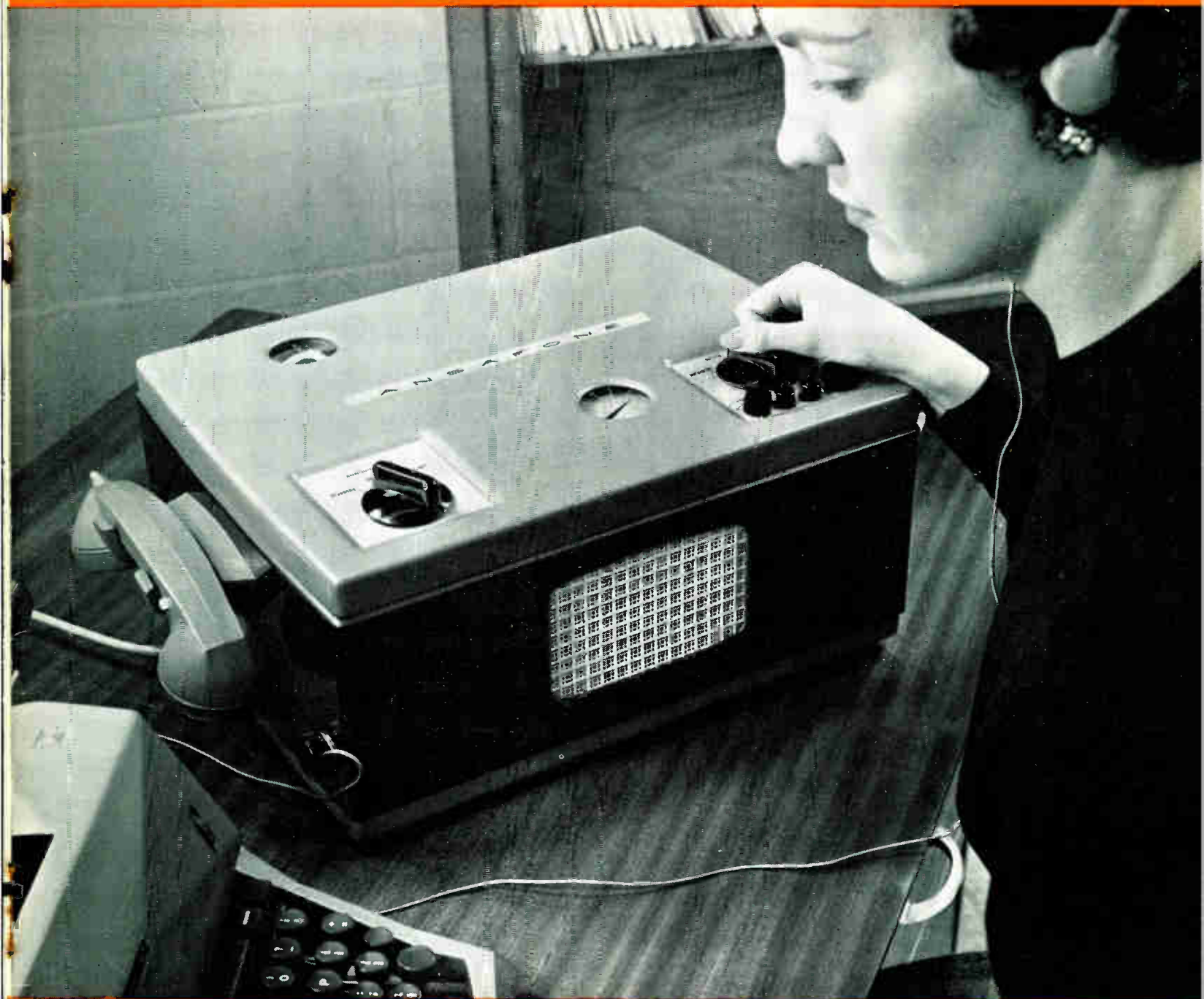


the TAPE RECORDER

PRICE 1/6

OCTOBER 1960
Vol. 2 No. 9

INCORPORATING "SOUND AND CINE"



IN THIS NUMBER

- Radio Show Report
- Building a High Quality Transistorised Mixer/Pre-amplifier
- 4 Track Tape Recording—"Profit and Loss" Account
- Tape Recorder Workbench
- A Custom-Built Stereo Recorder, Part 2
- Equipment Reviews
- News and Pictures from Here, There and Everywhere
- Teaching Tape—a Special Series for Beginners



