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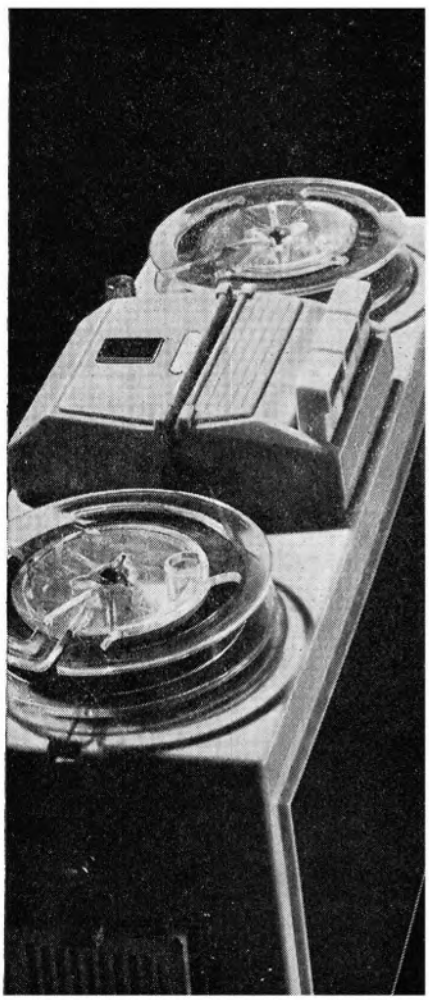

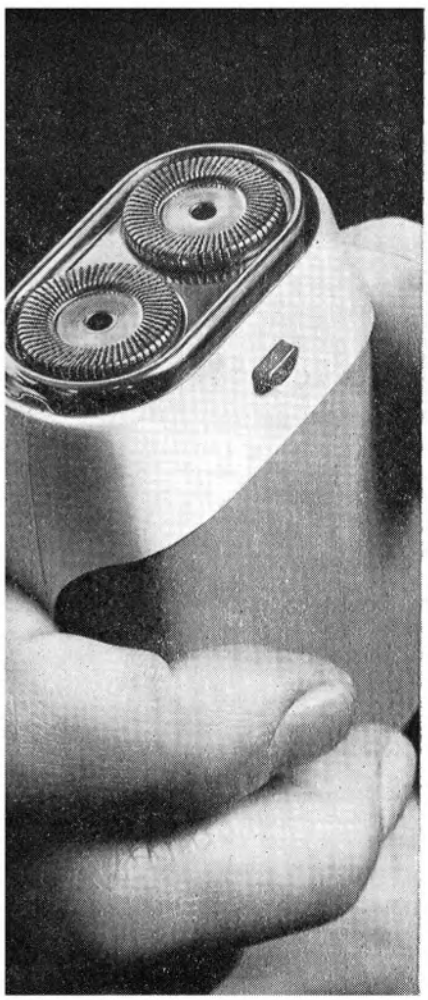

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editorial

TAPE RECORDING ENTHUSIASTS can scarcely be accused of living in the past, since, for them, the past is yet to come. The alternative, of course, has been to live around and beyond the boundary of the 'foreseeable future' and this column, like its opposite numbers in many other fields, has devoted no little space to prophecy and speculation. Time alone will show how accurate we have been, and yet perhaps the past *can* provide an arrow to the future. Perhaps, in the audio world of thirty years ago we may find some clue to that of thirty years hence.

Being a sprightly eight-year-old, early issues of this magazine may hardly be considered a 'window on the past' and we turn with reverence, therefore, to that elderly publication *Wireless World*, now in its sixty-fifth year and far from retirement.

On October 21st, 1932, an article appeared under the pen of Norman P. Slade, entitled *Sound Recording for the Amateur*. In a time when the 78 r.p.m. disc seemed the most promising medium for experimenters, the writer's suggestion that the *Blattnerphone* steel-tape recorder might one day be scaled down in size and price for the home may have seemed a little far-fetched. Cylinder, disc, magnetic and optical recording systems were discussed, an introductory paragraph being a possible insight to contemporary thought: "The argument in favour of film recording will be studied with interest, and will, it is hoped, give rise to some useful discussion".

Mr. Slade considered the sound film "to be the method *par excellence*, and will probably supersede all methods of recording as time goes on". Chief among its technical disadvantages was stated to be film shrinkage, though apparatus already existed to compensate for resultant pitch fluctuations. He continued "So far as the amateur is concerned, the developing and making of prints is hardly to be considered as a drawback, for if this system can be brought within his sphere this would be undertaken at a reasonable charge by the firm who supplied the unexposed film". 8mm. cine enthusiasts, in particular, might find amusement in this pre-war assumption of falling costs.

Of magnetic recording (then, one must remember, a 60 i/s affair), he stated: "Its advantages lie in the ease of making a record, once the apparatus is suitably adjusted, the increased playing time obtainable, the fact that the tape can be demagnetised and used over again, and the absence of anything corresponding to the damaging effect of a heavily weighted needle, with a consequent improvement of background, and also of wearing qualities.

"The writer understands that recordings are also remarkably permanent, and do not tend to deteriorate unduly with time." The only disadvantage appeared to be "the necessity of special apparatus".

Upheaval and excitement greeted the announcement, in 1963, of the *Telcan* video tape recorder. Yet all might have been avoided had the demise of another, and earlier, flash-in-the-pan been examined: the unnecessary uproar and subsequent disappointment of the Telcan saga was reflected, to an extent, in the optimistic prophecy surrounding the *Selenophone* paper tape recorder in 1937. The original Selenophone was a high quality (for the time) sound recorder using film or paper tape coated with a light-sensitive photographic emulsion. Recordings were made in a variable-area optical fashion at about 18 i/s, tape width being in the order of ¼in. Quoting from a *Wireless World* news report on May 21st of that year, "... it is being used as the basis of a new type of gramophone which its sponsors hope will eventually supplant the ordinary domestic disc machine. The home instrument will be very much smaller than its commercial prototype, and will use coated paper tape, the actual recording being done by a combination of photo-chemical and ordinary mechanical printing processes."

We would dearly like to know the thoughts of readers scanning this particular page of *Tape Recorder* in thirty years time, for we are obliged to end by quoting the latest news of revolution in video recording processes. A new and inexpensive technique allows more than 16 minutes of 25 f/s high definition television to be recorded, with sound, on a 7 in. spool of standard play tape. Has domestic video arrived? Time alone will tell.

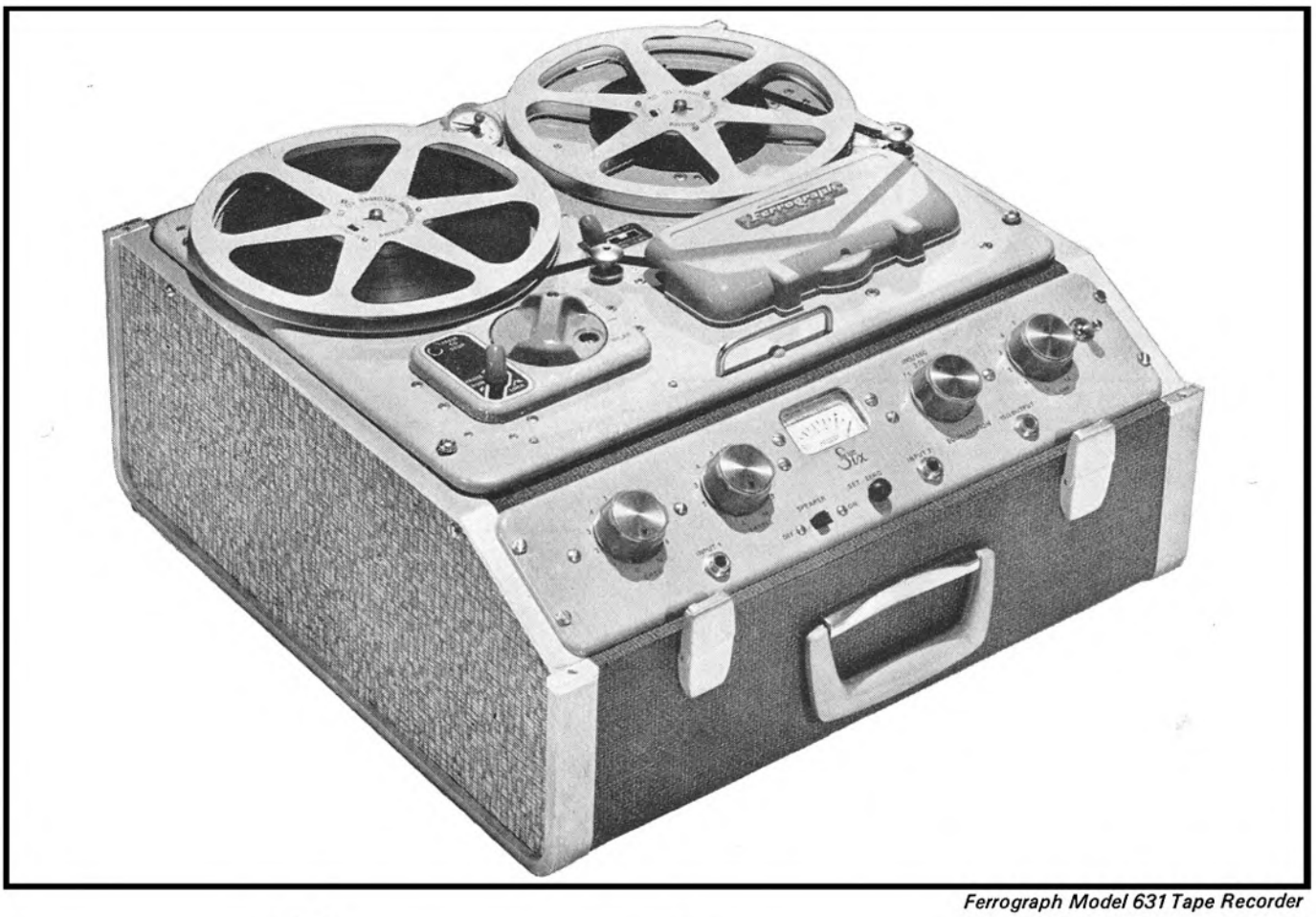
AUGUST 1966 **VOLUME 8** **NUMBER 7**

COVER PICTURE

That ultimate in battery tape recorders, the *Nagra III*, is seen assisting in the analysis of engine noise. The engine in question powers a VC-10 jet aircraft. The head-set worn by the operator is not, in fact, for monitoring purposes, but provides some acoustic isolation from an intolerably high sound level.

SUBSCRIPTION RATES

Annual subscription rates to *Tape Recorder* and its associated journal *Hi-Fi News* are 30s. and 38s. respectively.
Overseas subscriptions are 32s. 6d. (U.S.A. $4.50) for *Tape Recorder* and 38s. (U.S.A. $5.40) for *Hi-Fi News*, from Link House Publications Ltd., Dingwall Avenue, Croydon, Surrey.
Tape Recorder is published on the 14th of the preceding month unless that date falls on a Sunday, when it appears on the Saturday



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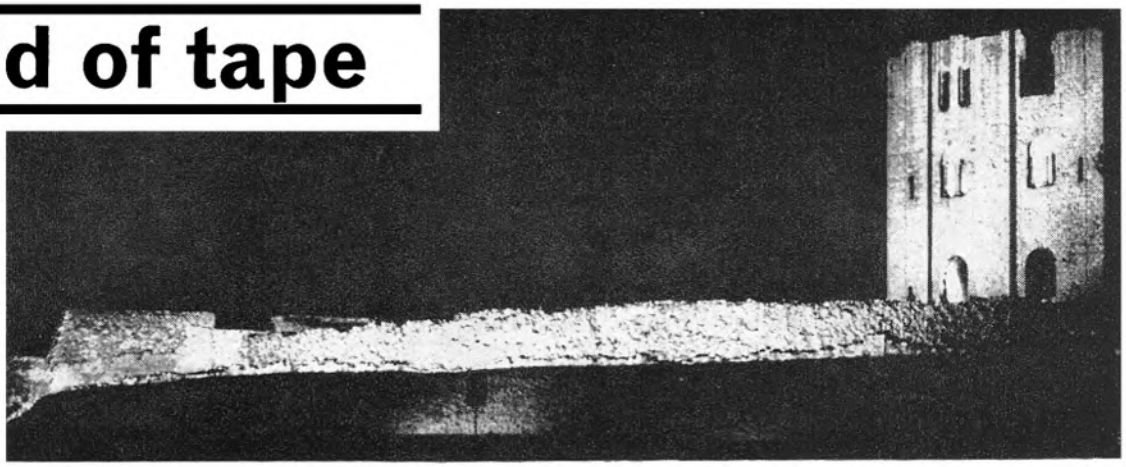


SOUND AND LIGHT AT SCARBOROUGH

SCARBOROUGH Castle became, this summer, the third British building to bathe in the light of a *Philips* Son et Lumiere installation, a privilege it now shares with the Tower of London, the Pyramids of Giza and America's Independence Hall.

Seven miles of wiring connect an array of coloured floodlights on 42 circuits and seven 20W sound channels, each feeding a column of five loudspeakers, to a magnetic 'nerve centre'—in the form of a multi-track Philips tape recorder.

Produced at the London studios of *Philips Records Ltd.*, the sound accompaniment tells the story of the castle's history, the castle grounds providing the stage setting while the 'actors' are conjured by synchronised lighting.

The spectacle will be repeated every evening until September 24th, being resumed in the holiday seasons of 1967 and 1968.

422U 5/22075 STOLEN

READER S. Standring of 61 Ivinson Road, Darwen, Lancashire was recently robbed of a *Ferrograph 422U* tape recorder—serial number 5/22075—and fifty *World Record Club* tape records. A reward is offered to anyone with information that would assist in the recovery of this equipment.

BBC RECORDING COMPETITION

INDIVIDUALS or groups residing in Britain, not engaged in sound recording as a profession, are invited by the BBC North Region to enter their 1966 Amateur Tape Recording Competition. Recordings must be on the theme of *Summer* and of not more than 8 minutes duration. Up to three separate recordings may be submitted by each competitor on ¼in. tape at speeds of not less than 3¾ i/s. Full or half-track equipment may be used, though in the latter case the second track must be clean. Closing date for entries is 30th September. First prize will be £25, runners-up receiving smaller awards and having their entries perhaps broadcast in whole or in part. Additional fees will be paid for broadcast material.

Full details of the contest, including rules and advice, are obtainable from : **BBC North Region Tape Recording Competition, Broadcasting House, Piccadilly, Manchester.**

NEW DISTRIBUTOR FOR CINECORDER

SOLE distribution rights for the *Cinecorder* have been acquired by *R.E.W. (Earlsfield) Ltd.*, 266-268 *Upper Tooting Road, London, S.W.*17. All enquiries regarding spares and accessories—including the perforated tape used on this machine—should be addressed to the company, but marketing of the recorder will be organised through electrical and photographic dealers.

HI-FI AND TAPE AT BRENTFORD

OF possible interest to readers in the West London area is a course in High Fidelity and Tape Recording, to be run at the *Brentford Centre for Adult Education, Clifden Road, Brentford.* Construction, use and maintenance of audio equipment will be covered, including the application of recorders in education, aspects of stereo, and the synchronisation of sound with film. The course will be held over three terms, from 7 to 9 p.m. on Tuesday evenings, commencing 26th September. Enrolment fee is 30s. and may be paid at the Centre between 7 and 9 p.m. on September 15th, 16th, 19th, 20th and 21st September. Also being organised are courses in Radio and Television Servicing and Amateur Radio Theory.

BATTERY TELEVISION RECORDER

THE Westel Company of California have announced plans to market the first battery portable television recording system. The equipment comprises camera and microphone (weighing 7 lb.), an 11 lb. recorder with shoulder strap, and 12 lb. rechargeable battery pack. Total price of the system, including 30-minute reel of 1in. recording tape, is about £3,500.

A separate machine is employed for playback, weighing 75 lb.

WESGROVE MAKE A MOVE'

WESGROVE Electrics Ltd., manufacturers of television cameras and low-price video tape recorders, recently moved from Worcester to London. Their new address is : **1 Maddox Street, W.1. (Telephone : REGent 4114.)**

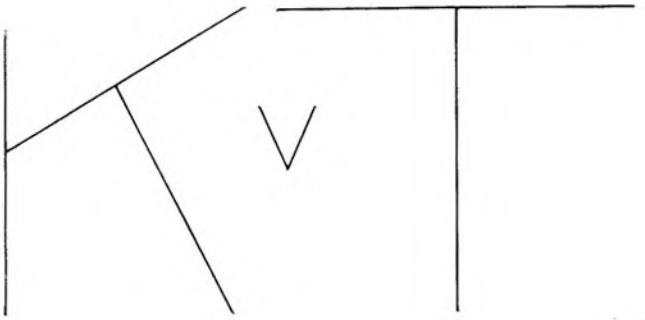
"Shall we ask them in to meet the Revox?"

ROLE OF MAGNETIC RECORDING IN SPACE

AT a recent luncheon given by the 3M Company in London, the American astronaut, Colonel John Glenn, described the important role played by magnetic tape in space research. "Without magnetic tapes the Mars interplanetary exploration vehicle *Mariner IV* could not have recorded the pictures which it sent back to earth. Again, magnetic tapes are in continual use by the *Tiros* weather satellites." Attention was twisted from the future to the past when Dr. M. H. Miller, Chairman of *Minnesota 3M Research Ltd.*, presented Colonel Glenn with a tape recorded volume of Sir Winston Churchill's speeches.

NEXT MONTH

THE SEPTEMBER ISSUE of *Tape Recorder*, to be published on Saturday 13th August, will be printed in three-column format and feature an orange cover. Reviews of the *Akai X-355* and *ME101* Fluttermeter will appear, along with practical tips on recording birdsong, by Philip Radford. R. F. Spriggs will describe a transistor microphone pre-amplifier while Peter Turner comments on *The Right to Copy*.



taken to task

A little public hatchet-throwing takes place under this title between Peter Turner and David Kirk. The Turner Hatchet is aimed at the 'Audio Annual' article* *Creative Taping as a Hobby*, which is later defended by its author, while *The Nature of the Beast* (Turner, June Tape Recorder) comes under fire from Kirk. In turn, the latter is defended. Readers incensed by one or other argument are invited to express their viewpoint in our correspondence columns.

KIRK ON CREATIVE TAPING

A REPLY BY PETER TURNER

ONE of the articles in the admirable *Audio Annual '66* is concerned with "some ideas for future expansion" of creative recording as a hobby. It is written by David Kirk, who is well-known to readers of *Tape Recorder*; and a photograph shows him seated, with a sickeningly comprehensive array of recording gear beside him—but silent, no doubt on a peak in Darien. (*The picture is not of David*—**Ed.**)

In a kind reference to an article of mine which appeared in *Tape Recorder* for August, 1965, he nevertheless doubts whether I came "close enough to the fundamental problem". I propose to let that pass, and rather to examine the extent to which he himself arrives at the truth. And he tries to do so by establishing an analogy between the tape recorder and the pen : between the recordist and the *journalist*. The trap is open :

> "If there is any single reason for the keen amateur recordist to feel discouraged, it is that the opportunity he has for putting his machine to practical use—or to make money—is almost nil."

It is not quite clear to me whether Mr. Kirk is here equating 'practical use' with 'making money' ; but at any rate the burden of his article is that the way out of the amateur recordist's dilemma is for him to find outlets for his recordings which will be financially profitable to him :

> "When a situation of the kind envisaged is finally evolved, the freelance market for tape-recorded material may be as great, if not greater, than the present market for hand-written fiction and fact."

Now, Mr. Kirk is right enough when he suggests that the limitation for the amateur is the absence of an audience :

> "... it is surely no more reasonable to expect the creative recordist to produce and collect ambitious tape plays, documentaries, sound-effects and artificial music *for himself* than it is for a writer to store his finished work in seclusion from the public eye".

In general, I think that is true, though I can think of one musician of genius—Skalkottas—who showed astonishingly little concern with the publication of works which are just becoming recognised ; and one should not forget the epics of *Gondal* and *Angria* which were the youthful products of the Brontë sisters. But it is certainly not universally true : indeed, one of the great charms of the tape recorder is that through it one can store up a collection of purely *private* photographs in sound, and play through them from time to time much as one glances through an album of photographs. In fact, Mr. Kirk might have considered more closely the analogy between the tape recorder and the camera rather than between it and the pen. I am quite certain that other recordists besides myself have regretted deeply their failure to secure such obvious things as recordings of their friends' voices : death or absence abroad cannot be foreseen.

It is a mistake to under-value uses of the recorder which depend upon no subsequent audience for their value : indeed, to the lonely and housebound a recorder can be a treasure. Nor does one wish to add to the army of victim-hunters : those ardent takers of colour-transparencies who blandly announce that they will show you their holiday slides after dinner. Tapes can bore as readily as slides ; and vary as much in quality. I have one friend whose slides I always long to see because they are so good, so varied and so interesting ; but neither the good photographer nor the good recordist is a common animal.

Nevertheless, David Kirk is right in thinking that what bedevils the amateur recordist more than anything else is, quite simply, that he finds that there is nothing to record ; but I cannot agree with him that the way out of this dilemma is to turn amateurs into semi-professionals, and get the spools turning in order to sell the result. Not that there is anything wrong in selling a recording ; but if sales are to become the main inspiration, then 'creative taping *as a hobby*' is over, and has been replaced by a spare-time job. Doubtless many amateur photographers hope to sell pictures ; but I doubt if more than a tiny number ever actually try, and failure does not prevent their continued clicking at every conceivable subject.

