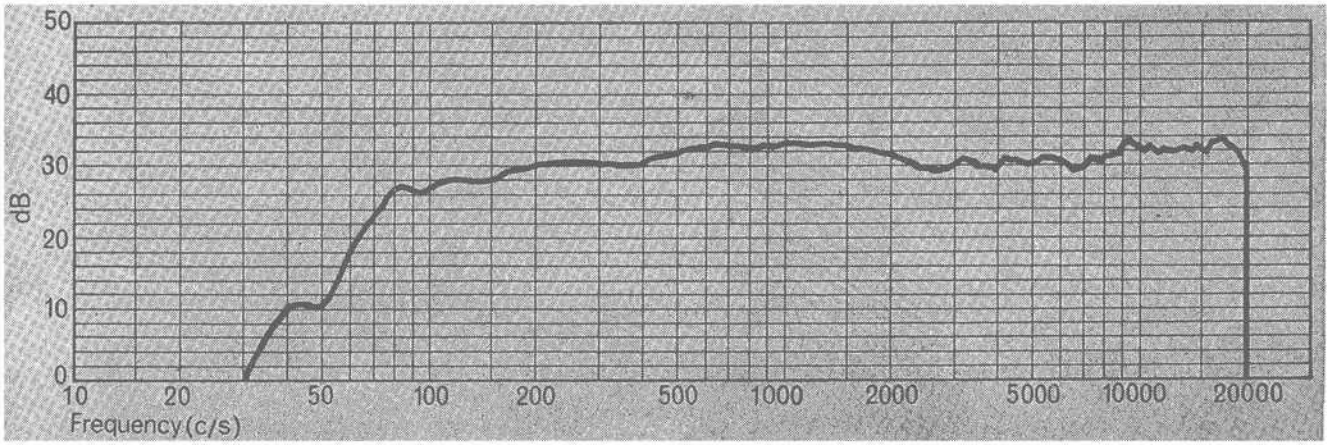


Fig. 4. Overall power response, output from across external speaker socket.

Don't buy a speaker

unless you have this Sonotone Challenge Chart with you—



This is the performance of the Solent, a new speaker by Sonotone, costing only £18 in a modern stylish veneered cabinet. You can easily pay £10 more for speakers which barely equal the performance of the Solent. Clip out this chart. Use it as your yardstick of value when you're shopping for speakers.

Hi-fi connoisseurs have long been familiar with Sonotone, as engineers of fine pick-up cartridges. Now this respected company has produced its own speaker. It's already the sensation of the Audio World. Read the facts. They may revise your thinking about what you should pay for a good quality speaker.

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So far we've talked about the logic of this new speaker.
Now for the technical details:
Woofer: 6½", 10,000 gauss, 1" pole.
Free Air resonance: 50 c/s.
Tweeter: 3⅜"—acoustically loaded (i.e. custom made to the actual cabinet).
Frequency Response: 40 c/s—20 kc/s.
Sensitivity: 98 dB at 12 w. (microphone 6ft).
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NEW!

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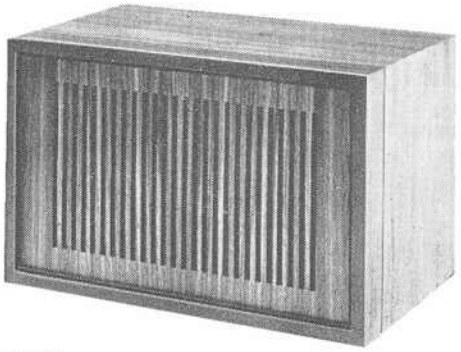


(14" × 9" × 8½")

TEST REPORT – THE SME SERIES 2 PICK-UP ARM

by Peter Knight

The ultimate in performance of the latest and best magnetic and ceramic stereo cartridges is governed by the nature of the associated pick-up arm. The arm is equally as important as the cartridge at hi-fi levels of record reproduction, and there is absolutely no point in trying to attain the best performance from a high quality cartridge coupled to a mediocre arm. Beautifully engineered and highly precision arms are fortunately available and the SME arm is certainly one of them, but before looking at this let us discover the requirements.

Backroom development is focused towards the design of cartridges which, when suitably mounted, will track maximum amplitude, velocity and acceleration groove modulations with the smallest possible tracking force (i.e., downward pressure of the stylus into the groove). Amplitude, velocity and acceleration modulations respectively are defined as from low bass up to about 800Hz, then up to about 2,500Hz and from this frequency up to maximum treble.

Some of the best cartridges today can perform in accordance with their specifications, and track at all frequencies, at a tracking force of little more than 1 gramme – sometimes less. On the other hand, cartridges of less exacting design will fail to keep their styli in the groove at low tracking forces, and will fail to trace the modulation even when the tracking pressure is increased. The result is groove jumping at high amplitude (low frequency) modulations and buzz or rattle at high velocity and acceleration frequencies when it is required to work this sort of cartridge at low tracking pressure. Increasing the pressure will keep the stylus in the groove, but at the same time subject the record to greater wear.

Clearly, low tracking force means that there is less wear on the walls of the groove than at higher forces which tend permanently to deform the wall surfaces and sadly to impair the quality of the recording even after few playings. The tracking ability of the cartridge at low force is related to the effective mass reflected from the movement to the tip of the stylus and also to the freedom of vertical and lateral deflection of the coupled stylus. The former is called *tip mass* and the latter *compliance.* Compliance, incidentally, is the reciprocal of stiffness, so the greater the compliance number, the greater the freedom of stylus movement.

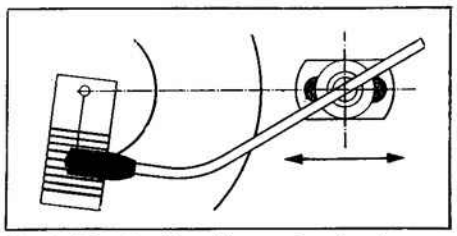


Fig. 1. Showing the alignment protractor supplied with the arm.

The very latest pick-ups have high static compliance values, in the order of 20cu (compliance units) and low tip mass values, around the 0·9mg region, depending on the design and cost. These parameters allow tracking and good modulation tracing at tracking forces of between 1 and 2 grammes, but the lower value is possible only when the cartridge is mounted on a precision arm, such as the SME.

Stylus pressure in terms of record material deformation is also, of course, related to the radius of the stylus tip. Diamond tips of

Fig. 2. The SME arm fully mounted and ready for playing.

TEST REPORT — THE SME SERIES 2 PICK-UP ARM

continued from previous page

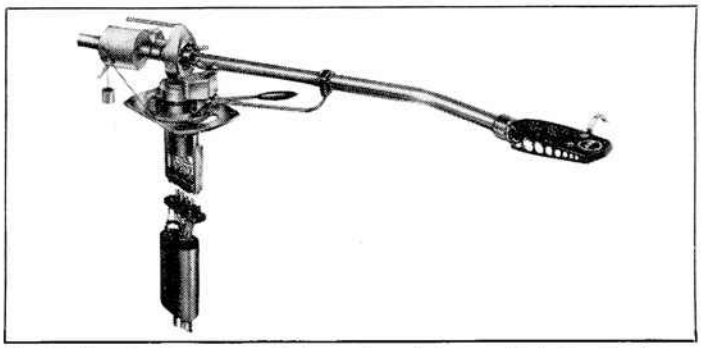


Fig. 3. Showing the screened plug and socket assembly below the base.

