

the TAPE

PRICE 1/6

JUNE 1960
Vol. 2 No. 5

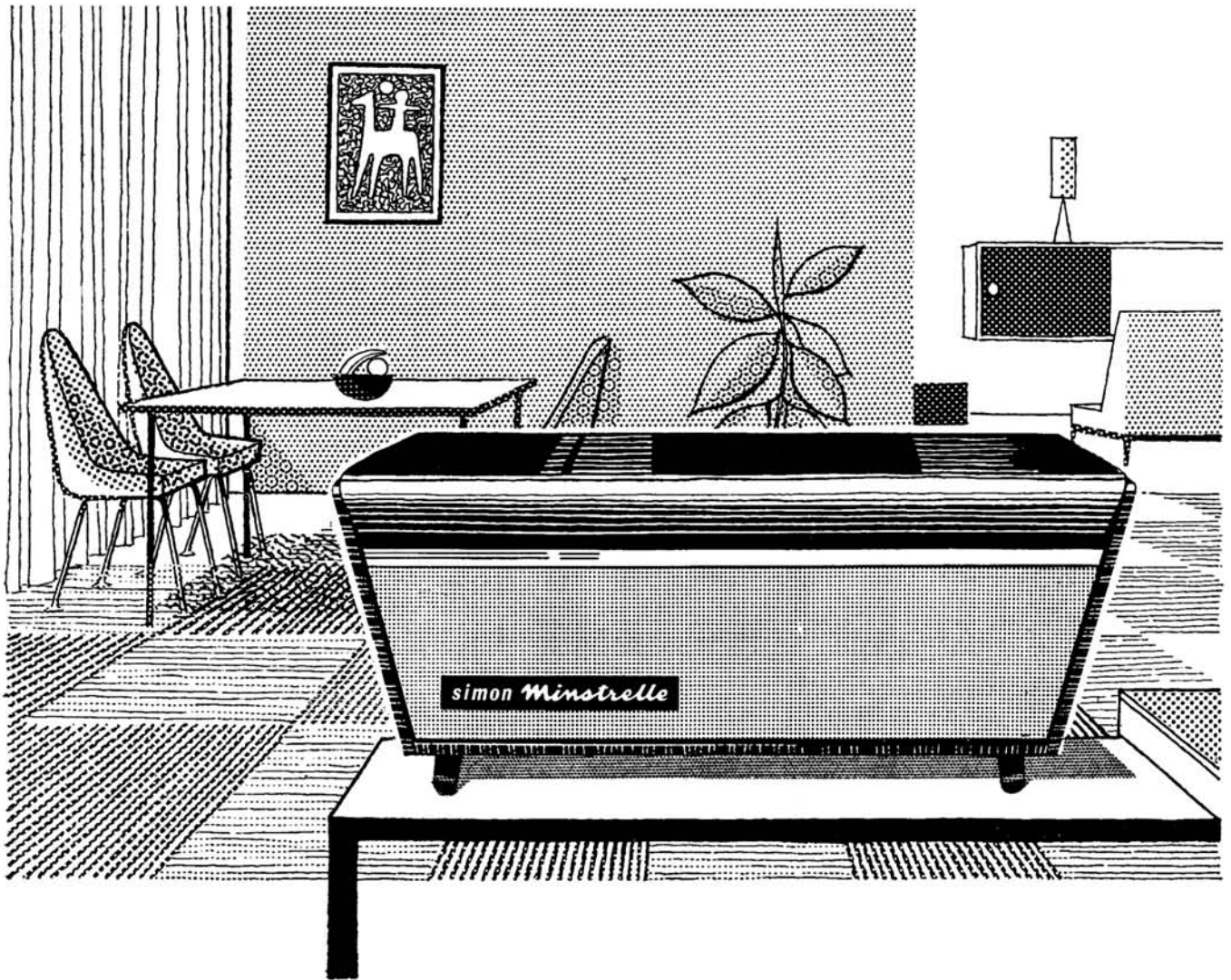
RECORDER

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IN THIS ISSUE

- News and Pictures
- Using the Parabolic Reflector
- Teaching Tape
- London Audio Fair, report and pictures
- Reviews of Recorders
- Tape and Cine Sound
- Readers' Problems
- Tape Workbench
- Readers' Postbag
- Tape Record Reviews



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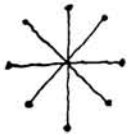
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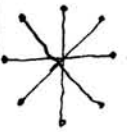
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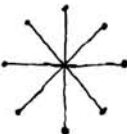
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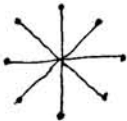
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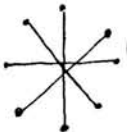
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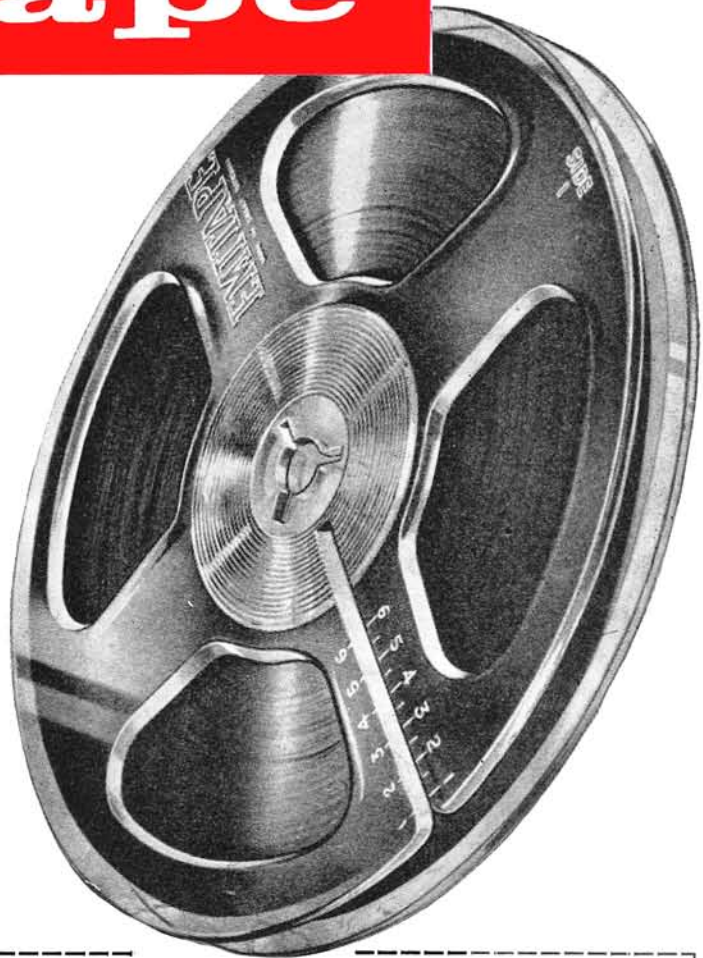
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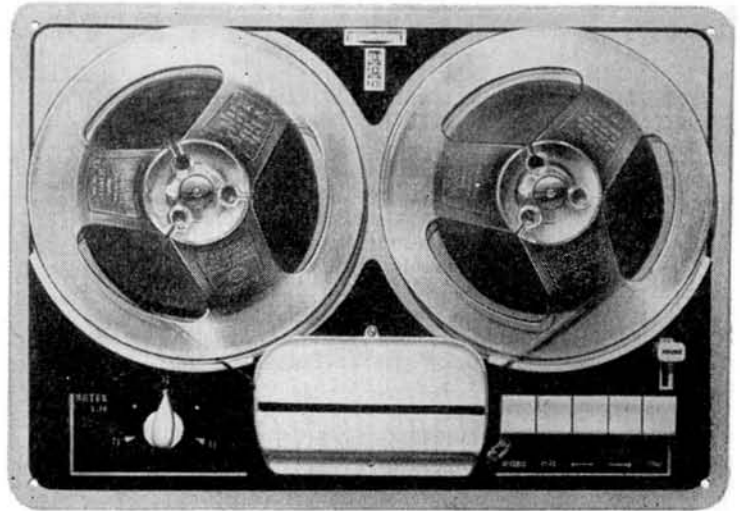
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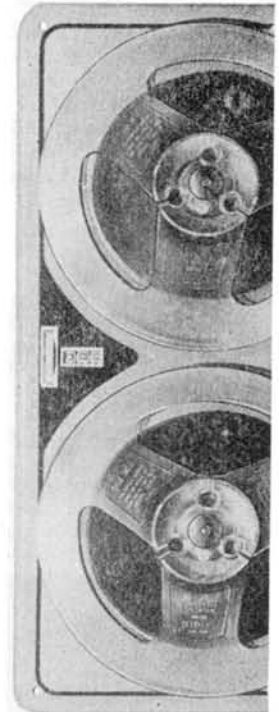
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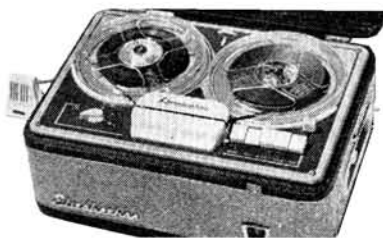
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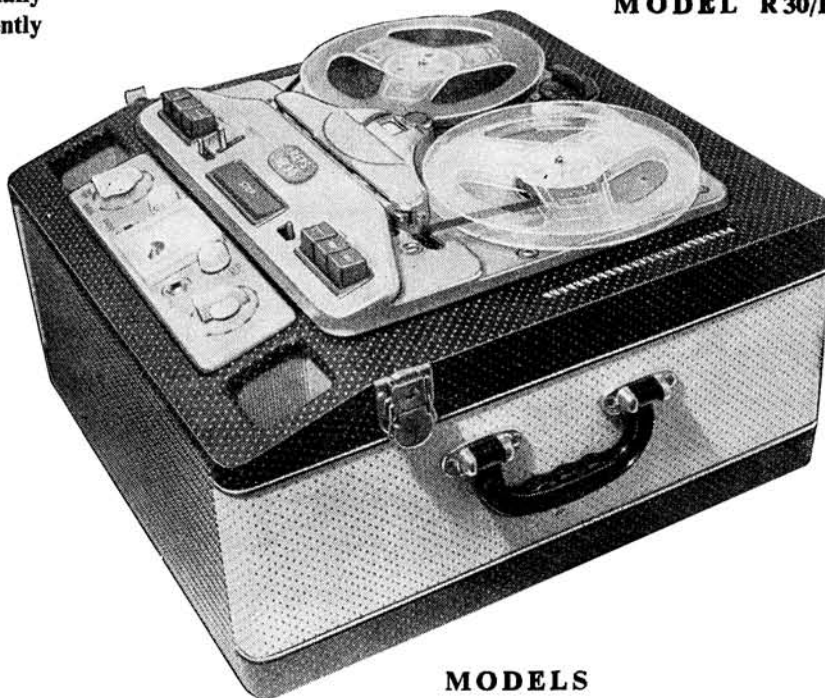
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FURTHER FACTS

It is not generally known that the Tape Deck mechanism is virtually re-built in the REPS machines. It is standard procedure to remove all rubber wheels—i.e., re-wind, idle and pinch—and re-grind them to a closer tolerance. Also the Capstan is skimmed to less than \pm 0.0001". This has resulted in a very low "wow" factor, especially at $3\frac{3}{8}$ ips which has led to the logical introduction of $1\frac{1}{8}$ ips in place of the 15 ips. The principal cause of "flutter" is due to



MODELS

R20 62 GNS. with magic eye record indicator
R30 66 GNS. with meter record level indicator
R40 70 GNS. as R30 but with push/pull sound output.

the eccentricity of the three-step pulleys which control the tape speed. This eccentricity occurs when the pulley is locked to the motor shaft and is due to the off-setting action of the fixing screws. This difficulty has been overcome by manufacturing pulleys over-size and machining to the correct diameter when fitted to the motor shaft. By this method a total variation of less than 0.0001" has been achieved at $1\frac{1}{8}$ ips. Initial measurement indicate total "flutter" content at $1\frac{1}{8}$ ips to be of a lower order than previously associated with $3\frac{3}{8}$ ips.

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★
EDITORIAL

WE are, frankly, amazed at the apparent disinterest of the Record Manufacturers in the big potential market which exists for music on tape. We know that a record is, traditionally, a black disc with a hole in the middle, and we also know that its daily users can be numbered in thousands against every individual user of tape; nevertheless, the writing of the words *Tape Records* is now so large upon the wall that, surely, even the most short-sighted diehard cannot fail to see it.

We have heard many arguments against tape records. It has been said, for example, that unscrupulous people will borrow them and copy them. We cannot accept such an unsoundly based reason. Are people more likely to pirate tape records than discs or radio performances? We have been told that tape records are uneconomical to make, compared with discs. Maybe that can be so, but quite large combines in America seem to be getting around that economy barrier. We have also heard it said that people don't want tape records. Don't they? On what experience is such a statement based?

Much more reasonable is the far less heard statement that *the ideal form of a tape record has still to be discovered*. But even that is without good sense, because "the ideal tape record" may be twenty years distant, and in the meantime there are probably a million owners of tape recorders in the U.K. whose machines will take tape spools of 5-in. diameter, playing at 3½ i/s, and that number is increasing at the rate of several thousands each week.

There is no doubt whatsoever that the modern microgroove disc, properly used, can yield to its owner a far better quality of music, *per pound spent upon playing equipment*, than can a tape recorded at 3½ i/s; and there is still less doubt that the modern disc has a long life ahead of it. However, that does not alter the fact that the multitudes who own tape recorders are more than content with the quality of music that their machines are capable of giving them. The record manufacturing companies must be the very first to admit that their economy is not based upon the orders from the Hi-Fi Few, but upon the demand of the millions; and that, far from encroaching seriously upon the sales of discs at this comparatively early stage, tape records would establish their own demand. For many years yet, tape records and discs with holes in them could live happily and profitably side by side. Households with disc players and tape recorders would surely buy both types of record, according to the whims of the moment.

We could continue to question and answer ourselves in this vein, but it is more interesting to assume that the record manufacturers have already done so, and to hope that holes in the sand and holes in the disc are not inseparable phenomena.

Usually—almost inevitably—when there is the slightest opening for business advantage in everyday life, we are being sold things almost before we know they are available. Who has overlooked what?

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COVER PICTURE

A FINE old London scene is the subject of this month's cover picture. It was quite unrehearsed. Our photographer was out with one of our reporters, on the way to the Thameside with the Stuzzi portable, in search of sound and pictures—and this overseas visitor took an interest. We hope you will like the result as much as we do.

NEXT MONTH



A VERY interesting and unusual "do-it-yourself" feature is one of the highlights of next month's *Tape Recorder*. It is a twin-clock time switch for use with recorders and other electric devices. The author is R. E. Steele. Full constructional details will be given, together with all the necessary diagrams, sketches and photos, and the complete feature will extend over the July and August numbers. *Reviews* of tapes and equipment, *Readers' Problems*, *Pages of news and pictures*, are only part of the month's lively contents list. **But please be warned—The**

Tape Recorder has Sold Out completely during the past 4 months. To be sure of your copy, please place a firm order with your supplier.

The Tape Recorder for July—On Sale June 24.

SUBSCRIPTION RATES

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It is surely a sign that Tape Recording has "arrived" as a useful pursuit, and not just as a time-absorbing hobby, that people are prepared to give up time and money to attend five or six day training courses on Tape. We give below an account of the recent Third National Tape Recording Course held at the Rose Bruford Training College, Sidcup, Kent.



To cater for all levels of experience the Rose Bruford Course was divided into a number of groups, and beginners were soon operating tape recorders with as much gusto as their more experienced colleagues.

Third National Tape Recording Course

LIKE its two predecessors, this Easter's course at the Rose Bruford Training College, Sidcup, Kent, was over-subscribed, and a waiting list had to be drawn up well in advance. Fifty students attended, and it was again noticeable that the majority had some interest in the educational uses of tape recorders. However, most other kinds of interest were represented too, including medical, Youth Clubs, drama recording, music, tape club members, etc. The course commenced on Tuesday, 19th April, and wound up with a playback of recordings made, and a lively free-for-all discussion on Sunday, 24th April.