The fundamental error, I believe, has been the popularisation of the recorder for uses which it cannot fulfil : for the recording of great musical performances, which are simply not available for the amateur, even if he could do justice to them if they were. One can re-record discs, tapes and broadcasts, of course, and turn the tape recorder into a substitute for the gramophone : but that has nothing to do with *creative* recording. Mr. Kirk refers to "those god-forsaken bodies—the local tape clubs"—a reference which is less than kind : he forgets that those clubs were formed precisely to further creative recording, if only by providing the much-needed audience for members' efforts, together with amateur musical performances which might possibly be replayable with pleasure.

Mr. Kirk wants recorded newspapers and magazines, books provided on tape by means of which he may have his "fiction spoon-fed from a tape machine" ; and indeed there may, for all I know, be a future for such things. But clearly they will be provided by full-time professionals, with amateurs coming in on the fringes, as they do with the present printed equivalents : it seems to me that if creative amateur recording depends upon such things, its future is small. I agree very much with him when he says that "expansion in sales of equipment will need to be led or followed by an increase in the *applications* of the tape recorder" ; but increased sales for such things as sleep-learning and background-music provision have, once again, nothing to do with creation. Nor has Mr. Kirk's collection of *Goon Shows* and other radio programmes.

Let us not be snobbish or starry-eyed about the matter : most people buy a recorder in order to have fun with it, or for some particular application of their own ; and nobody has the right to quarrel with that. But presumably readers of *Tape Recorder* at any rate hoped for something more when they obtained a machine : they may not have had lofty conceptions of art, but they thought that they could use tape for something which can be truly called 'creative' :

*Copies of the 1966 '*Audio Annual*' may be obtained from the Subscription Department, Link House, Dingwall Avenue, Croydon, Surrey. Price is 6s. post-paid.*

for making something of their own. I think they were right. When I look round at my own acquaintances in the recording field, I see some who record trains, some who record birds, some who correspond with people all over the world, some who teach themselves or others music and languages : all uses which are more or less private and individual, but all fascinating and satisfying enough to keep their enthusiasm alive and their purses open. They have all 'found something'. People who do not find anything of permanent value in their recorder almost certainly bought it for the wrong reason or for no reason.

In my own case, I bought my first machine because I was doing a little broadcasting and I wanted one to help me to prepare and rehearse scripts : a perfectly legitimate reason, I believe, and not an uncreative one. Though I have almost never used a recorder for the purpose for which I bought my first, I have kept an abiding interest in recording as an art—and art, as Aristotle taught us, is nothing more, and nothing less, than the right way of making things. For the last six years I have been concerned, increasingly, with the provision of entertainment for the old, the blind and the physically handicapped, through my association with one of those 'god-forsaken' clubs. Now here, pre-eminently, is a field where the amateur may use his recording skill literally for love : he records the material, he edits it, he arranges it, he makes it up into a coherent and enjoyable programme. Mr. Kirk tells of making money and of personal enjoyment, but he nowhere speaks of service to others ; and it is my belief that the vast field of service is that in which the amateur recordist can find his fulfilment. He needs, as has been said, an audience : here is one numbered in thousands. He needs stimulus to go out and record : there is nothing so efficient as a publishing-schedule. He wants to exercise his skill : here is incentive to do his best. If he need any other reward, his experience will give him that, abundantly.

THE TURNER BEAST

A REPLY BY DAVID KIRK

ARTICLES appearing in national magazines do not always represent the opinion of the Editor or his staff. Some publications even take the trouble to print a note, often on the correspondence page, to the effect that "The Editor does not necessarily agree . . ."

Whatever our own Editor's feelings regarding *The Nature of the Beast* when it was first submitted by Peter Turner, my first reaction was to litter the manuscript margin with question marks, exclamations and minor argumentative abuse. On learning that Peter had apparently experienced a similar inclination towards my 'Audio Annual' rambling, *Creative Taping as a Hobby*, I resolved to join him in verbal battle!

'The Nature of the Beast' (published in the June *Tape Recorder*) was evidently intended to stir the conscience of manufacturers into adopting a less mercenary approach to the design and construction of tape recorders. Three thousand words of criticism, comment and suggestion hinged upon the sentence "Style, it seems, hits the cash register : thus style is supreme". Whereas his plea for more convenient lid catches was both practical and warranted, the sweeping statement regarding styling was—within the limited confines of magnetic recording—the mere perpetuation of a myth.

Very few concessions have been made to stylists, and the most important of these—the so-called 'vertical trend'—may well, in fact, have been the fault of the advertising and public-relations industries. Manufacturing a domestic recorder to operate vertically is difficult and involves unnecessary expense. With the capstan on a horizontal axis, wear is accelerated, wow is accentuated, gravity clutches can be rendered ineffective, and operation becomes more difficult. I do not hold the stylists responsible for the 'vertical trend', because they would have relished the opportunity of relocating amplifier controls in more dominant positions for upright use.

As is the case in the motor-car industry, internal and external design are two separate arts. The stylist may do as he wishes within the limitations of the mechanical design : he may select the cabinet material, he may plan the facia panel, design the knobs, and perhaps even the deck covering, outlining his own components or selecting from the existing stock of an independent manufacturer. He is not, as Peter Turner implies, permitted to alter the *position* of important mechanical components—idlers, motors, turntables or mechanical controls. The exception, in the latter case, may apply only when solenoid or steel-wire controls are incorporated.

To illustrate the 'untouchable' nature of a tape mechanism once it has reached the prototype stage, let us consider a very well-known deck currently being used by several British manufacturers. Perhaps the engineers in question did not possess wow measuring equipment, but they were fully aware that the stability of their design was well below modern domestic standards. They had committed a minor blunder in relying on a spring to hold the capstan idler between the motor spindle and capstan flywheel. Vibration of the spring caused considerable wow by varying the mechanical linkage between the three components. Here seemed the ideal occasion for a slight mechanical modification—the idler diameter must be reduced to the point at which the motor would push it into place against the flywheel instead of trying to push it outwards. But this modification—much simpler than might be requested by a stylist—would have resulted in the deck being re-designed almost from scratch : such was the interdependence of component positions, idler dimensions, control linkage and braking. Are we really expected to believe that a manufacturer would go to all this trouble merely to obtain a slight improvement in appearance?

"The result is that you can fry an egg . . ." This reference to overheating in tape recorders is a valid one, but takes no account of the compromise facing motor designers. It is easy to produce an electric motor that will run for long periods at low temperature ; but what is lost in heat is necessarily gained in strength of the magnetic field generated by the motor coils. Many single-motor recorders tolerate a moderate motor field in order to keep down heat, overcoming the hum problem by placing the motor well away from the tape heads. Yet even this practice would not be tolerated in the Turner Beast, since that animal is required to have a "capstan drive without idler pulleys . . ." because ". . . the performance from the important aspect of wow and flutter is greatly improved".

In fact, direct capstan drive is another of the many compromises involved in tape recorder design. Direct drive is certainly much more robust than idler transmission, but is gained only at the *expense* of wow and flutter. Much of the cost of *Studer* equipment is spent on damping the motor 'tug and pull' by means of a large dynamically-balanced flywheel. In addition, the capstan must be driven at relatively high speed to obtain the full benefit of the flywheel, which means incorporating a very narrow tape-drive spindle with all the expense of further fine machining. Although I have already described an idler transmission that induced more wow than it was meant to iron out, a conventional idler will, if well made and treated with respect, provide some degree of insulation against motor speed inconsistency. Might I refer readers and Mr. Turner to pages 226 and 227 of Spratt's *Magnetic Tape Recording*?

Coming back to fried eggs, transistor circuitry has reduced the operating temperature of many modern recorders, despite its various disadvantages ; only *Ampex* and *Uher* seem to be using silicon transistors in their non-professional designs.

"Too many recorders limit the size of spool which can be accommodated." Of course they do, but why? The "ten-inch reel" which Peter would like to see would require a great deal more than a larger deck-plate. Considerably more powerful motors would be needed to

(*continued on page 275*)

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transport the weight of the elephantine spools at a reasonable wow level, the brakes would have to be larger and more effective than on today's 7in. domestic recorders, and a professional-style (professional-price) servo tensioning mechanism becomes essential if variations in reel diameter are not to affect the tape speed. None of the four 10½in. capacity recorders currently available under £260 feature such servo devices, though the *Wearite Tape Deck* and *EMI L4* battery portable do include them for spools of up to 8¼ and 4in. respectively.

Surprisingly few machines in fact "provide for a high *and* low-level input" and fewer still permit mixing of the two channels. I shall not enter the debate upon the need for such mixing facilities, though I would point out that I would never have become interested in sound recording if the cheap *BSR* and *Collaro*-decked recorders upon which I cut my teeth had not incorporated them. If there is any argument here it is surely that the so-called 'semi-professional' or 'hi-fi' recorders should not incorporate low-level microphone input stages, but simply have inputs suitable for (naughty, naughty) FM-tuner and gramophone amplifier. Those millionaire enthusiasts who are "concerned with hi-fi anyway" would surely possess mixers or preamplifiers through which to pass microphone signals. Many continental manufacturers, in fact, feed high and low level signals through the same input, merely placing an attenuator in the 'gram' patch cord—a bad practice if ever there was one. The trend, however, seems to be *away* from the extreme simplicity which Peter advocates. Perhaps we would do better to join forces against the fifteen-sixteenths brigade.

We are really on the same ground when it comes to plugs. Despite the tales I have heard of tip-oxidisation, I too would have "the good old jack every time". Having learned to live with DIN (for short periods at a time) I no longer despise continental plugs the way I did, but the mere mention of phono-plugs makes my blood run cold. There seems no alternative but to put up with these on amplifiers and tuners, though the wretched phono is difficult to solder, once soldered can easily disconnect, and is as unsightly as a pre-war radio receiver.

Which brings me back to a convenient closing point. As Peter has said, it is a mistake to buy a recorder for its popular styling. But it is no less a mistake to think that an ugly recorder is necessarily a solid recorder. On the contrary, a quiet and clean finish may well reflect competently designed innards: I am sure we are both agreed upon the excellence, within the limits of this imperfect world, of the *Revox 736* and *Ampex 863*. An industrial system capable of selling these at a reasonable price, after transporting them across vast portions of our planet, may well be against producing his ideal machine. They wish, quite reasonably, to cater for the folk who want their home studio to blend with weak low-slung coffee-tables. Such folk will rarely require "an eight or ten inch reel . . . for a long session", nor will they want variable speed rewind, other than that which is possible on some decks where the pause control activates the brakes.

The modern range of tape recorders includes machines with almost every conceivable sequence of features. If the Turner Beast does not yet exist, it is not through want of the manufacturers trying. My suggestion is that we stop screaming for more facilities, less facilities or new facilities. Peter would rather "leave such things as speed stability and electronic function to the expert". Since these aspects of design are intimately concerned with the one feature we should all be pressing for—*reliability*—would it not be more fruitful to focus our efforts on obtaining that?

IN DEFENCE OF THE BEAST

BY PETER TURNER

SOME years ago I tackled the sales manager of the firm manufacturing a tape recorder which I thought then—and still think—to be one of the best general-purpose machines ever made, about the layout of certain controls, the size of certain knobs, the flashy and easily-bruised material with which the solid box was covered, the fact that too many of the inputs were concealed behind a door at the back, and various other matters which made the machine difficult to use. His reply was simple: "I agree with you, my dear chap; but I want something which will sell in America". It was then that I realised that the 'stylist' was all, and took second place to the engineer. I have since heard of another machine, which was fitted with a solid deck-plate in prototype. The sales boys seized on this, and demanded a thinner plate in order to bring down costs. They got it; with the result that a solid blow on the recorder-case (as when handling in and out of cars or into halls, causes the deck to bend, puts out the setting of the capstan, and plays hell with quality. David Kirk is naïve indeed if he imagines that functional excellence is allowed seriously to limit the external flamboyance which sells most goods today.

I hope I made it clear in my article that I am not an engineer, and look upon problems of design only from the viewpoint of the practitioner. From that viewpoint, I know that the best machine I have ever used, from the wow-and-flutter aspect, appears to be the *Revox*. That machine uses direct capstan drive. Therefore . . . It also happens that this method gives a good speed *accuracy*, provided that the original engineering be accurate; and when one is concerned to edit material from all over the place into a coherent programme, one soon discovers that the expressions three-and-three-quarters and seven-and-a-half are expressions more of hope than of fact.

I have never suggested that my ideal Beast would be cheap, in terms of initial price. It would be cheap in the sense that matters: it would be reliable, durable, and not soon superseded by something genuinely better, as distinct from something tarted-up to look different. I should prefer to give a good price for a machine which satisfied me for years, rather than make annual changes of rubbish.

It may be that I express myself badly; but when David tells me that "surprisingly few machines in fact 'provide for high and low-level input' ", I can only reply that I have never owned or used one which did not. How many machines are there which do not accept the low-level signal from a microphone and the high-level signal from a radio? Most of the machines I have used allow these to be mixed, if only when the radio input can be controlled externally.

When, however, David tells me (ME!) that "it is no less a mistake to think that an ugly recorder is necessarily a solid recorder", I am tempted to throw my typewriter out of the window and write no more. The whole point I was concerned to make was that beauty *results from* perfection of function and is not something added on afterwards by stylists. The Beast would *be* beautiful: there would be no need for consultants and 'artists' to be dragged in to make an ugly lump look like a cocktail-cabinet. The way to produce shoddy, time-conscious tinsel is to make an inferior product and then frig it up to 'look good'. If "an industrial system . . . may well be against producing (my) ideal machine", that only proves what I already knew: that the industrial system is fundamentally wrong anyway. But what we do know is that, occasionally, it can produce a beautiful thing (like the new *Lenco* pickup arm); and that when it does, that thing *works*—in fact, it is beautiful *because* it works. That recorders are produced to fit in with contemporary décor is obvious; but that décor is as ephemeral as the advertisers can make it; and to be ephemeral is, *has to be*, trashy: nobody yet has made a Sheraton chair look like last-year's television set.

This, however, is a discussion about tape recorders and not about sociology. I believe that the present situation arises precisely because people buy on looks and not for use. What manufacturers try to do is to make what will sell; and it is our fault if they get away with it I was recently present when the meters were put on a machine for which exalted claims are made. At the point in the frequency-run where it was supposed to be not more than 3dB down, it was actually 26dB down. A second machine of the same vintage gave similar results. Taxed with this discrepancy between specification and performance, the sales rep. who had brought them along shrugged his shoulders and said: "I can sell them in the Charing Cross Road".

IN DEFENCE OF CREATIVE TAPING

BY DAVID KIRK

IF I intended to annoy anyone with my *Audio Annual* article, it was, to quote my mixed bag of thoughts, "those who derive pleasure from setting up, dismantling, learning the theory of, and servicing tape equipment". In fact, however, I appear to have attracted condemnation from one of the very individuals I had strived to defend—the creative enthusiast.

The point of my article is indeed a hope that society will provide a greater outlet for the activities of semi-professional recording enthusiasts—graduates from the rank of amateur—with financial reward forming an incentive. As is most certainly the case in journalism (I

(*continued overleaf*)

jump readily into "the trap" of comparing recordist and journalist), dreams of ultimate wealth support an army of amateur writers, all seeking the day when their standards reach those of the semi-professional. Peter Turner states that audio-publishing would be "provided by full-time professionals, with amateurs coming in on the fringes, *as they do with the present printed equivalents*". Nonsense! Eight of the ten feature articles published in the *Audio Annual* were contributed by amateur—or, at most, spare-time—journalists. Similarly, the bulk of *Tape Recorder* and *Hi-Fi News* articles are written by non-professional journalists. David Robinson, Rex Baldock, Alec Tutchings and Graham Balmain certainly devote their 'working time' to technical subjects, but I doubt whether they would claim to be "full-time professionals" in the journalistic sense. Mr. Turner is himself a 'spare-time journalist', though I doubt that he would apply the phrase "spare-time job" to his writing in the manner that he denigrates the 'mercenary' semi-professional tape enthusiast. As for *replacing* one's hobby by one's work, I count myself among the many people who have chosen to *combine* work with pleasure. This certainly makes life more tolerable and adds to the enjoyment of one's hobbies.

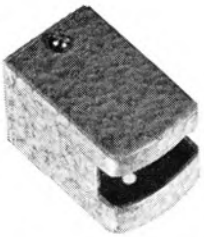
In speaking of "those god-forsaken bodies", I have not forgotten the *purpose* behind the formation of local tape clubs. Whatever they lack in terms of 'population', these clubs have one thing in common with the Soviet Union : they have been stifled by an excess of bureaucrats. For years, the 'club news' pages of our contemporary magazines have reported grandly upon the meetings of sub-committees, the appointment of new Chairmen and Presidents and the change-of-address of Secretaries. We learn, perhaps, that 'four members of the club held the microphone while the other eight controlled the recorder', the recording being, perhaps, an up-to-date version of 'Too Many Cooks'. Tape recording, unlike cricket, is essentially an individual's pastime, and many tape club members might find more satisfaction in joining an amateur dramatics group than bowing to a tape recorder as the 'sacred cow' of an unimaginative and aimless all-male social group.

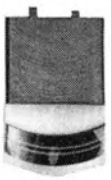
It is this aspect of recording that led to the success of the tape correspondence organisations. In *Stereo International*, *Voicespondence*, and the rest, are the cream of the amateurs ; the enthusiasts who record local choirs, amateur orchestras and spiritualist meetings—not through any extraordinary love of music, nor any exceptional interest in religion, but for the sheer fascination of learning an art. They, too, enjoy the incentive of an audience—hand picked for their common interests. In a limited sense, art is indeed "the right way of making things". But we should not take the teachings of Aristotle too seriously ; remember several of his fundamental beliefs were later disproved by Galileo!

With a few notable exceptions, local tape clubs have been far from successful in "the vast field of service", by which Peter presumably means the medical and social welfare services. The bungling efforts of preceding 'enthusiasts' have done enormous harm to the public image of tape clubs. Hospital staff, in many cases, have shied away from the offer of an extra channel of canned entertainment. There may be other interpretations of this un-co-operation, but the fact remains that this has been a field of wide-spread failure. Fortunately, there are individuals who regard the tape recorder as a tool to social welfare, rather than an elaborate machine for which uses need to be found at all cost. I refer here to the invaluable services being provided by the *RNIB* and Maurice Chambers's *Tape Programmes for the Blind*, and, of course, to Peter's own excellent work.

Even so, it is a pity that, after 25 centuries of Western culture, the sick and the aged still need to rely on amateurs to enliven their monotonous existence. Many well-meaning souls obtain great satisfaction from donating their pennies on 'flag days', but how many allow their mind to wander into the inadequacies of a civilisation that depends on voluntary charity to support its sea rescue service, to prevent the ill-treatment of children, for animal care, welfare of the deaf, cancer research, and the guidance of ex-criminals? Truly, one must not be "snobbish or starry-eyed".

Which makes a suitably inconvenient point at which to end this propagation of creative tape recording as a hobby.

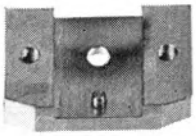


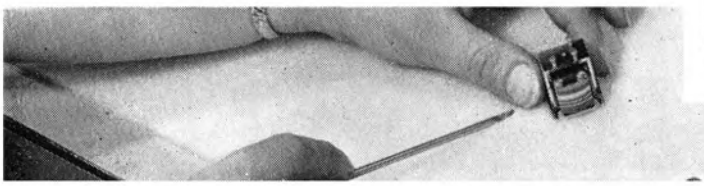


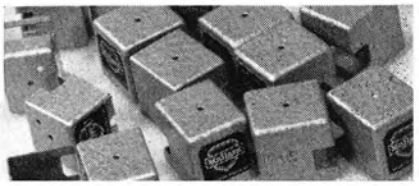
magnetic sound recording

PART FOUR / OF DECKS AND HEADS

BY C.N.G. MATTHEWS







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BY now we should have a good idea of the underlying principles of tape recording. This month we can see how they are applied and examine some of the problems involved. Then later we will be examining the problems in more detail.

Since we can get nowhere without the tape, perhaps it should come first on the list. What we need is a flexible medium which can be magnetised and demagnetised as often as we please. And it should be capable of maintaining its magnetic state indefinitely unless we deliberately change it. This means that we must use steel or some other material which can be employed to make permanent magnets.

As we have already seen, steel wires or tapes were used in some earlier recording systems. But springy steel is awkward stuff to handle and suffers from disadvantages besides that of weight.

Nearly all modern tapes are plastic-based. Standard-play (SP) tape is 0.25in. wide and has a thickness of only 0.002in. Because it is so thin, considerable lengths can be carried on reasonably small spools. For instance, a 7in. spool will accommodate 1,200ft. of SP tape and twice as much of double-play (DP). Since the tape will carry up to four recordings side-by-side, a little arithmetic tells us that the total recording length on a 7in. spool of DP tape is as much as 9,600ft.—over a mile and three-quarters. This is sufficient for about eight hours recording at $3\frac{3}{4}$ i/s.