0·0005 inch tracking even as low as 1 gramme, for instance, cause the record material to work somewhat above its elastic limit, but fortunately, plastic flow occurs only beneath the surface of the material, and surface deformation is vaguely apparent only after many playings at this low force. Elliptical styli (i.e., bi-radial diamonds of 0·0002 × 0·0008 inch) tend, however, to aggravate the trouble.

Here, then, is the present-day state of the art, and even this, which is yet somewhat removed from the ideal, can be achieved only when the cartridge is partnered by a good arm. It has been said that to avoid repeated playing sub-deformations of the record material, the tracking force with a tip of 0·0005 inch would not have to exceed about 0·2 gramme (0·1g for an elliptical stylus). Arm problems aside for the moment, the successful tracing of accelerations rising to some 1,000g at this low tracking force would demand cartridges with an incredibly small tip mass. A value of 66μg has been put forward for 0·0005 inch tips, and half the value for elliptical tips. There is, of course, no cartridge available at the present time with these ultra-parameters.

Now for the arm. At low tracking forces stylus side-thrust becomes important. The lower the force, the lower must be the overall side-thrust to keep the stylus correctly balanced in the groove for minimum distortion and the best stereo effect. Side-thrust stems from several factors, including bearing friction, stiffness of the signal conductors from the arm to the base and an inward force acting on the arm due to the head offset and the disc rotation. Head offset is adopted to minimize tracking error. This develops because the record is played with a pivoted arm but was originally made by the recording cutter moving across the disc in a straight line. For zero tracking error the playback arm action should match the cutter movement during recording.

Arms are available which provide parallel tracking and thus zero tracking error, but some of the early versions produced other problems at the expense of clearing the tracking error. A recent one, though, called the *Trutrack*, solves the earlier problems and will have advantages when cartridges become even more sophisticated than they are today. This employs a float carrying the arm, the former traversing along a trough containing silicone fluid, below which is mercury for signal conduction from the cartridge.

The offset of the SME arm takes the form of a bend, the geometry of which is cleverly engineered for minimum distortion rather than for minimum tracking error. This is because distortion caused by the tracking error varies in inverse proportion to the radius, which means that the distortion produced by a tracking error of 1½ degrees at 6 inches radius would be no greater than that produced by a tracking error of only ½ degree at 2 inches radius.

SME arms come in two lengths, 12 inches (the one tested) and 9 inches, models 3012 and 3009 respectively. The maximum tracking error of the former is, of course, smaller than that of the latter, but the error is as small as it can possibly be (related to distortion as just revealed) on the 9 inch model. The 12 inch model requires more space than the 9 inch and for this reason the latter is quite popular in spite of the inherent dimensional shortcoming.

The minimum (or optimum) tracking error is established by means of an alignment protractor, as shown in Fig. 1. This adjusts for zero error at 2⅜ inches radius and gives the best distribution of error for minimum distortion as explained above. Correct alignment of the stylus tip with the turntable spindle is achieved by sliding the arm base on its bedplate, and here can be obtained a total movement of 1 inch. In some arms, it will be recalled, the head itself is moved within the shell to secure this adjustment. The SME arm base adjustment allows for quick readjustment to suit a new cartridge since calibration marks are engraved on the bedplate. A cursor marked on the base is set to coincide with the calibrations as predetermined for the head in use. Slotted and knurled screws lock the base once the adjustment has been performed. There is also a height adjustment.

The arm is adjusted for balance with the head in position by means of a sliding counterbalance weight which has set-screw locking. Tracking weight is applied by adjusting a rider weight along a marked way-rod. This can be seen in part at the far side of the main counterbalance weight in Fig. 2. The rider weight is in two sections, and the front section is removed when a lightweight cartridge is employed.

Adjustments are made for longitudinal and lateral balance, and when these have been correctly processed the tracking weight can be adjusted in ¼g intervals to 5g maximum with the two rider weights in position and in ¼g intervals to 2½g maximum with one weight removed, giving an overall range of adjustment from ¼ to 5 grammes. The counterbalance adjustments cater for cartridges weighing from 3 to 17 grammes.

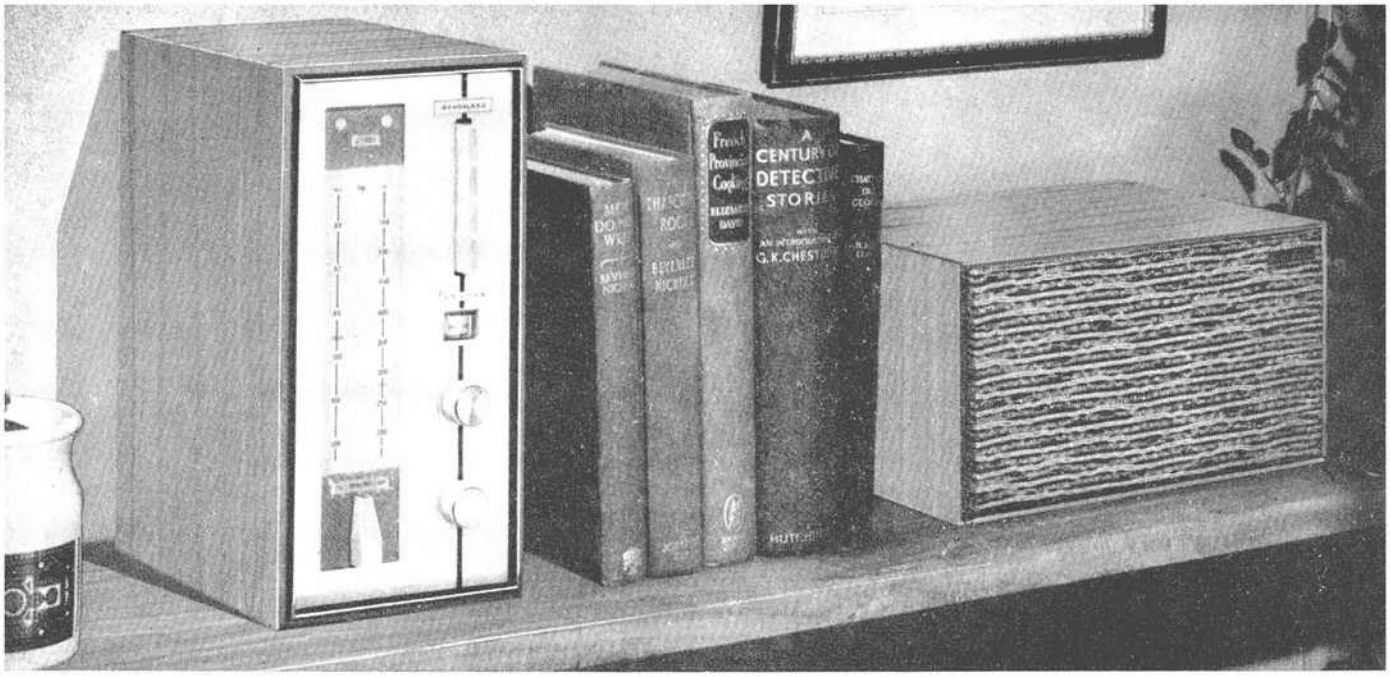
The SME arm also features the important bias adjuster referred to earlier. This combats the side force to which all radial arms are subjected. Friction between the stylus and disc produces a side force which tries to draw the arm forward. This force varies with tracking force, but not significantly with rotational speed of the record. Because the arm is offset, a turning force is developed relative to the vertical pivot of the arm, and this tries to swing the arm towards the centre of the record.