The line-up of tutors contained many names familiar to readers, Jack Singleton, Richard Burwood, I. W. Jarman, and Desmond Briscoe (BBC), Geoffrey Hodson (Organiser), Graham Jones, F. C. Judd, and John Borwick. A newcomer was Miss Daphne Oram, who superintended two quite different types of session.

Musique Concrète

Firstly, for those members who had indicated a preference and who were felt not to be of "a nervous disposition", she organised practical exercises and demonstrations in *Musique Concrète* for special effects. As we mentioned in these pages last month, when describing Miss Oram's recent TV appearance, she distils her special brand of electrophonic brew in a workshop built into her oast-house known as "Tower Folly", and the groups of students drove over by car for these occult seances.

Miss Oram's other contribution was a discussion and demonstration of the methods of obtaining a good microphone balance

HERE, THERE AND EVERYWHERE

of music in different acoustic conditions. This also was an outside event, and featured a choir of young voices, an orchestra, and a recorder band, in the nearby Hurstmere Secondary School. As is often the case, the acoustics were over-lively, and Miss Oram had distributed a number of Films Industries ribbon, and Acos crystal microphones so that the most useful positions could be shown by quick comparisons. The young musicians gave of their best, and greatly enjoyed the whole proceedings, especially listening to the tapes afterwards.

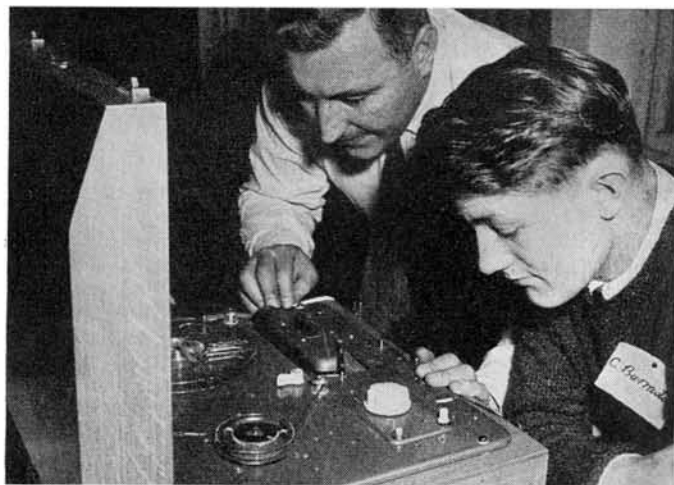
The rough division of the Time-Table was 3 days *learning*, followed by 2½ days *doing*, but it would be fairer to describe the afternoons of the first three days as "learning by doing". Based on information supplied on the students' application forms, they had been divided into 3 groups as possessing much, little, or negligible previous recording experience.

Gaining experience

These 3 groups were then shuttled during the 3 afternoons between various rooms where they could practice under three main headings—"Basic controls—how and why they operate", "Studio and recording operations", and "Tape editing".

For the first of these, F. C. Judd—in a room full of tape recorders of every description—introduced newcomers to the vagaries of winding back, magic eyes, pause and superimposing controls. With more advanced groups he demonstrated bias and azimuth adjustment, and the measurement of noise levels, response curves, etc.

John Borwick began his sessions with a reminder that, as in car-driving or using a sewing machine, being able to operate the equipment smoothly and well is every bit as important as knowing its technical workings. To give practice in the operation of the recorder and a mixer, and introduce microphone technique and the playing in of discs and tapes on a cue, two short scripts had been prepared. In separate studios, the students recorded and re-recorded these scripts in real professional manner. Graham Jones supervised one of these—a news programme on the lines of the BBC's Radio Newsreel—and produced results *nearly* up to Light Programme standards!



Great concentration was needed to identify exact syllables on the tapes, both during editing and the putting together of composite feature programmes.

HERE, THERE AND EVERYWHERE

The Rose Bruford Training College of Speech and Drama is situated in attractive grounds at Lamborbey Park, and the buildings themselves are some 200 years old. On the normal course students must combine drama and teaching. Special courses are under the direction of Geoffrey Hodson.



The third practical department was Tape Editing. I. W. Jarman's illustrated articles will be remembered by readers, and he found that most of the students had acquired a copy of his *How to Splice Tape* booklet, which enabled him to get straight down to brass tacks—or should we say steel razor blades. Of course, the main technique to be developed in editing is not simply that of making neat and accurate splices, but the ability to move the tape to and fro easily and identify recorded syllables, etc., immediately. I. W. Jarman had a large (expendable) supply of short tapes on which coughs, and other defects had to be excised. And if the words were sometimes cut out and the coughs left in . . . well?

Learning tape recording on the B.B.C.

I. W. Jarman has given hints on editing on a number of editions of the BBC's programme "Sound" on Network Three, and as regular listeners will know, he is at present broadcasting a series of beginner's lessons in tape recording entitled "Teaching Tape". His pupil on these programmes is Angela Jeffreys, who was a student on an earlier Rose Bruford course.

Armed with all the technical and operational skills of the first 3 days, some of the students were then turned loose on an unsuspecting Kent County to perpetrate all manner of outdoor interviews, "atmosphere" recordings, etc., for assembling into composite magazine programmes. Meanwhile, their colleagues were acting and producing High Radio Drama in the College's well-equipped studios, with a full battery of sound effects. To say that this well-planned course contained something for everyone to do, would be a gross under-statement, since everyone found himself or herself working "flat out" over most of the 5½ days, but it must surely give the lie to those who say there is nothing creative in using a tape recorder to find so many people willing to give up time and money to learning how to use a tape recorder better.

BASF News Letter

WE draw our readers' attention to a very useful and well-produced booklet, "BASF News Letter", which is distributed in England by F. A. Hughes and Co., Ltd., 4 Stanhope Gate, London, W.1. In its 18 pages are such interesting facts as: *High Frequency Magnetism; What is Double Play Tape?; Playing a Trick on Time; Letter to all New-Comers; and possibly most interesting of all is a two-page feature entitled Stage Effects, with eleven practical examples, from rain and waves to footsteps in the snow!* We have checked with the distributors that they still have a limited number of copies available for our readers, and that they may be obtained, free, from the above address while stocks last. We therefore recommend a quick request!

British Products at Hanover

With all the current talk about the Common Market, the Inner Six, and the Outer Seven, it is good to note that the British Electronic Centre's exhibit at the recent Hanover Trade Fair attracted considerable interest for the third year running, and that it brought promise of important orders. The exhibit was the combined effort of ten British manufacturers, all of them members of the R.E.C.M.F.

R.B. Tapes open Manchester Branch

A catalogue list of 147 models of tape recorders is announced by R.B. Tapes Co. Ltd., who have recently opened a big new branch at 89/91 Great Ancoats, Manchester, 4. Here, they claim, enthusiasts can see and hear any of the range that they stock.

Three Grundig News Items

Grundig (Great Britain) Ltd., have sent us the following three items of news. First, is the announcement that (as from July 1st) they are extending their guarantee period for tape recorders from 6 months to 1 year. This will include all registered guarantees



Our readers can obtain a copy of this free booklet. See next column.



"ELIZABETHAN" scored a big publicity hit with their Elizabethan lady, who is seen here beside Julie, My-Fair-Lady, Andrews just after the opening ceremony of the fifth London Audio Fair.

on or after 1st January, 1960. Second, a new recording lead—the SL 142 R—with built-in resistive attenuator has been specially designed for use with the "Cub". It is being issued with all new "Cubs" in addition to the existing lead (SL 154). Price, if bought separately, 8s. 6d. Finally, negotiations are proceeding for the formation of a new company in Northern Ireland. If successfully concluded, it is hoped to manufacture Grundig electronic products on a large scale in that Country.

Trading Name Changes

The manufacturers of the Elizabethan range of tape recorders, formerly known as E.A.P. (Tape Recorders) Ltd., have now changed their company name to Elizabethan (Tape Recorders) Ltd. The management, the address, and the telephone numbers remain unchanged.

The trading name of Taplin-Hirst & Co., Ltd., the manufacturers of Balmoral tape recorders, has now been changed to **Balmoral Electronics Limited**. The office address and telephone number remain unchanged—Oxford Circus House, 245 Oxford Street, London, W.1. Tel.: REGent 3311.

Tape club notes

Stereo has spread its twin arms to embrace the Acton Tape Recording and Hi-Fi Club. It all began on 16th March, when the club organiser, Hilda "Rusty" Chapman, took delivery of her Philips stereo machine, which arrived just two hours before the club was due to demonstrate to the Willesden and District Motor-cycle club. Recorded tapes were used, including the Ampex stereo demonstration tape. The evening was a great success, and it seems that several motorcyclists will be taking up tape as a result. A second evening—this time taking in a first attempt at amateur dramatics in stereo recording—was equally successful,

TAPE NEWS FROM THE CLUBS

except for the recording itself, which was acknowledged to be the world's worst! None the less, this is important news.

The Coventry Tape Recording Club has been busy as usual. On March 31st, with 49 members present, the Rugby Amateur Tape Recording Society was entertained, and the main event was an exhibition of a wide range of recorders and equipment. Some fifteen models were on view, including the new Philips stereo, the Korting 4-track, the Uher Universal, Simon Minstrelle, Steelman Transitate, Wyndson, and Timbra—a new Dutch machine. The following week's meeting was slack, on account of the Easter Holidays, but on April 28, with visitors from the Warwick and Leamington Amateur Tape Recording Society, the attendance was up to 56! On this occasion the main event was an address by L. W. Saunders of E.M.I. Sales & Service, when "print-through" and "tape storage" were discussed.

A talk on Loudspeakers was the feature of the April 4 meeting of the Crawley and Sussex Tape Recording Club, and on this occasion a new, regular 30-minute event was introduced—"Technical Queries and Answers". As the club becomes better known, it is receiving more and more requests to undertake recording dates. On April 10, recordings were made on the occasion of a farewell lunch to Sir Thomas Bennett, the retiring Chairman of the Crawley Development Corporation. Another appointment for May was to record the Duke of Norfolk during a visit to Crawley.

Doncaster and District Tape Recording Club also have plenty to report. One item (which makes us shiver slightly, remembering the "don't ever do it" warnings!) was a lecturette on how to take a feed from a TV speaker. Another; "how to construct a



Barely 18-months old, this was only the Tape Recorder's 2nd London Audio Fair appearance. But Hi-Fi News and the "Fair" began life together in the Spring of 1956.



The new REFLECTOGRAPH deservedly attracted a lot of attention. Here, L. Cunningham-Sands, its designer, explains some of the finer details to a visitor.

bulk eraser, using an old mains transformer". On March 24 a tape was played, sent by a member's son from Christmas Island, which included a native arrangement of *Tipperary*. On April 2 the Tandberg stereo recorder was demonstrated. On April 14, members were invited to bring their recorders and some spare tape. With everything at the ready, scripts were unexpectedly handed out and a First Tape Play was being produced before anyone knew what was happening! The Chairman visited the Audio Fair in London and returned with such a load of catalogues that a decision was taken to organise a trip to the Southport Fair this Autumn.

Grantham and District Tape Recording Club held another of its "monthly demonstrations" on April 14, and a Nottingham dealer brought with him a range of *Telefunken* equipment, including the M23 recorder which aroused great interest. A visit by a party of members to the London Audio Fair had its moments. One member, having taken a newly imported foreign recorder into the demonstration room bearing its name, had considerable difficulty in taking it out again! Another, who went to a friend's car to collect something, spent about 10 minutes with a policeman who thought he was stealing!

The Ipswich Tape Recording Club reports that its meetings are now being held fortnightly, and three new models of tape recorders have recently been demonstrated by members—*Philips EL 3542 A*; *E.M.I. TR 52*; *Steelman Transitape*.

Demonstrations of portables, including the *Stuzzi Magnette*, are noted in the report from Leeds and District Tape Recorder Club. A 35 mm. colour slide show (presumably with tape accompaniment) is on the list of future events.

One of the Rugby Amateur Tape Recording Society's recent events, as reported above, was a visit to the Coventry Club. On May 5, the club had a visit from Messrs. Wells and Adams of *Cosmocord Ltd.*, with a talk on the growing of crystals and a demonstration of stereo and the *Acos* stereo microphone.

More news of a tape-and-tyre evening. This time the tyre was on the other wheel, however, and it was the Leamington Scooter Club which entertained the Warwick and Leamington Amateur Tape Recording Society. The visit included a short recording of the History of Sound, demonstrations of stereo sound, and of battery-operated portables.

From the Stereo Tape Club in Africa we learn that these columns of our magazine have brought them letters from all parts of the world. They send us a further request, Will Mr. H. Lang,

of Tokio, Japan, please write again because his full address was indistinct, and they wish to thank him for his interest.

From Pete Rogers, Secretary of the Royal Air Force Tape Recording Society, we learn that the *R.A.F.T.R.S.* enrolled its 50th member at the beginning of March. Membership has also been opened to members of the Commonwealth and Nato Air Forces. Address: *Cpl. Rogers, P. J., Royal Air Force, Waterbeach, Cambridge, England.*

West Middlesex Tape Recording Club reports a highly technical evening on April 14, with *Solartron* scope, *Advance* sig genny, and a transistorised amplifier with several faults "built in", so that they could be switched in and out, and their effects observed.

Walthamstow and District Tape Recording Society should just about have completed their play *The Butcher's Revenge*. This photo, taken in March, shows it in production. All sound effects are by members, and they include public bars, greyhound track, kitchen at breakfast time, office, breaking china, etc. We await further news with interest, because the Society were considering its possible entry for a national competition.

Useful Booklet

A useful booklet has been received from The County Library, East Fergus Place, Kirkcaldy, Fife, Scotland. It is the latest in the "Readers' Guide" series (number 57), and is the Readers' Guide to Books on Radio, Radar, Television and Sound Reproduction. Its price is 1s. plus 2d. postage from the above address.



"The Butcher's Revenge" in preparation!
Photo—Walthamstow Guardian.

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By E. D. H. Johnson

DESIGNING AND USING A REFLECTOR

FOUR — RECORDING IN THE FIELD

SO far in this series, I have dealt almost entirely with the equipment with which the amateur can record the songs and calls of wild birds in the field, and little has been said of its actual handling and use. I propose, therefore, to relate a few of my personal experiences as a bird-recordist and to explain some of the technical and tactical problems which arose and how they were met and overcome. First, however, I would like to discuss in brief some of my views on the approach to the recording of bird sounds. I know from personal contacts that there is a thirst for "know-how" on the subject, and anybody who has followed me so far in the construction and purchase of equipment for so specialised a field of work must by now be looking around for material on which to practice and a line of approach to adopt.

For many years the broadcasts of Ludwig Koch and Eric Simms have proved beyond doubt that the public has an enormous interest in the sounds of nature, and whilst these recordings have been frequently played by the BBC similar programmes of bird song and animal sounds have been enjoyed in most other European countries, the United States of America and many other parts of the world. The arrival of the tape recorder has taken much of the mystery and difficulty out of the technique of recording, but so far those people who would most benefit by the ability to record the sounds of nature have been slow to take advantage of the fact.

Vast field of opportunity

To date the recording and broadcasting of bird-song must be regarded as having progressed little beyond the realms of entertainment, except in the hands of a few scientists who have used the tape recorder as a means of studying learning, behaviour, and the variations of song patterns between different populations of common birds. Between these two extremes lies a vast field of virtually unexplored opportunity.

The person who is first and foremost a recordist can find new and challenging problems to overcome in a field where no two situations will ever be the same. The collector's instinct can be satisfied by a steadily mounting list of species recorded. The bird-watcher will find that his powers of perception and appreciation of bird-song will be heightened, to say nothing of the amount of new voices he will learn.

The ornithologist who is studying a particular bird will be able to record its calls for comparison and study later, and his colleague who is concerned with broader issues will gather evidence to help him find the answer to such problems as the reasons for mimicry in birds. This last subject has figured in several broadcasts in Britain alone, both as entertainment and as a serious scientific discussion. On the last occasion a panel of eminent ornithologists were quite unprepared to commit themselves on the function of mimicry, so the field remains open for a bright lad, or lass, with the equipment, basic knowledge and an infinite capacity for taking pains.