The 0.002in. thickness of SP tape is nearly all plastic backing. Only about 0.0005in. is magnetic material, and the material itself is not iron or steel, but jewellers' rouge—a form of iron oxide, which is so hard that it is used for polishing jewels. We found last month that very hard materials make very permanent magnets. So, by using jewellers' rouge as the magnetic medium, we get the lasting recordings we desire. An impalpably fine powder of iron oxide is suspended in a special varnish, and one side of the tape is coated with a thin layer of the composition. Thus we get our permanent, flexible recording medium.

Although hard materials make permanent magnets, they are difficult to magnetise; but from the tape recording point of view this is an advantage. It helps us to avoid a form of trouble known as *print-through*. When a recording is wound on its spool we have in effect thousands of tiny magnets stacked one above the other. They are separated only by about 0.0015in. of plastic tape, which offers no impediment at all to a magnetic field. If the medium were easily magnetised the field from each layer of tape would have a magnetising effect on the layers on either side. With high-quality modern tapes, properly used, print-through is virtually non-existent. It can occur, though, when the recording current is unduly high or when tapes carrying recordings are stored at too high a temperature.

Having produced the tape, our next problem is to move it at constant speed past the record or reproduce head. Just winding from one spool to another will not do, because the tape would be moving many times faster when a spool was nearly full than when it was nearly empty. Remember that a point on the outside of a rotating wheel must move much faster than a point close to the centre, for a given number of r.p.m.

In many recorders three motors are used for this purpose, one for each spool and one for a 'capstan' arrangement which controls the tape speed. Other models have only one or two motors, from which the three drives are provided by flexible belts or pulley trains. There are many possible arrangements; **fig. 1** is a diagram of just one of them.

The real drive for the tape is the capstan and pinch-wheel, the former being usually glass-smooth and the latter rubber-covered. The tape is gripped firmly between the two and drawn steadily from the unwinding spool. A heavy flywheel on the capstan spindle ensures that it runs at constant speed in spite of any slight unevenness of drive. Small, fast speed variations would produce *flutter*, a rapid change of sound pitch whose audible symptom is described by its name. *Wow*, another fault with a descriptive name, is caused by slower speed variations. So the constant speed drive is a very important feature of the recorder.

The winding spool is driven through some form of slipping clutch, which may be either electrical or mechanical, at a rather higher speed than the tape. Because of the slipping drive it cannot pull the tape through the capstan and pinch-wheel. Instead it accommodates its speed to that of the tape, maintaining a firm but gentle tension to ensure even spooling.

On record and reproduce we usually have a choice of tape speeds, for example, $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. The tape is kept in close contact with the magnetic heads by pressure pads, pins or by strong back-tension. For really good quality reproduction we use the highest speed, but the slowest is normally satisfactory for speech.

Fast-winding, either backwards or forwards, takes place at much higher speeds. The capstan and pinch-wheel are disengaged and usually the tape is held clear of the heads to avoid excessive wear. Now the tape is drawn rapidly from one spool to the other.

One essential is some form of brake on the spool from which tape is being unwound. If it were allowed to 'free-wheel' it would carry on when winding ceased, spilling yards of tape and causing a troublesome tangle even if it did not ruin the recording. This brake can be anything from a simple friction arrangement to an electro-magnetic device. Provided it allows the spool to rotate more-or-less freely when tape is being drawn from it, but stops it virtually dead when the drive is off, it serves its purpose.

Tape recorders are easy to operate because the controls are so arranged that even if a wrong move is made, the damage is unlikely to amount to more than a yard or two of spilled tape. There are so many variations and slightly differing refinements on models by different makers that an attempt to give detailed operating instructions would be more misleading than helpful. One infallible maxim, though, is: *read your instruction manual and do as it says.* A surprising number of budding enthusiasts—and more than a few of the more experienced—fail to do this and then blame their instruments for poor results.

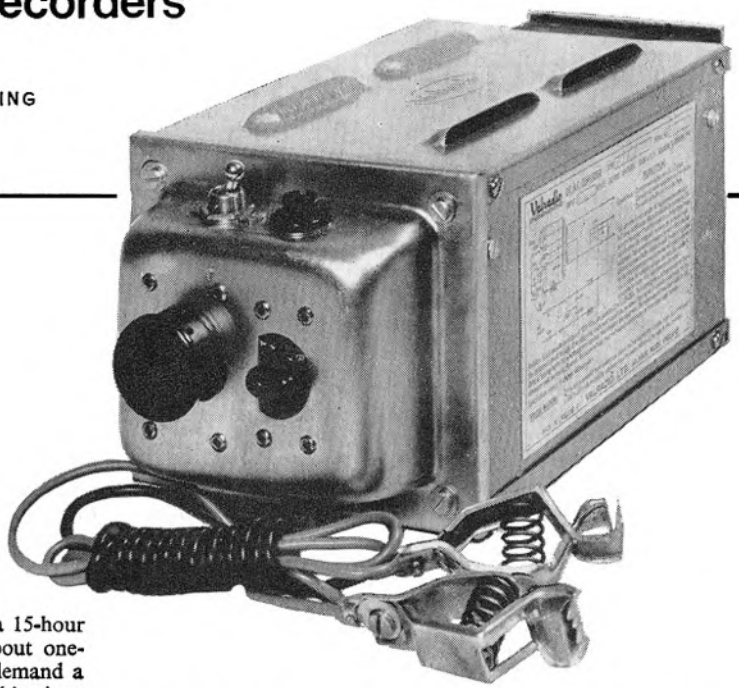
So much for the mechanical side. Now for a brief look at the very heart of tape recording, the magnetic heads. In principle these are all very much alike. In fact, many tape recorders use the same

(*continued on page 282*)

battery powered tape recorders

PART NINE: FURTHER ASPECTS OF CHARGING

BY MICHAEL GORDON



TO charge a nickel-cadmium cell fully, something like a 15-hour charging rate is required at a charging current of about one-enth the cell capacity. Thus, a cell of 200 mA/h would demand a tcharging current of about 20mA for 15 hours. After this time, assuming a cell in good condition, full cell capacity will be restored.

To push a charging current in the forward direction through a cell, the charger must be able to produce a voltage across its terminals in excess of that across the terminals of a fully charged cell. The experimental charger described last month succeeds in this respect by the nature of the mains transformer, rectifier and charging current control.

The charging current through a cell is governed to some extent by how much the voltage applied across the cell from the charger exceeds the nominal cell voltage. Generally speaking, charging current threshold occurs when the voltage delivered by the charger is of the same value as that of the cell. If the charger voltage is below the voltage of the connected cell, then there will be no charging current at all, and a *discharge* current may flow from the cell through the charger, depending on whether the charger has current continuity in the reverse direction.

Chargers using rectifiers or solid-state diodes automatically cut off in the reverse current flow direction, due to the action of the rectifiers themselves. Dynamos which are used to supply the charging current, however, have no protection of this kind, and if the dynamo ceases to produce a charging current (i.e., should it stop rotating) current will flow from the battery into the dynamo. It is for this reason that a relay (cut-out) is used in car charging systems. When the dynamo voltage falls below the battery voltage the cut-out contacts open and disconnect the dynamo from the battery.

The latest system employs an alternator (a device producing alternating current, AC), the rectifier between the alternator and car battery serving as an automatic electronic cut-out.

Charging systems used in battery tape recorders are, of course, designed to deliver the correct charging current to a number of cells connected in series, forming the battery. Normally, a single cell should not be connected to such a charger, as the higher than single-cell voltage delivered by the charger would be likely to incite a charging current in excess of that required by the cell and above the charging current specification of the charger itself.

To avoid overcharging, some chargers incorporated in recorders feature an automatic switch which cuts off the charging current (or reduces it) when the internal battery of secondary cells approaches its fully charged condition. This arrangement is used, for example, in the AC adaptor of the *Akai X4* battery-powered recorder. Here a tiny button pops up when the charge is complete.

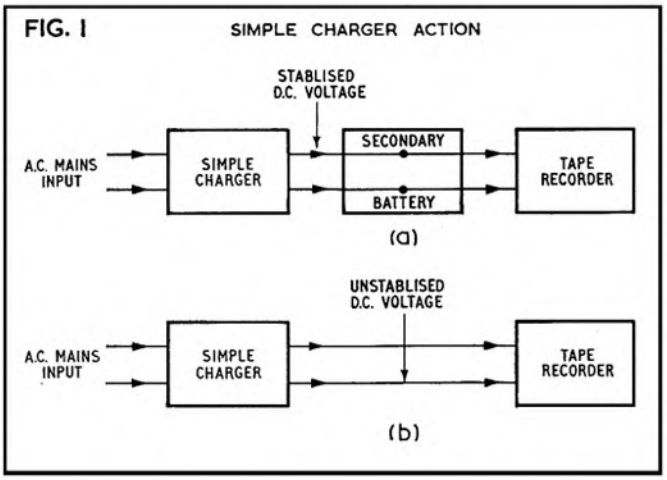
The *Uher 4000* is another machine that features an automatically controlled battery charging arrangement. These circuits, however, are somewhat complicated by transistors, diodes and Zeners and the precise controlling action may not be easy to define. Unfortunately, there would appear to be some lack of circuit action explanation relative to certain imported models, and to the enthusiast trying to work out the action for himself further complications may arise in terms of curious symbols and components which appear to have been developed specifically for the machine under examination !

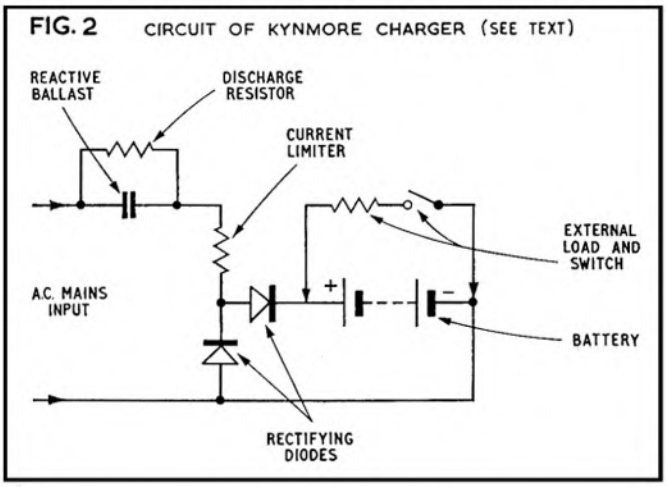
Some battery-powered enthusiasts prefer to have the charger as a unit entirely separate from the recorder proper, assuming that secondary batteries—as distinct from all-dry primary batteries—are employed. Of course, a complex charging (and often mains-powered) sub-assembly does add to the weight of the recorder when integrated, and weight may be a high priority consideration for certain field activities.

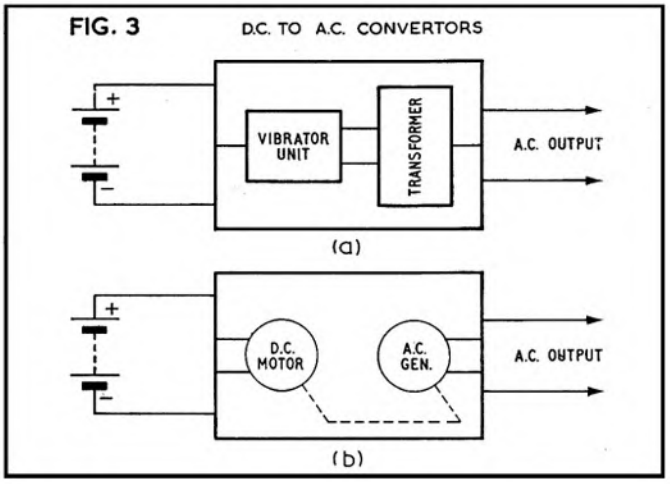
The existing pattern, however, is that battery-powered machines with integrated mains power units/chargers are designed to cater for a specific version of secondary battery, while machines completely devoid of mains connection are designed to work from easily obtainable primary cells ; and since these have now been engineered to a high degree of efficiency there is a really strong case for the lightweight machine of solely all-dry-powered design. After all, it is not a hardship to carry a spare set of cells on a field exercise ; nor is it difficult to obtain fresh replacements while operating in the field.

For prolonged domestic use, though, the battery-powered machine with mains facilities has certain advantages power-wise. Often, under mains-powered conditions the secondary battery within the machine is receiving a charging current from the main supply while it is actually delivering power to the machine. In other words, the battery serves as a *reservoir* between the mains supply circuits and the machine, and ideally the power of charge entering the battery would be equal to the power taken by the machine from the battery.

With this system, a reasonably simple mains-powering facility is added to a fundamentally battery-powered machine. The battery acts as a very low impedance source between the mains-derived power and the power input circuits of the machine, and for this reason voltage variations and hum from the supply are effectively ironed out. This would never happen, of course, by deleting the battery and connecting the mains-derived supply direct to the power input circuits of the recorder (see **fig. 1**). Indeed, the power from the mains supply







circuits alone may not be sufficient to work the circuits and drive-motor; or if the power was sufficient the voltage at the recorder would almost certainly rise with the drive-motor off (thereby overloading the electronics) and fall considerably (and fluctuate) with the drive-motor running.

The battery in this respect acts rather like the Zener diode voltage control considered in early articles of this series. Moreover, it acts like a large value electrolytic capacitor so far as hum suppression is concerned.

A simple constant-current charger of the type that may be used in the charging circuit of a device running from a nickel-cadmium battery is shown in **fig. 2.** This, in fact, is the circuit used in the *charging modules* of *Kynmore Engineering Ltd.* These are briefly detailed and pictured in the April, 1966 issue of this magazine, on page 104 (Part 5 of this series).

The circuit shows that the AC supply is applied through a series capacitor, across which is placed a 500K resistor to ensure that the capacitor is fully discharged when the AC supply is removed. The two rectifiers, which are semiconductor diodes, are arranged in a half-wave voltage-doubling configuration and are fed through a surge or current limiting resistor. The real load is the battery, across which the load of the equipment may be permanently connected or switched.

The circuit is designed in conjunction with the battery, and at all times when the AC input is applied the battery must be connected. It will be seen that the battery is effectively connected across the two diodes in series and the polarities are such that the battery puts the diodes into reverse conduction. Thus, even with the mains disconnected, the leakage from the battery back into the charger is negligible. The charger is protected on the AC side by a fuse.

The circuit employs no transformer isolation from the mains supply and the current control is performed essentially by the reactance of the series capacitor. From the charging aspect, this is desirable in that a substantially constant charging current is fed into the battery from the supply, irrespective of battery condition.

However, the use of an unisolated charging circuit of this kind could represent a real danger in certain applications—for instance, if permanently connected to the battery of a tape recorder. The circuit shows that one side of the main supply is connected direct to one side of the battery. In a tape recorder proper (or other non-insulated electronic equipment for that matter), one side of the battery may be in low impedance connection with supply circuit positive or negative and the metal chassis. As this circuit is invariably connected to the 'earthy' side of the microphone and other signal inputs and outputs, it will be appreciated that such 'earthy' parts of the machine would be in connection with one side of the mains supply with the charger connected.

If this happened to be the 'live' side of the mains, the 'earthy' parts of the equipment would be at 240V AC above earth proper. *An extremely dangerous and lethal situation.*

However, all would be well if the AC applied to the charger is derived from the secondary of a mains transformer, this winding being adequately insulated from the primary winding across which the AC mains is applied. As the charging current is relatively small and the efficiency of the charger high, only a small transformer would be required, main factor, however, being primary/secondary insulation.

It is often queried whether it is possible to operate ordinary mains-powered machines from a battery supply. The answer is definitely *yes.* As this type of machine cannot be converted internally from mains to battery powering, some external device is necessary to translate the available battery power to AC mains voltage.

It must be remembered that mains-powered recorders are somewhat sensitive to the waveform and frequency of the power supply, and in many models the motor used is of a type that depends on the mains frequency for its speed. Thus, a fluctuating frequency or frequency different from that of the mains supply will seriously affect the constancy and speed of the drive motor.

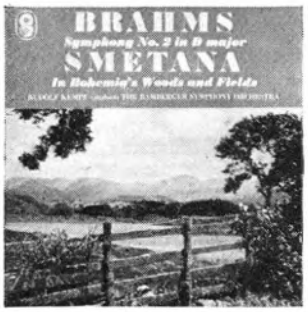
There are two prime types of translators or *converters* available to the enthusiast. One is a *rotary converter* and the other a *vibrator converter.* The latter is more suitable for tape recorder powering because the frequency of the output supply is controlled by a vibrating reed, which is itself designed to possess a natural or resonant frequency. This can be looked upon rather like the pendulum or balance wheel of a clock or watch in terms of timing the waveform. Thus, to some extent, the waveform frequency is held pretty constant in spite of changing lead characteristics.

The rotary converter, on the other hand, consists of an electric drive motor integrated with an alternator. The electric motor uses a commutator and brushes and thus operates from a DC supply, while the alternator utilises some form of continuous pickup from the armature and thus delivers an AC waveform which matches very closely that given by the standard grid system. However, as the load on the alternator varies, so to some extent does the speed of the drive motor. The frequency thus tends to vary, but in some cases the change in output voltage incited by this speed change counters the effect of the change in frequency.

Fig. 3 shows at **(a)** and **(b)** the battery/mains translating systems, and next month we shall be dealing with these in greater detail.

tape reviews

CLASSICS — **GEORGE GOODALL**
JAZZ & FOLK — **TONY FARSKY**



BRAMS/SMETANA. *Symphony No.* 2 in D Major; *In Bohemia's Woods and Fields* (Ma Vlast). Bamburger Symphony Orchestra conducted by Rudolf Kempe. **World Record Club TT424,** 3¾ i/s twin-track mono. 29s.

BRAHMS AND SMETANA were contemporaries, though in many ways they are contrasting composers rather than similar ones. Brahms in Vienna (where this symphony was written) represented the older established school; whilst Bruckner, composing in Vienna at the same time, was supported by a group of musicians who considered themselves forward looking and amongst whose numbers was Mahler. Smetana, on the other hand, working in Prague, may be said to have founded the modern school of Czech composers. Despite these differences in attitudes and background, however, the music of both composers can be enormously appealing. A large number of music lovers must have had their early interest aroused by such music as Brahms' *Academic Festival Overture*, and by Smetana's orchestral suite *Vltava*.

Brahms's second symphony, with its melodies, rich harmonies and orchestration, is a very satisfying work. Evidence of intellect is there too, in the extended and beautiful counterpoint of the slow movement and in the music's solid formal foundations. The Bamberger Orchestra produce satisfyingly rich sounds, though I felt that Rudolf Kempe could have allowed them to be more rhythmically elastic.

Smetana's *From Bohemias Woods and Fields* is the first cycle of symphonic poems under the title 'My Country' (*Vltava* is the second such cycle). The music is beautifully descriptive, but there is evidence of an intellect at work here as well. To describe gusts of wind in musical language Smetana uses a series of fugal entries, these being repeated with ever narrowing *stretto*, a very satisfying musical effect.

The recording is in the main spacious sounding and warm, but it is marred by a hard edge to string tone that becomes noticeable in the louder passages. On a smaller machine this may not be of serious account, however. Users of wide-range equipment will need to use some filter. Within these reservations, this is a very pleasant tape. **G.G.**

DOMENICO SCARLATTI. *Harpsichord Sonatas.*
Valda Aveling (harpsichord). **World Record Club TCM 68,** 3¾ i/s twin-track mono. 29s. 6d.

DOMENICO SCARLATTI'S enormous output of keyboard compositions had great influence on the development of technique. His sonatas, of course, are pre-classical works and do not have the highly developed and dramatic form of the classical sonatas. In fact the formal framework of some of them is the simplest of binary forms, similar to the individual movement forms appearing in the suites of Bach and Handel. Their style is completely individual and no doubt the period of his life spent working in Spain had a deal of influence here.

The selection of ten of these sonatas presented on this tape is an example of how devious his style could be, ranging from the lyrical to the brilliant. To make objective comment on the performance given by Valda Aveling is, of course, impossible. It is easy to adopt a strict academic approach to music of this period in spite of the inherent sensuality of it all, and what are points in favour with one person's judgement may well be considered in bad taste by another.

For my part, I found the performance uneven. She makes use of a brilliant technique where necessary and uses a colourful choice of stops, making free use of rubato to emphasise the music's sensuality. Occasionally the rubato is excessive and holds up the flow of the music. This seems particularly apparent in No. 449 in B minor at the close of track one. A pedestrian pace is chosen which, I feel, would be no crime in itself were it not for the many changes of registration and rubato effects holding up what must surely in this case be a continual, if not torrential, flow. However, earlier on the same track, in No. 14 in D major, she is at her more expressive, with a convincing and charming use of stops.

The recording quality is pleasantly close, but some filter is necessary when wide-range equipment is used. This, unfortunately, has the effect of reducing the changes of note quality produced by changes of registration. Towards the end of track two the mechanical noise from the harpsichord becomes very noticeable. In spite of these defects, for those wishing to become acquainted with this music, this should prove a rewarding issue. **G.G.**

BEETHOVEN. *Christ on the Mount of Olives.*
Vienna State Opera Orchestra and Vienna Academy Chorus conducted by Hermann Scherchen. **World Record Club TT406.** 3¾ i/s twin-track mono.