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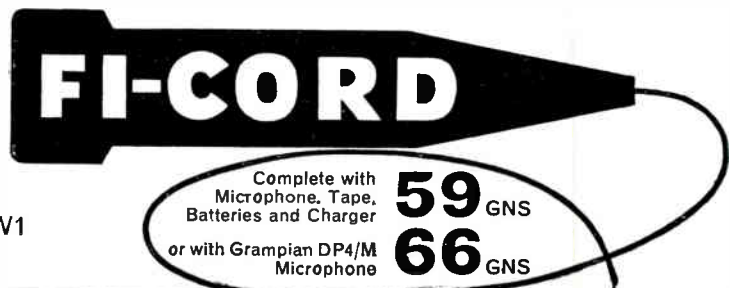
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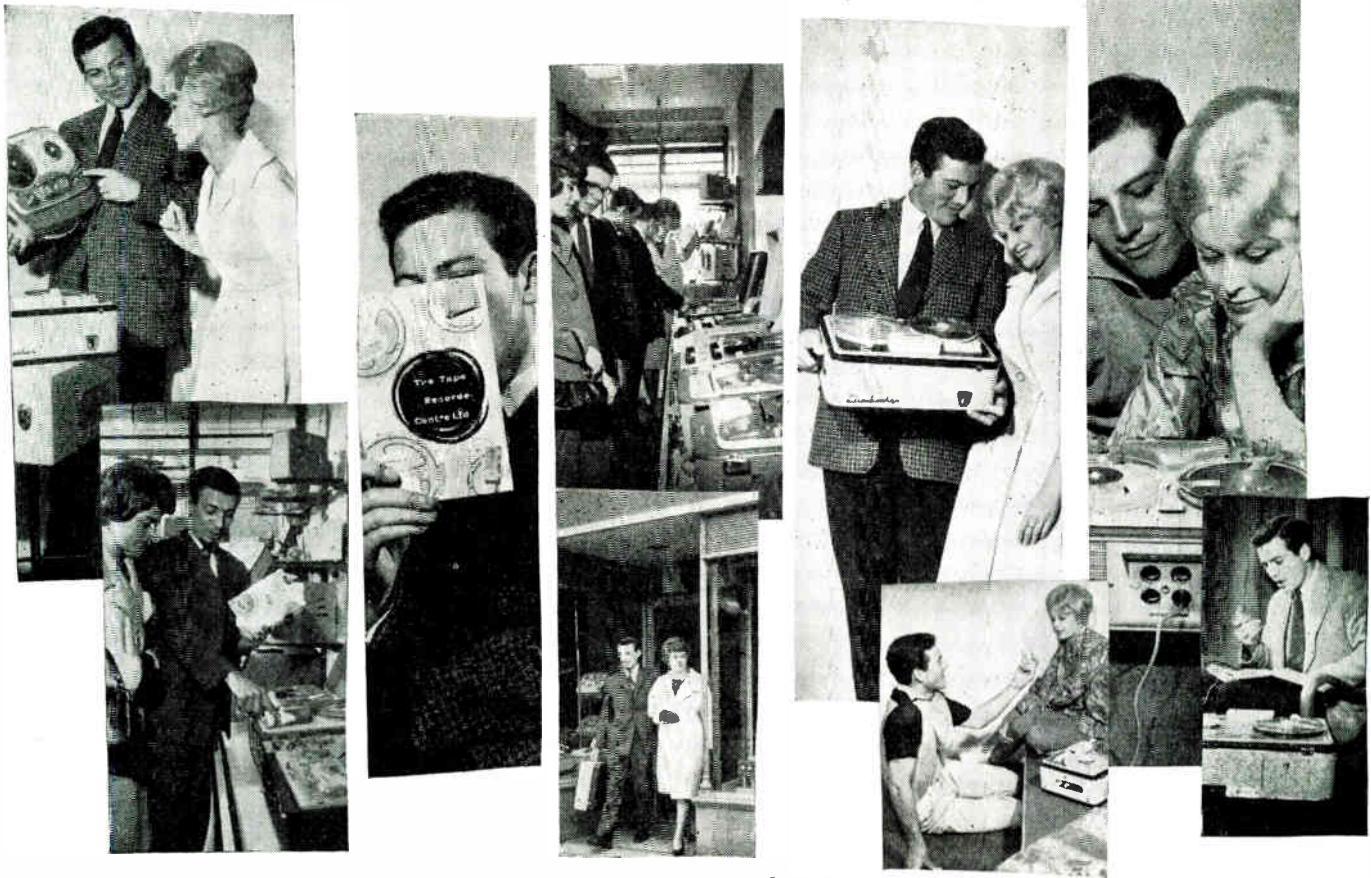
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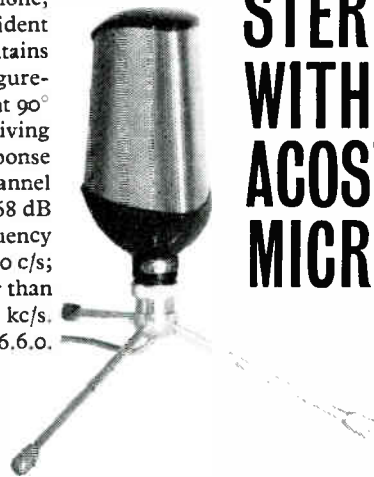
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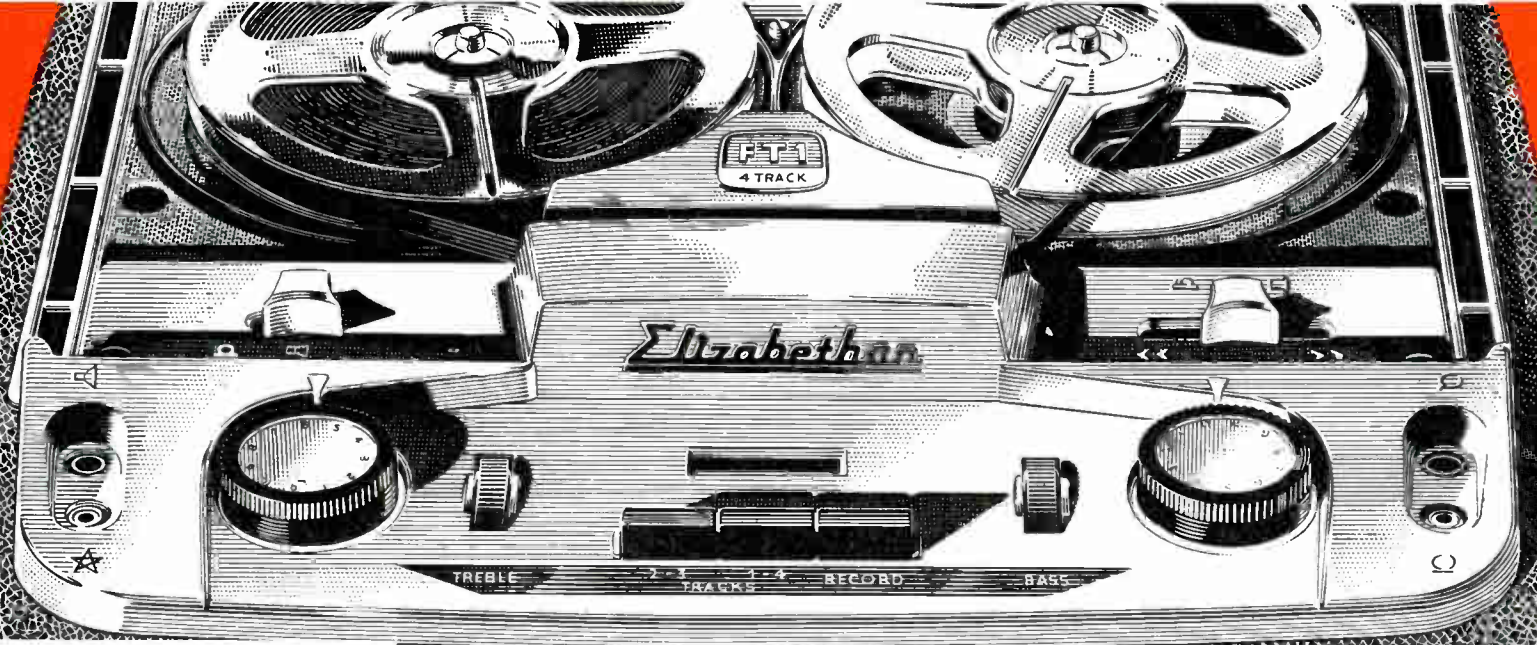