A good bird recording is seldom produced on the spur of the moment, except in cases of extreme good fortune. It is usually achieved by deciding on the subject and then setting out systemati-



The Stonechat's vocabulary is a special study of the author.

cally to overcome, one by one, all the obstacles which stand in the way of perfection. The result will be a compromise which will usually fall short of perfection, and which will perhaps please you less than it will please and delight other people. The better you understand the bird you are recording, the greater will be the value of your recording and whilst, for the pure collector, it may only be considered necessary to make one typical recording for each species, the real interest comes when we begin to understand the language of birds and to record their actual vocabularies.

As I mentioned in an earlier article, I began bird-recording a few years ago when I wanted to study the vocabulary of the Stonechat, which breeds near my home in Jersey, amongst the marram grass on the windswept coastal dunes. Over the years I had compiled a long series of notes from which I had tabulated its calls throughout the year, together with descriptions of the situations in which the various combinations of its "whit" and "chack" notes were uttered. But, as every bird-watcher knows, such sounds are almost impossible to express on paper in a manner which will represent them as they really are, and a tape recorder was to provide the only really satisfactory answer.

From the outset it was obvious that to approach too closely to the birds themselves, even though the Stonechat is not a particularly shy bird, would disturb them to the extent that I could not be sure that their behaviour was entirely uninfluenced by my presence. I therefore decided that I required to record their calls from distances of from thirty to seventy yards, and this, of course, made the use of a parabolic reflector essential, especially as it was necessary for me to follow the birds about their territories, from perch to perch.

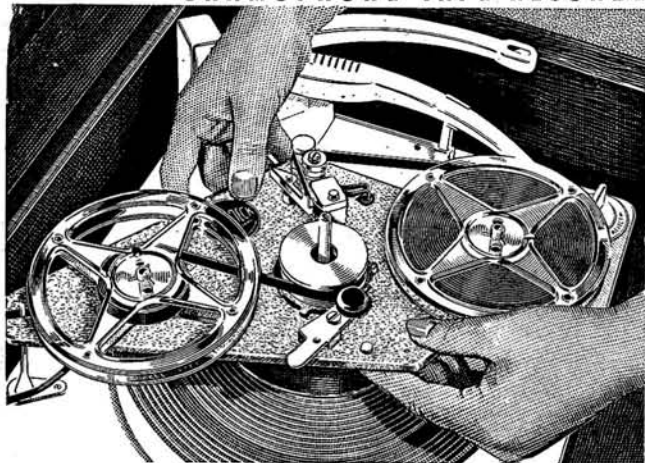
Using the parabola

I quickly set up the parabola on its tripod and sighted it on to the male, who had taken up a conspicuous stance on the highest part of a clump of sea-radish at the top of a bank. His calls consisted of an irregular mixture of "whit" and "chack" notes—"Whit-chack-chack, Whit-chack-Chack-chack-whit Chack-chack-chack-Whit"—and so on.

They were loud and urgent when I first arrived, and later they steadily diminished when I presented no further threat to the hidden young. I continued the recording for some ten minutes and then played it back. The male bird's calls were perfectly recorded. In fact I had succeeded beyond my wildest dreams, but there were a few most important lessons for me to learn at the very start.

Just as a telephoto lens on a camera may "flatten" perspective by reducing the apparent distance between an object and its

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USING THE REFLECTOR—(continued)

background, the parabolic reflector may give undue prominence the distant sounds which lie in a straight line behind the main subject. I was surprised to find that my Stonechat was accompanied by a chorus of Blackbirds and Thrushes, Robins and Chaffinches from a wood over a quarter of a mile away, which lay directly behind him from the position of the parabola. As I followed him around from perch to perch the murmur of the sea became equally obtrusive in another position, and in that direction wind noise spoiled the recording completely.

In a second run I overcame these defects by siting the microphone as low as possible so that no background sounds of any prominence were in line with the male bird's principal perches, and a grassy bank served to shelter the parabola from the wind and the sound of the sea.

The next recording, lasting about twenty minutes, was as near perfect as I could have wished and was one of the many that I have since used in analysing the Stonechat's language. Different combinations of its two notes are used for a whole variety of situations, and it appears as if the "Whit" call is used to draw the intruder's attention to itself and away from the young, whilst the "Chack" is used as a communication between the adults and to give warnings to the fledglings.

Later, in that first summer of my bird-recording career, and soon after I had acquired my vibrator convertor, I decided to see just how mobile my equipment could be. With a friend, Roderick Dobson, author of "Birds of the Channel Islands", I took the recording gear in a small boat to a rocky islet a mile and a half from the Jersey coast and we set up our camp in an old Martello tower. The reef, only about sixty yards across, was the breeding place of Common Terns, Oystercatchers, Herring—and Greater Black-backed Gulls and Rock Pipits, and the site of our only small colony of Storm Petrels.

When we arrived there was no sign of occupation in any of the petrels' burrows, and prolonged sniffing failed to reveal their characteristic musty smell, so we busied ourselves with the calls of the terns as they wheeled around the tower, first in some confusion at our presence and later with more purpose as we concealed ourselves in the doorway, high up at the top of an iron ladder. An earth wire ran from the recorder to a copper pin in a patch of damp sand at the foot of the ladder, and the vibrator, powered by a 12-volt car battery which we had brought with us, was housed in a little room which also served as a kitchen. There was little wind, and with the bare microphone on the top of the parapet of the tower I soon had some good examples of the general din of the colony and of the sudden silences as all the adult birds suddenly departed for a few minutes in one of their characteristic "dreads".

The parabola was essential

Fixing the microphone into the reflector, I then held it across my chest and followed a few individual birds until I had recorded a series of their flight calls as they circled above my head. Then I singled out a few which were feeding young in order to record the sounds they made as they came in with food for their chicks; harsh grating calls repeated rapidly, by which the young appeared to recognise the parents and emerged from the rock crevices to be fed. The parabola was essential for this kind of work, as it isolated the calls from the general pandemonium of the wheeling terns.

That night it was calm and starlit and at low tide the sea made hardly a murmur as, with a microphone on the top of a pinnacle of rock, I recorded the sounds of the Oystercatchers calling and piping all around us. Suddenly, at about eleven o'clock, the rocks around us began to vibrate with the harsh churring, grunting song of the Storm Petrels. They were there, after all, in their burrows in the crevices between the boulders and in the small scree of rubble left from the building of the tower a hundred and fifty years before.

The equipment had worked well and I was able to look forward to recording trips which were to extend later to some of the more remote parts of Europe. Next month I will describe the use of the recorder from the car.

REVIEWING TAPE RECORDERS



The Fi-Cord popular battery recorder was reviewed in September 1959.

PART FOUR ————— MEASURING SIGNAL/NOISE RATIO

IN Part Three (March, 1960) we defined the property known as signal/noise ratio, and showed how it depends to some extent on frequency.

After our rather long introduction we can now consider how signal/noise ratio is measured. Clearly two measurements are required, one of signal and one of noise. Measurement of signal is not difficult when the signal/noise ratio is above about 20dB, a simple valve voltmeter reading of the constant frequency signal (generally 1,000 c/s) being all that is necessary. However, it is difficult to decide at what level the signal is to be recorded. Quite clearly the higher the signal the higher the signal/noise ratio, but if a meaningful answer is to be obtained, then the signal must not produce magnetic overloading of the tape. Depending on the usage, signal levels that produce distortions of 5%, 2% and 1% have been used as the permitted maximum in professional work, 2% being the most usual figure.

Maximum Permissible Signal

Measurement of the distortion produced by a tape recorder is, however, a tedious and troublesome problem, and in the reviews published in *The Tape Recorder*, the permissible peak signal is taken to be that producing the volume indicator deflection quoted in the Instruction Book as the maximum. This has the inherent danger that the designer may well have allowed the distortion to rise to say 10% at maximum volume indicator deflection. This point is always checked, and the review notes where the distortion is high at the indicated maximum recording level. Apart from simplification of the testing procedure, this choice of maximum level has the practical advantage that it is in fact the level at which the user of a machine would take as his maximum. If the designer has made the wrong choice, recording quality is below average.

The measurement of residual noise involves an arbitrary choice of standards, for none of the international standardising bodies have as yet issued any standards for the measurement of the sort of noise that characterises a tape recorder. There are several problems, but we will deal first with the choice of a suitable measuring instrument, for this is a point on which some guidance is available. The human hearing system has a frequency response that varies with the level of the sound which is presented to the ears. For sounds that have a loudness in the excess of roughly 80 phon, the ears' response is substantially uniform over the frequency range from 100 to 5,000 c/s, but at lower loudness

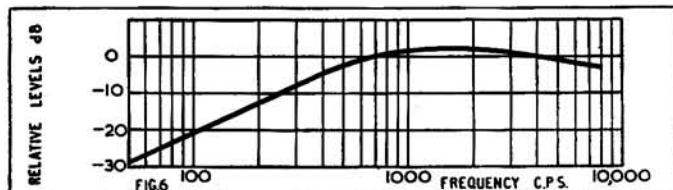


Fig. 2. Weighted characteristic at the 40 phons setting.

levels the ears' response falls away at both low and high frequencies. Loudness levels between 80 and 90 phon are about the maximum preferred by the ordinary listener when listening to orchestral music in the ordinary living room. However, unless the tape recorder is intolerably bad, machine and tape noise

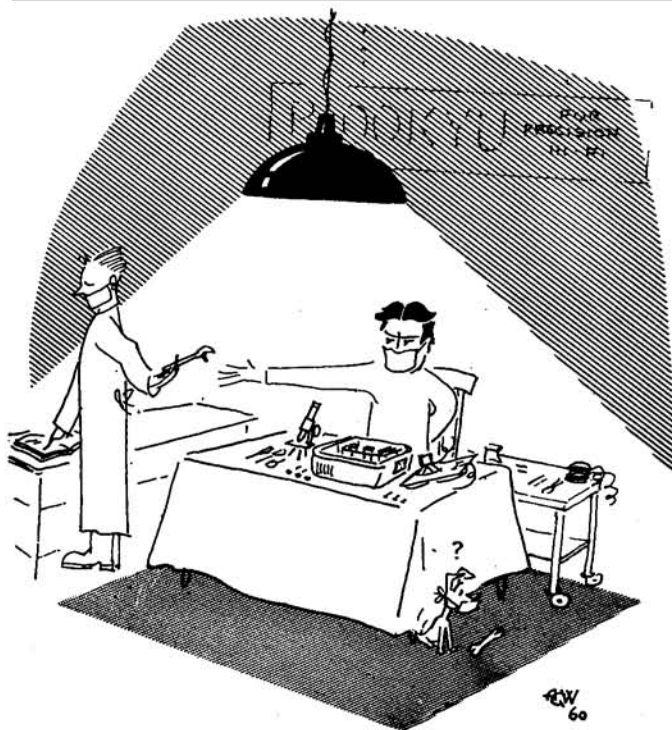
will be somewhere in the same region as room noise, roughly 40 phon.

At these low levels the ears' response is greatly reduced at both low and high frequencies, and for this reason the measuring instrument should have a frequency response that approximates that of the hearing system at the loudness levels at which the noise is heard. There are several standard instruments having response characteristics weighted in various ways to simulate the ears' performance, but the sound level meter standardised by the American Standards Association appears to be the most appropriate, and is used when measuring "noise" from tape recorders.

"Weighted" Noise

The response curve in the 40 phon setting is indicated in fig. 2. Readings taken on the 40 phon scale are referred to as "weighted" readings to distinguish them from the "unweighted" readings taken on the 100 phon (i.e., flat) setting. Weighted readings are always higher than unweighted readings, the difference being a measure of the energy spectrum of the noise being measured. When the noise includes a significant amount of mains frequency hum there is a large difference (10-20 dB) between weighted and unweighted readings, but when mains frequency components are low there may only be 2-3 dB difference between weighted and unweighted readings.

From the earlier discussion it will be appreciated that a cheap equipment, having a restricted frequency range, may well have a



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REVIEWING TAPE RECORDERS—(continued)

good signal/noise ratio, for the frequency range restrictions introduced to reduce costs actually help in improving the signal/noise ratio. For this reason, the frequency response curves discussed in the first instalment of this series should be studied in conjunction with signal/noise ratio figures.

Measuring Procedure

In the absence of an agreed standard, it is advisable to describe the measuring procedure in some detail to allow comparisons with advertisers' claims. A two-minute recording of a 1,000 c/s tone is made at the level indicated as the maximum in the instructions, and using the tape recommended by the designer of the machine. Half the recording is then erased, by running the tape through on "record" but without any input signal. The tape is then rewound and replayed with the gain control set to give an output in the region of one volt on the recorded tone. Three readings are taken, the first being the level of the tone, the second being the level of the residual signal on the erased section of the tape, the final reading being the noise on the virgin (unrecorded) section of the tape following the erased section.

This is an embracing procedure for it takes into account any lack of erase energy, poor waveform in the erase oscillator, and mains frequency ripple on the erase supply. It is not uncommon to find a machine in which erasing a virgin tape increases the residual noise level by 8-10 dB, a sure sign of the defects listed above. The signal/noise ratio quoted by an advertiser is likely to be higher than the value obtained from the above test, for experience suggests that they tend to measure the noise level on virgin tape, and thus fail to include the effects of an inadequate erase signal.

Other methods

There are several alternative procedures that are worth noting in that they are commonly used. The figure for signal/noise ratio may well be the ratio (in dB) of the noise power to a reference output power level of 1 watt, or to the rated power output of the machine. One watt is an arbitrary choice of reference level made with some justification. Manufacturers of machines of high power output will generally take advantage of their higher power by quoting the signal/noise ratio as the ratio of noise power to rated output power. In this way a machine having a power output of ten watts achieves a signal/noise ratio 10 dB higher than a machine having the same noise level but a power output of one watt. This is not entirely unreasonable, though in domestic situations it is unlikely that power outputs in excess of one or two watts would be used, and thus the claimed signal/noise would not be achieved in normal use.

None of the methods of quoting signal/noise ratio are entirely free from criticism but that used for *The Tape Recorder* reviews is thought to be the most reasonable, and to reflect most accurately the performance achieved in domestic use.

Finally, a few words about desirable values of signal/noise ratio. If noise is to be inaudible under quiet conditions, then a weighted signal/noise ratio in the region of 70 dB is required. This is a policy of perfection, for it cannot be achieved even in a studio type recorder. A figure of 60 dB, weighted, will satisfy all but the most critical listeners in very quiet locations. 50 dB is very good indeed, and is achieved in a few domestic machines. 40 dB is a performance that is good enough for the average domestic user, while 30 dB is the standard of the old 78 rpm records and is, or is not, acceptable depending on your tolerance.

J. Moir

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Readers' Problems

★ Do you have any questions on tape recording—technical or otherwise? If so, send them to our Editorial Office and we will find the answer or invite readers to help. But please limit each letter to a single query to help us in answering.

Magnetised heads

Dear Sir:—A friend of mine, who knows much more about tape recording than I ever hope to do, recently insisted on what he called *degaussing* my tape heads before he would even allow me to play-back one of his recordings. Now I'm sure he's right, but I want to know if I ought to get one of these degaussers, defluxers, depolarisers, or whatever you call it? And do you think I would be able to operate it correctly with my limited knowledge?

He seemed to wave the thing in a mysterious manner which it would be difficult for anyone to copy without knowing what he was doing. Magnetism is such a vague thing, that I'm not even clear how heads become magnetised in the first place, and how you notice when yours are badly in need of a "clean".

Yours faithfully, P. K., Kingston-on-Thames.

To try and answer your last sentence first, heads can all too easily become magnetised in practice, i.e., the metal core of the head is given a slight polarity (either in the North or South sense) instead of being completely neutral. Most people will have noticed, for example, that after only a short use around electrical apparatus, our screwdrivers and pliers become accidentally magnetised, and will pick up pins, etc., quite easily.