OF THE TWELVE CHORAL works with orchestra composed by Beethoven, only two, the *Mass* in D major and the ninth symphony, are at all frequently performed. His choral music is sometimes criticised by musicologists, and this may be the reason why practice condemns them. The oratorio recorded here is undoubtedly suited for performance on special church occasions, yet even in this context it is seldom heard. Possibly it may have been eclipsed by the more devotionally sincere and more musically profound Bach *St. Matthew Passion* which demands its performance at the same season. Whatever the reasons, here is a chance to acquaint oneself with this lesser known work.

The soprano voice sounded to me rather distant on this tape, and it may have been this that made her louder high notes sound somewhat strained. On the review copy, drop-out proved irritating in places, particularly so during the duet between soprano and tenor at the beginning of Track 2. There was also a subdued, very low frequency rumble audible at the start of Track 1 on the review tape. It may be possible to check for these defects before purchase.

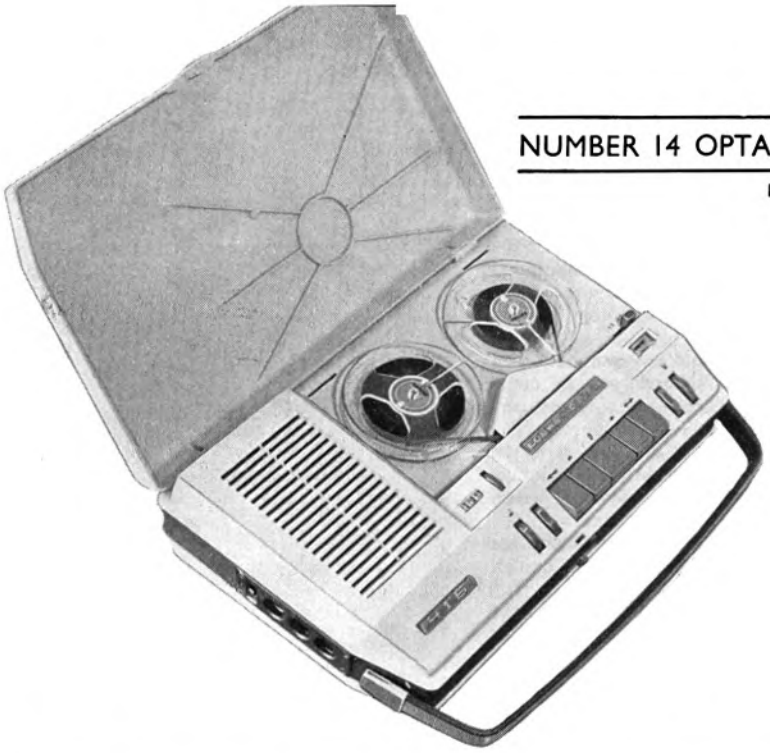
On the whole, I was not convinced that the absolute best was being made of the music, though there was a great deal that was lovely. **G.G.**

DEBUSSY. *Images for Orchestra* and *L'apres-Midi D'un Faune.* Orchestre National de la Radio-diffusion Francaise conducted by D. E. Inghelbrecht. **World Record Club TT428.** 29s.

IT IS DOUBTLESS BEING far-fetched to compare Debussy with Bach (except that, for me at any rate, *all* composers have to be compared with Bach!), but on this tape one feature they have in common is made clear. Everything they wrote, from their earliest compositions onwards, has such a high degree of professional finish that it often seems difficult to place them. On this tape we have two of Debussy's works with something like twenty years between them, yet both seem to have that inevitability of form and harmony, making it hard to recognise that one was written at an earlier period of Debussy's technical development than the other.

The *Images for Orchestra* in its two parts is the more important item on this programme, though the popular *L'Après-midi D'un Faune* is given pride of place on the box title. The parts of 'Images' are played in the order given on the box and not in the order given either in the programme note headings or in the text of the notes. The music is truly impressionist: descriptive, colourful and with forms in recognisable enough shape but with only suggested outline. Perky tunes crop up here and there, the *Keel Row* coming as a little surprise in the first of the Gigues.

Who better than a French conductor with a French orchestra to play this sophisticated music for us? The recording quality is good, too, so this proves to be a very acceptable issue. **G.G.**



NUMBER 14 OPTACORD 416

BY DAVID KIRK

field trials of battery portables

I FIRST saw an *Optacord* at the 1963 Audio Fair and recall being much impressed by its solid appearance. The machine in question was the *414*, predecessor to the *416* which it much resembled. It was not until a few months ago, however, that I was able actually to handle the machine to determine whether its quality and convenience of use matched the attractive case.

The recorder differs from most other designs in having an upward-facing loudspeaker located at the side of the deck. In addition to the pleasing appearance, it quickly proved to possess a more practical advantage, for the drive-unit located under the plastic grille must be one of the largest ever to be incorporated in a battery portable. Improved still further by the large plastic lid, which tends to reflect sound forward, the sound quality from pre-recorded tapes was really excellent. A powerful transistor amplifier and effective treble control gave clean reproduction at sound levels as high as can be obtained from most mains-only machines when used with internal speakers.

Controls are sensibly positioned on a sloping panel in front of the deck. Five grey push-tabs select, from left to right, rewind, record, stop, play and fast-forward respectively, the record and play controls interlocking in the conventional manner. A rim-operated rotary control to the far left governs treble on replay, while another to the far right varies record and replay gain.

To the right of the tone control is a pause switch, a mechanical device which retracts the pinch-wheel and applies the brake. This could be locked in position and freed without resort to the stop switch—a logical arrangement but one sadly missing from many so-called 'pause' mechanisms. The purpose of a pause control is to permit temporary halts in recording, free from interfering clicks and bangs that might be introduced by other mode selectors. Such clicks are not, incidentally, necessarily of an electrical nature, and may be caused merely by the microphone picking up the last echoes of the acoustic bang of the mode-selector striking home. They may be overcome simply by turning down the gain control each time the tape is stopped or started.

MANUFACTURER'S SPECIFICATION. Half-track transistor mains/battery recorder. **Tape Speeds:** 3¾ and 1⅞ i/s. **Spool Capacity:** 4½in. **Frequency Range:** 50 c/s—12 Kc/s at 3¾, 50 c/s—7 Kc/s at 1⅞ i/s. **Output Stage:** 1.5W push-pull. **Level Indicator:** Meter. **Power Supply:** Five dry cells or 110/220V, 40—60 c/s mains. **Dimensions:** 15 x 9¼ x 4½in. **Weight:** 9lb. **Price:** £53 11s. **Distributor:** Highgate Acoustics, 71-73 Great Portland Street, London, W.1.

The 416 pause control achieved all that was desired of it, being silent in operation and allowing no tape 'creeping'.

To the left of the gain control is a switch, arranged to select alternative circuitry for high and low-level input signals. Markings corresponding to microphone (M) and radio (R) come into view when the switch is suitably positioned.

Although the press-tabs had that solid resistance to movement associated with larger mains-only decks, they were nevertheless comfortable to operate and wide enough for the largest fingers. The three-digit spool rotation counter, on the other hand, was very light and was consequently used more often than are, I suspect, the coarser counters on many modern decks. Nevertheless, I look forward to the day when press-button instant-reset counters become universal ; they appear simpler in construction, and therefore cheaper, and are much more convenient to use.

Two speeds are provided, 3¾ and 1⅞ i/s, from a sliding control beside the take-up spool. In addition to selecting recording speed, this control also doubles or halves the *fast wind* speed. When switched to 3¾ i/s, the 416 was capable of winding tapes faster than any other mains/battery or battery portable yet tested.

Recording from the dynamic microphone (supplied) was a simple matter and involved merely placing the DIN plug in the socket marked 'micro', setting the input selector to 'M' and pressing the record tab. In this position, modulation level could be set by sliding a finger along the gain control and observing the small meter. Recording from radio, disc and tape was rather less simple, though perhaps I am criticising the application of the DIN system rather than the wiring of the 416. Let me state, however, that connecting two tape recorders constructed to DIN standards is *not* merely a matter of plugging an ordinary DIN lead into the two machines. I can only assume that *Loewe Opta*, *Tandberg*, *Uher* and *Körting* all have their own variations upon the DIN theme. One resorts, of course, to experimenting with split stereo-recording cables, introducing an element of 'fiddling in the dark' to an otherwise very logical activity.

Tape recordings of FM broadcasts were at first tinged with radiated motor crackle, but this was reduced by, first, turning the external

(*continued overleaf*)

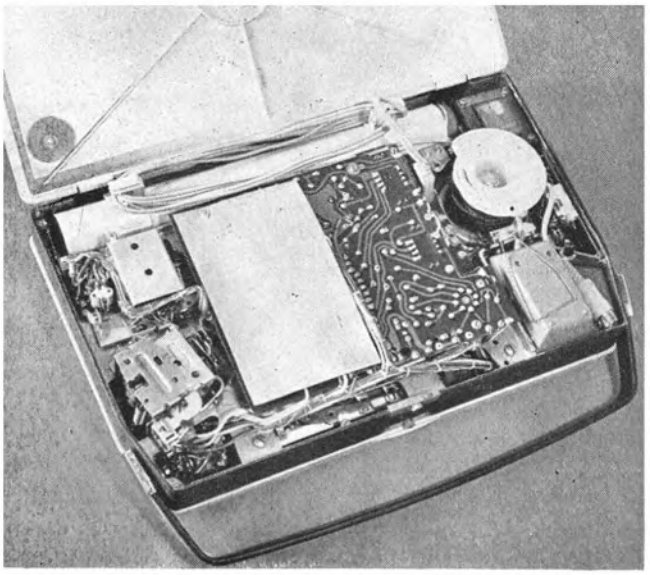
monitor to full treble and minimum bass, and then moving the recorder and aerial until the quietest position had been found. Returning the amplifier tone controls to 'flat' then generally removed all trace of interference. This procedure, which has been necessary on almost every portable I have handled, proved quiet effective with the 416. Slight motor 'hash' was nevertheless present, being somewhat worse with recorded material than on replay of other tapes.

Acoustic motor noise was low, though a slight 'knocking' became noticeable towards the end of the trial.

The 416 was remarkably free from wow, and an examination of 'the works' revealed why. It is solidly manufactured on a cast metal chassis, circuitry being on a large printed board. Access to this part of the machine is gained by unhinging the base, which comes away from the body in a similar manner to the upper lid. Access to the battery compartment is also achieved in this manner, ample storage space also being provided for the microphone, the cable of which may be wound round a plastic hub beneath the loudspeaker.

Batteries were very easy to insert, being five torch-cells, and are stored in a removable plastic tube, this tube also featuring a pair of hooks round which the mains cable may be stored. The mains plug is located in a socket within the recorder when battery operation is required, this being removed and connected directly to the power supply for mains working. The only disadvantage of this otherwise foolproof system is that an adapter is needed to match the continental two-pin plug into standard British sockets.

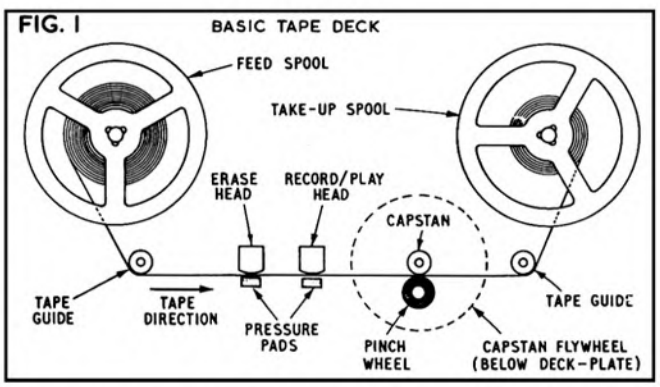
Only one mild criticism can be made of the recorder's handling 'in the field'. Although not particularly heavy for a mains/battery machine, its semi-flexible handle tended to oscillate up and down when one was walking. This had no distressing effect on tape speed stability but was, to put it simply, uncomfortable. *Philips* overcame this point by introducing a metal handle for their *EL3586*. If the designer of the 416 lived with his machine for a while, I am sure the *417*, or whatever they ultimately call its successor, would incorporate a more substantial handle.

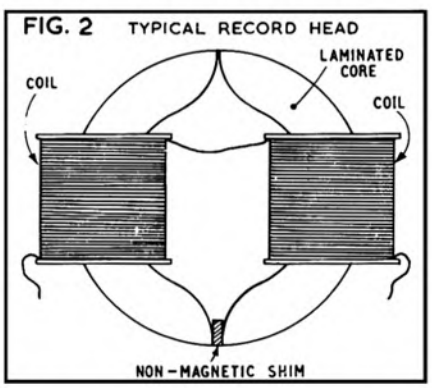


Optacord 416 with lower lid removed. Battery storage tube and mains lead are visible at rear, motor housing being seen at lower left.

The Optacord 416 is the best of the mains/battery portables available under £60, and leaves little to be desired in terms of frequency response and wow and flutter. Greater attention to motor suppression and elimination of those infernal split-mandrel hubs (which commence life by being too tight and end by skidding within the spool) would render this a very acceptable, even if rather expensive, general purpose machine.

MAGNETIC SOUND RECORDING CONTINUED





head for both recording and reproduction and a second head for erasing. A section of a typical head is shown in **fig. 2.** It consists of a laminated coil of some such material as *Permalloy*. This has a very narrow hysteresis loop, which means that it can be magnetised with ease but loses its magnetism immediately the magnetising field is removed. Narrow gaps at each end of the core are filled by non-magnetic 'shims' and on each side a multi-turned coil is wound.

Through these coils flows the sound-frequency current. With such an arrangement, quite a small current produces a powerful magnetic field which spreads out a little at the gaps. By drawing the tape past one of these we ensure that it is magnetised in sympathy with the magnetism of the core. Because of its low hysteresis, the core magnetism is controlled entirely by the coil current. So, allowing for limitations which we shall be considering later, we get a faithful recording.

A magnetised tape drawn past an unenergised head reverses the recording process. Small alternating EMFs at the original sound frequencies are induced. These are amplified and eventually operate the loudspeaker.

Usually the same amplifier is used for both recording and reproducing, but for a good volume of sound the loud-speaker requires more power than the recording head. For this reason it is common practice to switch in an extra stage of amplification during playback.

Straightforward amplification would be of little use in a tape recorder. This is because both tape and heads behave differently at different frequencies. They tend to exaggerate notes at some pitches and respond very feebly to others. We have to 'bias' the tape to prevent distortion, and we must modify the amplifiers to compensate for the response of the heads. Tape biasing is a problem that we shall be considering next month, but we should look at the amplifier requirements now.

The heads, since they are iron-cored coils, have a high inductance. An important property of inductance is that its opposition to current flow increases with frequency. So on higher notes the magnetising current is reduced and tape magnetisation is much feebler than it should be. Thus, with a 'straight' recording amplifier we would lose most of our treble response.

On playback we run into another snag. The magnitude of the induced EMF depends upon the speed at which the magnetic field

(continued on page 294)

BUDGET BOOMS

M. F. WOODWARD DESCRIBES A VERSATILE ACCESSORY

THERE are no subtle political overtones in this article, no hints of income tax reduced to 6d. in the pound. It is just aimed at those who, with restricted budgets, wish to obtain maximum value from funds available for purchase of important pieces of equipment and who are prepared to construct the accessories for themselves.

Of all accessories, the microphone boom is one of the most important to the live recordist. Anyone who has attempted to set his microphone on a vibrating table or perched it precariously on the edge of a piano will know the advantage of a boom, whilst for the instrumental or choir recording an elevated position is quite essential.

My own essay into booms was first made some years ago, when organ recording first became for me a serious hobby. At that time I was using a large ribbon and also a heavy moving-coil microphone, and the necessity of hoisting these gadgets some ten feet up in the air and isolating them from the structural vibrations associated with powerful church organs was quite a problem. The key to the situation was seen in a London photographic shop specialising in ex-service equipment. In the litter of ex-Spitfire camera guns and 20-yard reels of (non-standard and outdated) film, I came across a "Mk. III Stand Instrument", a solid affair with three heavy timber extending legs culminating in a revolving and elevating pillar and a ball joint fitted with a 3in. square steel platform, the whole affair fit to do justice to *H.M.S. Dreadnought*.

For 65s. plus 5s. for a canvas case, the thing was mine, and at once it became the foundation for the first boom, quite apart from acting (with very minor modifications) at different times as a very solid tripod for ciné and 35mm. cameras and making a good support for ciné and still projectors. With regret, I cannot identify the shop where it was bought; all I can remember is a longish journey by Underground into the East End of London, to an address scribbled on an envelope and given to me by a friend. I have no doubt, however, that Mk. III Stand Instruments are still available from the little shops which make London such an enchanting place for the bargain hunter.

Next, from the cellar workshop there came a section of a long cast off walnut wardrobe, and from it a tapering piece (1in. thick by 6ft. 6in. long, 2in. wide at one end and 1¼in. at the other) was cut to form a slightly springy arm. It was then sanded smooth, stained black, wax polished and drilled 15in. from the thick end to register with the tripod ball joint platform. From the larder came an empty *Cow and Gate* tin (about 9in. long x 7in. diameter), into which the thick end of the arm was nailed; the tin was then filled with a semi-dry mix of fine concrete, the top being finally smoothed over with a steel trowel. Amateur concretors should note, by the way, the great advantage of using semi-dry mixes, whether for building or audio purposes, for the dryer the mix the quicker it will set, and the less it will shrink and craze on setting, quite apart from the additional strength it will possess.

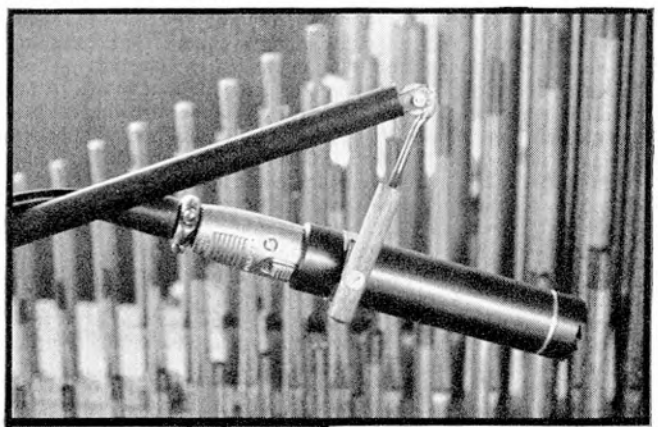
With the drying of the concrete and painting of the tin's exterior a matt black, little now remained but to bolt the arm on to the platform, using ¼in. bolts and butterfly nuts, and to drill the thin end to take a small scrap aluminium universal joint and clamp shaped to receive the microphone. So all was now complete, and the revolving and elevating pillar, plus the adjustable ball joint and legs, gave universal control to my *Mark I* boom—a 6ft. projection or up to 10ft. height.

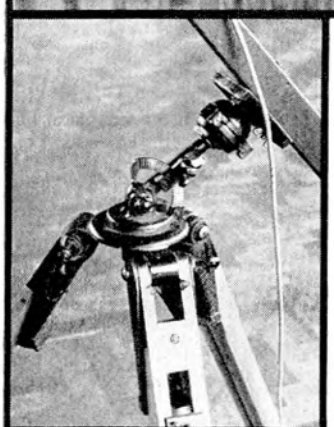
So far, so good; but the affair could hardly be called elegant, and its appearance in public caused some eyebrow raising, not to mention, on occasion, an outright ban! Thus the arrival on the market of first class and light weight condenser, ribbon and moving-coil microphones was treated with much enthusiasm. Just as the ex-army shops produced the catalyst for the previous design, so it happened in the case of my own *Mark II* boom when a local shop—the *Felixstowe Surplus Stores* of The Broadway, Felixstowe (if I may advertise)—offered recently some ex-army tank aerials at 6s. 6d. each. Made of steel tube, copper sheathed externally and comprising three successively tapering sections, each 4ft. long, these were made for rough use and are consequently nice and whippy. The topmost (and thinnest) section was really too whippy, so it was discarded; but there was left a good total 8ft. length able to carry at its end a small microphone. In this case, as a concession to appearance, I clamped the arm to a photographic tripod, with a 2lb. cast-iron weight drilled to act as counterweight when necessary. A tiny universal joint (made in my case from some pieces of an old player-piano mechanism) plus a Terry clip enables the tiny condenser microphone (in this case a *Hammond M.100*) to perch elegantly on the end of the slender tube and to be angled in any direction required.

To be really ambitious, I purchased a second aerial and used the thickest 4ft. section as a further extension to the 8ft. rod and achieved a 12ft. height—not to be recommended for horizontal use however!

Not only is the *Mark II* job more attractive in appearance, it is a lot easier to transport from place to place, being light in weight and easily broken down into it's 4ft. long components.

Mark III? Not yet—I am waiting for some ex-service Hovercraft to come on the market.





Above: Lightweight Hammond M.100 capacitor microphone on universal bracket and Terry Clip.
Left: Swivelling pillar and ball joint of ex-army tripod.
Below Left: Mk. I boom set up against a small Willis pipe organ.
Below: Mk. II boom with 8ft. arm.

television ON TAPE

IT is a source of great mystery to us that motor car manufacturers in the 1920's failed to foresee today's slab-sided travelling machines, instead restricting their designs to the bulging intricacies that passed as pre-war fashion. Receding even further into history, why was it necessary, with so many trees tumbling down stone-age hillsides, for anyone to *invent* the wheel? Perhaps we are a little too complacent. Surrounded by electric lighting, the aeroplane, wireless communication and nuclear power, it is easy to forget the years of experiment, the problems and the frustration that went into the development of the simple crystal radio. Would Marconi have been pleased or annoyed at the suggestion, in the early days of his experiments with wireless, that young schoolchildren might, half a century ahead, be building crystal receivers from a single week's pocket money?