The stylus then tends to favour one wall of the groove, thereby putting a permanent lateral deflection on the cartridge. This can both distort the signal and affect the balance of the stereo channels. An opposing force or bias is given on the arm by a small weight attached to a nylon thread. The other end of the thread is attached to the bias level on the arm pivot after passing through a loop on a thin wire guide which is fixed to the base screw. This whole assembly can be seen in the foreground to the main arm assembly in Fig. 2. The bias lever arm has thin grooves cut into it at ¼g intervals corresponding to the tracking force being used. The bias can thus be easily adjusted to suit the tracking force, thereby ensuring that the optimum value of compensation is applied at all tracking forces.

Other features include a built-on arm rest with a nylon jaw, stainless steel throwover locking link and a hydraulic arm control operated by a small lever at the pivot-end of the arm. The arm will slowly lower its stylus on to a disc no matter how quickly the lever is operated. Fig. 3 shows the five-way plug and socket assembly beneath the base. The 'plug' part of the assembly is wired with 4 ft of low capacity cable and an efficient screen avoids hum problems.

The SME arm is certainly a very highly engineered piece of hi-fi equipment, and there are already many thousands of enthusiasts in this country and overseas enjoying its superb performance and aesthetic appeal. The arm is carried on knife-edge bearings, while very low pivot friction is achieved by the use of dust-sealed precision ball races. The design is such that bearing adjustment is never required, and some idea of bearing freedom can be gleaned by the fact that the arm will be deflected vertically, and horizontally by a force as low as 0·02 gramme. Dynamic damping of the arm mass-stylus compliance resonance results from the use of elastic coupling between the two main portions of the arm mass. This technique also reduces the effect of rumble from the motor. The shell accepts all cartridges with ½ inch fixing centres.

The Perfect Combination



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- All Silicon Transistorised (18 transistors + 18 diodes)
- Same size and style as Maxamp 30 (10½" x 5½" x 7¼" deep)
- Self-powered (Stabilised H.T.)
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- Tuning meter for A.M. and F.M.
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- Muted Tuning Facility, switched.
- Local/Distant reception switch.
- Stereo reception indicator light.
- F.M. Chassis silver plated.

SPECIFICATION

A.M. Tuning Range: 550-1650 kHz (kc/s)
Sensitivity: 5 μ volts
Distortion: Less than 1.5% for 30% modulation
Selectivity: —30db at 9 kHz

F.M. Tuning Range: 87.5 – 108 MHz (Mc/s)
Sensitivity: 2 μ volts for 20db quieting (I H.F.M.)
Discriminator Bandwidth: 500 kHz (peak to peak)
Distortion: Less than 1% at 75 kHz deviation
A.F.C.: ± 100 kHz
Capture Ratio: 5db
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GENERAL Polished wood housing (Teak or Walnut finish)
"Danish Silver" control panel
Dimensions: 10½" x 5½" x 7¼" deep
Mains Supply: 110; 200-250 V. A.C.

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The illustrations show the effective harmony of the styling of the **STEREOMAX** and **MAXAMP 30,** which is equalled by their performance. (Naturally, either instrument can be used with other apparatus of comparable quality, if so desired).

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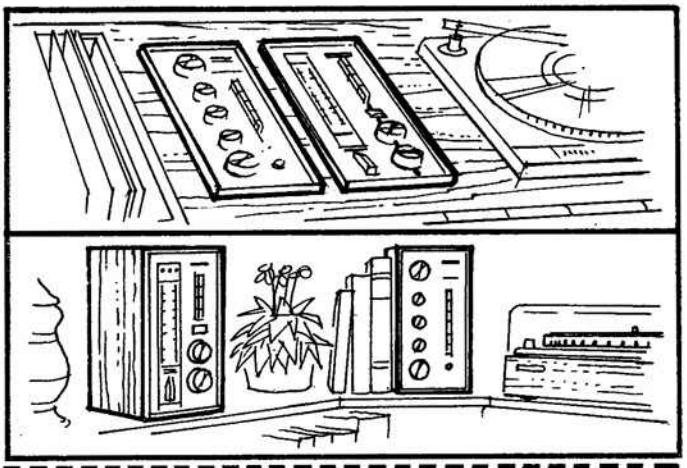

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MAXAMP 30

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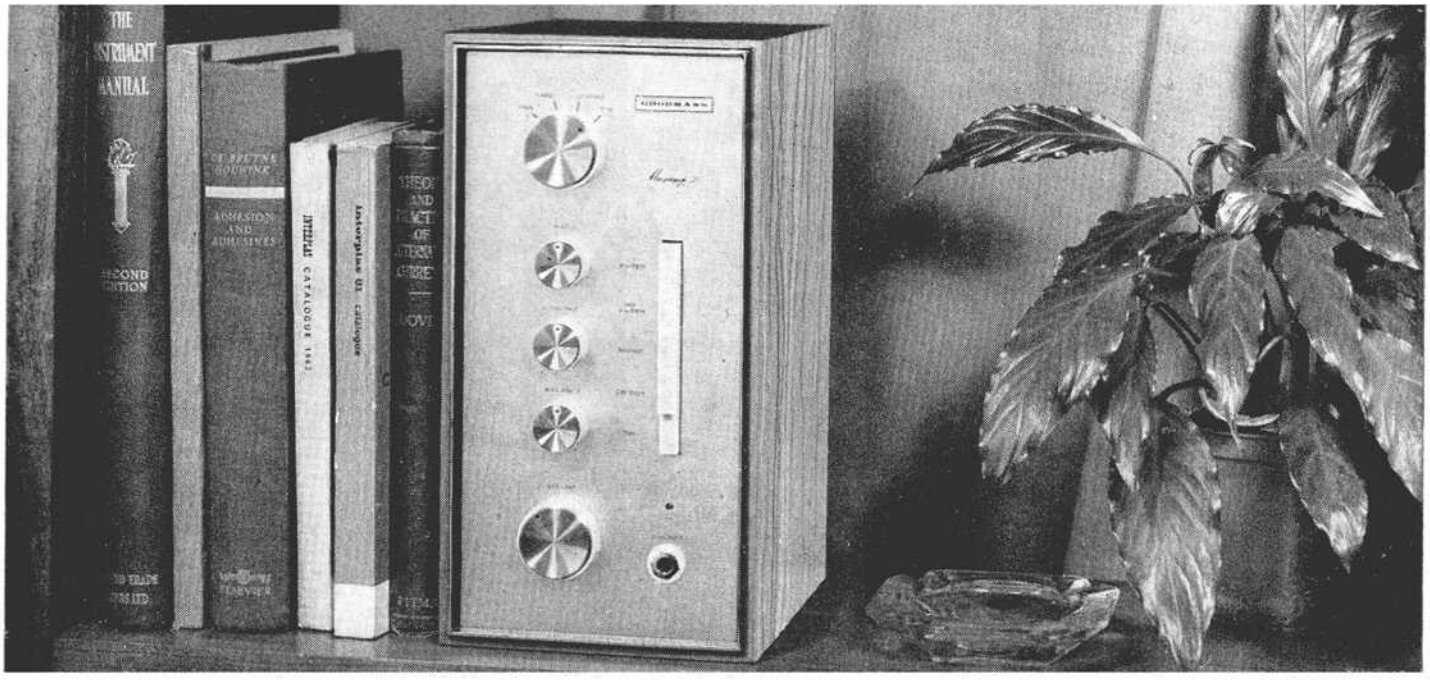

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THE TAPE DIRECTORY

Particulars of Tapespondents are given in the following order: name, age, occupation, address; special interests, tastes in music; type of machine, spool sizes speeds; area of tapesponding required.