Indeed, bringing tools of this kind close to Record/Replay heads is a frequent cause of the latter being magnetised in their turn. Other causes are disconnecting the head or removing valves in the Record position, testing the head with a voltohmmeter, surges from the motor system if switching is too abrupt, and occasionally a fault in the bias oscillator.

The signs of magnetisation of the heads are increased noise and a tendency to lose high frequencies. Since the recording on the tape itself is liable to be permanently spoilt, owners of tape records and high fidelity recordings will be naturally loath to lend these to anyone whose heads are "an unknown quantity".

There are a number of effective depolarisers on the market, and the correct method of using them is not at all complicated. They should be switched on when still a fair distance from the head, and then slowly passed over the head and gradually withdrawn. Switching off should be delayed until the Unit is again several inches away from the head. In this way, the head will be subjected to 50 c/s alternating magnetic impulses which first become increasingly strong and are then diminished gradually so as to leave the head in a demagnetised state.

Finally, if you consult your friend, you will probably find that he occasionally gives the above treatment to other odds and ends such as tape guides and pillars as a further precaution against noisy tapes.

Magic Eye Circuitry

Dear Sir:—For some time now, I have been puzzled why tape recorder circuits have the magic eye fitted across the record head network. When we make a recording we want about 30 dB's treble boost, yet the magic eye is adjusted for a modulation level for a certain record head current at all frequencies. If this is the situation, then how do we get our treble boost, if we have to reduce the record gain control to keep our magic eye at a certain position, at high frequencies?

Why is the magic eye not fitted before the treble boost part of the record amplifier, where it would give a true indication of a level frequency response input? Yours faithfully, A.W.A., Ashted.

The sensitivity of a magic eye level indicator is adjusted so that the target shadow will just "close" for the chosen limiting value of recording current. This maximum distortion-free current—it may have a value of 200µA or more, depending on the head of the tape—is fixed by the overall design, but remember that the magic eye itself takes no

account of the precise frequency content of the signal. On average, therefore, the movements of the eye will give as accurate an indication of the total modulation current in the system after pre-emphasis as before it.

If your suggestion was followed, we would control our input signals by reference to the magic eye, and yet the top boost added subsequently might, on certain high-pitched sounds, introduce overload distortion.

Tape Storage

Dear Sir:—The problem of tape storage must surely have received some attention in view of the ephemeral nature of magnetic recordings and I should be glad to know if there are any containers on the market which can shield a tape from any extraneous fields. Such a container would be particularly desirable for ensuring the safe arrival of a recording sent over long distances, in view of the likelihood of the electrical equipment being encountered on the way.

There are some queries arising from 4-track machines which were touched on in a recent letter. Presumably the normal width of tape is used, but is not something lost—e.g. signal/noise ratio? If narrower tracks can be used on 4-track machines without loss, why cannot narrower tapes be used on 2-track machines. With many thanks for an interesting and informative magazine.

Yours faithfully, R.E.S., Bilton.

Professional tapes are indeed sealed in metal screening cans on occasion, during transit or archive storage, but we know of no source of suitable containers for amateur tapes.

Answering your second question, everything else being equal, the signal to noise ratio on a 4-track recording will be degraded by approximately 6 dB referred to that of a 2-track recording. It would be possible to accommodate two tracks of the new 4-track width on $\frac{1}{2}$ in. wide tape, but the strength and "manageability" of such thin tape would be well below the standards now enjoyed.

Tapes at 60 c/s

Dear Sir:—I should be grateful for your advice in the following matter. My son, who is at a Canadian University, has sent us a 5-inch tape of his experiences since he emigrated, but we can't play it back properly on any standard machine here as at $3\frac{1}{2}$ i/s, it is far too slow and at $7\frac{1}{2}$ i/s the speed is unintelligible.

He expected some difficulty and wrote the following: the recorder is German and in Germany at 50 c/s the tape runs at 9 centimetres per second. However, Canadian Electricity is 60 c/s, so you'll have to get someone with technical knowledge to figure things out. As it is of great sentimental value, and so far unheard, so as to be able to understand it, I should greatly appreciate any valued help you may be able to give. Yours faithfully, L. F., Birmingham.

If your son was in fact using a tape recorder designed for 50 c/s mains on a 60 c/s supply then his tapes may well have been recorded at 20 per cent. above the nominal speed. The nine centimetres per second which you mention corresponds to our $3\frac{1}{2}$ i/s standard speed, and you will indeed obtain a 20 per cent. slow effect on playback at this setting. Except for discovering a source of variable AC mains, we can only suggest that you get in touch with someone who has a Reflectograph tape recorder. This has a continuously variable running speed and could be used to make a fair copy of your tape at any specified standard speed.

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TAPE AT THE LONDON AUDIO FAIR

"Some designs spoke for themselves."

As predicted, the Fifth London Audio Fair was the best ever on the subject of tape. Out of a total of 74 exhibitors, close on 40 had some aspect of tape recording to show and demonstrate, and the proportion of tape-minded visitors was just about as high. Manufacturers and overseas importers had certainly risen to the occasion, and in many cases the new components which they had announced just prior to the Fair proved to be part of their carefully maintained security "smoke-screen" hiding even more exciting new products, uncovered on the day.

Two examples of this technique were **Walters** and **Chitnis**. The former had announced the first viewing of their new "404" recorder, but went one better by showing in addition an entirely new battery-cum-mains model. Chitnis too had cleared through the Customs literally hours before the Fair opened a completely new semi-professional machine, and a really exciting variable-speed deck.

Instead of describing the exhibits in alphabetical or numerical order, I propose to escort readers on my own conducted tour, as being perhaps the most realistic way to show non-visitors what they missed.

Accompanied by Alan Watling, the cartoonist, I made "a clean start" by walking over from *The Tape Recorder* stand, which we shared with *Hi-Fi News*, to look at the **WAL Bulk Eraser**. This will completely erase a 7-inch spool of tape in a matter of seconds, and costs £7 18s. 6d. Other **Wellington Acoustic Laboratories** items were the Mono and Stereo Wal Gain transistor pre-amplifiers and an entirely new pocket audio oscillator. The latter is called the *Waltrak*, produces a 1,000 c/s sine wave at 1, 0.1, and 0.01 voltappings, and costs £6 10s. The next door stand featured the **Cosmocord Ltd.** range of pickups and inexpensive microphones, including the ubiquitous *Mic. 39*.

The **Veritone** representative gave us a complete description and demonstration of the new *Venus de-luxe* recorder. Although



Wilmex Ltd. were showing Irish tape and a new splicer.

the retail price is fairly high, £69 6s., the fact that this machine incorporates practically every popular facility is bound to make a wide appeal. At the **Truvox** stand, and later in their demonstration room upstairs, I asked for the *R6 and R7* recorders, and *Mark 6 deck* to be sorted out, as I was a little vague as to which was which. They soon straightened me out and produced excellent playback quality on the *R6* which uses the new *Mark 6 deck*. Where it is desired to build the recorder into a cabinet,



*The well-known battery recorder on the **Telec Tronic Ltd.** stand.*

etc., the deck may be purchased separately, and the *Type M* amplifier is supplied to match. The *R7* recorder is a fairly new machine, and tracks in both directions.

We next gazed enviously at the mixer units and recorders on the **Vortexion** stand, and I was intrigued by a new device known as an erase fade unit. This consists of one of the familiar **Vortexion** faders mounted in a screened box, with a wander lead which you simply plug into the erase sockets to give efficient fading of pre-recorded signals, e.g., in sound-track and super-imposition applications. At £93 13s. the recorder now has provision for stereo plug-in replay heads.

Magnetophon recorders

At the **Welmec Corporation's** display and demonstration of **Telefunken Magnetophon** recorders we followed everyone's example and ran our fingers over the keys of the *M24* professional machine. The 4-track *Magnetophon 76* is extremely small in size (and price, at 64 guineas) considering the facilities included, and a new stereo recorder is known as the *Magnetophon 77*.

We had an enjoyable time at the **Trix Electrical** stand, remembering that they had appeared at last year's Audio Fair with a new machine—the *Trixette Companion*—which incorporated the **BSR Monardeck** (so soon after its debut that we cast several friendly aspersions as to whether the box contained any "works" or not!) The *Trixette* range now comprises three recorders, the *Companion*, the *Everest* and the *Comet*, using the **BSR**, **Collaro Studio** and **Garrard** decks respectively, and the representative took our leg-pulling in good part and turned the

TAPE AT THE LONDON AUDIO FAIR

tables on us (literally) by opening up each machine to show us the neatly laid out chassis.

There was news of a terrific price reduction at the **Technical Suppliers, Ltd.**, stand. Their 4-track stereo *Electron* recorder is now to cost 62 guineas instead of 77 guineas. The reason for this change, we were informed, is that a large North American order, for which T.S.L. are also the distributors, has meant increased production and a selling price reduction of some 19%. A new microphone was also on show. It is the *MX3*, a small crystal microphone, and costs 45s. with a wire table stand included.

Grundig add stereo

The largest and most recent addition to the **Grundig** series of recorders—the stereo *TK60*—was reviewed in our May issue. It has its own amplifier and twin detachable loudspeakers, and heads a list of complete recorders as follows:— *TK60* (128 gns), *TK55* (92 gns), *TK35* (82 gns), *TK30* (72 gns), *TK25* (62 gns), *TK20* (52 gns).

The *Steelman Transita*pe battery recorder is now supplied by **Telec Tronic Ltd.**, in 4 colours, black, tan, white, or red. We gave full marks to the clever layout of their upstairs demonstration room. Each of the four walls carried a different thematic use of the recorder. On one side, for example, we had "In the Office", with a typist's desk, foot-operated switch, and earphones. The other three themes, equally aptly illustrated were "In the Car", "In the Lecture Hall", and "Out and About".

Reflectograph deck

There were enough samples of the new *Reflectograph* deck on display to allow a whole octopus of outstretched hands (ours included) to get the professional feel of the controls. The speed control on the Fast Wind and Rewind function has a centre zero



Lustraphone Ltd. showed microphones to suit all tastes.



Julie Andrews performed the opening ceremony and received a charming bouquet from *Prudence Hassan*, daughter of the Fair's organiser, while *Mr. Berry of Trix Electrical* looks on.

position, and we were able to send the spools purring happily in one direction then the other as we edited whole imaginary tape programmes in the space of seconds. Following on the heels of the *Type A* 2-track recorder was the first viewing of the *Type B*. This will give replay of 2-track or 4-track stereo tapes, and of course flexible mono record/replay. The manufacturers are **Multimusic Ltd.**

The demonstrators of the German *Butoba* battery machine at the **Denham and Morley Ltd.** stand swung this remarkable recorder through all angles to show its ability to maintain the correct running speed in any position. We are very much looking forward to the Field Trial of the $3\frac{1}{2}, 1\frac{1}{2}$ i/s, 5-inch spools, push-button controlled *Butoba*, and will publish this next month if time allows.

Up to the demonstration rooms

At this point, although we had only half completed our circuit of the Ground Floor, we climbed to the three Demonstration Floors, knowing that most firms were represented there too. Our first call was at the **Recording Devices Ltd.**, room. Alongside the familiar *Stuzzi Magnette* and *Tri-corder* (3 speeds including 15/16ths i/s) was the attractive *Stuzzi "Mannequin"*. This employs the BSR *Monardeck* in an extremely shallow case, and produced fantastic volume, for its size. Incidentally, in last month's issue, we omitted to mention that the price of the *Magnette* is £72 9s., and the new address of **Recording Devices Ltd.**, is 44 Southern Row, London, W.11. To prove that even tape recorder manufacturers occasionally smoke the pipe of peace, we found **Mr Simon of Simon Equipment Ltd.**, chatting in the **Recording Devices** room, and joined in congratulating him on the unique success of the *Minstrelle* table-top recorder (see Review in this issue). There is now a portable version.

We next found ourselves admiring three sets of microphones in succession. The ribbon and moving coil types of **Standard Telephones and Cables** suit every kind of professional application in and out of doors, for Public Address work, commentating or



MORE DETAILS OF THE FAIR

"I know we HAD one here somewhere, sir."

interviewing. A.K.G. (Vienna) through their agents **Politechna (London) Ltd.**, have surely the widest range imaginable from the studio condenser types C12 and C28 down to the more lowly D9 at about £4, and an attractive new moving coil cardioid, the D11 at just over £5. We were not lucky enough to find anyone on duty at the **Reslosound** room, but their neat bi-directional and cardioid ribbons and easy-to-use stands were much admired.

The Ferrograph 808

The **British Ferrograph Recorder Co.** were giving continuous stereo demonstrations on the *Model 808* equipment. This machine omits the usual output stages and speakers, and allows purchasers a useful area of choice in employing existing good quality gear. Ferrograph's adjoining technical query room was under permanent siege, and stereo conversion was naturally a leading topic.

New Ampex recorders and tapes

Ampex, and their U.K. distributors **Rank Cintel Ltd.**, showed an appealing array of high-performance recorders of which the present writer most covets the 601. This is a leather-cased 7½ i/s two-track portable. The famous 3-track stereo professional equipment could also be heard, and some of the 7½ i/s 4-track stereo tape records from the U.S.T. catalogue which we were assured are due for vigorous marketing over here. Indeed we were subjected to a taste of this vigorous marketing, and, far from buying up every tape record in sight, the present writer was prompted to the following note of heresy:—"How do you hope to sell tapes which will produce a meaningless jumble



The Brenell range extends from the Three Star portable to complete Stereo versions of the Mark 5.

on existing 2-track machines, when the owners of the said machines have not exactly been queueing up to buy 2-channel tapes?" It's the old story of selling conversion kits so that you can sell the tapes, or vice versa.

Lustraphone Ltd., have microphones and accessories to suit all tastes, stereo or mono. Their newest low-price model is the *LD.66* moving coil at £4 2s. 6d. **Scotch Brand** introduced the new *No. 200 Double Play* tape last year and their current surprise item is a special mailbag 3-in. spool of this. It is called the "*One-Five Special*", costs 5s. 3d., and gives 15 minutes 2-track recording at 3½ i/s. The manufacturers are **Minnesota Mining and Manufacturing Co.**

More new machines

At the next three rooms to be visited we found new machines operating alongside established models. These were the *Spectone 171*, using the Garrard deck (£40 19s.); the *Elizabethan Major*, using the Collaro Studio Deck (£68 5s.); and the *Walter 404*, using their own joy-stick type mechanism (£44 2s.). In the last-

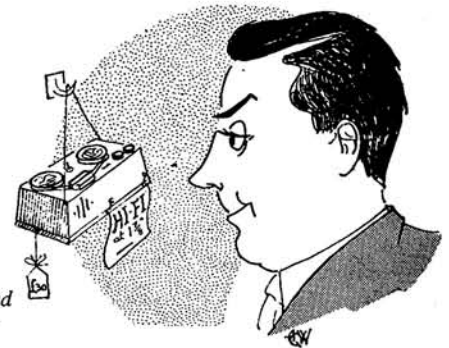


Scotch brand tape displayed the record sleeves of many companies.



"Excuse me, did it wiggle up and down or left and right?"

MORE DETAILS AND PHOTOS OF THE FAIR



"Other designs had to be labelled."



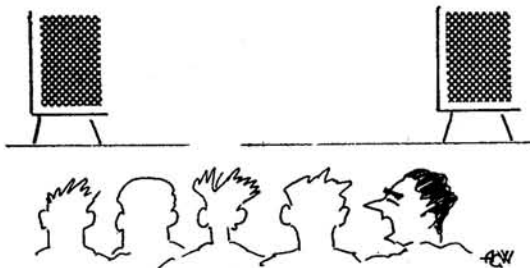
The Grundig demonstrations were particularly well attended, and the interest in buying or converting to stereo was very evident.

named room we were intrigued by a brand new battery/mains recorder—not yet christened—which is sure to prove popular. We found it light and easy to handle, and admired the safety window preventing you from using batteries and mains together! One of the first production models has been promised for review.