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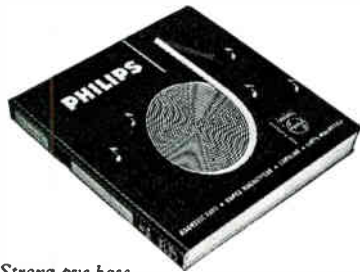
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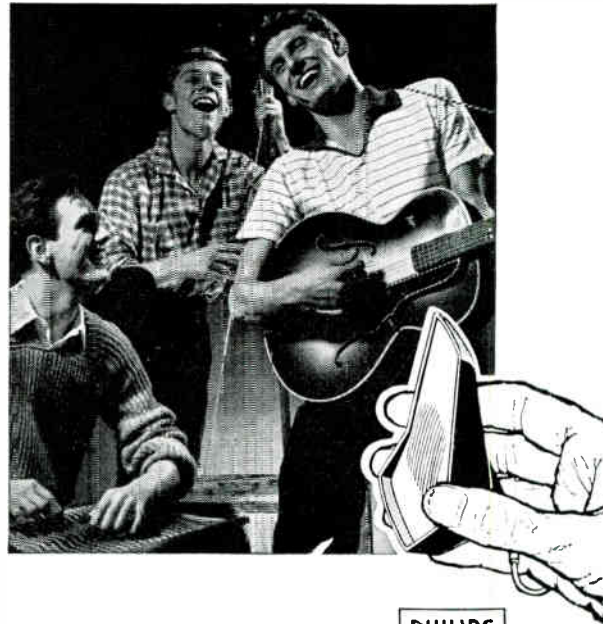
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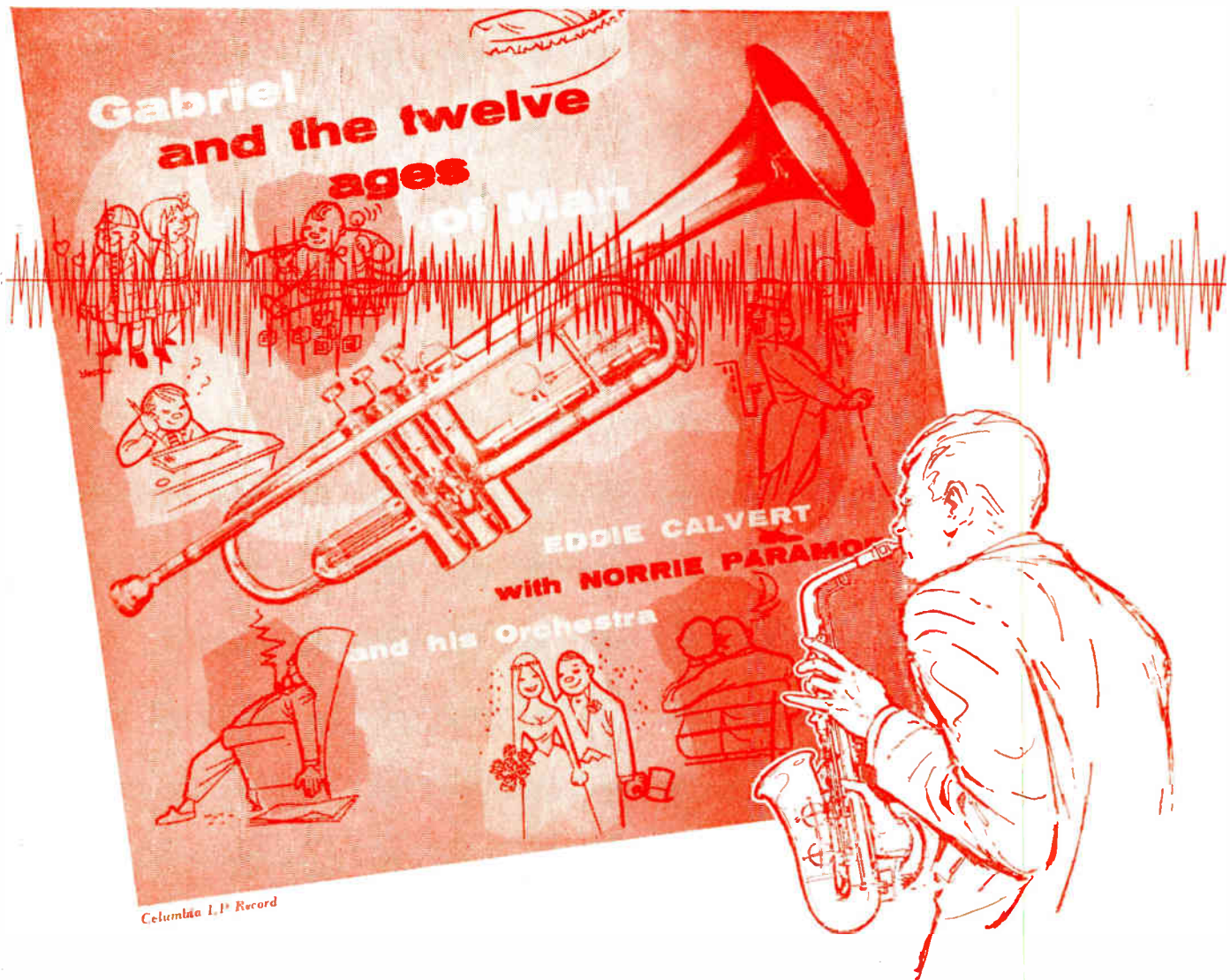