BEDFORDSHIRE

Mrs P. M. Barling, 37, housewife, 10 Kingscroft Avenue, Dunstable, Beds. Reading and writing, Christian youth clubs, naturopathy; light classical, religious. Portogram, Unicorder, 7 in, 1⅞, 3¾, 7½. Anywhere.

Wilfred Oakey, 39, postman, 28 Kenneth Road, Luton, Beds. Bible study, classics; classical. Cossor, four track, 5 in, 3¾. UK.

CHESHIRE

Timothy D. Kay, 20, salesman, 17 Reynard Street, Hyde, Cheshire. Radio, reading, SWL; pop, organ, light classical. BRS deck, home-built amplifier, 7in, 1⅞, 3¾, 7½. UK, USA, Canada, Australia. Preferably female.

Tony Niblock, 27, flour miller, 127 Paterson Street, Birkenhead, Cheshire. Music; classical, folk, C&W. Ferrograph 631, Philips, 8¼in, 1⅞, 3¾, 7½. Anywhere.

DEVON

P. A. Bousfield, over 60, retired, 1 The Elms, Chudleigh, Newton Abbot, Devon. Photography, collecting view cards; opera, operetta. Robuk RK3/4. Philips EL3552, 7in, 1⅞, 3¾, 7½. Anywhere.

Alec Gale, 50, dental technician, 2 Marlborough Road, Sherwell, Plymouth, Devon. Archery, boating, camping; light classical. Philips 3586, 7in, 1⅞, 3¾, 7½. Sweden, Denmark (English-speaking).

ESSEX

Stanley W. Baker, 32, male nurse, 7 Northumberland Avenue, Linford, Stanford-le-Hope, Essex. Short-story writing, first aid, motor cycling; brass bands, light orchestra, classical. Reps. 10, Truvox 64, National, Sony, 7in, 1⅞, 3¾, 7½. Singapore, UK, anywhere. Males only. Every tape answered.

Alan Kingsley, 18, projectionist, 81 Limbourne Avenue, Dagenham, Essex. Fishing, shooting, entertaining; all pop groups. Ferguson, Collaro, 5¾ in, 1⅞, 3¾, 7½. America, Australia, New Zealand, Spain, Italy.

Colin C. White, 31, telephonist supervisor, 90 Canonsleigh Road, Dagenham, Essex. Modelling, gardening, DIY; all except jazz. Windsor Vanguard, Philips, 7in, 1⅞, 3¾, 7½. UK, Italy. Females only.

HERTFORDSHIRE

D. J. Bridges, 62, engineer, 75 Handside Lane, Welwyn Garden City, Herts. Photography (half frame), sailing; folk, strings. Ferrograph, Grundig, 5¾in, 1⅞, 3¾. North and South America, India, Ceylon (English-speaking).

Victor Magedera, 30, printer's assistant, 58 Ross Crescent, Levesden Green, Watford, Herts. 8mm, travel, people; pop. Philips EL3300, cassettes, 1⅞. Ceylon.

David J. Wakefield, 25, labourer, 69 Farland Road, Adey Field, Hemel Hempstead, Herts. Hi-fi, piano and accordion playing, short wave; all good music. Robuk RK3, 7in, 3¾, 7½. UK, France, Germany, Australia.

LANCASHIRE

Bill Applegarth, 26, 2 Stanley Terrace, Preston, Lancs. Stereo, 8mm; all types. Ferrograph 5, Tandberg 62, 3in to 8¼in, 1⅞ to 7½ inclusive. Anywhere.

Kenneth Birkell, 19, brushmaker, 24 Church Street, Ribchester, Nr Preston, Lancs. Woodworking, DIY, modern dancing, cycling; pop. Philips EL3541, 7in, 3¾. Anywhere, preferably girl of same age.

William Flynn, 48, van-driver, 61 Garstang Road North, Wesham, Kirkham, Lancs. 8mm; electronic organ music. Telefunken, 7in, 3¾, 7½. USA, Canada, Germany.

A. G. Shenton, 24, butcher, 64 Gaskell Street, Newton Heath, Manchester 10, Lancs. Dancing, motor racing, reading; all types. Ferrograph 631, 8¼in, 1⅞, 3¾, 7½ Sweden, France, Australia.

Pat Weekes, 40, gardener, 1 Temple Court, Victoria Street, Liverpool 2, Lancs. Photography, collecting old books; pop, jazz and folk. Olympus Pencorder F, 3¾in, 1⅞, 3¾. South Africa, USA, Hong Kong.

LINCOLNSHIRE

Frederick J. Hughes, 45, storeman, 12 Willesby Road, Spalding, Lincs. DIY, sound effects, swimming, 35mm photography; any but opera. Brenell MK552, Robuk, 7in, 8¼in, 1⅞ to 15 inclusive. Anywhere English-speaking. Male or female.

Graham J. Hughes, 18, trainee signalman, 12 Willesby Road, Spalding, Lincs. Swimming, all general interests; anything but opera. Sound Riveria, 7in, 1⅞, 3¾, 7½. Anywhere English-speaking. Male or female.

LONDON

Russel M. Callaghan, 53, administrative technical aide, 171 Powerscroft Road, Clapton, London E5. General; stereophonic music, big bands, C&W. Philips EL3549, Grundig TK20, 7in, 1⅞ to 7½ inclusive. Any country (English-speaking).

Cornelius P. Dee, 28, security officer, c/o 13 St Lukes Avenue, Clapham, London SW4. Irish and Scottish traditional music and songs. Philips, 7in, 3¾. Eire, Scotland.

Tony Hasemer, 25, BBC TV engineer, 4D Candover Street, London W1. Hi-fi, theatre, people; anything but modern jazz. Sony TC250A, four track, 7in, 3¾, 7½. UK, USA, France, Holland (French-speaking, male contacts preferred).

John Maude, 24, civic entertainments, 2 Cecil Mansions, Marious Road, London SW17. Camping, photography, theatre; pop, jazz. Philips, 7in, 1⅞, 3¾, 7½. Anywhere.

Jim Nagae, 16, student, 38 Calonne Road, Wimbledon Common, London SW19. Open-air recording. Sony TC-905, 3in, 3¾, 1⅞. USA, Japan.

Henderson Springer, 21, telecommunications engineer, 29 Victor Road, Brent, London NW10. Christian youth groups, especially interested in starting an 'Evangelical Tape Recording Club'; sacred records. Philips EL3553, four track, 7in, 1⅞, 3¾. Anyone in North-west London with same interests.

SUFFOLK

Charles G. Aldred, 16, student, Highwood, 21 Constitution Hill, Ipswich, Suffolk. Tennis, badminton, photography; pop, C&W. Grundig TK1, two track, 3in, 3¾. France, USA. Females preferred.

George Maplestone, 32, bread salesman, 'No-Name', St John's Road, Saxmundham, East Suffolk. Freshwater fishing, tropical fish; pop, C&W. Philips EL3556, four track, Philips EL3301, 7in, 1⅞ to 7½ inclusive. Anywhere English-speaking. No letter required.