The **Fi-Cord 1A** miniature battery recorder needs no description to readers and the main point to note is that the **Grampian DP4M** microphone—previously an optional extra—has proved so popular that it is now listed at the competitive all-in price of £69 6s. Visitors to the **Brenell** room saw how the **Brenell Mark 5 Deck**, interchangeable heads, and **Mark 5** amplifier can be used to build up a versatile mono or stereo recorder in stages.

Three impressive displays of recording tape and accessories were those of **Irish Tape (Wilmex Ltd)**; **B.A.S.F. (F. A. Hughes & Co. Ltd.)** who showed their prize-winning colour film "The Magic Tape"; and **M.S.S. Recording Co. Ltd's** popular grades of **Mastertape**.

As we mentioned earlier, a novel **Chitnis** exhibit was a newly-arrived German deck. The drive is applied via a pressure roller to the under surface of a large flywheel. The point of contact



"Yes. Tape Hiss has that smooth, silky quality . . ."

may be moved along a radius of the wheel to give continuously variable speeds between the pre-set limits of $7\frac{1}{2}$ and $3\frac{1}{2}$ i/s.

Handling the tape magazines on the **Garrard** easy-loading deck is certainly child's play, but it has been said that locating parts of a recording takes a longish time, etc. With our ears more than usually close to the ground (we had by this time negotiated these three flights of stairs 3rd times!) we heard a rumour of a handy clock-type indicator which will fit on the magazine and render this operation as easy as timing an egg, or easier. Well done, **Garrard**.

The **Challen Instrument Co.**, have produced a new version of their battery portable recorder, to be known as the **Minivox Type C**. This has a greater power output, loudspeaker, and (dare we say it) a 5-guineas higher price. As dusk and the combined spirits of **Alan Watling** and myself were by now falling fast, the **Cha. Inst. Co. rep.** made us his friend for life by giving us comfortable chairs, little **Pisa** towers of packing cases for foot-rests and played us some **Mozart** from a **Minivox Type C** that sounded as if it came from Heaven.

J.N.B.



The new battery/mains recorder, being demonstrated by Mr. J. F. Parrington of Walter Instruments Ltd.



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YOUR SOUND TRACK

Part 4 ————— Effects and Music



The Bell and Howell 640 is a fascinating machine for 16mm work. Equipped for optical and magnetic sound tracks, and supplied with plug-in magnetic heads, two supplementary sound tracks can be laid down on Zonal stripe, after the first has been recorded.

THE past three articles of this series have described the making of "Cue Tape" and "Cue Sheet", the planning, writing, and recording of the commentary, and the editing and padding of the commentary tape so as to tailor it to the measure of the cine film. The next stage is the addition of sound effects as desired. From this point onward, the actual selection and inclusion of sound effects is very much in the hands of the individual worker, for it must depend (a) upon the nature of the film and its suitability for effects, and (b) the existence of real "effects shots" or the possibility of creating synthetic ones.

Effects are often unwanted

It can happen that sound effects which were shot specially for a film may seem unnecessary and even out of place when one tries "to edit them in". In such cases it is usually advisable to leave them out; and the experimenter can congratulate himself on having produced such a good commentary! Some shots really seem to ask for sound effects, however, and such effects are then usually as important as commentary, and they should be given the same treatment. For example, assume that the film is made around an apiary. Commentary will hold all the general shots together; but if a hive of bees is opened, perhaps to show a close-up of bees on the combs, then a good sound sequence of buzzing is worth more than all the words that could be written. A parallel example would be a close-up of running machinery—anything similar in fact, provided that the sound pattern is of a broad nature, and not one which suggests an attempt at rhythmic synchrony.

"Editing-In" the Sections

Referring back to last month's article, and the description of "editing-in" blank lengths of tape to space out the sections of commentary, the relevant film sequences should first be timed from the cue tape and noted on the cue sheets. The sound effects will presumably have been recorded on separate spools of tape, so the next job is to select the best and most suitable sections, and to cut them out with scissors. And here, to save any trouble and confusion, make a mark on extracted tape lengths, so as to indicate which is the beginning and the end in each case.

Next, consult the cue tape and note the exact points of time at which the effects should begin and end. For example, assume that the picture sequence in question begins three seconds after the closing word of a commentary section, and that it lasts for 4 seconds. Therefore, at a $7\frac{1}{2}$ i/s tape speed, the "effects tape"

length will have to be cut to $7\frac{1}{2} \times 4 = 30$ inches, and a similar length must be cut from the blank "padding" tape to accommodate it.

In the example chosen, the first cut in the blank padding tape will have to be made at $3 \times 7\frac{1}{2} = 22\frac{1}{2}$ inches from the preceding commentary section. Splice in the 30-inch effects tape and play the tape, using the stop watch to check that the effects cue in and out in accordance with the cue sheet.

The foregoing technique applies also to sound effects which are of equal value and comparative volume to the commentary. In some cases, of course, the overall plan of sound and pictures might indicate a background treatment of effects, in which case they would take their place on a level with the music (if any), and be blended in and out by superimposition or mixing.

The Music

The results of the foregoing, and the editing described in the previous article, will be a sound track of alternating sequences of silence, commentary and effects; and its overall length, in time, will correspond to the running time of the film. So far so good; and the next stage is the addition of the music. This should always be left till last if there is any "lifting or dubbing" to be done, because whereas it is often possible to transfer speech and effects more than once without serious audible deterioration of quality, music does not lend itself to such treatment, except by machines of really high professional standards.

There are several alternative methods of arriving at the desired objective of music, effects and commentary blended as one on the finished sound track. Direct superimposition may be the first thought; and so it is advisable to point out its greatest hazard—that of misjudgments; these can wreck all the good work already done in the preparation of the track so far. If superimposition is to be attempted, it is advisable to make a copy of the commentary effects tape, and to practice on that.

Warning—copyright!

If two recorders are available, plus a disc player, it is sometimes possible to add music to the commentary without even the use of a mixer, by mixing the inputs through interconnection of the leads, and by use of the volume control on the disc player. It is assumed, however, that readers who are equipped with tape recorders, cine cameras and projectors, will also have provided themselves with some form of mixer! And please note here that if music is to be lifted from disc, for use on film, the question

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YOUR CINE SOUND TRACK—(continued)

of Copyright arises. It is essential to request permission from the Mechanical Copyright Protection Society (MCPS), and the cost will not be unreasonable.

When it comes to the actual blending of music and commentary, it should be remembered that the commentary must not be altered in level, or faded in and out. It is the music which must be brought up and down in level in order to achieve the marriage. Avoid sudden volume cuts at all costs. It is good practice to establish a maximum music level, and to rehearse with the fader knob until this level can be regained almost automatically. The average minimum level should also be decided upon and rehearsed before serious recording work begins.

In practice it will generally be found that the background music level is considerably lower than might at first be thought necessary. This is because the fades, from music to commentary and back, should be as unnoticeable as possible; and they must therefore be as slight as possible. It is not good to have a considerable drop in music level before each section of commentary, because this results in an irritating warning to listener that "commentary is coming". Only when particular emphasis is required should such a sudden change of level be made.

Watch it and cue it

By using the cue sheet and stop watch it is possible to anticipate the points at which commentary is about to cut in and out; and this may be made even easier by marking the tape with *Chinagraph* pencil, or even by cue-ing it by means of coloured *Arrowtabs*—possibly three of these tabs (different colours) at pre-arranged intervals.

It is a good technique to time the fading of music as the final words of the commentary are spoken. This helps the illusion of continuity because the mind is instantly alert to the spoken words, and is thus less receptive to the changing music level. Similarly, the fading up of music at the end of a commentary section should begin slightly before the last words are spoken. Carefully done, this is most effective and pleasing.

Zonal stripes and three tracks

For those who are so fortunate as to possess *Bell and Howell* projectors with magnetic track facilities, the final operation of marrying commentary and music is, of course, as fascinating as it is simple. For those who may be contemplating such a purchase, a few explanatory remarks may be welcome. The film will of course have been sent to *Zonal* for striping, and a full magnetic stripe will run throughout its length along the un-sprocketed edge.

The *Bell and Howell* projector is supplied with two plug-in magnetic head assemblies—one for full-stripe; the other for edge-stripe. Immediately preceding the record/replay positions of the heads are the erase heads—full-stripe or edge-stripe, as the case may be. It is therefore possible to make a full track recording, using the full width plug-in lead; and then to make a second recording, using the edge-stripe head. In which case the edge-stripe erase component of the head wipes off a thin section of the first recording, (about $\frac{1}{3}$ of it), and this erased strip receives the new recording.

Changing the language

A third head, obtainable as an extra, is also an "edge-stripe assembly", but with its erase and record/replay components positioned to operate on the inner edge of the full stripe. Thus, as can be appreciated, two subsidiary sound tracks can be recorded after the initial full track has been put down—one on either side of the remaining central $\frac{1}{3}$ —giving three separate tracks. The first to go down can be the commentary; the second can take any effects or extra sounds; the third can take the music.

The beauty of this really flexible system is that either of the edge tracks can be replayed separately, via the appropriate head—or erased and re-recorded: or the three can be played together, using the full stripe head. Or again, by using one of the edge tracks for commentary, this can be changed as desired, or even recorded in another language, without disturbing the other two tracks.

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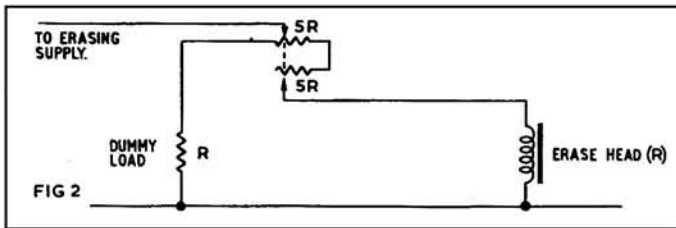
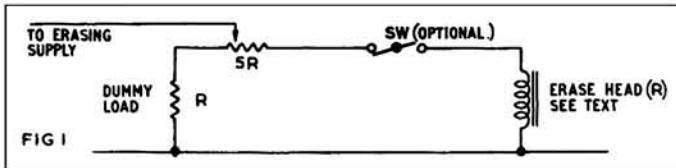
Practical suggestions for the tape handyman _____ by A. Bartlett Still

No. 13. FADE ERASE

ABOUT nine months ago—in the fourth of the present series, to be exact—I wrote on the subject of Superimposition. After discussing the facilities that were offered to the tape recorder user, I tried to give some assistance to any who might wish to modify their own machines.

It does seem that a number of enthusiasts have found this device useful in editing and programming tapes when only one machine is available, and I have been glad to learn that in several instances my remarks have been of assistance.

This month I shall try to describe a logical development of the idea of superimposition—Fade Erase. By replacing the



switch with a variable control, the programme material that has already been recorded can be faded in and out as required. This means that, with a little practice, the operator can perform some of the functions of the recording gain control after the recording has been made.

In my previous article I made the point that, in order to maintain constant loading on the bias oscillator—important for correct feed to the record head—the erase cut-out switch had to replace the erase head by a suitable dummy load resistor. For a suitable Fade Erase system, it is equally necessary to keep the loading within limits as far as possible, and so we have to provide a gradual transfer of the oscillator output from the Erase Head to the Dummy Load. This is, unfortunately, one of those things easier said than done, and almost any circuit will suffer from theoretical disadvantages. Happily the average machine is usually prepared to ignore one or other of these, and I think it will be found that one of the three circuits can be used as a basic design for almost any model.

Erasing head impedances

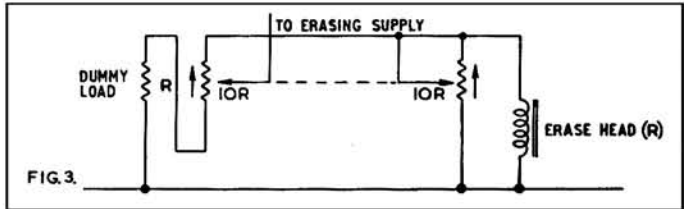
It will be seen that in every case the resistance of the potentiometer is related to the resistance (R) of the Dummy Load, which should itself be equal to the impedance of the Erase Head at the oscillator frequency. For the assistance of newer readers I will repeat the list of approximate values I gave before:

Collaro 270 ohms, Brenell 270 ohms, Truvox 4.7 K ohms, Lane 4.7 K ohms, Grundig 1 K ohm. Further guidance can doubtless be obtained from the appropriate manufacturers.

Fig. 1 shows the circuit of one of the simplest forms of fade erase. Neglecting the inclusion of a switch for the moment, it will be readily seen that, with the slider at either end of the potentiometer, the bulk of the erasing power is fed either to the head or to the dummy load. When the slider is at the dummy load end, however, the power in the erase head has been reduced, but not removed entirely. If, on your machine, it still has an erasing effect, a switch should be used. This can most conveniently be the type of

potentiometer switch often used as a mains switch on volume and tone controls.

Fig. 2 is a variation of the first circuit using a double-gang control. It will be seen that increased resistance is put in



series with the Erase Head to reduce further the power supplied to it. A double-gang potentiometer is used again in fig. 3. This time it is wired to ensure that no power can reach the erase head in the "off" condition because it is shorted out.

To what extent power must be removed from the head will depend on the erasing efficiency of a particular machine. This can be determined, from the point of view of this application, by using an ordinary resistor(s) instead of a potentiometer for a quick check, putting the slider connection first to one end and then the other to try both extremes. With all three circuits the loading on the oscillator is slightly below the normal impedance at each end, and a little above in the middle, it is not expected that trouble, due to changes in record head biasing, will be experienced unless the potentiometer values are changed radically from those given.

There now remains the small amount of erasure due to the record head bias. While there are several ways of dealing with this electrically, they all run the risk of increasing the hum level when the head is switched to playback. I therefore suggest that if the fade erase system is being used to "fade in" a programme, in order to clean up a recording, the tape be kept just clear of the record head by means of a shield made of postcard material. It will be found that quite a small separation is sufficient for the purpose.



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FIRST REVIEWS OF TAPE RECORDS

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***Bach.** *Brandenburg Concertos.* The Hamburg Chamber Orchestra, conducted by Harry Newstone. Saga STF 4012-3. 7½ i/s. £8 8s.

Full marks to Saga for having made this performance available on tape; I confess to having awaited its arrival with impatience. Nor indeed was I in the least disappointed, and I can recommend it with but a few minor reservations. Essentially, it is a cheerful reading; the Hamburg orchestra rise to the occasion with evident gusto, and the soloists not only give good account of themselves technically but manage to blend themselves into the fabric, each yielding to the other when the moment of maximum musical interest has passed them by. There are several anxious moments, to be sure, and credit must be given here to the firm continuo line, which, if somewhat over-recorded in the stereo version, prevents the complex contrapuntal superstructure from coming to grief.

Certain sections are outstanding, particularly on the second tape. The fugal finale in No. 4 is the most delicately balanced I have yet heard, while No. 5, which is marginally the most successful here, is distinguished by some dashing harpsichord playing in the cadenza to the 1st movement (even if Herr Grebe loses an ounce or two of momentum in his anxiety to provide maximum variety), and some truly marvellous chamber music playing in the slow movement. On the debit side, the last movement Allegro of No. 3 is little more than a scamper for home, and the Minuet in No. 1 is even more dreary than usual.

The recording is much more full-blooded than the disc version, if inclined to over emphasise the lower parts. Stereophony saves the day in No. 6, by alleviating the thickness of the texture, but produces some curious effects in its wake, such as the cellist in the slow movement of No. 5, who seems to have deserted his colleague on the harpsichord in favour of the flute. One final point: Saga have a passion for putting items in the wrong order, which can be fascinating on occasions, but is usually slightly tedious. This set starts off with No. 2, followed by 3, 1, 4, 5, 6.

***Offenbach.** *Gaieté Parisienne*, abridged. The Philharmonia Orchestra, conducted by Herbert von Karajan. Columbia BTB 307. 7½ i/s. 47s. 6d.