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ES/1/68

the TAPE RECORDER

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EDITORIAL

DEVELOPMENTS in the world of tape and tape recorders remind us of that very clever and popular series of *Shell* advertisements, with the speaker looking both ways, and with wording to the effect of: "This will be good, wasn't it". Things are happening so fast that they are *fait accompli*, and almost past history, while one is still discussing their future. These remarks apply particularly to four-track tapes and recorders. One year and three months ago, while a member of our editorial staff was on holiday in Germany, he sent us a news hand-out from Telefunken which described that Company's latest development—a four-track system for domestic tape recorders. Today, counting swiftly and probably inaccurately on the fingers, there are a dozen British-made four-track recorders in production. At least six months ago, the *Ampex* Corporation of America formed its new subsidiary company, U.S.T. (United Stereo Tapes) and, as we reported some time ago in this magazine, successfully tied up some of the world's best disc label titles for release on tape—at four tracks and a speed of 7½ i/s.

On another page in this number of *The Tape Recorder*, James Moir discusses four-tracks under the heading of "Profit and Loss", and inevitably the editorial content of the magazine will be dealing with the subject more frequently and at length. In the meantime, however, we can use the remainder of this column more usefully by concentrating upon those three magical American initials—U.S.T.—and by speculating, first, upon the possible reasons for their non-appearance over here, and (second) upon the apparently disinterested attitude of the Record Companies towards tape records in general. It was September 1959 that we retold the story about the ostriches in this column and on this very same subject. Perhaps, after twelve months of "nothing doing", fishermen readers will prefer to think in terms of trout and flies. No one really knows why a trout leaps out of the water after a fly, when his basic rations are far more solid and fishy. Some say he does it for fun: others maintain that he regards the fly as a delicacy—something to fill in the odd half hour and the odd corner of his tummy. Be that as it may, neither the spotted brown disc Trout, or the rainbow disc Trout of this country has yet condescended to rise to the tape fly that has been dangled so invitingly above their noses—although we know from what we read that disc sales are not all that they ought to be. Why, then, no tape records?

Could it be, perhaps, that we are going to be given four-track tapes, as and when the time is considered to be ripe? Could it be that, great as the present market appears to be, the holders of the big music catalogues are deliberately overlooking it, pending the four-track day?

CONTENTS

	Page
Teaching Tape	
(5) Microphone Balance	
By I. W. Jarman	437
Here, There and Everywhere	
Six pages of pictures and news	438
High Quality Transistorised Mixer Unit	
By N. W. Bridge	445
Tape at the 1960 Radio Show	
A report in words, photos, and cartoons	448
A Custom Built Stereo Tape Recorder	
(2) The Circuitry	
By A. G. Watling	450
Four Track Recording	
A Profit-and-Loss Account	
By James Moir	453
Readers' Problems	455
Tape Recoil	
By Stanley Unwin	457
Tape Recorder Workbench	
(16) Building a mixer	
By A. Bartlett Still	459
Our Readers Write	461
Details of New Products	465
Equipment Reviewed	467
Classified Advertisements	472
Advertisers' Index	474

COVER PICTURE

WE have several times included stories on telephone answering devices, which rely on tape to deliver a pre-recorded "standard instruction", and in several cases even record short messages from callers. This month's cover picture shows a clever application of the Ansafone (see story on page 438) in which the typist transcribing some of the requests for loan renewals on books (up to 40 per day) telephoned into the St. Marylebone Central Library by borrowers.