SURREY

George W. Nevill, 61, clerk, 68 Brishton Road, Redhill, Surrey. Gardening, world affairs; light orchestral and swing. Philips EL3548, 7in, 1⅞, 3¾. Western Canada, Trinidad, Zambia, South America, Gibraltar.

Robert Taylor, 26, railwayman, 70 King's Road, Farncombe, Godalming, Surrey. Hunting; pop, folk, light music. Cossor, two track, 5in, 1⅞, 3¾. Australia, New Zealand. Male or female.

SUSSEX

Peter Fautley, 17, student, 13 Gaskyns Close, Rudgwick, Horsham, Sussex. Electronics, sound effects, model-making; pop and some classical. Robuk RK3, two track, 7in, 1⅞, 3¾, 7½. UK only. Preferably male or female of same age group.

A. G. Hollett, 49, publisher's assistant, 112 Astaire Avenue, Eastbourne, Sussex. Photography; light classical. HMV 2208, 7in, 1⅞, 3¾, 7½. USA, Eastern countries.

Bradley J. Hoad, 37, mortician, St Ivan, Swingate Cross, Hellingly, Sussex. Photography, cacti; pop, jazz, light music. Fidelity, 5¾, 1⅞, 3¾, 7½. Anywhere.

Ernest Walters, 18, clerk, 8 Cedar Close, Langley Green, Crawley, Sussex. Bus-spotting; pop, folk, some gospel. Philips EL3586, two track, 4in, 1⅞. UK, Eire, Western Europe (English-speaking). Preferably same age group.

WARWICKSHIRE

J. T. Cartwright, 41, company accountant, 45A High Street, Broom, Alcester, Warks. Music, Anglican Church history, general affairs; modern, classical, church. Reflectograph, 8¼in, 3¾, 7½. Britain, France, USA.

Trevor Coveney, 24, labourer, 49 York Road, Sidemoor, Bromsgrove, Warks. Sound effects; organ, popular, light classical. Fidelity Playmaster-2, Philips, 4in, 5¼in, 1⅞, 3¾. Canada, Australia, USA. All tapes answered.

YORKSHIRE

Harry D. Appleyard, 34, driver, 447 Huddersfield Road, Wyke, Bradford, Yorks. Cine photography, hi-fi; film music, light classical. Brenell Mark 5, 8¼in, 1⅞ to 15 inclusive. Anwhere overseas.

Leo Collins, 42, tailor, 65 Allerton Grange Way, Leeds 17, Yorks. Fishing, 35mm colour slides; musical shows, blues jazz, folk. Cossor, four track, 7in, 1⅞, 3¾. UK.

R. Newsome, 37, chief projectionist, 94 Planetrees Road, Bradford 4, Yorks. 35mm, 16mm, audio hi-fi; varied but no pop. Roebuck, 7in, 1⅞, 3¾, 7½. Anywhere but UK. English-speaking.

David A. Roebuck, 25, mechanical engineer, Londesborough Arms Hotel, Market Weighton, East Yorks Travel, motoring, swimming, snooker, films; C&W Tandberg twintrack, 7in, 3¾, 7½. USA, UK, Germany.

SOUTH AFRICA

Eben Burger, 47, furniture and appliance salesman, 14 Scott Crescent, Brenthurst, Brakpan, Transvaal, South Africa. Customs and music; popular, folk, light classical. Two Philips (mono), one Grundig (mono); 7 in, 1⅞ to 7½ inclusive. Universal.

Rodrigo D. Nunes, 16, student, 8 Bloukloof Flats, Tamboerskloof Road, Cape Town, South Africa. Chess, numismatics, SWL, electronics; pop and light music. Philips EL3553, 7 in, 1⅞, 3¾. Own age group in any country.

BELGIUM

Ivan Beunkels, 18, student, Leiselestraat 62, Sint-Michiels, Brugge, Belgium. Reading, cycling journeys; modern music (Shadows), classical. Grundig TK40, four-track, 18 in, 1⅞, 3¾, 7½. England, USA.

Frank Verguts, 37, civil servant, 7 Florisstraat, Antwerp, Belgium. Photography, body building, travel; all kinds except heavy classical. Novak, 7 in, 1⅞, 3¾, 7½. All countries, male only.

IRELAND

Michael Brown, 21, student, 137 Sandown Road, Belfast 5, N Ireland. Photography, motor cycling; light classical, folk, instrumental. Philips EL3553, four-track, 7 in, 1⅞, 3¾. Worldwide.

Traolach De Burca, 37, medical doctor, Br Droicmeada Tma, Ath Fhirda, Co. Lut, Eire. Contacting members for Teip-Gael, Irish language or Scots Gaelic only. Philips EL3542, Sony TC900, 7 in, 1⅞, 3¾, 7½. Anywhere.

NEW ZEALAND

John McInnes, 27, high school teacher, c/o South Otago High School, Balclutha, New Zealand. Using tapes in teaching, canoeing, fishing, Christian youth work; folk, general. Sony 464, four track, 7 in, 3¾, 7½. Anywhere. No letter required.

SCOTLAND

David J. Bowman, 14, student, 43 Craiglockhart Road North, Edinburgh 11. Photography, travel, painting, table tennis; popular. Cossor CR1606, 5¾ in, 3¾. USA, Australia, Canada.

Selwyn Cowan, 38, salesman, 78 Braidholm Road, Giffnock, Glasgow. Glenn Miller, Jimmy Dorsey, Artie Shaw, Benny Goodman, Big Bands 1930–1944. Stella ST459, Cossor CRI605 (both four track), 7 in, 1⅞, 3¾, 7½. UK.

Jack McKillop, 32, cab-driver, 447 Hawthorn Street, Glasgow N2. Astronomy, philosophy, people; catholic music. Civic T72, 7 in, 1⅞, 3¾, 7½. Anywhere English-speaking, especially UK, USA.

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TEST REPORT JORDAN WATTS LOUDSPEAKERS

by Peter Knight

When listening to these speakers for the first time, one is immediately aware of the lack of coloration, coupled with the excellent transient reproduction and the big-speaker sounds, in spite of the conflicting smallness of the enclosures. Both models employ the Jordan-Watts modular driver unit. The Jumbo – the smaller of the two – consists of an infinite baffle (air tight) enclosure, while an enclosure of reflex design is used for the Juno. The Jumbo measures 16½ × 8 × 3½ inches and weighs 15 lb. It is thus ideal for placing on a bookshelf or similar mounting. The Juno is almost twice the size with dimensions of 24½ × 12 × 6½ inches and weighs 30 lb. This needs to be placed on something more substantial, but even so it is small for a reflex design.

Both models are finished in teak and Vynair and can be obtained with impedances of 3 to 5 and 7·5 to 16 ohms, the former fitting in well with the output impedances of some small transistor amplifiers, thereby avoiding the use of a speaker matching transformer to realize full power output of such amplifiers. Both models can handle up to a full 12 watts, which makes the Jumbo the smallest speaker of this kind with such a high power handling capability. The treble response of both models is established by the driver alone, and this is in the order of 20,000Hz. The Jumbo goes down to around 70Hz and the Juno to 40Hz. Incidentally, the Jumbo replaces the earlier 'Mini 12' and the Juno the 'A12'. Prices are £17 12*s* 6*d* and £24 10*s* 0*d* respectively.

To appraise these speakers, one must look at the driver or unit itself. While the J-W modular unit adopts the basic principles expounded in the first days of moving-coil units, it differs greatly in detail from the paper cone units that we have become accustomed to over the years.