This selection, which first appeared on disc late in 1958, is a welcome addition to the tape catalogues, or indeed to any catalogue. Many, the present writer included, find the full score of this remarkable ballet just a shade too much of a good thing in its entirety, and this would seem a case for judicious cutting, as exercised here. The effervescence, curious subtlety and delicate poise of the score are all enhanced by a recording, which if lacking in bite, otherwise does full justice to the performers. The clarity imparted by stereo is quite remarkable, though with the treble boost necessary certain instruments, notably the piccolo, are apt to obtrude to an uncomfortable degree.

***Tchaikovsky.** Piano Concerto No. 1 in B flat minor, Op. 23. Sergio Fiorentino with the Hamburg Pro Musica Orchestra, conducted by George Hurst. Saga STE 3006. 7½ i/s. 70s.

This new arrival faces fairly steep competition from Geza Anda, albeit in mono, on CAT 259 (84s.) and the potential purchaser will thus be presented with a healthy dilemma. The Columbia version, which was recorded some six years ago now, is in many ways a brilliant performance, intensely musical and almost spell-binding, even if Anda never quite reached the pinnacles of sheer pianism that later exponents have sat atop. Fiorentino, by contrast, attempts nothing rash, puts nothing in that is not there already, and is inclined to detach himself emotionally while the surrounding orchestra are busy blowing and

scraping with great fervour. The result is that while the performance is fluent and musically fairly satisfactory, the *molto maestoso* is lost, the essential nobility gone with the wind, and we are left with what can only be described as an adequate, if unexceptional recording. In fairness I must add that the final allegro has a fair ration of fuoco about it, and that although the brass remain quite monstrosly timid, the performance ends with a flourish. Thus I would still recommend Anda to those who seek a fine performance, but Fiorentino to those with stereo decks and who are less fussy and content with mildly diluted Tchaikovsky. A.R.B.B.

A Nicht wi' Burns. A selection of songs, verse and fiddle solos by Robert Burns. Music on Tape SV 167. 7½ i/s.

Scotsmen have a reputation, deserved or otherwise, for being careful when it comes to laying out cash. The number of excerpts included on this tape—27 in all—would appear at first sight, however, to be pretty good value, and justify the “bawbees”. The selection too has been sensible enough. A fiddle solo of *John Anderson my Jo, John*, follows the narrator's hearty rendering of *My Love she's but a Lassie yet*, and is followed in its turn by a baritone singing *O' a' the Airts*; and there's *Tae the Unco' Guid*, *Afton Water*, *The De'il's awa' wi' the Exciseman*, *Ye Banks and Braes*, and many more favourites.

Unfortunately, it is the musical performances that might make our bawbees remain with the moths in our sporrans. The baritone's voice I can only describe as plummy and suggestive, and although the female singer produces sounds which listeners to the BBC Scottish Home Service can tune in any night—in their Highland fastnesses, safe as yet from the detergent advertisements—she might have made a braver attempt at some of the highest and lowest notes. The recording is blameless enough, with the impression of being in an inn atmosphere only sketchily conveyed. The violinist is repeatedly referred to as “our fiddler in the corner”, but the closeness of the solos suggested rather that his elbow was right in the foreground.

A redeeming feature of this tape is undoubtedly the verse reading, and the female reader's *Tam Glen* is excellent. Returning to an l.p. disc, “*An Evening with Robert Burns*”, Columbia 33CX1317, one found a very similar choice of musical items, and a much higher, if more long-haired, standard of musical performance. The formal presentation of the disc will please musicologists better, but pointed most clearly the tape's essential quality—an informal style such as you and I might rise to after the mellowing influence of a Burns Supper. J.N.B.



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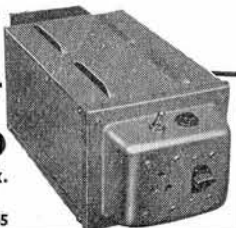
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THE "Minstrelle" is the first recorder to be reviewed which uses the new Garrard Magazine tape deck. Double play tape is used giving a playing time of a little over 30 minutes on each track at a fixed tape speed of $3\frac{1}{2}$ i/s. The magazine or cassette can be literally thrown on to the machine, and is as easy to change or turn over as a gramophone record. The deck will be the subject of a separate review so that further details will not be elaborated here. Suffice it to say that the wow and flutter on this particular sample was quite exceptional for this speed. Measured on a G. B. Kalee wow and flutter bridge the figures were; wow 0.08 per cent, flutter 0.13 per cent, and total wow and flutter 0.14 per cent.

This was a good start, so the playback response was next tested using a calibration tape with a surface induction characteristic corresponding to a time constant of 200 micro-seconds. This is the C.C.I.R. recommendation which is not yet an official standard, but seems to be the recording characteristic generally used in this country and the Continent for the sub-standard speed of $3\frac{1}{2}$ i/s. The response is shown in Fig. 1, and is seen to be sensibly level from 100 c/s to 7,500 c/s, the top frequency of the test tape.

Head was "spot on"

It was noted that the azimuth adjustment of the head was "spot on" which assures wide range response from pre-recorded tapes, or tapes recorded on other properly set up machines. The tone control range is shown by the dotted curves of Fig. 1. The most level response is obtained with the control turned back a quarter from the fully clockwise or maximum bass cut position. A little top cut allows American pre-recorded tapes, with N.A.R.T.B. characteristics, to be reproduced with a level response. Note that the tone control is only effective on "monitor" or "playback", and does not affect the recording characteristic.

The hum and noise was -32 dB on the test tape level, which was -12 dB below theoretical peak recording level where the tape distortion should be 2 per cent. Before accepting the resultant peak signal to noise ratio as 44dB a check was made that the machine would record a level $+12$ dB on the test tape level, without visible distortion on a C.R.T. It did, and I was pleased to see that when recording at this level the light bands of the magic eye just reached the edges of the green band as described

in the instruction book. As a further check, the recording level was turned up a further 3dB so that the magic eye indicated overload, and on replay the recorded waveform was just visibly distorted indicating about 5 per cent distortion.

I may say in passing that many Continental machines with very wide frequency response specifications would not pass this test, as the wide response is often obtained by deliberate under-biasing which causes recorded distortion to show up only a few dB above test tape level with a resultant "muddy" quality which rather takes the gloss off the much vaunted frequency response.

I feel rather strongly about this fetish of very wide frequency response claims at low tape speeds. Frequency response in itself is almost the least important quality factor at this speed, much more important are such things as "under signal" noise, intermodulation, and "drop outs", all of which are aggravated by under-biasing. It is these faults which have given $3\frac{1}{2}$ i/s the label "substandard", in quality rather than speed, which is its true connotation.

The record replay response of Fig. 2 shows that it is still possible to record a wide response with adequate bias, if proper pre-emphasis equalisation is used. While doing these tests it was noticed that the high note pre-emphasis used for recording could be heard on the monitor speaker, it could however be reduced to normal balance by turning down the tone control a little from the level position. As noted earlier this does not affect the recorded response. A little bass rise is also used in recording, amounting to 3dB at 100 c/s, and 6dB at 40 c/s. It will be seen from the loudspeaker response, shown later that this modification in response is not likely to be audible on the internal loudspeaker, but it does improve the overall response, and is worth while if the excellent output of this machine is fed to a large wide-range speaker.

3 watts output

The overload point of the push-pull output stage occurred at 3 volts R.M.S. across the 3 ohm loudspeaker; this corresponds to a power output of 3 watts. It was found that a peak recorded tape generated peak power output with the playback volume control three quarters on, the remaining quarter allowed a margin of about 4dB for tapes which were slightly under-recorded. This shows evidence of careful design, and means that properly recorded tapes can be played at full gain with only momentary clipping on loud peaks.

The machine was next loaded with a White Noise test tape and the overall response, including the loudspeaker and cabinet, measured on a calibrated microphone. This response is shown in

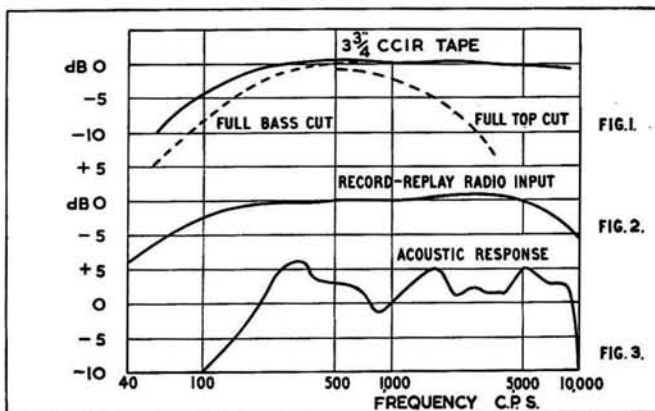


Fig. 3, and shows that the acoustic response over the middle and high frequency range is level within ± 3 dB limits from 200 c/s to 8,000 c/s. If you are not used to assessing speaker responses this may not look very impressive, but, in fact, for a cabinet this size the response is remarkably good. It is a sad fact that to reproduce

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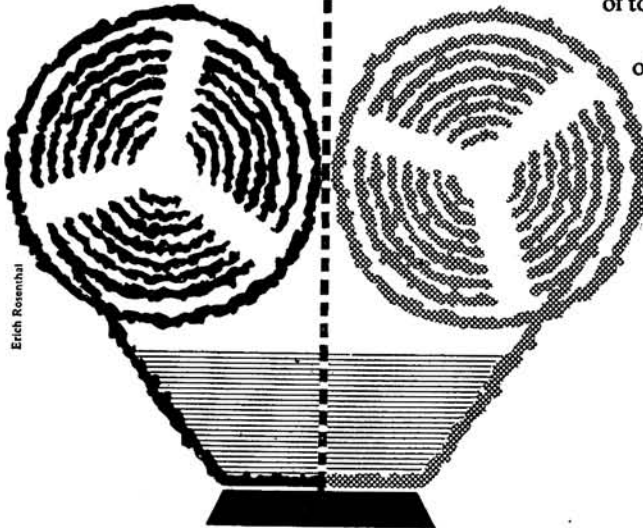
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EQUIPMENT REVIEWS—(continued)

the bottom few octaves within the same limits necessitates a large and bulky cabinet with an internal volume of some 8 to 10 cu. ft., together with a 12 in. or 15 in. speaker with adequate magnet and coil length. Subjectively the response sounds smooth and uncoloured, and has a forward unobstructed quality which is the result of good equalisation, a level speaker and amplifier response, and an almost complete lack of the usual cabinet resonance or "boom" which spoils the sound quality of so many portable recorders.

Acoustic output

Finally, the peak acoustic output of the output stage and loudspeaker was measured on the 1,000 c/s noise band at a distance of 1 ft. from the speaker fret, and found to be 28dB above 1 dyne per sq. cm., or 100 dB above threshold. As the measurement was done at 1,000 c/s it can be expressed as 100 Phons. I have given this figure for comparison with other equipment to be reviewed later, as I feel that in a self-contained recorder such as this it does not matter much whether the acoustic power is produced by a small output stage, and an efficient speaker, or conversely by a powerful output stage and a less efficient speaker. The important thing is how much "din" it produces. The 1,000 c/s acoustic output must of course be considered in conjunction with the speaker response curve to get an idea of the programme level obtainable.

I have described the tests on this recorder at some length so as to establish a pattern for future reviews. Briefly the sequence will be; wow and flutter, replay response and effect of tone controls, record/replay response, peak recording level referred to a standard test tape level and its relation to the volume indicator reading, peak signal to noise ratio, overall acoustic response, electrical power output, and acoustic power output.

General impressions

Now for a few subjective impressions and opinions on this unit. Some mechanical noise was noticed from the deck, on first switching on after a rest period. This seems to be due to a "flat" developing on the capstan drive idler wheel. It disappears after a few minutes running, and even at its worst has no audible effect on reproduction. The wow and flutter bridge also failed to show any increase, and the noise only really mattered when recording from the internal microphone.

My only complaint is really a criticism of the deck rather than the recorder which incorporates it. It concerns the lack of a fast rewind; the only fast spooling provided is in the forward direction, and I found it a bit frustrating, after doing a brief test recording, to have to reverse the magazine, spool forward, and then turn the cassette over again to see if I had rewound by the required amount. However if the magazine is used to record a half hour's programme which can be played as easily as a gramophone record by the rest of the family, and turned over for a second helping, then the fast spooling facility comes into its own to skip unwanted items or to wind quickly to the end of a reel before changing programmes.

Apart from this minor criticism I have nothing but praise for this well designed, and well proportioned unit, and I think it will soon make its mark as a family recorder. The cabinet and styling certainly has "woman appeal," and the magazine loading will undoubtedly endear it to the less technical members of the family. On the other hand, the well laid out controls offer every facility desired by the recording enthusiast; fading, mixing, monitoring, and superimposing can soon be mastered with only a very little practice.

A. Tutchings.

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Manufacturer's Specification

Mains voltage: 200-230 volts, 50 c/s; or 100-130V, 60 c/s.
Consumption: 90 watts. Tape speeds: 7½, 3½, 1½ i/s. **Recording sense:** half track standard. **Wow and flutter:** less than 0.2 per cent. **Equalisation:** C.C.I.R. Monitor volume control; bass and treble controls. Mixing, superimposing, straight through amplifier. **Outputs:** from preamplifier, and 15 ohms speaker outlet. **Loudspeaker:** 8 × 5 in. elliptical. **Dimensions:** 15½ × 16½ × 7½ in. **Weight:** 30 lbs. **Price,** including Acos Mic. 40, and recording lead, £51 9s.

Manufactured by Magnafon Record Co., sole distributors:
Market Developments, 221, Bishopsgate, London, E.C.2.

★ * *
ONE'S first impression of this machine, which is large by some present-day standards, measuring 16½ × 15½ × 7½ in., is of a very clean design with quite an attractive appearance.

Full marks must be given not only for the provision of a recording lead that is so often an annoying extra on the price, but also for arranging a pocket in the cabinet that will house it, together with the microphone and, most important, the usefully long mains lead complete with plug. Again, I fear, this machine is a succession of contrasts. No marks at all can be given for the Instruction Leaflet. It is, admittedly, difficult for your reviewer to assess how great would be the assistance it offers to the complete novice, but as in places it is not only ambiguous, even flatly contradictory, one must suggest the idea of a complete re-write. There are still many prospective purchasers to whom a tape recorder is a thing of absolute mystery, the process of initiation should, above all, inspire confidence in its use.

Motek K10 deck

This machine was the first that has come my way using the new Motek K10 tape deck, similar, though smarter, in appearance to the earlier K9. The Specification of this tape recorder quotes a Wow and Flutter figure of less than 0.2 per cent. On the model reviewed this was unfortunately not true. While the flutter level was extremely good, Wow as high as 0.5 per cent. was traced, it is believed, to the Pressure Roller. This is doubtless an unfortunate and isolated example, but it serves to show that if a tight specification is to be applied to a mass production item, rigid inspection and testing is called for. It must also be noted that the azimuth adjustment of the Rec/Playback head was incorrect as received, some 8dB increase of playback signal at 8 Kc/s from a standard Test Tape was obtained by realigning the head.

Playback of an E.M.I. Test Tape TBT1 is shown in Fig. 1, which displays the effect of the Treble and Bass controls. While this is an excellent indication of performance when replaying a tape record, it is largely the overall response, record and playback, that is of interest. The other curves plotted show the response at the three tape speeds, replaying with the tone controls at maximum Bass and Treble and metering from the "amplifier" output socket. The recordings were made at a level 20dB down from full modulation.