NEXT MONTH

ALAN Watling gives the final details of his *Custom-Built Stereo Recorder*, next month, including the setting up procedure and how the whole equipment was fitted into a "Stag" dressing table. Also of interest to the technically-minded will be a home built tape deck, designed by one of our readers to operate with simple transistor circuitry of the kind described in the recent series of articles by A. Tutchings. The readers who prefer to use their tape recorders creatively, and are less interested in the technicalities, have not been forgotten, however, and in addition there will be a full coverage of news and pictures from the world of tape and all our regular features. As we continue to hear of people having difficulty in obtaining copies of "*The Tape Recorder*" we strongly advise the placing of a firm order with your dealer or newsagent.

The *Tape Recorder* November issue—on sale October 28th.

SUBSCRIPTION RATES

The subscription rate to *The Tape Recorder* is 21/- per annum (U.S.A. \$3.00) from The *Tape Recorder*, 99 Mortimer Street, London, W.1. Subscription+Index, 24/- (U.S.A. \$3.25).

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TEACHING TAPE

A SPECIAL SERIES FOR BEGINNERS

By I. W. JARMAN

PART 5—MICROPHONE BALANCE

IN the previous article, I dealt with the various types of microphone available and the the problems of balancing the microphone to obtain the most realistic reproduction of the original sound.

It was pointed out that one of the major problems of balance is obtaining the correct ratio of direct (the sound which travels straight from the sound source to the microphone) to the indirect (the reflected sound which reaches the microphone by various paths). I explained that these reflected sounds may well be distorted, certain frequencies having been absorbed to some degree by furnishings, etc. The frequencies so affected are mainly those above 500 c/s.

Since the room in which the amateur will be making his recording is likely to be the lounge at home, we can assume that a certain amount of high frequency "damping" will take place because of the curtains, carpets and armchairs or settee, possibly resulting in a muffled sound. To achieve a faithful reproduction of the original sound, it is necessary to ensure that all frequencies are equally affected as far as damping goes.

Low frequency (bass) absorption

The absorption of bass notes can be achieved by using either resonators or resonant panels. The most common example of a resonator is an empty bottle—by blowing across the mouth of which, vibrations are set up and a note is produced, the frequency of which will depend on the volume of the bottle. If the bottle is filled with absorbent material then the sound produced will quickly die away.

The absorbent panels, which may be of hardboard or plywood, will also resonate, the vibrations being damped out by heavy absorbent material behind the panel. A disadvantage of this type of absorber is that although it will damp out the particular frequency for which it is designed, it may leave other frequencies unabsorbed.

Somewhat similar is the membrane absorber which is in the form of a shallow box, inside which is absorbent material (e.g. glass wool)—one end of the box being covered with roofing felt protected by perforated or slotted hardboard. As with resonators, the size of the membrane absorber will determine the frequency to be damped. In order to achieve any substantial bass damping many resonators (or other forms of treatment) must be used affecting different frequencies. Multi-resonators in the form of special tiles, drilled or slotted, are the most usual forms of bass absorption.

Before moving on to talk about microphone balance, it is necessary to point out that the acoustical treatment of a room to control the sound reflections (reverberation) is not the same as insulating a room against external sound. Sound absorbing materials may help in insulation of a room, but for complete insulation thick laminated walls or double walls with an air gap between them are necessary.

Microphone balance

The exact position in which to place the microphone depends, of course, on the acoustics of the room and therefore although the positions recommended may be satisfactory for most occasions, on others it will be necessary to experiment to determine the most suitable position.

Speech balance: Generally speaking, the person to be recorded should be between one and two feet from the microphone and should talk directly to it. If the speaker is excessively sibilant, this can be partially overcome by slightly tilting the microphone. The microphone should, of course, be kept well away from the recorder to avoid picking up motor noise and should



In this B.B.C. studio discussion the microphone (a condenser cardioid) is suspended so as to avoid table-bumping, pick up all speakers equally, and not obscure vision. The table surface is perforated to prevent reflections. (B.B.C. Photo)

never be used on the same table as the recorder, since any vibrations of this may be picked up by the microphone.

Piano balance: The main problem when balancing a piano is to achieve a reasonable balance between the treble and the bass notes which, of course, carry more power than the treble. It follows, therefore, that the microphone should be positioned near the treble end of the piano, suspended slightly above the level of the strings (tilted towards them) and not placed on the piano since the vibrations, in the form of an annoying "thumping" noise, may be picked up by the microphone.

Generally speaking, when balancing an upright piano, the best position for the microphone will be just to the right of the pianist and about 5 ft. above the floor, the microphone tilted towards the strings. In the case of the grand piano, the best position will usually be found about two to three feet out from the centre of the curve on the right hand side. As in the case of the upright piano, the height of the microphone should be about five feet and it should be tilted towards the strings.

Trial and error

Variations around these positions will, of course, be necessary in some cases, depending on the acoustics of the room in which the recording is made. You may find it worthwhile experimenting with other positions also—I have heard of a good piano balance being achieved by placing the microphone under the piano, the reflected sound being recorded.

If you intend doing any experimentation, you should keep a note of the various positions, i.e. make a rough drawing of the piano and mark the positions around it. Identify each recording as its made, e.g. "Position 3, mic. 5 ft. high". Having made a number of recordings, play them back and compare them.

Vocalist with piano accompaniment: To record a vocalist with piano or any other instrumental accompaniment using only a single microphone, you will probably find that the bi-directional, ribbon type is best. The vocalist, of course, will be on one side and the instrumental backing on the other. One of the most important things to remember is that the accompaniment should be sufficiently soft to enable the vocalist to perform naturally and not have to shout to be heard above the instruments.