But if we admonish the intelligent ape for not inventing the wheel, how can we excuse our own inability to see beyond the present. In a few years time, the domestic television recorder will have joined the electric toaster and the vacuum cleaner as just another gadget to simplify (!) the task of living. Will the reader's grandson believe that the folk of the mid-sixties were falling over backwards in anticipation of canned visual entertainment? Probably he will query the reason for such fuss before setting a time-switch to transcribe a favourite entertainment ("All Our Yesterdays"?) coinciding with his flying lesson.

The fact remains that considerable interest exists at the present time, inside and outside tape recording circles, in the prospect of home television recording. For it was only last year that the video tape recorder emerged from dreamland at a price almost within range of the public. The *Philips EL3400*, which cost several million pounds to develop, sold for a little under £1,000 and will be followed, in coming months, by similar devices selling for less than £400.

The purpose of this short series is to outline the basic principles of television, and the problems of recording pictures on tape. We commence with the very simple Baird system, continuing with an examination of the EL3400, and culminating with a survey of possible alternative recording techniques.

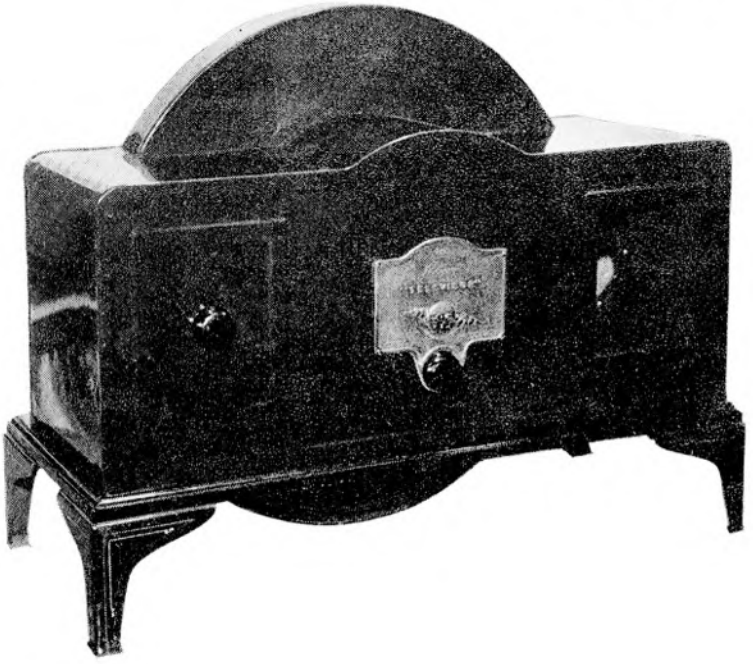
John Logie Baird died in 1946 at the age of 58, having pioneered the art of television. Baird was concerned not merely with the recording and reproduction of moving pictures (which had already been made possible by Friese-Green's excellent, albeit expensive, cine film system); he wished to develop a means of sending pictures from one part of the world to another, preferably making use of the technique of wireless transmission. Since conventional radio enabled the broadcasting of electrical impulses—be they voice, music, morse-code or anything else—Baird saw the problem to be one of converting light into electric signals. Even in those days, the photocell was known for its property of reacting to light in an electrical manner. Several forms of photocell exist, one version altering its electrical resistance in the presence of light and another actually generating a current. The latter are employed, for example, in space-satellites to re-charge batteries from the rays of the sun.

A photocell is not unlike a microphone in that it reacts to intensity (or volume). The photocell does not, however, react to the colour (or frequency) of light, or to its direction. We shall not go in to the similarities or otherwise of stereophonic sound and stereoscopic vision, since, for our purposes, they are irrelevant.

Baird's problem was to find a means of guiding the 'eye' of the photocell over the picture he wished to transmit. If he could achieve this, the photocell would create a series of electrical signals corresponding to the brilliance—the light intensity—of each tiny spot of the surface over which it passed. A device invented by Paul Nipkow in 1884 provided the solution.

The *Nipkow Disc* is shown in **fig. 1** and comprises a large disc mounted on a horizontal axis and rotated, in the Baird system, by an electric motor. A spiral of small holes, each containing a circular lens, spanned the width of a viewfinder. The inner and outer holes (labelled **A** and **B**) form the left- and right-hand edges of the picture and have the effect of splitting the frame into a series of slightly curved vertical lines. The number of lines is governed by the number of holes in the spiral, each hole being turned into a streak by the effect known as *persistence of vision*. The latter effect is really a short-term visual memory and prevents the world being completely blotted out each time we blink—until we consciously think about it. This 'memory' operates for about one tenth of a second—more than sufficient time for the rotating disc to form a picture.

The quality (or definition) of a vision reproducing system is determined by the amount of detail that can be accommodated in the



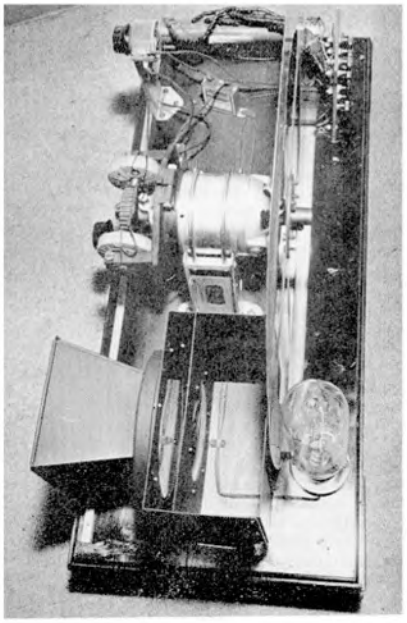
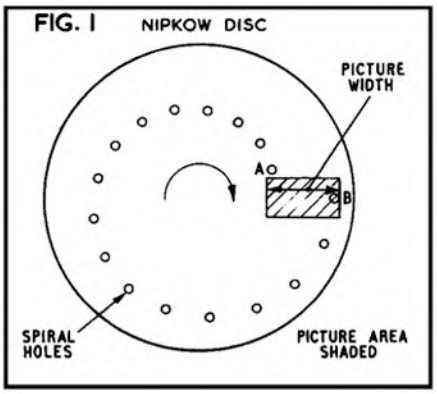
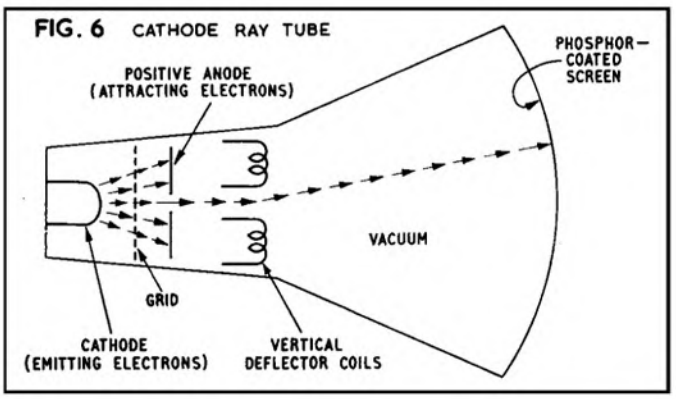


Fig. 5 (left): Televisor minus cabinet. Relationship viewing lens, Nipkow disc and lamp can be seen in the foreground.

television ON TAPE

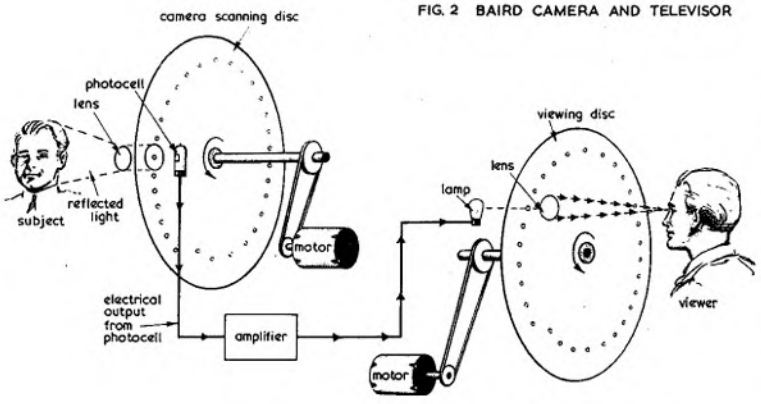
Fig. 3 (left): Imitation of a Baird 30-line television picture giving an approximation of definition and size.
Fig. 4 (far left): Baird Televisor in cabinet. Note viewing screen to right.





Part one: Nipkow discs and all that . .

Fig. 5 (below): Televisor minus cabinet. Relationship viewing lens, Nipkow disc and lamp can be seen in the foreground.



picture. The major factor in television is the number of 'dots' that combine to make the matrix. Early in our schooldays we learned of the considerable increase in quantities that occurred when even a small number was squared. In an area measuring 4 x 4in., no less than 16 one inch squares could be accommodated. If this is a statement of the obvious, it also explains the need for a very high frequency response in modern television equipment. Sending a two-dimensional picture through an electrically one-dimensional cable may be theoretically impossible. In practice it is merely very difficult!

Fig. 2 shows a closed-circuit (i.e., the picture is not being broadcast) Baird system. To the left of the diagram is the subject to be televised. Light is reflected from the subject's face on to the revolving Nipkow Disc, the disc allowing only a small amount from one area of the face through at each instant. Behind the disc is a photocell, on to which the light from each moving dot falls; a lens system is employed to focus the tiny amounts of light on the cell. The photocell is connected to an amplifier which boosts the signal to a current level suitable to light a lamp in the reproducer. Here the process is reversed and the output of the lamp—varying in the same proportion as the light which entered the photocell—passes light out through a rotating disc where it is seen by the viewer as a (rather dotty) picture of the original subject. A photograph is reproduced in **fig. 3** at similar dimensions and definition to a Baird television picture. The machinery which would have received it is shown in **figs. 4** and **5**. Readers will now understand why the BBC discarded the system after transmitting for a short period.

The poor quality of Baird television had two causes. Firstly, Baird chose to use conventional audio systems in the amplification, broadcast and reception of pictures, and the frequency response of even the best audio equipment did not then greatly exceed 11 Kc/s, which limited the system to 11,000 'dots' per second. A *single* frame of a modern television picture is composed of up to 160,000 dots.

(continued overleaf)

FIG. 7 TELEVISION RASTER

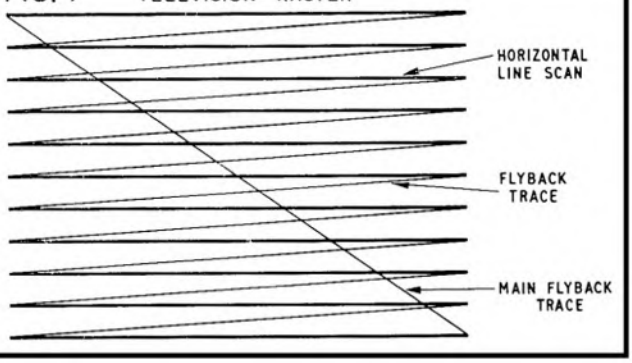
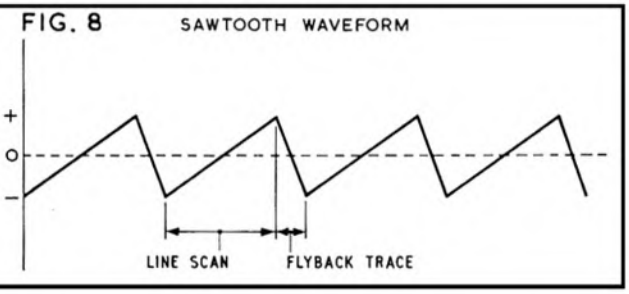


FIG. 8 SAWTOOTH WAVEFORM



Baird had to share his 11,000 over *twelve* frames, which left only 900 dots for each frame. Even this may seem an extraordinarily high figure for such a low picture definition, but thirty lines containing thirty dots and repeated twelve times per second pulls the frequency response up to an inescapable 30 x 30 x 12 c/s, or 10.8 Kc/s. As a small consolation, **fig. 3** does look clearer from a distance!

If the Baird television system had any advantage over modern high-definition television, it lay in the field of picture recording. J.L.B. conducted several successful experiments in transcribing video to 78 r.p.m. gramophone records. There is nothing to suggest that he ever managed to accompany such recordings with synchronised sound, and it was in the sound respect that Baird broadcasts were farcical. Only one transmission frequency was made available by the BBC for television and it was normal procedure to broadcast both sound and vision on that channel at different times. Thus, the viewer would watch the performer going through the motions of his act and then, when the act had finished, would switch a loudspeaker into circuit, turning the vision disc off, for the pleasure of *hearing* a second performance of the programme. Television actors were also obliged to wear much more contrasting make-up and clothing than they do now, in order that they be seen at all.

The second limitation of Baird television lay in the scanning system. There was a speed beyond which a 3ft. Nipkow Disc could not be driven in safety, nor stabilised to the degree required for a steady picture. To achieve the definition of a modern television system, the disc would have needed a much greater diameter, the circumference rotating at something around 600 miles per hour.

The fundamental difficulty involved in designing a video tape recorder capable of operating with television standards of today is that we are dealing not in kilocycles (thousands of cycles) but in megacycles (millions of cycles). A modern professional video tape recorder is capable of recording more than four million dots per second, the intensity of each dot being faithfully converted into a magnetic field of comparable strength and stored thus for an indefinite number of years. Further, the video tape may be reproduced, copied, erased and recorded again entirely at will, the only cost involved being in the wear of the tape and record/reproduce heads.

In addition to an increased number of dots per frame, modern television also has an increased frame rate. The effective number of frames transmitted every second is 25 and it is no coincidence that this is half the (50 c/s) mains frequency. To reduce flicker even further, the 25 frames are split into 50 200-line frames by scanning alternate lines. Thus one half of the twenty-fifth of a second devoted to each frame is spent in scanning the odd lines (first, third, fifth, seventh, and so on) while the second half is used for the even lines (second, fourth, sixth, etc.).

The beauty of modern television lies in its total rejection of mechanical components. There are no spinning wheels to hamper the efficient and safe working of the receiver and nothing, beyond the valve filaments, to wear out. It was an application of the cathode-ray tube that made non-mechanical television possible. A CRT is similar to an ordinary valve, and even more so to the magic-eye modulation level indicator. Electrons are shot at high speed from a heated *cathode* at the rear end of the tube towards a positively charged anode plate half-way down the neck. A hole in the anode allows a narrow stream of electrons to shoot at high velocity towards the display tube. This electron stream is guided across the surface of the screen by deflectors between the anode and tube-face. These can take the form of electromagnetic coils or electrostatic plates, and distort the electron stream, causing it to sweep the screen in a series of lines. Basic components of the tube (oversimplified) are shown in **fig. 6.** The pair of deflection coils shown provide vertical movement of the stream only. A second pair, omitted for clarity, are incorporated to facilitate horizontal scanning, and the combined effort of the coils (or electrostatic plates) allows the stream to be guided over any part of the screen. A phosphor coating on the inside of the glass screen converts the energy of the plunging electrons into light.

Fig. 7 illustrates a single picture scan. With 405 line television, this drawing would ideally depict some 200 lines, though that would be rather hard on our draughtsman! Instead, a few horizontal scans are shown, each with its flyback line. It will be seen that the electron beam scans the screen in much the manner that our eyes would scan a page of print. In reading this column, for example, the eye would commence at the top of the page and follow the top-most line of words from left to right, then sweeping back to the left again, and repeating the movement on second, third and succeeding lines. For a precise analogy, the eye would need to skip the even lines and then return to the top of the page to scan a second time, skipping all odd lines.

The amount of light given off by the phosphor screen coating is directly related to the velocity and density of the electron stream. Thus the fine inking of the *flyback-trace* between the bolder horizontal scans represents the 'blanking' signal that is deliberately applied to the beam as it hops, very rapidly, from the end of one line to the beginning of another.

The coils causing this scanning pattern operate on the principle of electro-magnetic deflection. Just as the pointer of a compass can be made to swing in the presence of a magnetic field, and a current-carrying conductor moves in an electric motor, so the electron stream in a cathode ray tube can be distorted by a suitably placed magnet or electromagnet.

It is not difficult to determine the type and the frequency of signal that is applied to the horizontal deflection coils. Firstly the type—the shape of the waveform. Since the beam is to scan horizontally at a fixed speed and then shoot back at a much higher speed, the deflection coil must be supplied with a *sawtooth* signal. **Fig. 8** shows such a waveform as it might be plotted on a graph. The signal moves slowly and linearly up to a high voltage, 'peaks' and then falls at a faster rate back to its starting point in each case. This waveform, when applied as current to the horizontal coils, provides a corresponding magnetic field (namely a field oscillating from one pole to another and then, at higher speed, back to the original pole), deflecting the electron beam to produce a single horizontal trace on the phosphor screen. The trace moves from one side of the screen to the other in synchronism with the sawtooth signal, returning at a correspondingly increased speed.

The frequency of the sawtooth signal can be calculated from the number of horizontal lines to be traced during each frame (two times 200 or, for our purposes, 405 lines). This figure applies only to one twenty-fifth of a second, of course, and 405 must now be multiplied by 25 to give us the required figure—10,125 c/s. This is the familiar 10 Kc/s whistle that some young souls like to point out teasingly to older television viewers. Human hearing generally falls off with age at this frequency.

The vertical coils require a similar signal wave-form but at a lower

(continued on page 288)

BY ANTHONY WIGENS

SOUND AND CINE

PAVING THE WAY TO PRODUCTION

Talking over the script with his leading lady, the author uses a tape recorder to preserve ideas and snatches of dialogue that will fit into the film.

THE theme of my current film is vandalism. I have written a script which combines the technical challenges of lip sync dialogue with visual variety (the planned climax is a blazing cornfield) . . . and it is a subject my film-making team all care about. Most of the filming will be on farm locations when the corn is high, and only a preliminary scene can be shot earlier.

With an all-volunteer cast I feel it is important to work in a few concentrated bursts, or enthusiasm is likely to flag. Therefore I am advancing production plans as far as they will stretch on paper, to eliminate delays on location.

Even if you prefer to jump straight into filming and face problems as they arise, my production check-list may show just how snags arise. Here is what I have accomplished so far:

Scripting: it is no good writing actions and words into a script if they cannot be performed. My first move was to probe the reactions of my leading lady on the whole subject of vandalism, in something like a depth-research interview which I taped. Some of her ideas were written into the script. In this way, while she learned something about the girl in the script, the girl in the script was made a little like her.

Screen testing : the film will be worthless if it fails to carry conviction. I have shot silent film of my actress, Kay, before, but now we will have the further problem of sound—and post-sync sound at that. Therefore I am carrying out a screen test on both Kay and the boy who leads her astray in the story. I will film them separately, acting out a short scene from the film, and then film them together, keeping a tape recording of the test too. On replay, together with the film, the recording will show their rating as actors. But the film will then be striped, and my actors will be invited to re-record their test scene dialogue in sync with the film on screen, to see how well they succeed in dubbing their lines.

Exploring locations : the locations I visualised in writing the script were country spots in Hertfordshire, for whose protection from vandals the film makes a plea. But they were in my mind's eye as I wrote, not actually before me. There is a shot in which the girl pauses at a stile and sees the country bus approaching in the distance. There is a stile, there is a road, and it is the route for a country bus. But I know for sure that no focal length lens I have access to could embrace the whole picture as I visualised it. Ahead of me are long country tramps to establish the best stile and the best view for a shot of the approaching bus and it will probably be on a road five miles from the stile.

Sound effects : most of the sound track will be naturalistic, and re-recorded only where it fails to achieve its purpose. So backgrounds will be recorded along with dialogue, and then taped again without dialogue for marrying up with any post-sync dialogue that may be recorded later. Only as a last resort do I plan to fake effects. The scripted effects include the sound of the bus, a bottle smashed in the road by the young layabout, and the crackle of blazing barley (it is all barley around these parts).

Special shots : two scenes present particular difficulties. One I can write out of the script if I am in a jam. This is a shot from the bus of the layabout standing in the road flagging the bus down. I could probably take it by catching the right bus and shooting without asking the driver's permission. *The main problem is that I do not want the bus to stop*! Will the driver take my word that the youth in the road so anxious, apparently, for the bus to stop, is really only acting a part for my camera? Tricky! I can see myself having to make a few journeys in advance to sound out the problem. If necessary I shall make formal approaches to the bus company.

Even greater is the problem of the fire. I have a farmer as a neighbour, and when he hears about the theme of the film I hope he'll let me film the preliminaries to the fire scene at the edge of one of his fields. In the film the young couple invent a game they call *Farmer's Roulette*, flicking matches from between a finger and the striker on the box, so that they fly, blazing, towards the corn. This could be filmed safely, stamping out any flame that appears.

But for the big blaze I am relying on our local fire siren. This sounds regularly through the summer, calling out our volunteer firemen to a succession of cornfield and haystack fires. If I can be loaded up and ready I should be able to reach the fire station just down the road about the same time as the volunteers do. Then I can follow them into action, and record the sound after I have shot the necessary footage.