The larger, paper-coned unit is sometimes arranged to reproduce only the lower – and possibly middle – frequencies in conjunction with the enclosure, in which case a high-frequency reproducer (tweeter) is used for the treble. An extra mid-range reproducer may also be found in some full-range speaker systems. Such an arrangement working in conjunction with a suitable crossover filter – splitting the low, medium and high frequencies and conveying them to the appropriate units – is capable of extremely good reproduction, and it is found in a large number of contemporary hi-fi systems all over the world.

An almost equally popular alternative is the use of a single speaker unit (driver) designed to respond well at all frequencies, from low bass to high treble. Again, the latter is greatly assisted by the nature of the enclosure. Speaker units of this kind often have specially shaped cones, with a smaller cone decoupling from the main cone at high frequencies, the latter then taking over the reproduction while the large cone is effectively muted. The Jordan-Watts unit is a full-range driver, but it only has one cone. This, however, is very scientifically designed both in terms of shape and material. Its suspension is also somewhat more sophisticated than that found in ordinary paper cone models.

Variable Cone Diameter

The design is such that the cone progressively diminishes in effective diameter as the frequency of the signal applied to its speech coil increases. This happens without cone break-up and without disturbing intermodulation symptoms. This means that at high frequencies only a small diameter in the centre of the cone is effective, while as the frequency is reduced so this diameter from the cone centre expands. A great deal of thought has gone into the designing of this principle and also a great deal of development to get the principle to work in practice. This has led to a cone of only 4 inches in diameter made of metal, which is by far the smallest dimension ever before used for the cone of a full-range driver, but this small size was found necessary to avoid intermodulation effects. The cone is of a hyperbolic form, having a flare given by the law $y = \frac{75}{x}$, and, aided by the nature of the suspension, a remarkably smooth response over the whole of the useful audio spectrum is achieved, with the effective cone area decreasing with rising frequency.

For such a small cone to produce an acceptable acoustic output at low frequencies, its in-out movement needs to be greater than that required by a speaker of larger cone diameter. It is known, of course, that a large cone excursion encourages Doppler distortion, whereby the frequency of higher frequency sounds produced by the cone are changed up and down in frequency owing to the large movement given by bass frequencies. However, the mathematics of the Jordan-Watts cone appear successfully to overcome this problem. Listening tests indicated freedom from both Doppler and modulation of the treble frequencies by the bass.

Mr E. J. Jordan has described the design of his module driver in a recent edition of the *Wireless World* (November 1966), and there is also quite a bit of information on its evolution in E.J.J's book called *Loudspeakers* (Focal Press). Both of these references are well worth reading if one has a technical turn of mind. It would seem that the cone metal started with aluminium but, according to the *WW* article, the metal titanium seems to have certain added advantages. The driver unit is enclosed in a vented, plastic case but when viewed within the reflex enclosure seems such a small mite to deliver such high quality sound at 12 watts rms.

Cone break-up and resonance effects are deleted by the nature of the mechanical termination at the cone edge, and this also constitutes an airtight seal allowing infinite baffle loading techniques. The suspension system comprises tangental elements made of silvered beryllium copper, giving very free cone excursions in the order of ±⅛ inch. The suspension is designed to withstand all

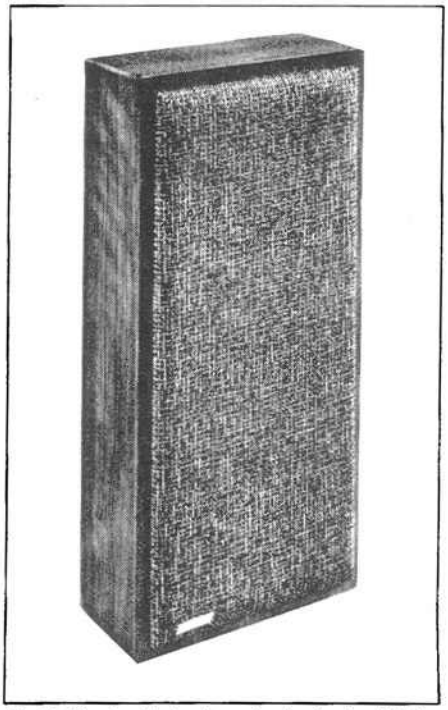

Fig. 1. The Jumbo loudspeaker by Jordan-Watts.

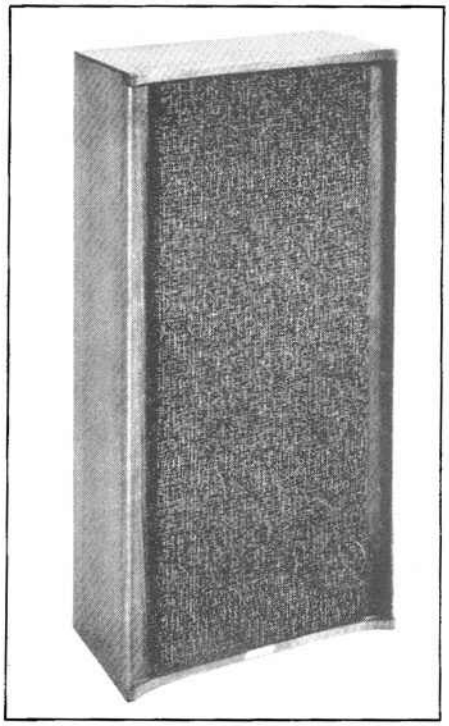

Fig. 2. The Juno loudspeaker which, like the Jumbo, employs a modular drive unit.

climatic environments and it cannot progressively distort with time. It is through this that the audio current is applied to the speech coil. The speech coil itself is wound – according to the impedance requirements which, incidentally, should be clearly indicated when ordering – on a former of aluminium and the magnetic gap length is such that the coil remains immersed in full field strength even at maximum cone deflection.

The module is acoustically damped and the method employed ensures that the If response is linearly maintained, it being claimed an advantage over the more conventional electromagnetic damping since it takes effect over the entire cone surface instead of only at the centre. It also maintains balanced unit damping where more than one driver is employed in a single enclosure or line source cabinet (the latter for public address work). The case is made of plastic, while the cast chassis has a total rear radiation area four times that of the cone itself.

The reflex enclosure, as would be expected, has the better bass response of the two models, and is also more efficient than the smaller, infinite baffle version. The volume of the reflex enclosure is 0·6 cu. ft. The vent is directly below the driver and is extended into the form of a rectangular tunnel by appropriate internal woodwork. This gives a low-frequency output well down to 40Hz, and sweeping the speaker (loaded to an amplifier) with an audio oscillator certainly confirms that this is true. (Details of suitable enclosures can be obtained from the manufacturers.) The Juno employs an enclosure similar to that described for a single module down to 40Hz. This handles 12 watts rms and where even greater power requires to be accommodated on a single channel, two modules can be used (giving up to 24 watts rms).

It is worth noting that the lowest frequency that can be adequately reproduced is limited by the longest dimension of the listening room. The frequency, in fact, is equal to a factor of 560 divided by the longest dimension in *feet*. The author's listening room is just a little in excess of 20 ft in this respect, making it possible to reproduce very little under 30Hz. Anyway, a signal of this frequency applied to the Juno could certainly be discerned – albeit, vaguely.