The vocalist should be about eighteen inches from the microphone and the piano about five feet or so. In the case of a crooning technique, where the sound produced by the vocalist is of low volume, the microphone will need to be much closer.

(To be continued next month)

HERE AND THERE AND



Tape helps the Marylebone Library

“THE Ansafone is an instrument for answering an unattended telephone—it is a piece of simple automation and can maintain a telephone service without human aid”. That is the claim by the manufacturers of the Ansafone, and after seeing one of these machines in operation at St. Marylebone Central Library we feel that this claim is completely justified.

It was found at this library that valuable time was lost answering telephone calls. It meant that a Librarian must interrupt the work he was attending to and answer the phone. Mr. Guy, Head Librarian and his assistant Mr Larksworthy discussed the problem and after contacting several large organisations found that there was a machine that would cut down waiting time by answering phone calls automatically, known as the Ansafone. It is done in the following way. On an incoming call the bell is allowed to ring for 10 seconds, at the end of which the instrument answers with a recorded message of approximately 14 seconds duration. (This announcement cannot be varied by the owner or user of the instrument except by application to the manufacturers.) When this message has been relayed the caller may record the details required. The total recording time available is 60 minutes made up of one or more messages and a full 3 minutes recording time is always guaranteed. If the caller should speak for the full sixty minutes, towards the end of this period a pre-recorded announcement will advise them that the instrument is about to disconnect itself from the line. If less than three minutes is available on the tape the machine will not answer and the bell will keep ringing. If the caller should stop speaking for a period which exceeds 10 seconds, a pre-recorded announcement of termination is made at the end of which the machine disconnects itself and is then ready to receive further calls. Although the instrument is always connected to the phone, calls can be made or received in the usual way. The recording level is controlled automatically to compensate for the good and bad lines and soft and loud speech.

This system was ideal for the library. It allowed people wishing to retain their books for a further period to phone, record their book number and the date issued and save them the trouble of travelling to the library.

Underwater music on tape

YE Olde Fellbridge Hotel, East Grinstead, Sussex, recently became the first hotel in Europe to have a solar heated swimming pool. Called the Bahamas Pool, it provides salt water bathing at temperatures from 10 to 20 degrees above normal.

The pool is also the first to incorporate underwater music, which comes from a specially designed loudspeaker linked to a general sound system for background music, on the Reditune endless tape principle. The underwater music is part of a very comprehensive and flexible system supplied and installed by Magneta (B.V.C.) Ltd. This incorporates a 50 watt amplifier serving twenty-four speakers, which are operated on eight circuits to distribute sound in other parts of the hotel. The sound system enables VHF interference-free radio and continuous recorder music to be broadcast and a calling and paging service operates from the same instrument with provision for microphone announcements to take priority on all circuits.

Electronic Stethoscope

A novel scientific use of a tape recorder has been found by a doctor engaged in investigating the noises which can be heard in the heads of patients suffering from certain forms of neurosis by means of Soniscope electronic stethoscope. It was necessary to record these noises for further hearing by other doctors, and the only instrument for this purpose was a tape recorder. With the assistance of E.M.I.'s miniature dictating machine—the Minifon Attaché—a suitable attenuator circuit was assembled for connecting the stethoscope to the recorder. The interesting experiments were featured in a paper read at the recently held Third International Conference on Medical Electronics at Olympia.

Ampex distributors name change

THE name of the company marketing Ampex Professional recording equipment in the United Kingdom has been changed from the Redwood City Engineering Ltd., to Ampex Great Britain Ltd. They will continue to perform the sales, service and liaison functions previously carried out by Redwood City Engineering Ltd. Offices of the renamed firm, a subsidiary of Ampex International S. A. Fribourg, Switzerland are adjacent to Ampex Electronic Ltd., Reading, Berks.



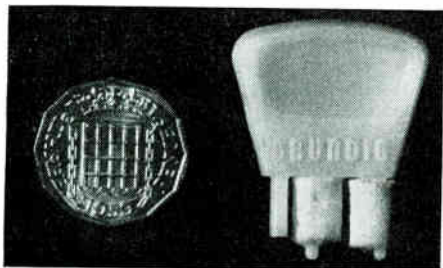
Al Burnett and Ann Austin of the Pigalle Club in London took their Grundig "Cub" battery recorder to London Airport to greet American cabaret star Steve Rossi (left) who is here to perform at the Club.

EVERYWHERE

Londoner Wins Emitape Silver Challenge Cup

THE Emitape Silver Challenge Cup for the Tape of the year, entered in the Competition Section of the 1960 British Amateur Tape Recording Contest organised by the *Tape Recording and Hi-Fi Magazine*, has been won by Mr. N. Paul of London for his 15 minute tape entitled "The Rest is Silence." Club section winner was Mr. C. J. Garrett of Tonbridge, for his tape entitled "Ban the Phon" and the School Section award went to Mr. P. J. Kingston of the Stanground V.C. Primary School, Peterborough, for their tape entitled "Our School."

Mr. Paul's winning tape, described the tense drama of a condemned man's last hours before going to the gallows. It was made with members of an amateur dramatic group in Muswell Hill. Beside the Emitape Cup, Mr. Paul also won a Truvox R6 Tape Recorder presented by the manufacturers together with a cheque for £10 and a certificate presented by the magazine sponsoring the competition.



The "Grunbug"??