In this case, the blaze footage is such an essential part of the film that I want to secure it before I film the 'Roulette' scene and everything that leads up to it. If all I manage to shoot is burning scrub, then I will have to find a similar location and match the acting to the fire.

Continuity : before the first scenes are filmed we will establish precisely what our actors are wearing, and how they are wearing it. This will be written out as a reminder for them on their call sheet of location dates. Continuity of voice levels is a trickier problem, but by recording all linked dialogue in one session I hope to avoid the change of pitch that is so obvious, sometimes from sentence to sentence, in TV reportage. Where there are breaks in dialogue the audience will not remember voice pitch accurately enough to be disturbed. If we dub the film later, to achieve a better track, the problem won't be so great.

Equipment : this will all have been tested beforehand. Location recording will be on the portable *Philips EL3300*, and studio recording on the stereo *EL3534*. I have not decided which camera to use yet, but if the wide-screen attachment I have on order comes through in time, the film may be in 2:1 ratio widescreen. The projector will be the *Eumig Mark S*, with track transferred from tape to *Zonal* stripe.

OUR READERS WRITE . . .

. . . pro the beast

From: C. P. Finn, 'Bramber,' Haunton, Tamworth, Staffordshire.

DEAR SIR, I wholeheartedly agree with every word of Peter Turner's article in the June issue. It soon became very obvious to me that a search for the machine which had all the features I wanted, was fruitless. I therefore set out to make one. I bought a decent deck and a good amplifier kit, on the basis of the idea that a good speaker, etc., can be purchased later, the aim being to make good *recordings*.

I have altered and added to this arrangement in the past five years, quite freely, since the recorder is worth much more to me than its potential second-hand price anyway.

A man does not buy his best clothes 'off the peg'—he chooses his materials and has them cut and sewn to his taste and size. So it is with tape recorders—you alone know what you want—go and make it.

And unlike the tailored suit, it will work out cheaper in the end, quite apart from the knowledge and experience acquired.

Yours faithfully,

. . . about a warning

From: I. J. Davis, 19 Brigham Road, Reading, Berkshire.

DEAR SIR, I have been reading the *Readers' Letters* column in recent months with more than my usual interest. The letters from D. J. Bolt and C. Braddock (February and March respectively) in particular caught my attention, as I feel that their comments on British-made tape recorders are justified.

I own two recorders, one German, and the other made in Britain. The German recorder is a *Grundig TK40*. This machine has worked efficiently and reliably for the past eighteen months. The service from the local agents has been a joy to encounter. When the recorder was taken to them for an overhaul the job was done quickly and thoroughly, advice and help being gladly given.

The second machine was made in this country, its price was almost the same as the TK40's—namely £82 10s., but there the similarity stops. If British made tape recorders suffer from a common fault, with the exception of *Ferrograph*, *Vortexion* and *Brenell*, it is nearly always the workmanship or finish and the after-sales service. This second machine was bought in September and, after 28 hours use, half of the ¼-track head ceased to function, editing with the aid of the digit counter was impossible (I think this item was merely a decoration), the three motors 'ticked' like a trio of noisy clocks—though a check with the *Metrostrobe* showed that the speeds were not affected. There were other faults : the leathercloth covering began to peel off, labels round the controls too were coming unstuck, screws round the lid were either badly fitted or becoming loose, several loose screws being positioned round the carrying handle.

The recorder was returned to the manufacturer on the promise that the faults would be corrected as quickly as possible. That "quickly as possible" lasted nearly three months, from the beginning of October until the 28th January when it was returned. During the correspondence I found that, despite polite letters from both the sales manager and service manager, the firm was not unduly worried about safeguarding its reputation. In a letter in November I was told that they had not received the recorder and believed it was lost or stolen. This took a week for the dealer to sort out.

In a telephone conversation I was treated in such an off-hand manner that I was left fuming. In a letter I wrote afterwards I made it clear that I was not going to be satisfied by vague excuses and lack of service and that if they could sell this particular model of recorder perhaps they could rid me of this one and refund the money. As you may have guessed, the recorder was returned in a matter of days ; a day before its arrival I received another letter of vague excuses, protests at my angry letter and a blunt refusal of my request for a refund.

Made in Britain was enough to sell a product a long time ago, but nowadays seems to be a warning to prospective customers. In your last editorial you mention that the eastern manufacturers could learn from Western examples. I feel that some British manufacturers could learn from the Germans in providing a reliable product backed by a thorough, quick and honest service. *Yours faithfully,*

. . . again the beast

From: D. Johnson, c/o 37 Tomkinson Road, Nuneaton, Warwickshire.

DEAR SIR, For the first time in my life I have taken up my pen to write words of disagreement—about Peter Turner's *The Nature of the Beast*, published in the June issue. It seems to me that he has eaten a dictionary.

He says that manufacturers should make recorders to which facilities may be added later. Mr. Turner—*they do*. He then contradicts himself by pleading for such a machine and then saying he did not want to have to add a mixer.

The reason why some recorders have sockets mounted at the back is that they are envisaged as being part of a permanent audio set-up—where wires are better out of the way than round one's neck.

Editing is possible on almost all recorders. After determining the distance between playback head and a tape guide, one may use chinagraph against the guide and measure the distance back to the section to be spliced. This also overcomes the danger of covering the heads with wax.

On most machines it is possible to unplug the motors or valves from the power transformer to achieve, in the latter case, the 'mechanism only' facility Mr. Turner requires. (*A risky practice, particularly where metal rectifiers are employed*—**Ed.**)

Those who like to do their own servicing do not mind undoing a few screws. Thumb screws are easily knocked or loosened and this is the reason for their general replacement by *Phillips* screws.

I remain a proud *Ferrograph* owner. *Yours faithfully,*

TELEVISION ON TAPE CONTINUED

frequency. While a single *horizontal* trace took less than one ten-thousandth of a second—as we observed—one *vertical* scan lasts one fiftieth of a second—two hundred times as long.

It is wrong to speak of 'vertical traces' since the electron beam at no time draws a vertical line. The beam is deflected from the top of the screen to the bottom in the series of zig-zag movements that make up the horizontal scans. This full vertical deflection takes place twice during each 'still' and thus has a frequency of 50 c/s. Since the mains power supplies in this country are also 50 c/s, the picture can be 'locked' to the mains to prevent instability.

If we turn our attention now from the vacuum inside the cathode ray tube to the controls in the television receiver, we can observe the way in which some of these achieve their effect. The *brightness* control adjusts the voltage on the grid : the less negative the voltage, the faster are the electrons pulled from the cathode and the larger the number accelerated through the anode on to the phosphor screen.

The *vertical hold* control provides fine variation of the 50 c/s saw-tooth generator. As components age, or when room temperature changes substantially, the generator circuit may become unstable, causing the picture to jump upwards or downwards on the screen, and the young lady's legs to come down over her head!

Similar control of generator frequency is provided by the *horizontal hold* which varies the nominally 10,125 c/s line frequency.

With the first of these three controls we also have the principle by which pictures of black, white and shade are formed on the screen. By varying the brightness of the spot (by voltage on the grid) as it scans the screen, a detailed photograph may be constructed.

A television camera is in some respects a 'receiver' in reverse. And it is the output of the camera that is broadcast to the viewing public. Since both camera and receiver feature an electron beam scanning at 405 lines per frame, 25 frames per second, it follows that any variation in intensity of the output from the camera will correspond—on precisely the same section of the screen—to a change of beam strength in the receiver.

So much for theory. In Part Two of this article we shall examine commercial television recording machines and describe the problems involved in recording four million 'dots' per second.

PERSONAL BIAS

I HAVE long suspected the cosmos of conspiring against me, and it certainly had a go last week. On behalf of Merseyside Tape Recording Society I requested an interview with a radio and TV personality ; he readily agreed, apologising for being able to give *only* half an hour, between rehearsals. So with *Grampian* and *Fi-Cord* I thundered off to BBC HQ, (Manchester) — and met him at 10.30 a.m. His next rehearsal was at 11.0.

Despite sporadic noises off, the waiting room seemed adequate ; but he suggested a studio and I wouldn't miss such a chance—we settled down in the monitor room of Studio One and I connected the *202* to the mains. "That's a very handsome machine," he remarked. "I've used the old *1A*, but not this model."

"It's very good." I said warmly. "It's never let me down yet."

("Tcha!" cries Ebenezer, warty nose and beady eyes protruding over my left shoulder as I write. "Tempting Fate, y'know." Yes, Neb ; I *do* know . . . now!)

Even before we spoke, the VU-meter went crazy as I raised the gain. In went the headphones ; down went my stomach. Our speech was barely audible above an angry droning. We stared at each other. I double-checked the mains voltage and connections ; no better. I tried the batteries ; just the same. Playback and other functions were perfect ; but all we got on recording was a powerful hum of the kind that even your best tapespondents won't tell you about.

With a strained smile I stammered apologies, and exchanged the mike-lead. No . . . I swapped the mike. No . . . I removed the battery cassettes, gave their contents a bloodshot scowl and replaced them. No . . . My victim was staring at my bag as though it were Pandora's Box and we were sitting knee-deep in equipment, wires and sundry accessories.

I sweat at the memory of it. Marvellous acoustics, a personality whose time was precious—and the gremlins were on piece-work. "Don't worry," he soothed. "It's happened to me, on location, many times—I know exactly how it feels."

SUGGESTED MOVING OUT

Perhaps we were picking up very close interference? He suggested moving out into the main studio. I grabbed the machine, one mike and one lead, and followed him on to a balcony at the far end, overlooking the assorted booms and parquet floor. I connected the mike and headphones, engaged the 'record' function, and raised the gain. And died the death of a thousand drop-outs.

My face must have frightened him. I offered him the headphones. He donned them, listened, and his eyebrows disappeared into his hair. Well, at least it wasn't just me. He could hear it, too . . . an erratic sour whistling, a gabbling warble that faded in and out whenever the mike was moved. The Astronomer Royal doesn't believe in green Martians ; he would, if he'd heard this lot. It scared me. So did my wrist-watch. It showed five to eleven—nearly rehearsal-time.

With the gain just above a certain level the Martians came in strongly ; with the gain just below that level our voices scarcely seemed to register. And the level seemed to fluctuate, just to help—I had to keep adjusting the gain ; the VU-meter readings became sheer nonsense ; most of the time, the Martians were apparently drowning out our speech—I could hear my voice coming through on the headphones, but not my subject's and whenever I moved my hand near the control panel the Martians began singing up and down some alien scale. In sheer desperation we plunged into a condensed interview while my subject held the mike.

A thousand blessings on my subject who calmly continued into ten minutes of rehearsal-time until a producer's search-party was imminent ("Last seen heading *that* way, with a weirdie geezer and a heap of equipment," they'd be told.) He did his utmost to ensure that I got an interview that made my journey worthwhile.

Before leaving me, he said : "Settle down and play it back, and if it's not bad, fair enough ; but if it's an impossible mess let me know during the rehearsal and I might be able to sneak out for a few minutes afterwards and have another go." Fortunately, no further strain on his generosity was needed : on replay the interview proved intelligible, and only occasionally did the Martians really become intolerable ; altogether, in fact, I came home with fifteen minutes of genuinely interesting and often hilarious material, and some high-speed dubbing may eliminate the stratospheric whistles.

But the next time bad acoustics and extraneous noise make me sigh for the chance to record in a BBC studio . . . ! It proves that you can't win.

Mind you, a friend has already learned that. He bought an impressive-looking *Truvox*, admired its controls, plugged it into the mains, switched it on, checked the instructions, loaded a tape and tried to play it. The Truvox went on looking impressive but refused to budge. He studied the manual sideways, backwards, upside down, translated it into Sanskrit and back to Birkdale English with a smattering of fluent Scouse, tried every possible combination of controls and verified that there wasn't a local powercut. No luck. So he phoned the dealer and (if I may quote) "played 'oly 'ell with some poor bloke".

IT CAN HAPPEN TO THE BEST

Out came an engineer by car. He studied the machine, glanced around the room, and then thoughtfully said : "Ah . . . I think I see the trouble." Lost in wonder at such wisdom, my friend watched as the engineer walked to the wall, knelt down, and gently depressed the switch on the mains socket. Click. One perfect machine. One red face. This is a true story ; and it can happen to the best of us.

Did some editing for Ebenezer the other day ; posted the results ; back came a card saying : "Neat work, laddie. Not even a shristle. Many thanks." Goody, I thought, then did a double-take and grabbed the phone. "Neb, you old twit—what the 'eck is a shristle when it's at home, if it has a home?"

"Tcha," he said. "You don't know? *You?* A recording journalist?"

"'Fraid not," I admitted. "Never even heard of 'em."

"Mmmmmm . . .," he said. "Well, I suppose you can't always be absolutely up-to-date, and I only invented the word last week. It happened like this . . ."

He'd heard a broadcast of the soundtrack of Olivier's *Henry V*. As the chorus described the English army setting sail for France, he was struck by the phrase : "Hear the shristle that doth order give . . ."

He scratched his capacious bonce and cogitated. Shristle? Probably an obsolete musical instrument. His crumbling dictionary displayed a shortage of ideas between "shrink" and "shrive." He asked everyone he met ; he wrote to the papers ; he drove the local museum curator mad. But nobody knew anything about shristles. Finally, and just in case his spelling was a bad guess, he checked the passage in a volume of Shakespeare's plays—and uttered a screech that put twelve years on his wife.

The film had snapped and been spliced together and a bit containing "ill whi" had been forever lost. The text read : "Hear the shrill whistle that doth order give . . ." The joint was perfect ; it had fooled him utterly, and shristles had been invented. After all, we have flutter and wow, feedback and print-through and umpteen other terms . . . but is there a word which means : 'the running together of two words by careless splicing'? No! Or rather, there wasn't—as far as I know. There *may* be such a word ; but, if not, then Ebenezer has made yet another contribution to the field.

BY JOHN ASHCROFT

tape recorder service

NUMBER 56

wyndsor 707

BY H. W. HELLYER

TO continue where we were interrupted by the Editor with his scissors and paste . . .

The *Wyndsor 707*, basic circuit of which is shown on the adjoining page, is a machine about which there have been a few praises sung, and a few pointed criticisms made. Of the praises, this scribe would wish to speak softly. The *707* featured in an independent review some time ago, and was pretty highly praised as value for money. Well, it depends on what you mean by value, and what you expect to get for a modest outlay. In fact, the *707*, in both the half and ¼-track versions, is an attractive machine in looks and performance, with a *BSR TD10* deck and some facilities that are lacking on a number of machines of even higher price and greater reputation.

It is astonishingly easy to service, the whole deck-plus-amplifier lifting away from the main cabinet on the removal of the five cross-headed bolts clearly visible at sides and rear. No hidden screws, no secret clips to prise off, no bits of plastic to lever away; and sufficient length on the speaker leads to allow most repairs to be done by simply swivelling up the top board and propping it with ten to twelves inches of convenient support. (The shaft of a light hammer is the usual standby in our workshop, its upper end against one of the deck screws—*not* the temptingly easy flywheel bearing or motor lamination support please !)

A colleague of mine has a theory about machines that are too easy to service—asserting that this is because they too often need service. We feel that Messrs. *Ferrograph* and *Brenell*, who make access very simple, would take exception, though we need only add that he is a *Grundig* fan, who still worships every relay on his *830*. Suffice to say that having lifted the board-plus-deck of the Wyndsor 707, the complete works are easily accessible.

The amplifier is, as before, a pseudo printed-circuit. That is, a Paxolin board, mounted on angle brackets to the deck support, with components wired to tags punched through the board. The track, speaker and other small switches, plus the input and output sockets, are separately mounted along the front top of the metal escutcheon. No fiddling about at the back—which ought to please Peter Turner, at least ! The record/play switch is directly mounted on the spindle, which also has its advantages over the spring-and-lever brigade.

If anything, this is part of the trouble we experience, usually when an owner has had the machine long enough to become a little critical. Then, there are complaints of hum and instability—some of them, we must hasten to say, quite unjustified, and the result of uninformed usage. But where there is genuine hum, look first to the leads from the volume and tone controls, the switches and sockets back to the amplifier panel. Wyndsor have been a little too generous with these, and at least an inch can be cut back from most—more from some, all adding to the improvement in signal-to-noise ratio. Providing, of course, the remade wiring is of a good soldering standard.

Take particular note of the earth wiring. As there is no metal chassis, the grounds, or earth returns, are made by connection of the screened cable braiding. There is one common HT negative tag, to which the common of the main electrolytic capacitor goes, roughly in the middle of the board; but input stage returns are made to a tag at the front lower side of the board, and, via a short jumper lead, to the spigot of the first valve base. It is extremely important that the returns be kept as originally laid out. Where the braiding appears to float in mid-air, doing nothing, leave it so ! Connecting it to a tempting earth is asking for the creation of a hum loop. As a corollary, the correct chassis returns must be good and of low resistance. In particular, there is an earth tag at the left under-side of the deck, which takes part of the return wiring, and which can be the source of hum and instability if the screw works loose.

Even more disturbing is the effect of an incorrect connection at the output socket. My auxiliary diagram, **fig. 2,** shows the various connections to the sockets, viewed from the solder points (equivalent to the plug pins). The catch is that the external loudspeaker must be connected to Pin 3 of the socket (not as stated in the instruction book), with the braid taken to the plug casing tag and definitely *not* Pin 2, even though this is an earth return. Connecting to this point would complete a beautiful hum loop which may be useful for dubbing sound-effects but is not much good for clean reproduction. The screening effect of the metal top plate is used quite effectively in this model, if the connections are made properly.

It should perhaps be stated again that these notes are mainly for 'owner-drivers' or those purchasing a second-hand recorder about which they have no information. New models may not be expected to evince the horrifying troubles we have implied. They will, however, show one disturbing symptom that should be noted and explained.

If no input connections, microphone or radio, are plugged in, and the machine is switched to record, a pronounced hum level will be noted when the tone control, acting as monitor gain on record, is advanced about two-thirds of its arc. This depends also on the setting of the main volume control. Alarming as this may seem, there is nothing wrong with the machine—except that the makers have saved a bob or two in production by omitting to fit shorting input sockets. This is one case where David Kirk's championing of the jack connection has some point, for the DIN socket is not easily adapted to a shorted input for a high-gain preamplifier stage, vulnerable to hum and noise with an unloaded grid-cathode circuit. Obviously, if one is recording with no input—as for example when erasure alone is required—then the gain controls should be turned to minimum. This is general practice, even with input circuits of more professional standard.

With the machine switched on and the deck inactive, a radio input feeds through as a straight amplifier. But the result may sound slightly 'bassy' and some tone control adjustment will be needed. Then, when one switches to record, the monitor sounds too 'toppy' and there is no real compromise. This is not a machine that can be set up for recording levels and quality then switched to record—the amplifier facility is a happy chance of design, not a deliberate attempt to emulate a more professional machine. In other words, the record channel gives the more realistic equalisation for judging quality, whereas an input under play (i.e. neutral) conditions, is modified by the equalisation circuit. A glance at **fig. 1** shows this.

Talking of equalisation, there is a common fault that needs mentioning. A pronounced howl when the volume control is advanced usually denotes that the feedback circuit has open-circuited. The components are neatly wired around the switch, but the wires to the panel are rather tight, and as the panel tends to flex, especially after the machine has been opened once or twice, a bad connection is easily caused. We have had several with fractures inside the insulation of the connecting wire. The moral is, do not trust your eyes, but check with a meter, or make temporary shunts of odd pieces of wire to prove the fault.