The provision of an "Amplifier" output socket, in addition to an outlet for the connection of a 15 ohm extension loudspeaker, is to be commended. It is felt that the output avail-

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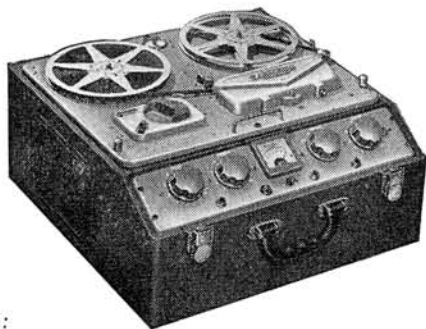
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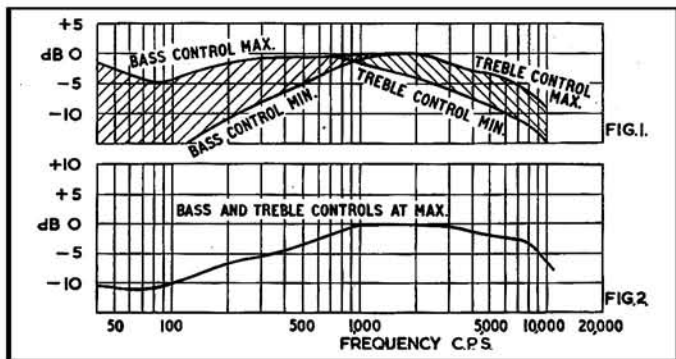
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able (up to 15 volts RMS) is rather high, particularly in view of the fact that a large proportion of the noise signal is "standing", i.e., unaffected by the playback gain control. This means that the signal/noise ratio (which is extremely good at high volume levels) worsens as the playback level is reduced.

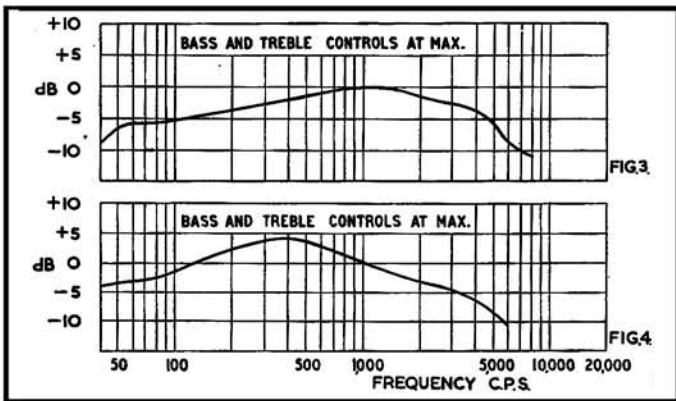


The addition of a simple resistive attenuator to reduce both signal and noise to a level more readily acceptable by the average amplifier would also permit the output impedance to be reduced and would, under certain conditions, improve the treble response through external apparatus.

Table I

Signal/Noise Ratio	7½ i/s	3½ i/s	1½ i/s
Unweighted	48dB	42dB	38dB
Weighted	52dB	45dB	40dB
Full Modulation Distortion—3 per cent. at 1 kc/s.			
Sensitivity at 1 kc/s—Mic.	1.3-mV.		
Gram.	160 mV.		

Concerning treble response, the writer has gone on record elsewhere as holding the opinion that today too much store is set by frequency response figures, indeed, a far more respected personage than your reviewer has remarked that "The more you open the window, the more the muck flies in". The Magnafon TR 60 cannot be said to have an impressive performance in terms of frequency response, but it has got a good signal/noise ratio and a good distortion level for a fully modulated tape. What does this mean? Quite simply that I have been able to make and replay recordings that have sounded



cleaner than other, supposedly better, machines, and that my impressions of its overall performance run counter to the suggestion of the measured results.

Summing up, therefore, I do feel that one or two improvements could be made at little, if any, cost. As far as performance is concerned, while there may well be room for improvement in certain respects, I still come back to the fact that, replaying its own recordings of varying types it *sounds* to offer value for money better than other machines at both higher and lower prices.

A.B.S.

LETTER FROM NEW YORK

AFTER all I have written about tape developments, with the accent on recorded cartridges, I hardly dare give you the latest lowdown. But here it is. And while thanking you for your Audio Fair details let me tell you that it was at the New York IRE show that these events took place. No fewer than three new tape "opportunities" are now with us. From *Armour*: from *Zenith*, through *Minnesota*: from *Ampex*. Let me take them in that order.

You have probably heard a lot about the Armour Foundation who have long been associated with magnetic recording research. Their plan is for a cartridge that can be used for existing tape recorders, and which can also be played on specially designed changer-type systems. This cartridge uses standard ¼-in. tape with a tapered leader, suitably terminated to operate with an automatic threading device. Tapes can be used for recording, erasure and replay in the normal way, or can be merchandised as tape records, ready recorded.

In a demonstration at the IRE show, this cartridge was shown in semi-automatic operation. When placed in position in the player, a shaft engaged with the cartridge hub, turning it until a plastic leader in the machine connected with the tapered leader. The tape was then drawn past the head and capstan to the take-up spool, and play commenced after a few seconds of automatic threading.

Next comes Zenith's device, intended to play cartridges of the CBS-Minnesota type. Though it is predicted that instruments will not be available for some months, the cartridges are very thin and hold tape of only 1/7 in. width instead of the customary ½ in. The running speed is 1½ i/s and the engineers claim (and I repeat *claim*) that its playing curve is as good as flat from 50 to 15,000 cycles. This they say is obtained with a new one-micron record/playback head. But that is not all. The cartridges which are 3½ in. square will contain more than one hour of music, recorded in one direction, and will have a rewind time of 20 seconds. There are three tracks, for this is stereo of course, and the third track "can be used to add color to left and right channels, according to whether the recording companies decided to use it or not".

The Armour cartridge uses four tracks, two each way, and can be used at 3½ or 1½ i/s. It measures 3½ in. in diameter and is naturally thicker, using standard width tape; as stated, it can be used normally as well as on automatic changers. The Zenith-CBS narrow tape system, for which the Zenith machines are planned, will not be suitable for normal recorders. The idea here is for auto-changer use, giving up to six hours of replay.

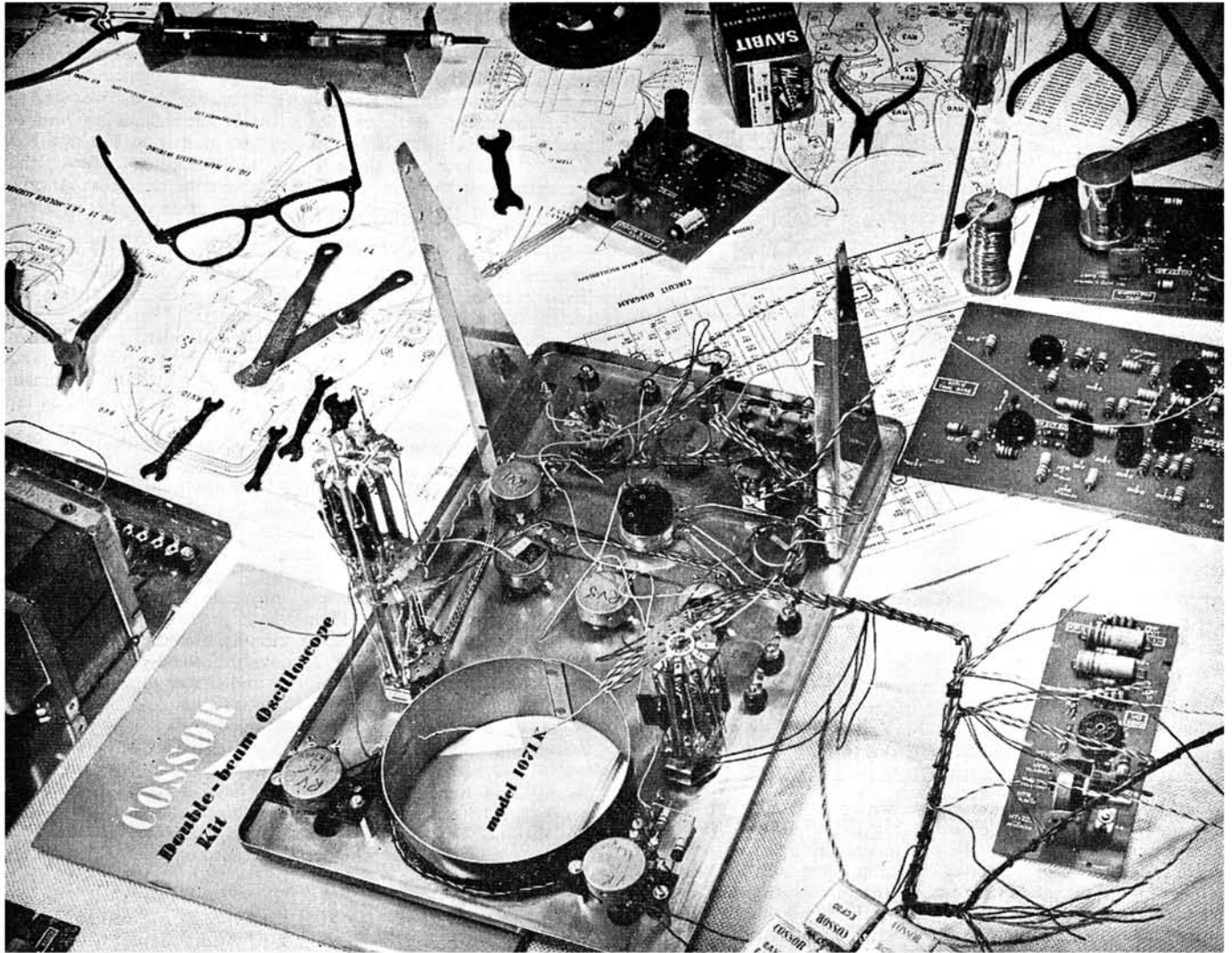
Ampex also announce a new cartridge, but while admitting that it is two or three years distant as a commercial proposition, they offer it to the industry on a Royalty-free basis "when the industry can agree on its standards". This cartridge system covers a 1½ i/s speed on standard ¼-in. tape.

So there you have it. And I expect you will be asking just the same questions as I have been asking—and what a large slice of the industry is already asking: "where is it all leading?" Many are frankly skeptical about the advantages of the very slow speed, and seem to see it as a medium for low cost sound for the not particular user. This, despite the claims made for it. Others are outspoken about 7½ i/s as the accepted speed for the quality needed by hi-fi users. They maintain that this speed on standard ¼-in. tape has now really dug itself in *after unnecessary setbacks caused by too much talk of slower speeds and non-standard devices*.

I prefer not to pass comment at this stage, though I have yet to have it proved to me that these ultraslow speed moves can really do what is claimed at this period of tape development. I think that you are fortunate, where you are, to have relatively few tape complications!

One thing emerges from all these moves however. The accent is undeniably upon tape music for the home. The idea of the tape record player has quite a firm root in commercial minds. But so far these minds still seem to differ quite a bit when it comes to realities.

Yours sincerely,



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. . . about a second TV set

From:—K. Oglesby, 40 Arncliffe Gardens, West Hartlepool, Co. Durham.

Dear Sir:—The advantages of a second television to the recording enthusiast are obvious, and an adequate old single-channel set can be acquired for a few shillings. The great snag is the trouble and expense of a second aerial, and for years I was told by experts that it was impossible to run two sets from one aerial. However, I found that by simply fitting the ends of the two cables into one plug both sets worked at once, with no loss of performance by either. The two inner and two outer wires must be entwined before the plug is fitted together again.

Yours faithfully,

* * *

. . . about clockwork motors

From:—J. Kemp, 76 Charlton Road, Shepperton, Middx.

Dear Sir:—I was interested in the specification mentioned by P. M. Brown (October last). I too feel that clockwork drive has real advantages in a portable job. In fact I aim to build one, and wonder if any reader knows of a supplier of new clockwork grammo motors. Some provision for earphone play back is, I think, desirable, e.g., the monitor should be usable on its own. Certainly a loudspeaker is uncalled for, and I do feel that one should be able to go "outback" without a crate-full of spare batteries.

Yours truly,

* * *

. . . about tape in the Southern Hemisphere

From:—C. V. Hougaard, 66 Chamberlain Road, Vincent, East London, South Africa.

Sir:—I wish to express my appreciation, as an overseas reader, for your stimulating magazine, and as you state in your current Editorial that your policy is to make your paper the most interesting and reliable information journal of its kind in the world, I trust you will accept a few suggestions from a reader—south of the equator! Recently you have reviewed a series of "mains free" miniature recorders, with an explanatory preface that a technical review with emphasis on performance is out of place, since these small machines do not claim high fidelity, but here I disagree, as any review not assessing at least the quality of the recording makes such a review of interest only to the dilettante who is prepared to pay for a toy. Your review of the Steelman "Transitape" gave very little information. I heard this machine at a demonstration and was very favourably impressed, and considered it good enough for my amateur requirements, but the price is a bit too high here. Why it should cost over £100 in South Africa I do not know. Other battery sets in the lower price bracket have not all impressed me: I wish to plead, therefore, that in future you report on the quality as it seems to me that it should not be assumed that all battery recorders necessarily give mediocre results.

So far I do not recollect that you have reviewed recording amplifiers, and I trust that you will give some attention to this omission, particularly as many recordists seem to be buying proprietary decks and assembling their own machines. Some tips as to matching amplifiers, heads, and mikes would be greatly appreciated. I have scanned your advertising pages in vain for

an integrated stereo recording amplifier, and have written to several firms without success. It seems—unless I am mistaken—that manufacturers in the U.K. are very slow in producing such a piece of equipment: I have in fact written to several manufacturers by air mail, but in all cases they state they are not interested. These integrated stereo recording amplifiers have been freely obtainable in the United States for many years, and it now rather seems that my requirements will have to be directed to America, although the dollar exchange is against us.

I very much appreciated your reviews of tape decks and regretted the discontinuance of the all too short series.

Finally I would like to see the reviews of battery sets confined to one page and the other page devoted to the review of a mains machine, so as to give all the new machines—particularly 4 tracks—a turn at being reviewed, ere they become obsolete owing to the effluxion of time!

Yours tapefully,

* * *

. . . about learning to talk

From:—John Conway, 29a Kent Road, West Wickham, Kent.

Dear Sir:—If any of your readers have children around the age of two years or less, and have a 7½ i/s tape recorder, I would be very grateful for some recordings of their infants' vocal activities. I am helping a professional speech therapist with some investigations into the general pattern of speech development. This starts right from birth and goes through many subtle changes before speech is established. I have collected a good deal of material already but progress is very slow: good quality recording in domestic surroundings is not easy anyway, and where the principal part is taken by an unpredictable baby or toddler, it can be very difficult to get suitable results. So, if anyone is interested I shall be pleased to give them more details, send some tape and cover any postal expenses.

Yours faithfully

* * *

. . . about parabolas and Fi-Cords

From:—Ralph E. Gough, General Manager, Fi-Cord Limited, 40a Dover Street, London, W.1.

Dear Sir:—We are repeatedly being asked by Fi-Cord users to advise them where they can obtain a parabolic reflector to use with their Fi-Cord recorders. We, ourselves, have been unable to discover any manufacturer of reflectors and would be interested to learn from any of your readers whether they are able to recommend a manufacturer of a portable reflector suitable for use with the Fi-Cord.

Yours faithfully,

Can any readers be of assistance? We have been going into this question with John Kirby, *compère* of the BBC's "Sound" programme and he recommended the Elland Metal Spinning Company, South Lane, Elland, Yorkshire. Unfortunately they do not produce a complete reflector ready for use, but only spin the parabola.

* * *

. . . tape record players

From:—A R.A.F. reader, Morpeth, Northumberland.

Dear Sir:—Your March Editorial has prompted me to claim a case for the "tape machine" as simple a successor to the gramophone. There must be many others like myself who use a tape recorder as a recorder, but feel the need for a "tape player" for a specific purpose, for example in a car. There, a gramophone is unsuitable, and with a radio one is subject to, or should it be, at the mercy of the BBC's programme planners? The pleasure of having one's own choice of music as a background to motoring is easily imagined.