A tape-cleaning attachment is now supplied with the Grundig TK24 4-track recorder (see photo). This plastic

attachment has three prongs, two fitted with felt pads round which the tape travels to remove dust and other foreign particles. It fits into three holes in the deck of the recorder.



A Fi-Cord reports the Show

WITH the experience of several year's foot-slogging around Radio Shows, Audio Fairs, and the rest, behind us, and the difficulty of note-taking while carrying cameras etc., we decided to give a try to the new Office Dictating system from Fi-Cord, described in these pages last month.

The 27 ounce Fi-Cord 101 was found to be ideal for verbal note-taking as we visited the various Stands and Demonstration Rooms. Instead of laboriously writing down the details of new products on show, or items of special interest, we simply spoke the information into the built-in microphone. Better still, we often persuaded the Exhibitors to record the story, but in all too many cases we found that they were so intrigued by this new midget machine that we had to reciprocate and give a demonstration ourselves!

This last aspect made it very necessary for us to make the fullest possible use of the *Wind On* and *Wind Back* facility—which is controlled by different degrees of pressure on a single control button—and the Digital Position Indicator was fairly whizzing round as we wound on to demonstrate, and returned to our previous setting for further note-taking. We relied on the Indicator entirely, and it never once let us down. Associated with this numerical indication is a useful accessory in the shape of a pad of Memo Cards. Using these, we were able to jot down brief notes of where exactly on the tape our most important items were recorded. Back at the office, transcribing of these notes on to a typewriter was plain sailing, and except for the softening of a few superlatives, which had somehow crept into the notes dictated by actual Radio Show exhibitors, we had the whole Exhibition taped. Our photograph shows John Borwick recording notes on the G.E.C. Periphonic loud-speaker system which is being explained by G.E.C.'s Dennis Humphriss. Information on the Fi-Cord 101 may be obtained by writing to Fi-Cord Ltd., 40a Doves Street, London, W.1.



Auditions were being held every afternoon at the "Boys and Girls Exhibition" at Olympia recently. The Leslie Paul trio were ready to play almost any number, and Olympic Sound Studio's sound engineers were on hand to record members of the audience. A panel of judges including such well-known people as Cliff Richard, his manager, Tito Burns, and the Editor of Disc, Gerald Marks. The prizes included a recording test with a well-known record company, a long week-end in Vienna for two, and a Stuzzi Magnette battery portable tape recorder.

NEWS AND PICTURES FROM THE



First "Trade" broadcasts ever

MR. G. S. TAYLOR, Chairman and Managing Director of Grundig (Great Britain), Ltd., is seen above recording an announcement opening a series of special radio programmes to the tape recorder trade. These programmes will be transmitted from Radio Luxembourg, commencing on September 23rd.

The Tape Recorder Centre in Central London

THE North London Showroom of the Tape Recorder Centre has long been known as one of the best places to visit when shopping for tape recorders and Hi-Fi equipment. Hundreds of different makes are always in stock and so conditions are ideal for inspecting and comparing various types before purchase. The staff are experts on their subject and can be relied upon to advise where necessary. We now learn that a new branch Showroom has been opened at **82 High Holborn, London, W.C.1. (Chancery 7401).**

P.S. Opened Monday—crowded Tuesday—raided Wednesday! The new Tape Recorder Centre Ltd. showroom had only just been stocked up with a display of hundreds of models and makes of tape recorders and Hi-Fi equipment. It was crowded



M.S.S. Calculator

THE M.S.S. Recording Co. Ltd., have produced this handy calculator for tape recorder enthusiasts. Printed with playing times for all grades of tape, reel size, and tape lengths at speeds of $1\frac{1}{2}$, $3\frac{1}{2}$, $7\frac{1}{2}$ and 15 i/s, and costing 2s. 6d., it is available from retailers stocking Mastertape.

out on Tuesday and aroused great interest from the public. Too much interest it seems, because at 3.15 a.m. on Wednesday morning the 7th September, two men drove up on a motor scooter outside the Tape Recorder Centre, smashed the plate glass with a dust-bin lid, grabbed a most valuable recorder and made off. The noise attracted the attention of a police officer but the raiders got away on their scooter.

MR. H. A. Spender would like to hear from anyone interested in forming a Russian Language Tape Club. It is hoped to record "Russian by Radio", which is transmitted by Radio Moscow; and also enlist the assistance of amateur dramatic groups to record plays and books which have been made available. Full details can be obtained from Mr. H. A. Spender, 169 Henry Prince Estate, Earlsfield, London, S.W.18. Typewritten letters or tapes at $3\frac{1}{2}$ i/s are requested as the Mr. Spender is partially blind and would experience difficulty reading handwriting.

AT the second meeting to be held at the St. Georges Hall, Pinner View, North Harrow, **The Harrow Tape Recording Club** enlisted three new members. The treasurer Mr. D. Fisher played back extracts from a varied selection of Fi-Cord recordings, ranging from an interview with West End buskers to a Norfolk Broads holiday tape. The next meeting will be held at the above hall on Thursday, 29th September at 7.30 p.m. More information will be supplied on request from the Secretary, Mrs. T. Fisher, 5 Gloucester Road, North Harrow, Middlesex.

MR. R. V. Huddleston, European Secretary of **Stereo International**, the organisation catering solely for stereo enthusiasts, would like to hear from any reader interested in this branch of recording. No membership charge is required and the only rule is that members must own a stereo recorder. Membership forms can be obtained from Mr. Huddleston, but any enquiries should be sent on tape and not in a letter.

Secretary: Mr. R. V. Huddleston, 33 London Road, Grantham, Lincolnshire.