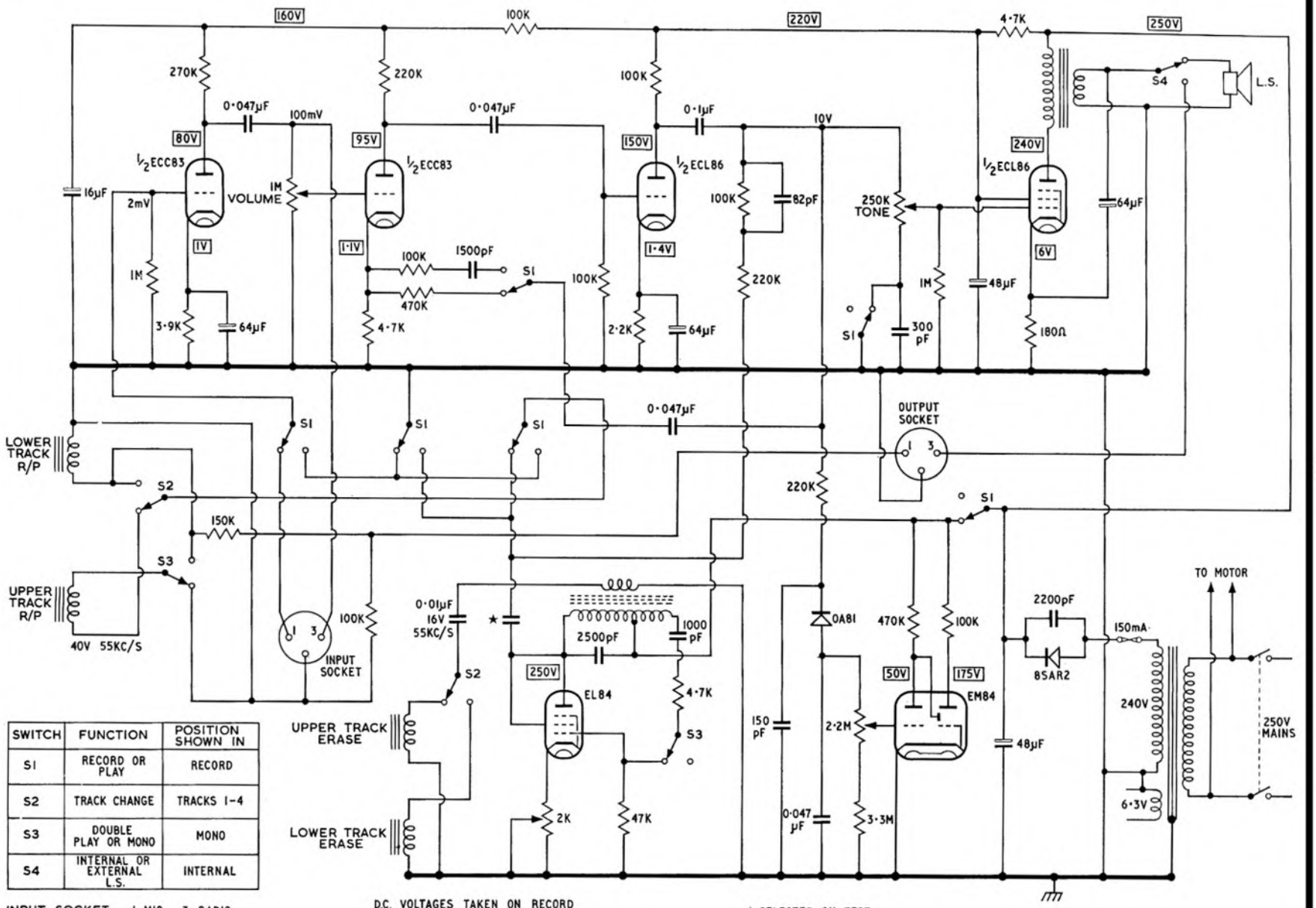
Another connection that sometimes tends to come adrift after some usage is the return lead (i.e., the common negative) of the main smoothing capacitor. This is connected, through the panel, to the common earth tag previously mentioned. Its disconnection gives symptoms that are obvious and inescapable, and a quick peep at the underside soon shows the rather large wire-ended component to be dangling.

This is hardly Wyndsor's fault, and is easily remedied—but it gives me the opportunity to have a crack at manufacturers of components who imagine their products are always going to be fitted and used under the ideal labatory conditions they enjoy. Brittle wire ends to capacitors and wire ends that fit under aluminium rivets, giving ultimate high resistance joints, are far too prevalent. The only real answer is rigid support mounting. In audio, this kind of mounting may lead to connections of significant length, with the result of hum or instability. (Of course, direct connection to valve-bases, etc., is ideal, and a machine such as the Revox, with every

(*continued on page 292*)

FIG. 1

WYNDSOR 707 CIRCUIT DIAGRAM



SWITCH	FUNCTION	POSITION SHOWN IN
S1	RECORD OR PLAY	RECORD
S2	TRACK CHANGE	TRACKS 1-4
S3	DOUBLE PLAY OR MONO	MONO
S4	INTERNAL OR EXTERNAL L.S.	INTERNAL

INPUT SOCKET 1. MIC. 3. RADIO.

OUTPUT SOCKET 3. L.S. 1. STEREO

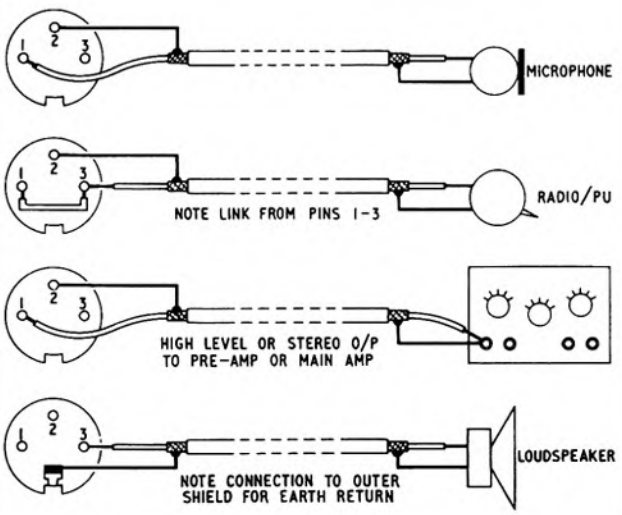
D.C. VOLTAGES TAKEN ON RECORD UNDER QUIESCENT CONDITIONS

A.C. SIGNAL VOLTAGES TAKEN ON RECORD (V.T.V.M.)

★ SELECTED ON TEST

D.C. VOLTAGES BLOCKED IN □

FIG. 2



stage its own nest of supported components, costs money to produce —and takes up a little more room.)

As this article is turning out to be a collection of digressions, it does not seem in the least inapt to move on to some modifications that have been introduced in later versions. In the magic-eye circuit, the 0.047 μF has ben deleted from across the modulation level preset, and instead a 0.1 μF fitted from grid to cathode. In the driver stage (or head amplifier for recording), where the triode section of the ECL86 is employed, several changes have been made to allow for improved heads and to improve the equalisation. The 0.047 μF from S1 to the stereo pin (Pin 1) of the output socket is deleted and instead a 0.1 μF is fitted from the anode of the ECL86 to the S1 section feeding back to the ECC83 cathode. The 0.1 μF from the anode of the ECL86 to the top end of the tone control is reduced to 0.047 μF and the 0.047 μF from anode of the second stage to grid of the ECL86 triode is reduced to 560 pF. A little thought shows that these changes need only involve the purchase of one small capacitor—but a word of warning, don't be tempted to do things by halves. If you want to make the changes, make them all at the same time.

There are one or two unofficial modifications that can help reduce hum pick-up, but do not improve overall performance. A 1M resistor across the grid of the ECC83 and a reduction of the 3.9K cathode resistor of the input stage are among these ; but perhaps the most effective is a physical repositioning of both this resistor and its decoupling capacitor. If the return ends are taken directly to the valve spigot, and the jumper lead to the return tag retained, a better low-noise figure is obtained for small-signal inputs.

Be careful, when making any changes of this nature, not to let the components protrude outwards from the panel, and always refit the clamping band of adhesive tape on the cable harness. Failure to observe this elementary precaution can cause a nasty hitch when the deck platform is swivelled down into place. There is a small cut-out to accommodate the spire clip, which is a perfect trap for loose cables.

The oscillator needs little mention. Mounted on its separate sub-panel at the right-rear of the machine, it seldom requires attention. As a guide to the output that is obtained, an *AVO Model 8* on the 100V AC range gives approximately 30V reading across the erase head and about 50V bias at the record head.

Head adjustment is quite simple, the two heads being clamped by a common bar and fitted on a rocker mounting so that setting of small brass screws through the clamp gives correct azimuth. The record/playback head has only one screw, to its left, and a small spring above it to the right. If there is any occasion to remove heads, take care when refitting that they sit forward in the moulding as far as they can go, and that this small spring is properly seated in the cut-out of the top clamp.

(*continued on page 294*)

NEW PRODUCTS NEW PRODUCTS NEW PRODUCTS

OSMABET BATTERY ELIMINATOR

DESIGNED for use with transistor radios, record players and tape recorders, the *Osmabet Power Mite* provides 9V DC from a 200/240V AC mains source. An isolated mains transformer and balanced hum-free smoothing network provide up to 150mA. through standard cell terminals. The price is £2 5s.

Manufacturer: Osmabet Ltd., 46 Kenilworth Road, Edgware, Middlesex.

NEW STYLES FROM B.R.C.

RECORDERS in the *Marconiphone* and *Ultra* ranges, manufactured by the *British Radio Corporation* have been re-styled. The Marconi *4206* employs a single-speed version of the *Thorn* tape deck, offering ¼-track recording at 3¾ i/s. Grey leathercloth and silver finish are featured on this model and on the ¼-track *4208*, which has the added speed of 1⅞ i/s and solenoid pause control. Respective prices are £28 7s. and £35 14s.

Speeds of 7½, 3¾ and 1⅞ i/s, 7in. spool capacity and two-channel input mixing are to be found on the *4210*, a ¼-track machine employing the latest Thorn deck and finished in black leathercloth. This model sells for £47 5s. Effectively identical to this machine is the £46 4s. Ultra *6206*.

Manufacturer: British Radio Corporation Ltd., 2-5 Upper St. Martins Lane, London, W.C.2.

SANYO MAINS/BATTERY RECORDER

AN addition to the range of battery recorders lately introduced by *Sanyo* is the *MR 110*. As an alternative to torch-cells, however, this model may also be powered from 110/240V AC mains and features automatic gain control, speeds of 3¾ and 1⅞ i/s and AC recording bias. Erase bias is DC and output power is 0.8W. The recorder operates on two tracks and takes spools of up to 5in. diameter. Claimed frequency range at 3¾ i/s is 100 c/s—7 Kc/s, and the dimensions are 11½ x 10¼ x 3in. The MR 110 sells for £37 16s.

Distributor: Sanyo Sales and Service, 23 Savage Gardens, London, E.C.3.

MICROSOUND SOUND-EFFECTS

THIRTY-NINE different subjects, from *Cows* to *Thunder* are listed in a booklet of sound-effects produced by *Microsound, 70 Nursery Road, Cheadle Hulme, Cheadle, Cheshire*. Under each title are included between three and 16 effects which may be purchased on tape or 45 rpm disc. Recordings are free of copyright and are charged on a duration basis. Effects recorded to order on 7in. discs cost £1 15s. per 5 minutes, while recordings on tape are 10s. 6d. per half-minute, 13s. 6d. per minute, 17s. per two minutes, and 22s. 6d. per three minutes. These charges apply to orders at 15, 7½ or 3¾ i/s.

BIB FLEX SHORTENER

NEAT and effective accessory now being produced by *Multicore Solders* is the *Bib* Flex Shortener. Retailing at 2s. 6d. per set of four, it is manufactured from transparent plastic and will store semi-permanently up to 12 ft. of mains flex or thin microphone cable.

Manufacturer: Multicore Solders Ltd., Multicore Works, Maylands Avenue, Hemel Hempstead, Hertfordshire.

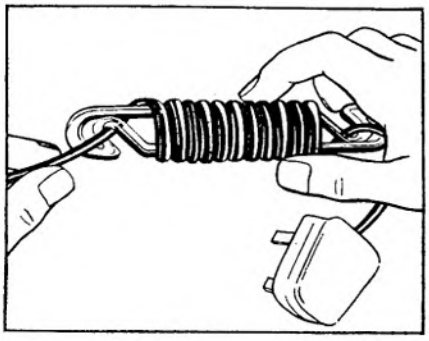
STANDARD BATTERY PORTABLES

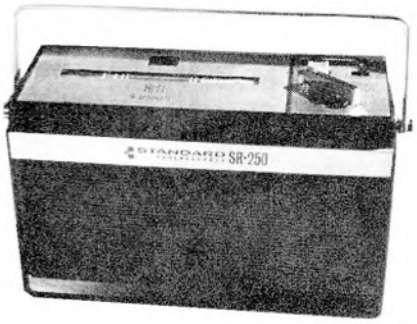
TWO new battery tape recorders have been introduced by ***Standard***, both setting an example of original design. Cheapest of the two is the *SR-200* which sells for 18gns. and operates at 1⅞ i/s. Recording time is 50 minutes on two tracks of 2in. reels, modulation level being controlled automatically. Maximum output through the internal speaker is 300mW and dimensions are 7½ x 4¾ x 2½in. Sockets for microphone, battery supply cut-out, external speaker and external power supply are incorporated, the recorder being supplied with a dynamic microphone, leather case and demonstration tape.

The Standard *SR-250* operates from mains and batteries and features speeds of 3¾ and 1⅞ i/s, giving a maximum recording time of one hour on two tracks of a 2½in. reel. Output power is 1.5W and dimensions are 10 x 6½ x 3¾ in. Weight is 5½lb. and the price, including microphone, demonstration tape and mains lead, is £29 8s.

Distributor: Denham and Morley Ltd., Denmore House, 173/175 Cleveland Street, London, W.1. *(continued overleaf)*

Left: Sanyo MR 110 mains/battery recorder
Below Left: Bib Flex Shortener
Below: Marconiphone 4208 three-speed
Right: Standard SR-200 battery portable
Below Right: Standard SR-250 battery recorder





CBS MAGNETIC TAPES

DENHAM and Morley are now handling *CBS Extended Range Audio* recording tape in standard, DP and TP forms. The brand is described as equally suitable for two and four-track techniques and is priced as follows:

Standard Play (Acetate): 3in. spool containing 150ft.—6s. 6d.
5in. spool containing 600ft.—£1 1s.
5¾in. spool containing 900ft.—£1 8s.
7in. spool containing 1,200ft.—£1 13s.

Double Play Mylar: 3in. spool containing 300ft.—12s. 6d.
5in. spool containing 1,200ft.—£1 16s.
5¾in. spool containing 1,800ft.—£2 10s.
7in. spool containing 2,400ft.—£3 8s.

Triple Play: 7in. spool containing 3,600ft.—£5 5s.

Distributor: Denham and Morley Ltd., 173/5 Cleveland Street, London, W.1.

For the benefit of readers with no maker's literature—an omission we are pleased to see that has been rectified on the later, more ambitious, *Vanguard*—the following figures may be helpful. Inputs: Microphone, 2mV into 1M; Radio, 250mV into 1M. Outputs: High level, 500mV from 1M; Loudspeaker, 3-5W, 3ohms; Stereo (¼-track models), 8mV at 3Kc/s.

Mention of the Vanguard provides a good closing chord for this sonata. It is far too early for us to concern ourselves with service information. The makers would hardly thank us for encouraging readers to delve into the innards while guarantee periods are still valid. But this seems to be a machine into which much more thought has been poured. Using the *Magnavox 363* deck, with a ¼-track arrangement involving full sound-on-sound facilities, and having a good control layout, it is much more 'professional' than previous models.

The Radio/PU input is more sensitive, the high-level output is more easily matched, and a 4W output is provided into a 15-ohm speaker, mounted in the lid and capable of being extended up to 18in. Moreover, it uses standard jacks with connections and controls on the front panel—which should please all our above-mentioned critics. But much of the most praiseworthy innovation in *this* critic's reckoning is the provision of a good instruction manual, with circuit in the rear.

cuts the coils. When we attempt to reproduce low frequencies this speed is very slow. Consequently the bass notes are cut out almost completely.

Now we are in a bad way. We have lost most of our treble during recording and nearly all of our bass during reproduction. Fortunately, we can do something about both by including *equalisers* in the recorder. These are circuit networks which we use to change the frequency characteristics of amplifiers. They will have an article to themselves later, but we can say now that we use one equaliser in the record amplifier and another in the reproduce amplifier. On record we boost the treble response and on playback we boost the base response. Thus we compensate for both errors. Equalisation is switched automatically as we change from record to playback, but there is often a manual control so that the response can be adjusted to suit different recording requirements.

All the equalising in the world will do no good if the recording head current is too high. This is called 'over-recording'. Since there is a limit to the extent to which a tape can be magnetised and to the voltage which an amplifier can handle without distortion recording at too high a level can ruin the quality of the recording. For this reason most tape recorders incorporate a *level indicator*, either a 'magic-eye' or meter. The level control on the tape recorder is adjusted so that, during the loudest passages, the magic-eye just fails to close or the moter needle never quite reaches a datum line. Proper adjustment of the level control during recording is an acquired knack. It is one of the secrets of really fine-quality reproduction.

This, then, is an overall picture of tape recording. Next month we shall be considering the recording process in detail.

equipment reviews

FIDELITY PLAYMASTER

MANUFACTURER'S SPECIFICATION. Quarter-track mono recorder (¼-track model available at £23 2s.). **Tape Speed:** 3¾ i/s. **Spool Capacity:** 5¾in. **Wow and Flutter:** 0.25% RMS. **Frequency Range:** 60 c/s—10 Kc/s. **Signal-to-noise Ratio:** 50dB. **Output Power:** 3W. **Recording Level Indicator:** Magic-eye. **Price:** £26 5s. **Manufacturer: Fidelity Radio Ltd., Olaf Street, London, W.11.**

THE basic deck of this recorder is the well-known *BSR TD2* tape transport, although this fact is skilfully hidden by a new all-plastic top plate and cabinet. The deck is supported on a pressed steel chassis which carries an 8 x 3in. elliptical speaker on the left-hand side and a large 12 x 2in. printed circuit across the front, which supports the edge-type gain controls and the input/output phono sockets.

The effect of all this plastic and metal is to increase the acoustic noise from the single drive motor to a quite devastating level, and to colour the acoustic output from the loudspeaker to a marked extent.

The magic-eye record level indicator is fed with badly smoothed HT so that the edges of the beams are fuzzy and ill defined.

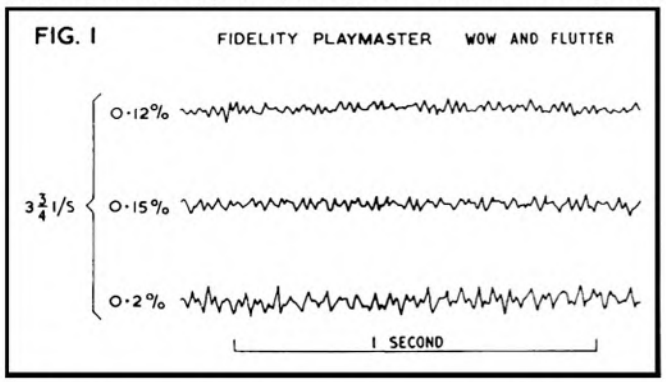
The tape speed of 3¾ i/s was maintained within the specified limits of ±1% at the beginning and end of a 5¾in. spool of tape. Short-term speed fluctuations were within the specified 0.25% RMS, and the fluttergrams or pen recordings are shown in **fig. 1.** The average reading was 0.15%, dropping slightly to 0.12% when the component flutters tended to cancel, and rising to 0.2% for short periods when the recorded and playback flutter components were in phase. The main flutter frequency was at 50c/s, corresponding to the motor rotation frequency of 3,000 r.p.m. Fortunately the ear is not very sensitive to such relatively high frequency flutter, and the wow components at capstan and idler wheel rotation frequency were very low.

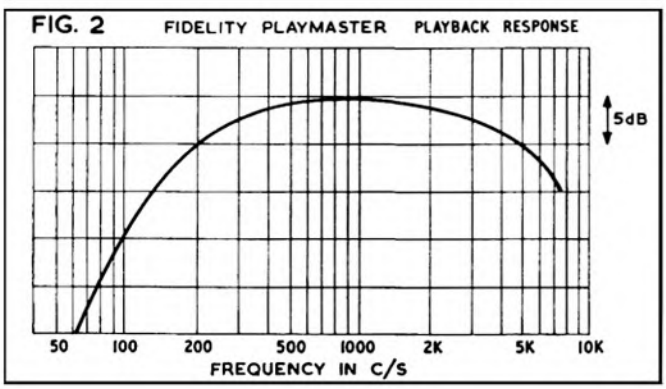
The playback equalisation was measured by playing a 140μS 3¾i/s test-tape. The response, measured at the extension speaker socket with a 15-ohm resistive load, is shown in **fig. 2.** This shows little evidence of play back equalisation of any kind, and is the kind of response to be expected when playing a medium-impedance head into the normal input impedance of an earthed-emitter transistor amplifier. Operation of the tone control removed more and more of the already inadequate high-note response without appreciable effect below 200c/s.

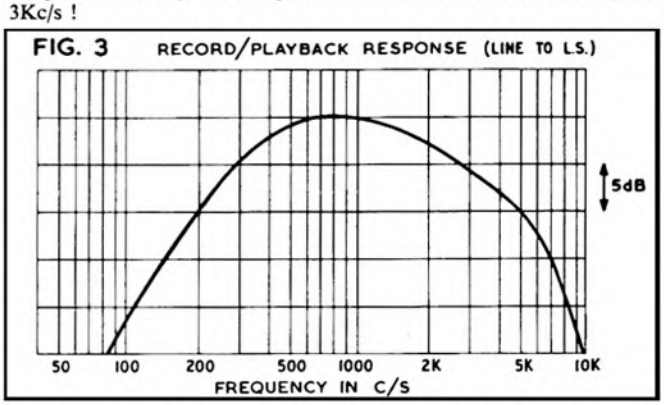
System noise was 30dB below test-tape level and appeared to consist mainly of harmonics of the mains frequency radiated from the motor and picked up on the head and switch wiring.

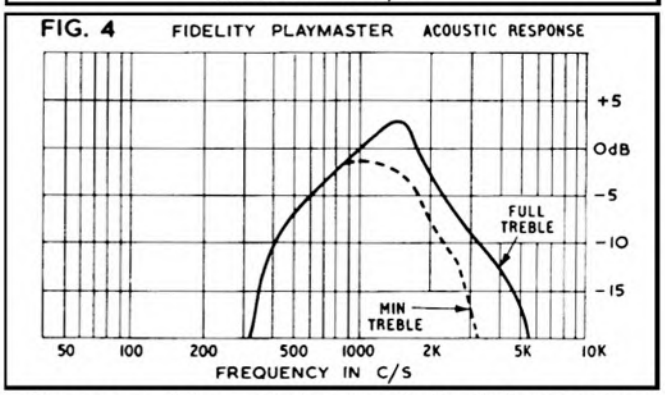
The record-play response of **fig. 3** showed a further loss of both bass and treble, so that, although the response was reasonably balanced about the 1Kc/s mid-frequency, line recordings from radio or pickup had a hollow quality with little 'body' or high frequency 'edge'.