Sweeping to the treble end gave the absolute impression of smoothness, and while the author's auditory senses faded out around 15KHz, his daughter still proved the output up to about 18KHz. No doubt a test microphone and response indicator would have shown the output to be present still up to 20KHz, but such special test equipment was not available. The speaker was tried on several valve and transistor amplifiers, and it really gave first-class performance in conjunction with one of the latest transistor types. Music material ranged from pops to heavy sustained organ renderings, and even at full power on the latter there was no show of distress within the module. A corner-room position certainly gave the impression of bass lift, but this was probably an effect due to room acoustics.

One could class this speaker between the conventional three-unit system with cross-over and the electrostatic, for although not as clinical as the 'static, it is certainly on the way towards this sort of subjective characteristic. The Jumbo responded treble-wise equally as well, but deep bass was lacking, as can be expected, particularly on organ music. However, it could be restored to a noted degree by corner mounting. This, again, could handle the low frequencies up to full power without any trouble at all. Neither speaker had discernible peaks or resonances, and both pure tones and harmonically abundant signals were reproduced with equal quality.

The Juno would be my bet if I were looking for a small speaker of outstanding performance and unique design. If space were really limited, however, the Jumbo would also be well worth looking into. Speaker units devoid of crossover filters and reactive components fail to introduce a factor into the amplifier loading that may affect the negative feedback, and this could apply particularly to some of the transistor amplifiers now on the market.

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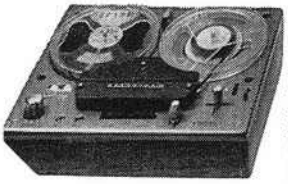

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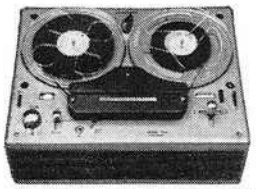

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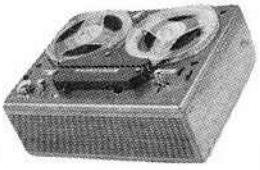

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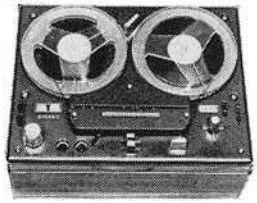

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by completing and returning the questionnaire facing page 10

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5½" 900' 10/–	5½" 1200' 12/3	5½" 1800' 19/3	5½" 2400' 28/6
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Classified advertisements in 'Amateur Tape Recording' cost 1*s* per word, minimum 10*s*. Box Nos. 1*s*. 6*d*. extra. Advertisements and remittances should be sent to Classified Advertisement Department, ATR, 9 Harrow Road, London W2.

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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)

Autocourse – the review of International Motor Sport. The two editions of this annual covering years 1962-63 and 1963-64 are now available at 12*s* 6*d* each post paid from **Book Sales Department, 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 25*s* 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.

A BATTERY-DRIVEN TAPE DECK

continued from page 27

should be very small. Once the erase head position has been found, appropriate fixing holes can be drilled. The record/replay head position is found in the same way except that care must be taken to ensure that tape contact at one head is not obtained at the expense of good contact at the other.

When tape is being transferred from supply to take-up spools in the record or replay functions, the supply drum is completely free. Experiment will show that movement of the deck may intermittently increase the spool rotation in the direction of tape travel. Momentarily the tapes tension drops and the tape/head pressure is lost. A pressure pad at the record/replay head serves the purpose of maintaining the tape tension and head contact irrespective of take-up spool fluctuation. This consists of a small piece of felt glued to an alloy strip, bent at right angles. One arm is bolted under the bridge (6BA) and the arm carrying the felt bears against the pole faces. Pressure is maintained constantly during all functions. Since the erase head/tape contact is not so critical, a pressure pad does not seem necessary, but clearly could be fitted if tape fluctuation became excessive.

The deck is now almost complete and it remains only to provide a permanent connection between the function switch and the battery supply. The shape of a 1·5 volt dry cell is such that a special holding clip or case is required. My own way around the problem was to use the body of a cheap electric torch. The bulb was carefully broken and all glass removed, leaving the screwed brass cup with centre contact at the base. After the cement residue had been scraped away from the lip, a lead was soldered inside the cup. A second lead was then pushed through and soldered to the centre contact by applying a soldering iron to the contact at the outside. The brass cup was then filled with liquid fibreglass, which was allowed to harden. This was, of course, screwed into the torch bulb socket. Note: the cylindrical electric torch case must be capable of taking two 1·5 volt cells end to end, thus providing a 3 volt supply for the motor.

Testing and Performance

There are two aspects of testing – mechanical and electrical. Mechanically, the deck design is such that the quality of performance is dependent on controllable factors. Wow can be kept to a minimum by finding the drum and platform centres accurately and the more powerful the motor, the less will be the fluctuation due to load variation. Furthermore, a powerful motor will offset one of the disadvantages of this type of drive – the increased driving torque required as tape accumulates on the take-up spool. Although not yet fitted in the deck shown, inertia rings of lead, bolted concentrically in the hollow drums, would increase drive resistance to effects caused by intermittent load variation. Lubrication in the form of light machine oil should be applied sparingly to only the drum shafts. Any attempt to oil the motor shaft in the swinging arm will result in oil on the idler and consequent slipping of the drive.

THE THINGS YOU SAY

continued from page 32

Market for Amateur Tapes?

Your letter from correspondent E. Smith (November issue) interested me vastly because I recently suffered similarly and deplore the lack of information given by the BBC to amateurs who wish to try their hands at recording talks, or short stories. I was fortunate enough to have the scripts filed away but, of course, my tapes all had to do a double journey. What I would like to know – is there a market for tapes of talks, stories, etc., outside the BBC monopoly? For example, women's clubs, pensioners' meetings, etc. Maybe *ATR* could help there by running a market supplement for amateurs who have something to say, but cannot get anyone to listen!

Barton-on-Sea, Hampshire **V. Ranzetta**

Constructor's Success

I have built the noise-cancelling mike featured in the September 1966 issue of *ATR* and found that it performs extremely well even in a crowded coffee bar and used for *Ton-up* interviews. The mike will be going with me and my Q-Cord 203 at Christmas for the proposed interviewing of all the 'Father Christmasses in Manchester'.

Keep up the good work.