Unfortunately available battery operated recorders are very expensive and/or have spools that are too small to avoid frequent repetition. I visualise a transistorised machine using its own batteries (picnics too?). It would have two playing heads and play in both directions, but have no record or erase facilities. Even rewind might

(continued on page 253)

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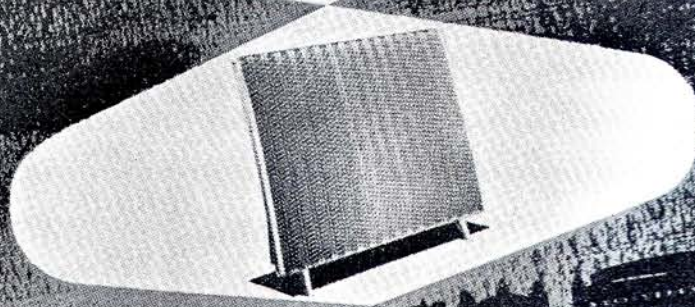
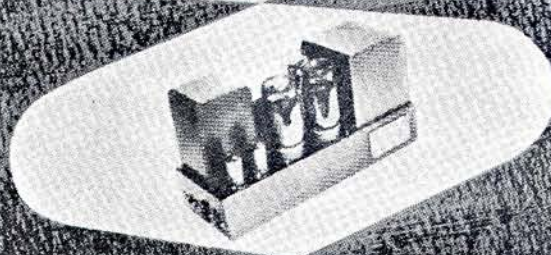


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READERS' LETTERS—(continued)

not be essential. There would only be two controls, easily recognisable, and suitable for operation by feel alone. One an on/off/volume control, the other a manual direction of play control which would save the complication of automatics. The size would be little greater than, say, the Clarion, but with four- or even five-inch spools. A small loudspeaker and playing speed of $3\frac{1}{2}$ i/s would be acceptable for "pop" music. In any case it is doubtful if "hi-fi" could be appreciated whilst competing with the noise in the average motor car.

I should be grateful for your comments on this idea, and for any suggestions as to where, as I am considering assembling such a machine, I might obtain suitable components. *Yours faithfully*

We have received a number of letters which suggest that a battery-operated playback-only tape machine would prove extremely popular for car use, picnics, etc. How about it manufacturers?

... about tape in Malta

From:—Thomas Galeo, 10 Psaila Street, B'Kara, Malta, G.C.

Dear Sir:—I am very keen on science and what not, and about six months ago I bought a new British Ferrograph tape recorder. In all these six months I've always recorded music with, every now and then, a joke or a short play.

I wish now to use my recorder much more widely: thus developing a very interesting, educational and mind-easing hobby. In Malta there aren't any clubs for tape recorder owners, or if there exists its only one; so I wish to enroll into some such club in England. I would be more than obliged if any readers could help me in this matter. *Yours sincerely,*

P.S. Could you please give me at least one name of an "Inventors' Club" if such a club exists in England?

... about useful hints

From:—A. E. Jordan, "Highfield", Duke Street, Settle, Yorkshire.

Dear Sir:—I hope the following ideas will prove useful to all tape enthusiasts. Experience may have shown that the piano is one of the most difficult instruments to record. Even on expensive recorders, playback sounds muffled; however, this can be overcome by doing the following.

Using a suitable recorder (my own) Grundig TK20, etc., you record through the Mic. in the usual way, but instead of pressing the Mic. input button, press all three:—Mike, P/U, and Diode. Playback normally, and you will be surprised at the difference. Every note can now be heard clearly.

Some tape recorder owners, such as myself, are unfortunate enough to have no superimpose button on their deck, this too can be overcome by placing a strip of anything smooth, such as stiff card, etc., in front of the erase head when recording over pre-recorded tape, thus preventing the first recording from being erased. The results are similar to those produced on any recorder equipped for superimposing. *Yours faithfully,*

Thank you for your suggestions. We are a little mystified by the piano recording hint, and feel sure that results will be disastrous on some machines.

... about learning French by tape

From:—Robert Cooper, 28 Silverdale Road, Bushey, Herts.

Dear Sir:—When in Paris last week, my friends Suzanne and René, both retired from teaching, asked me whether they could be of service to those who are interested in their language in this country.

After discussing ways and means, we came to the conclusion that it would be more practical if I made their kind offer known to as many Tape recorder enthusiasts as possible and also tell them that they should specify what text they wish to have recorded. I know that our friends are willing to oblige, on the other hand, one would hesitate to put them to great inconvenience and especially expense. I would therefore suggest that, before they are approached, people interested should write

to me joining a self-addressed stamped envelope and tell me what text, story, etc., they wish to have. We can then decide the best course to adopt. *Yours sincerely,*

... about a Hong Kong recorder

From:—Cpl. D. Garbutt, c/o 20 Indep. Recce Flt., Army Air Corps, Sha-Tin, N-T, Kowloon, Hong Kong.

Dear Sir:—Being a reader and a stereo ham I would like to thank you for a magazine that has helped me a great deal, but being abroad does not give me the scope and news I require. I have a Stereo/Monaural tape recorder, which I think would be of interest to your readers. It is an Akai. Specifications are as follows: Frequency Response: 30-15,000 c/s at $7\frac{1}{2}$ i/s; S/N ratio: more than 50 dB; Usual 3 speeds; Stereo (in line) and monaural double track system; NARTB curve; wow and flutter is under 0.2 %, Total; it has, of course, a half side playback and recorder unit separate.

I would like to join a Club with interests in this sphere of sound. Thanking you again for your magazine, which I get every month. I remain, *yours sincerely,*

... about tape threading

From:—D. L. Cockayne, 49, Liniol Road, Walsall, Staffs.

Dear Sir:—I was interested to hear how Wm. A. C. C. Smith overcomes tape threading problems. I do not thread any tape at all; this may seem hard but I find it easy. The secret is that there is now available double-sided sticky cellulose tape, and I simply fit a piece around the spool hub. This method is very useful when speed is essential as the tape has only to be pressed on. *Yours faithfully,*

... about exchanging tapes

From:—Mrs. M. E. Waterfall, 11 Sussex Road, Petersfield, Hants.

Dear Sir:—In reply to H. W. G. of Parracombe (in the May issue) my husband and I have regularly exchanged tapes without any trouble at all. He is at sea on a tanker and has a Stuzzi-Magnette with him—I have a Grundig TK25 at home. We use the 3 in. and $3\frac{1}{2}$ in. spools and send them to and from the Continent, the Persian Gulf and Australia.

The only difficulty is the postage cost which is 7s. 6d. or 9s. to Australia by air—usually more than the tape costs in the first place. On the Customs declaration label we always add the words "family affairs only", but that probably only eases our minds and does not influence the Customs in the least.

We have found exchanging tapes a wonderful way of keeping in touch, and hope that H. W. G. will find as much pleasure himself. *Yours faithfully,*

... Irish pals in South Africa

From:—G. P. Kelly, 51 de Beers Terrace, Kimberley, C. P. South Africa.

Dear Sir:—A tape pal of mine in England has just sent me a complimentary copy of your very fine magazine. I have found your magazine to be everything that my friend has told me, on



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READERS' LETTERS—(continued)

previous tapes. Here in Kimberley, well for that matter in South Africa itself there are no magazines set aside for Tape Recording, and I notice that the B.B.C. has programmes set for the Tape Recording fan, well I can't say as much for our South African Broadcasting Corporation.

I am the South African Rep., for the Irish Tape Pals Association, with its headquarters in Limerick, Ireland, and organised by Eddie O'Niell, and to help me there is a chap in Cape Town, Jan. A. de Villiers, who looks after the Cape area of South Africa, and we have quite a number of members who form the South African group, and continually I am receiving enquiries of the Irish Tape Pals Association, and its aims and objects.

Yours tapefully.

... about taking up Cine

Since the commencement of our current Tape and Cine series of articles, we have received a great many letters on the general subject of Home Movies. A frequent question from newcomers to Cine relates to the film size, 8 millimetres, or 16 millimetres. Accordingly we have asked one of our contributors to give an omnibus reply, and this appears below.

IF you are among the many hundreds of potential cine enthusiasts who are planning to take up this new and exciting hobby in the coming Summer months, you are more than likely asking yourself the dozen-and-one questions about the equipment you should buy. There is, however, one vital point that should be settled before anything else is considered; and the object of this article is to present all the facts, fairly and squarely, to enable you to make that decision. It is simply this: "What size? 16 mm. or 8 mm.?"

The writer was rather shocked, recently, to notice this all-important question dismissed in a sentence of about 50 words; for the surrounding informative material spoke almost entirely about 8 mm. cine, inviting the inference (however unintentionally) that the choice of equipment lay between the available types of 8 mm. This, of course, is very far from the truth; and though the cost of an 8 mm. outfit is far less than that of a 16 mm. outfit, the eventual cost could be considerably higher if the newcomer found—much too late—that he had bought unwisely in the first place. The amount of the initial outlay, and the cost of films, is naturally very important; but the potential purchaser is the one to decide what he can afford, in terms of what he wants—not the manufacturer of the most popular products. So, leaving the question of relative costs till the end, here are the facts.

There is no basis of comparison whatsoever between changing from one size of *still* photography to another, and changing from one size of *cine* to another. In case some readers have had no previous experience in photography, and plan to start right in with cine, this statement should be clarified. You may buy a sub-miniature camera (*Minox*) which takes a picture of 8 × 11 mm., or a miniature (*Contax*) with picture size approximately 25 × 37 mm. or one of the many standard "120" models with picture size 3½ × 2½ inches. You may change from one camera whenever you like, and all your previous pictures remain with you for ever. You can have new prints made at any time. But with cine photography, all your work with 16 mm. film, or with 8 mm. film, is useless if you change—unless you are prepared for the alternative of keeping and using two separate projectors. And do not forget that the earlier pictures you take are likely to be the ones that will be treasured most, if they are family pictures.

Your requirements

The deciding factor, apart from cost, is the job to be done with the equipment. If you want cine to provide you with a "living photo album"—a record of the family, or friends, pets, or life about the house, seaside and picnic parties—of close, intimate shots, etc.; and if you intend to show these pictures in average-sized rooms, with a picture size of about 3 feet wide; and if you have no further ambitions, then without any doubts or second thoughts buy 8 mm.

If your ideas of moving pictures include scenery—distant and detailed subjects—or if you have any ambition for doing serious work—or if you are thinking in terms of making sound films of really good quality—then you have no choice. You must buy 16 mm.

Since these are drastic statements, qualification is essential. First, consider "Definition". All photography is based upon the fact that

certain chemicals are affected by light, and will register changes when light falls upon them. These chemicals are spread in the form of an "emulsion"—on an acetate base, for negatives and reversal transparencies—on paper for prints. Today, with highly advanced manufacturing techniques, these chemicals are produced of microscopically small particles—but they are particles, none the less, and if you magnify them sufficiently you can see them; and magnification, or "enlargement", is the begin-all and end-all of cine photography.

The grain

You do not notice "the grain" of the chemicals in photographic prints, because the average print rarely exceeds x2 enlargement. But when sub-miniature cameras are used, an enlargement of x10 or 15 is necessary for a convenient print, and special "fine grain" films must be used, or the grain begins to show. A strand of your child's hair might be registered on many tiny chemical grains in a negative measuring $3\frac{1}{2} \times 2\frac{1}{2}$ inches; but on a miniature negative the same strand of hair would be focused down on to far fewer grains. If you enlarged to the same size from the two negatives, the larger negative would obviously yield better detail, because there would be more available particles (fragments of grain) to carry it. If you enlarge any picture to the extent at which the grain begins to show, you are breaking up the "lattice-work" into dots and gaps—and there can be no detail where there is none to enlarge.

Translate all the above into everyday, understandable cine film sizes, and you will appreciate its limitations. The approximate area of a single 8 mm. "frame," or picture, is 17 square millimetres. The area of a 16 mm. frame is about 78 square millimetres—i.e., about $4\frac{1}{2}$ times the area available on 8 mm. This means, on the one hand, that you must enlarge on 8 mm. film $4\frac{1}{2}$ times as much as a 16 mm. film in order to get the same picture size on the screen. On the other hand, it means that an 8 mm. film has to be asked to register the same wealth of detail as a 16 mm. film which has $4\frac{1}{2}$ times the area to accommodate the same picture when filming. And, as already explained, it cannot do it.

Distant scenery, really fine detail, etc., are beyond the limitations of 8 mm. cine. If they are required, the answer is 16 mm. cine. There must be no hedging on this point. But, equally fairly, if, only everyday moving snapshots are the aim, on a par with good, ordinary everyday still pictures, in black-and-white or colour, then 16 mm. cine could be a waste of the extra money it involves.

In terms of quality of sound, 16 mm. film running at a filmed speed of 24 frames per second is about the same speed as the tape recorder's $7\frac{1}{2}$ i/s. Comparably, 8 mm. film running at 24 f.p.s. is at about the same speed as the tape recorder's $3\frac{1}{2}$ i/s.

The question of cost

Now for cost. 8 mm. cameras, with single lens, can be bought for as little as £18 new, or £10 good secondhand, and projectors for about £25 new, and £20 good secondhand. In the top flight, cameras with three lenses cost about £180, plus projector for magnetic sound, about £160. Total £340. 25 ft. double run spools of colour film, running time at silent speed, 4 mins. 10 secs., price £1 5s. 5d. (inclusive of processing).

New 16 mm. cameras, single lens, from about £80 new, or £35 good secondhand. Projectors cost from £52 new, to £30 good secondhand. In the top flight, camera with three lenses, £300. Projectors for optical and magnetic sound, with recording facilities, £350. Total £650. 100 ft. spools of colour film (running time at silent speed 4 mins. 10 secs.) price £3 12s. 10d. (including processing).

The above prices are approximate, but fair. It will be seen that cine costs about twice as much to instal in its 16 mm. version as in 8 mm., and the films cost nearly three times as much to buy in the larger size. However, the top flight equipment listed in the 16 mm. class is that which is used professionally for industrial work and much TV.

This is by no means intended as a summary in favour of 16 mm. The writer is quite unbiased. He contemplated 8 mm., but decided that he would eventually change to the larger gauge, and so bought a 16 mm. outfit. Those who expect to end up with 16 mm. can begin with a modestly priced 16 mm. camera, and go up the price ladder later! Those who know that 8 mm. will do all they want will be very happy indeed with the truly beautiful colour that is available, and the very adequate domestic quality sound, for commentary and musical background, that a good tape recorder can add for them.

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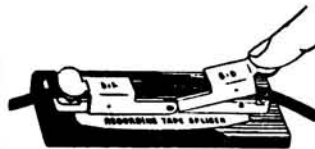
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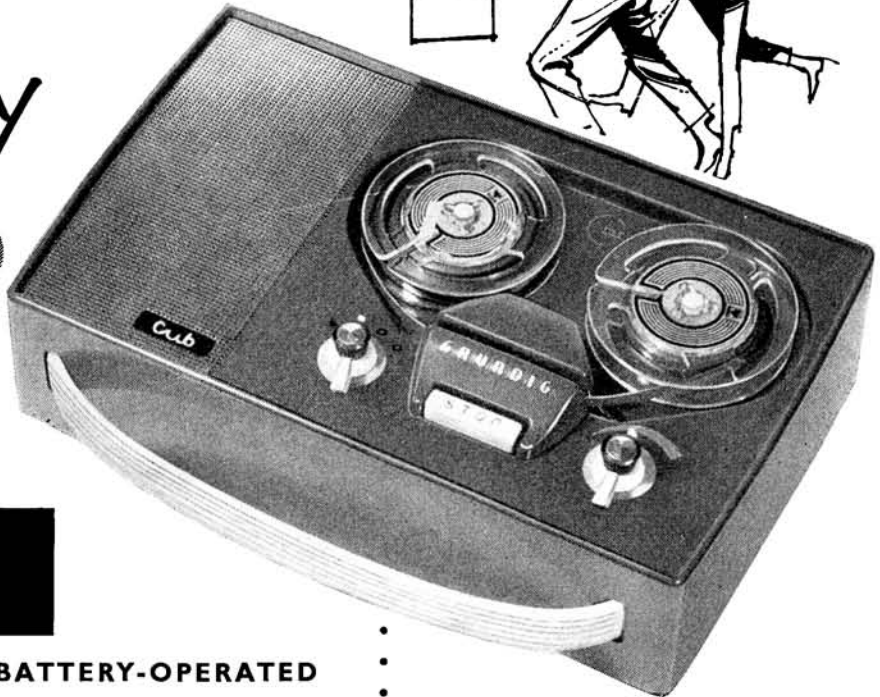
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