The combined response of the electronics, loudspeaker and 'cabinet' was measured by recording 25 one-third-octave bands of filtered white-noise and measuring the sound output on the speaker axis. A simple listening test showed that less than half the noise bands were even faintly audible, and the calibrated microphone response showed the unique curve of **fig. 4**—a response level within ±6dB from 400c/s to 3Kc/s !









The response of the crystal microphone feeding the input transistor, now switched to an emitter-follower configuration, was even more lacking at low frequencies, but by this time there seemed little point in making any further exact measurements.

I happen to know that the TD2 deck and heads, fed through a properly designed transistor amplifier, does not disgrace even the widest range high fidelity speaker system, but in this case the blame must be equally shared between record and replay equalisation—if any—and the unlucky combination of speaker and cabinet which looks all right—but sounds all wrong. **A. Tutchings.**

Postscript : *We are informed by Messrs. Fidelity that substantial circuit modifications have been made to the Playmaster since the review model was submitted. These have resulted in improved frequency response and reduced hum level. A more detailed comment may be published in the near future.*

AKAI ATE-7 BULK ERASER

MANUFACTURER'S SPECIFICATION. Accessory for high-speed erasure of ¼in. magnetic tape. **Power Input:** 220V 50—60 c/s. **Spool Capacity:** 3—10½in. **Fuse:** 5A. **Dimensions:** 4 x 5¼ x 3in. **Weight:** 6lb. **Price:** £13 2s. **Distributor: Pullin Photographic Ltd., 11 Aintree Road, Perivale, Greenford, Middlesex.**

IF a bulk-eraser is switched on or off with a reel in position, a once-per-revolution 'bonk' will be heard when the tape is played. This effect is neatly side-stepped on this eraser by making the spindle on which the reel rotates also act as the on/off switch, so that it has to be depressed to unlock, thereby springing up and switching on the power; a red light on the tip of the spindle shows that it is now active. Thus the reel *must* be brought to the eraser with the power on. In the same way, it is impossible to switch off at the eraser when a reel is in position, as the spindle cannot be depressed far enough to switch off the mains supply, and the power can only be cut when the reel is safely removed from the unit.

The radiated 50c/s field was measured with a 1 x 4mm search-coil

READERS' PROBLEMS

Readers encountering trouble with their tape equipment are invited to write to the editorial office for advice, marking their envelopes "Readers' Problems —Tape". Replies will be sent by post and items of general interest may also be published in this column at a later date. This service does not, however, include requests for information about manufacturers' products when this is obviously obtainable from the makers themselves. Queries must be reasonably short and to the point, limited to one subject whenever possible. In no circumstances should such letters be confused with references to matters requiring attention from other departments at this address. We cannot undertake to answer readers' queries by telephone.

A BIAS OSCILLATOR

Dear Sir, I recently tried to construct an echo-chamber using various old tape recorder parts, with an erase head, record head and amplifier, and a series of playback heads. The idea worked fairly well except that the signal was horribly distorted.

After discussing it with a friend he suggested that I needed a bias supply to mix with the audio signal. Is this the case? If so I would be glad if you would supply me with the circuit of a bias oscillator that I could use. *Yours faithfully*, **G.S., Greenford.**

Without knowing a little more about your echo-chamber set-up it is not possible to be too specific about bias circuitry. You mention that you have an amplifier but do not give details, so we do not know whether it is capable of the addition of a bias oscillator. The demand is not great, requiring just one valve, either a twin triode or single pentode, depending on whether you want a push-pull, normal Hartley, modified Colpitts or tuned-anode oscillator. If the power supply is available, and if you can get hold of a suitable oscillator coil the design is not stringent.

A suitable circuit that is easily adaptable to your needs is the push-pull type shown in Graham Balmain's article on 'Hum and Noise' on page 23 of the February 1964 issue.

and meter calibrated to read 300 gauss RMS at 2mm from the top plate of the eraser. 300 gauss (OdB) was obtained over a radial distance of 3in., from a radius of 1½ to 4½in. At distances of 1in. and 5in. from the spindle the field dropped by 3dB.

The field consisted of a strong vertical field flanked by two equally strong horizontal fields, with much weaker vertical fields on the outside. This shows that the orthodox deep stack of 'E' laminations is used, with the leakage field from the tips of the 'E' used for erasing.

Track 3 on a four-track recorder was recorded at peak recording level (+12dB on test-tape) and first erased with the track furthest away from the field source. Erasure was better than 60dB at all parts of a 7in. reel with a hub radius of 1in. On a 5in. reel, with a hub radius of ¾in. erasure was incomplete (—50dB) at the inside of the reel, but was fully effective if the reel was turned over to bring the test track nearer the unit surface. A small diameter hub 3in. reel could not be fully erased in either position if mounted on the spindle, but complete erasure was possible if it was rotated with the outside edge of the reel touching the spindle with the body of the reel over the erasing area.

I had no 10½in. reel available to test the outside erasing limits, but the search coil tests indicate that it would be wise to reverse the reel, to erase both sides, to ensure that the outside turns of tape are fully erased across the full width of the tape.

COMMENT

This is a nicely styled unit which does its job well. I particularly like the spindle switch method of ensuring that the worst faults of bulk erasing are not possible on this eraser.

Incidentally, there seems to be a widespread belief that a tape should be removed to a distance of several feet from a bulk eraser before the eraser is switched off. In fact, the field falls to a level well below the coercivity limit of the tape within a very few inches from the top surface of the eraser. Thus, it is most important to continue turning the reel as it is lifted clear of the eraser over the first ½in. or so, completely to avoid radial 'swish' or 'bonk'. **A. Tutchings.**

A further cause of distortion is incorrect head matching. You say you have a series of playback heads. If these are not impedance matched, some quite strange effects can be noted. Even after providing bias (and here we would refer you to the recent series of articles by K. R. Wicks) you may have to experiment with playback heads, first by connecting a single one, then adding others and reversing connections one by one, then altering the coupling circuits, in order to preserve the correct loading.

USING VU-METERS

Dear Sir, Having recently purchased a new *Revox* 736 tape recorder, I am in some doubt as to the correct way of using the VU-meters fitted to it. My previous recorder, a *Ferrograph 4A/N*, had a peak-programme-meter and experience suggests that these two types of meter give different information. I find that, using the VU with peaks not exceeding 100% on the scale, I get an appreciably lower recording level than with the PPM, with a consequent drop in signal-to-noise ratio.

In view of this, I am wondering whether an average recording level on a VU should cause the needle to hover round the 100% mark, with peaks exceeding this figure. I have tried this with the Revox and find that using good quality tape there is no audible distortion, even if the needle goes right off the scale on peaks.

In view of the very brief instructions supplied with the machine and the fact that I suspect something has been lost in translation, I should be grateful for your observations on the correct use of VU-meters. *Yours faithfully*, **M.L., Prescot.**

The essential difference between a VU-meter and PPM is the subject of some controversy in the tape recording fraternity. In the USA the VU is much favoured and we find them widely used in Japanese equipment, much of which was originally tailored to the American market. But over here and on much of the Continent the PPM holds pride of place. Staunch protagonist is Auntie BBC, who cannot be gainsaid in matters of this nature. Whereas the VU responds to loudness, the PPM responds to peak amplitudes of the waveforms, which is a rather different thing.

Thus a VU can be set up on a tone of one kind, and gives completely misleading indications when a different type of material is inserted. It must be used 'on site' for setting recording level with the actual sounds being recorded.

On the other hand, the PPM has a fast rise-time and slow decay and can thus be set for correct recording level with any input, the setting

(continued overleaf)

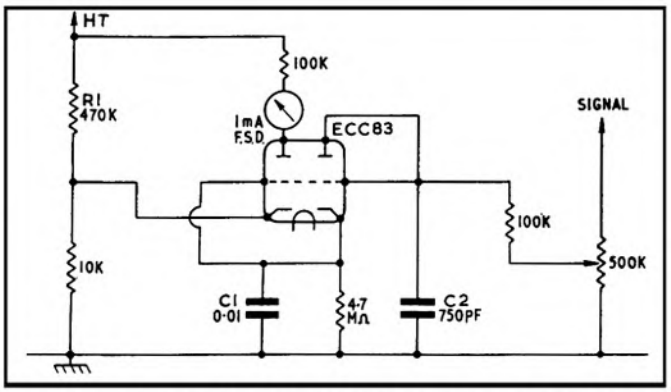
holding for any conditions. If the tape recorder runs into overload with a particular tape at a given setting, then the next lower setting can be used, and only the brief overload peaks will take the pointer on to the red. One has to become used to the decay time and not to make rapid level adjustments as the pointer shows transient peaks. Generally, the damping is better and overshoot not so pronounced. The scale is logarithmic, usually in dB's, though linear scales may be used. The VU is more often linear, scaled in voltage and often hovers too low for accurate setting with small level change on transient sounds.

A RECORDING LEVEL METER

Dear Sir, I have purchased a *Linear LT45X* tape amplifier for use with a *Magnavox Studio* tape deck. Would it be possible to use a recording level meter in place of the 'magic eye' incorporated in the amplifier? If so, what type would be suitable, how much would it cost, and what circuit would be necessary?

Yours faithfully, **G.J.H., Birmingham 27.**

A recording level meter could be fitted in place of magic eye using the circuit in the diagram. This is the same circuit as that used with the TWPA/4, described in detail in the February and March 1963 issues by A. W. Wayne. The meter is a 0 to 1mA type, which can be obtained from Shirley Laboratories or from Home Radio Ltd., 187 London Road, Mitcham, Surrey. Practically any similar movement could be used, so an edge-reading type could be purchased without fear of possible unsuitability.



The circuit is straightforward. The 470K resistor R1 could be altered to give exact balance, and if you want a better delay characteristic (this is a peak-reading type) increase C1 to 0.015 or 0.02mF. The capacitor C2 is important, being 750 pF and preferably a good disc ceramic, as this one performs the function of by-passing the bias from the detector.

Cost depends on what you can obtain cheap around the spares shops, and what you have in the spares box. The principal expense is the meter—and even a good type costs less than a pound.

CHEAP TAPE AND HEAD WEAR

Dear Sir, I recently purchased cheap tapes advertised in this magazine since they seemed to be of exceptionally good value and for my purposes, the study of languages, high fidelity is not of great importance.

I should like to buy more of these tapes but am particularly worried by the prospect of rapid head wear through abrasiveness. Living normally in a tropical climate (Fiji Islands) I am also concerned about the reaction of tape to a constantly humid climate. Your advice on these points would be appreciated.

Yours faithfully, **G.W., London, S.E.23.**

We would think cheap tape quite adequate for the study of languages as such. If your interest extends to phonetics, however, you might conceivably have trouble with the output fluctuations which afflict some kinds; these would affect the accuracy with which speech inflections were reproduced if used on a narrow-track machine at low speed.

For a hot humid climate, it is wise to avoid all acetate-based tapes and the thinner PVC-based ones, as they would almost certainly be cupped in those conditions.

We know of no cases of undue head wear being directly attributable to

cheap tape. The design of the recorder—particularly the pressure-pad arrangements—would seem to have far more influence. If you are worried about this, you could easily have your machine checked for excessive pressure and bad fit of the pads to the heads. Provided you stick to DP tape, you could have the pressure eased with advantage to head life. Ten grams should be adequate on a properly designed recorder.

A HEATED ROBUK

Dear Sir, I would be glad of your advice regarding a difficulty I have experienced with my new *Robuk* tape recorder.

The hub of the take-up reel appears to get very hot. After some 90 minutes of use, it gets so hot that it is unbearable to touch. I am wondering whether this is normal and if any harm will result to a tape becoming excessively heated in this way.

Yours faithfully, **T.M.K., Watford.**

Your problem, a seizing bearing on the take-up motor, may be the result of lack of lubrication. Since the spool carrier gets hot in the way you describe, however, we would think that the trouble has developed beyond this stage and you may need a new right-hand motor by this time. (This is, of course, a three-motor machine, and take-up is determined by series switching of the spool motors, with a limiting resistor. There is no clutch.)

CONTINENTAL PINS AND PLUGS

Dear Sir, I have just bought a *Grundig TK18* and wish to record from the tape connection on my *Decca TP85*. Messrs. Decca inform me that the tape socket is, in fact, a diode connection. All connections take miniature jack plugs.

The TK18 manual says that if you have a radio fitted with a diode socket you may use the SL33 lead and a suitable plug. I have purchased the lead and find that it has three connections—yellow, red and black. The jack plug that I wished to attach to this lead has only two connections and I would be grateful if you could tell me how the lead should be wired up.

Yours faithfully, **R.B.L., London, S.W.5.**

The SL33 lead is the general-purpose type which can be used for both recording and playback when applied to the dioide socket of many Grundig machines. For your purpose, only the screen and pin 1 are used, that is the black (pin 2 of the socket, earth connection) and yellow plugs. The red plug can be left disconnected, or used as a high impedance output line if you want to play back through an external amplifier. You are hardly likely to want to use the Decca TP85 for this purpose.

Therefore the black lead goes to the outer or shank of your jack plug and the yellow lead to the inner or tip, with the red lead taped back out of the way.

MOTOR NOISE ON THE 202

Dear Sir, I am experiencing a little bother from motor-noise on my Fi-Cord 202. Can you make any suggestions as to how this can be overcome?

Yours faithfully, **T.S.W., Poulton Le Fylde.**

The problem of motor noise on this model could have several different causes.

Check the motor brushes first: these are prime suspects. A visual inspection should show whether these are sticking or worn.

Check the motor decoupling capacitor. This is a 16 μF electrolytic, directly across the motor. Do not just bridge this for test, as it is possible for a leak to develop, giving higher motor noise than usual. Disconnect one end and temporarily substitute. Check also that the red and brown twisted leads from the motor do not lie too close to the other 16 μF capacitor the one adjacent to the record/play switch. These leads should be routed to the outside of the loom at the extreme right-hand edge of the circuit board, viewed from the front.

Next, test the 300 μF decoupling capacitor and inspect the 1K resistor on the motor armature circuit. If this needs replacement you will have to rebalance the motor.

Make sure this noise pick-up is not due to a bad earth at the socket panel—due to the anodised finish of the deck and front panel. If necessary, fit a bus-bar earth. Note also that the remote control socket can short-circuit to the oscillator transformer case; if the latter is too close, bend it clear and if necessary insulate the case. Check the screening of the appropriate leads while you are about it. Very often a dry joint in the screen return is quite enough to pick up motor noise on a machine of this type.

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SITUATIONS VACANT

Remunerative hobby for retired person having some knowledge of tape recording operation. Phone LAB 5678.

Technical Salesman with good tape recorder and certain Hi-Fi knowledge for expanded sales facilities at our Brighton premises. This also includes a certain amount of disc cutting. Good remuneration, permanent position with various benefits. Write stating age and experience to Personnel Manager, John King (Films) Ltd., Film House, East Street, Brighton, Sussex.

FOR SALE—PRIVATE

Reslo RBT/H with desk base £7. Grampian DP4/1, swivel adaptor, transformer, £6. Six channel microphone mixer/pre-amp., £15. Reslow-Low-Z cable sets, £1. Adcock, 62 Montague Road, Cambridge.

New Tandberg Model 62 stereo tape deck just purchased £115.10s.0d. under guarantee. Will accept £95. Webb, 56 Mitcham Road, East Ham, London, E.6.

Tandberg 62 stereo, 4 months old, perfect. Only 5 hours use. **Plus** 3 Kodak L.P. tapes (two unopened) and modest stand microphone. Plans changed by bank manager. Demonstrated on first-class equipment by appointment. Cost £130. Sell £80. Delivered London or equivalent. SEVENOAKS 56893.

Connoisseur's Bargain : Uher 4000-S Report tape recorder, complete with automatic control microphone, rechargeable battery, mains unit, shoulder carrying case, ten double-play tapes and BASF cutter box. Perfect condition : £75. Correspondence only—Harry W. Tait, Congress Theatre, Eastbourne.

Uher Portable T/R as chosen by BBC, Batt. or mains. Leather case and special ribbon mic. Purchased Dec. '65 and never used. Serious illness compels sale. Cost £123 offered £100. Dr. Morey, 1 The Grove, Lincoln.

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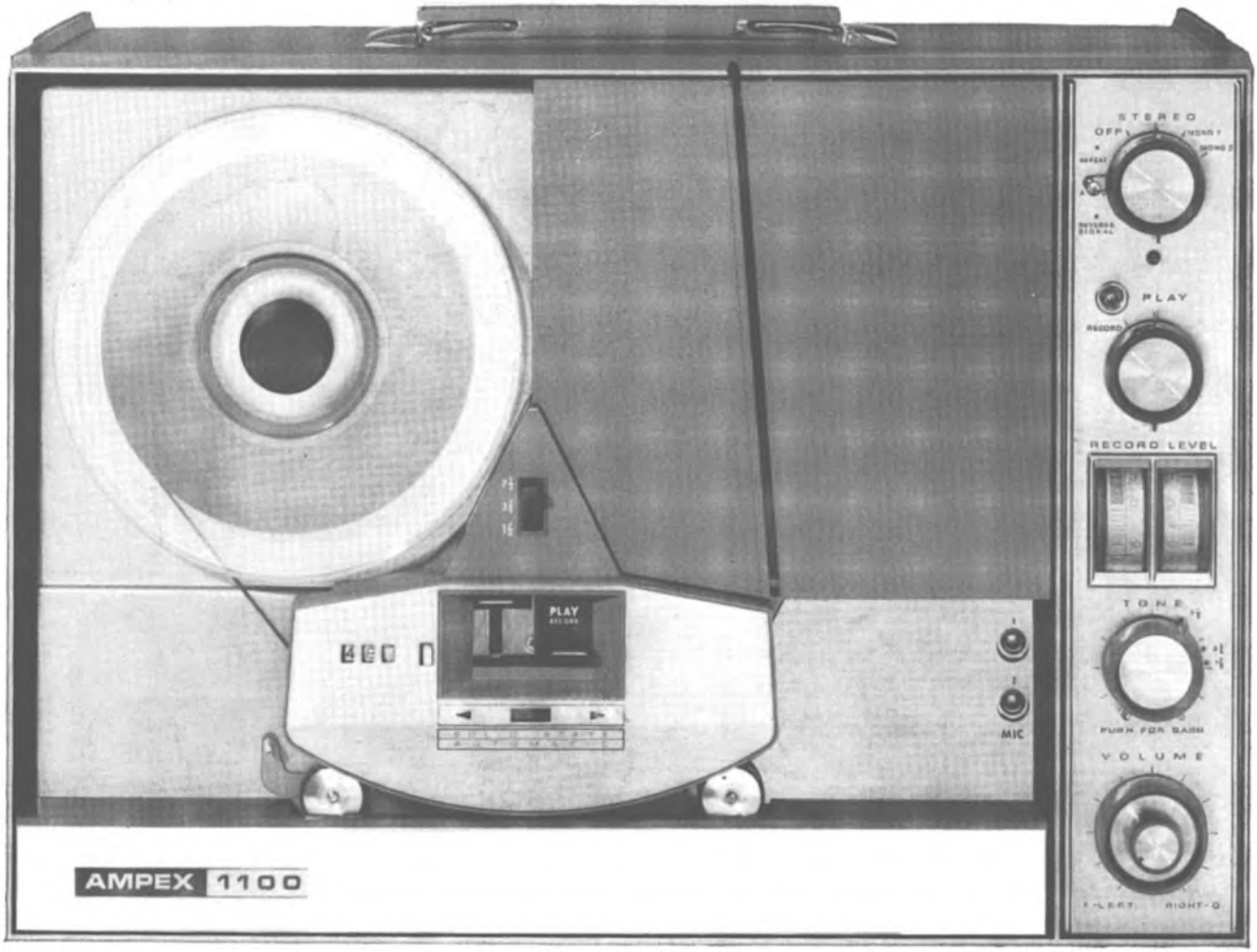

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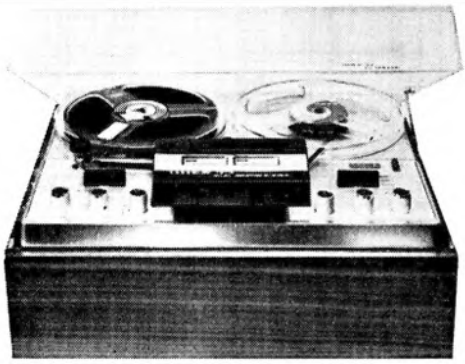

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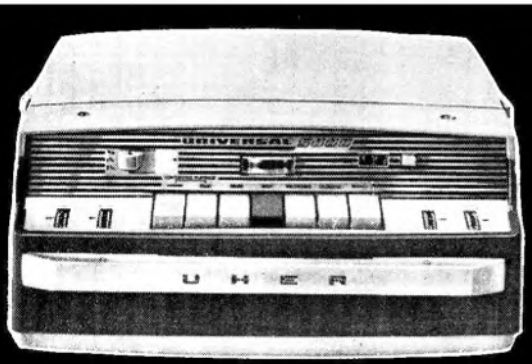

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