Hyde, Cheshire **Y. D. Kay**

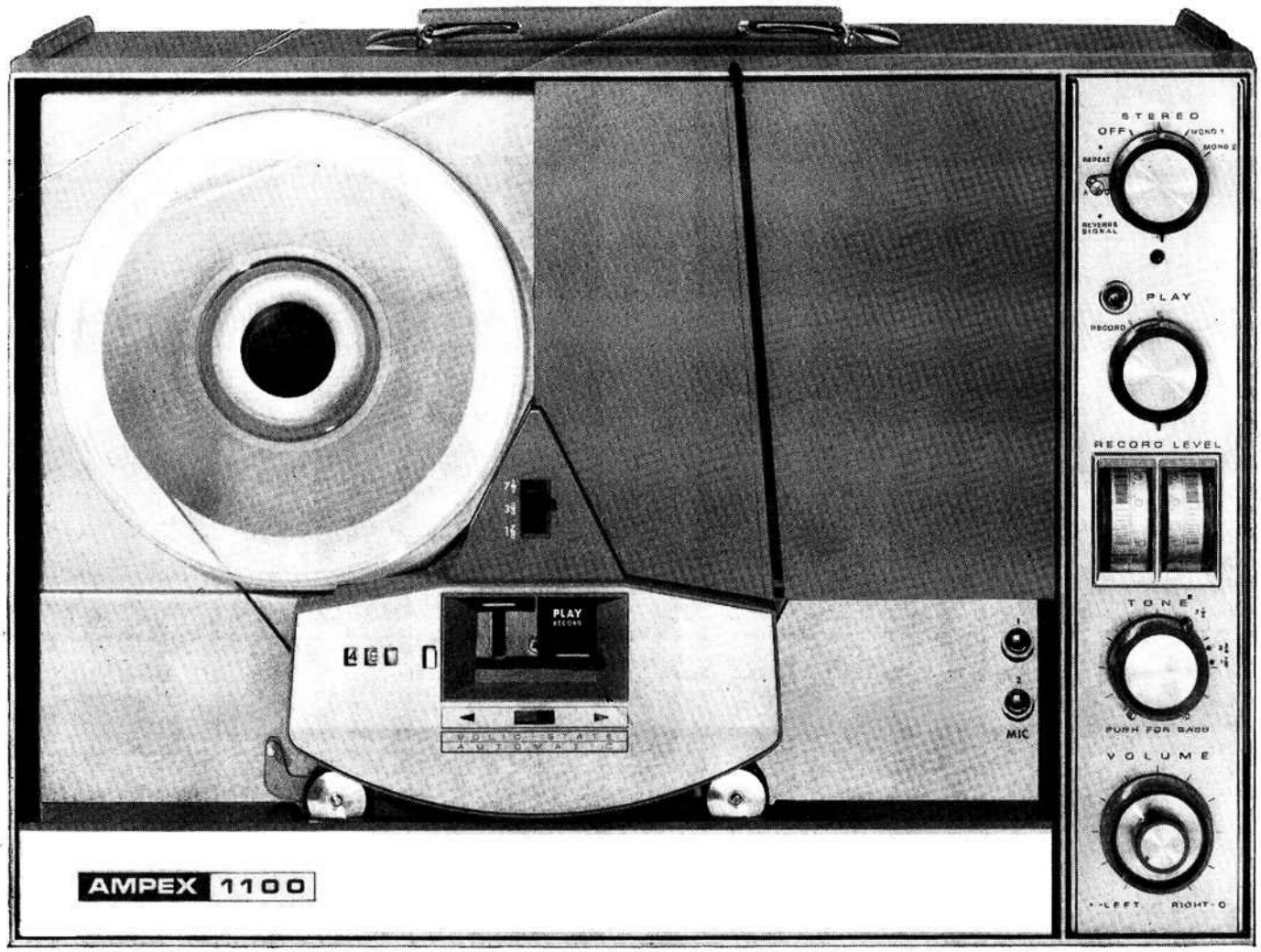
Hi-Fi or Noise?

I wonder how many more so-called 'hi-fi enthusiasts' are like me. I started some five years ago with a record player and thought it was wonderful. Gradually becoming discontented after hearing others and especially after visiting Audio Fairs, I have built, bit by bit, what seems to me to be a rather expensive outfit but which gives me a lot of pleasure. What worries me, however, is the fact that it never sounds as I think it should – pure imagination perhaps. One day I listen to it and think 'good heavens, what's gone wrong with the darned thing now' and the next day I listen enraptured and it's marvellous. The only explanation I can think of is that it depends on what mood I am in. On my off days, I don't listen to the music, I listen to background noises mixed with hum, wow and flutter and hiss!

Which brings me to your Editorial Comment (*ATR*, Nov 66) about noise factors and distortion – why worry about the electrical side when the motor driving the tape sounds like an old threshing machine? Why isn't the mechanical side of a tape recorder as quiet as a first-class record transcription deck – or does one have to pay several hundred pounds for this benefit?

Recently I had to return a well-known make of tape unit, which cost nearly £100, to the manufacturers because of this horrible noise – and, incidentally, this was not imagination. Perhaps I am unlucky and this is an isolated fault. I am a newcomer to recording, having bought this tape recorder only ten months ago, and it would be interesting to hear comments from other readers who may have the same problem.

Northampton **T. Hollings**



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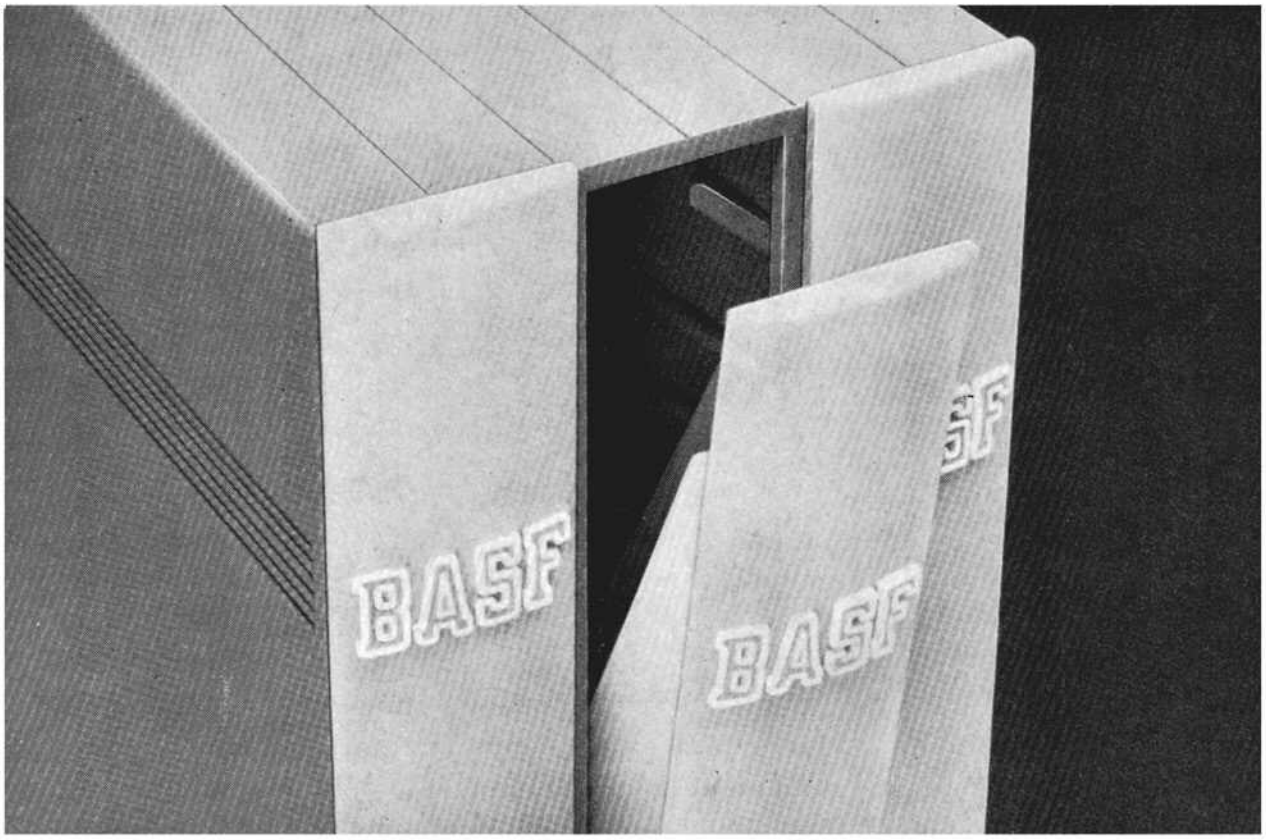

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