AT a meeting held on the 19th August at the King's Head, Acton High Street, the **Acton and West London Recording Club** received a visit from Mr. Wells and his team from Cosmocord Ltd. The main point of interest was the new Acos "Stereo 44" microphone, which was stripped down showing the component parts. An impressive demonstration followed showing the capabilities of this microphone when used with a Brenell recorder and Tannoy speakers, and after this a discussion took place which allowed the members to split up into smaller groups to talk to Acos engineers. This enabled questions to be answered on various problems of microphone techniques. Several visitors from other clubs were present showing keen interest in the proceedings. Details of future meetings can be obtained from the Secretary, Mr. D. Wiseman, c/o 8 Woodhurst Road, Acton, London, W.3.

SEVERAL readers in the Taunton area are taking preliminary steps to form a tape recording club. If anyone is interested in this new venture they should contact Mr. R. V. Smith, 83 Priorswood Road, Taunton, Somerset.

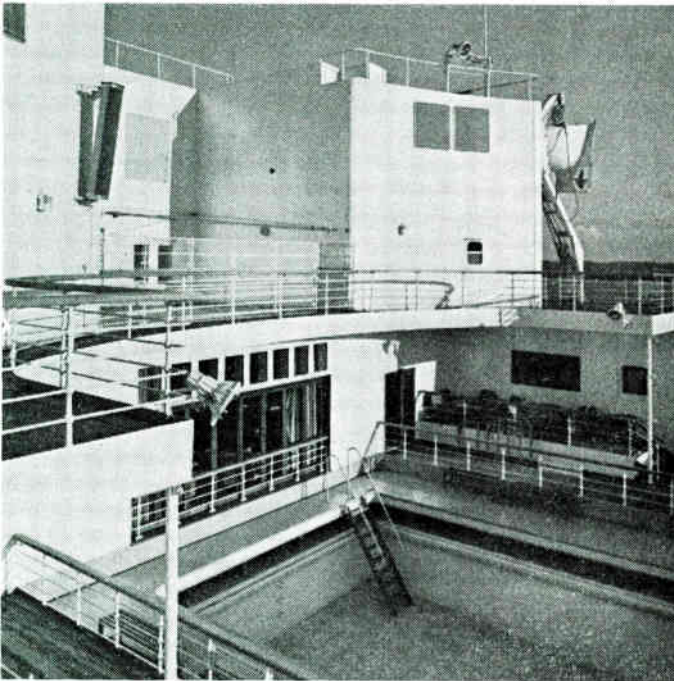
WORLD OF TAPE

ON the 16th August, Mr. House of Grundig (Great Britain) Ltd. visited the **Brighton Tape Recording Club** showing the range of tape recorders and accessories manufactured by his firm. At a later meeting the club was "at home" to the Eastbourne Tape Club, who provided an interesting evening's entertainment in the form of *Music Concrète* and interviews with holiday makers. New members will be welcome and information of future meetings can be obtained from the Secretary, Mr. R. Vivian, 37 Ditchling Road, Brighton.

Reflectograph playback machine

THE Reflectograph Model "D", which comprises the new professional Multimusic Tape Deck and specially-designed playback pre-amplifier, was shown for the first time to the public at this year's Radio Show at Earls Court. It is believed that the Model "D" is the first British professional machine which has been produced especially for making copies of tapes. It can be used for replaying tapes, when connected to a high-quality external amplifier. The stop and start facilities of the new Tape Deck makes this model particularly suitable for copying and editing. It will also permit copying half-track recordings for use on a quarter-track machine. Both the playback pre-amplifier and power pack are bolted to the main deck for standard rack mounting. The pre-amplifier comprises three stages—two voltage amplifying and a cathode output stage. There is no output gain control. The price of the Reflectograph Model "D" is 55 guineas, and supplies will be available during November of this year. Manufacturers: **Multimusic Ltd., Maylands Avenue, Hemel Hempstead, Herts.**

Sea-borne Hi-Fi



The "Windsor Castle" is the newest vessel in the Merchant Navy, and has tape and hi-fi equipment to match. The photograph shows one of the many column loudspeakers over the swimming pool. Stanley Kelly contributes an appraisal of the audio installation in this month's "Hi Fi News".

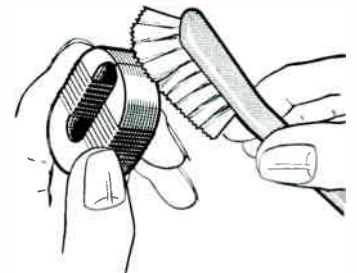


The Directors of Elizabethan (Tape Recorders) Ltd., entertained the Press in true Elizabethan style at the Gore Hotel, London recently. The party was held in the realistic Elizabethan setting of the hotel's "Star Chamber." As the guests entered they were requested by a bearded gentleman in full Elizabethan costume to sign the visitors book with a quill pen and then to start the afternoon with a drink of mead. Serving wenches waited upon them and Mr. Lubin, Mr. Larholt, and Mr. Newland-Smith demonstrated the fine range of 4-track recorders introduced at this year's Radio Show.

TAPE TIPS — by Guy

— No. 1 —

Keep the
Erase Head Clean!



ALL manufacturers stress that the heads on a tape recorder must be kept clean but many users do not realise quite how important this is. An erase head, for example, that is coated with the powdered tape coating will not erase properly. This is because the erase flux, due to the alternating erase currents fed into the coils of the head, is shorted through the oxide powder—leaving less demagnetising flux to wipe the unwanted recording from the tape. A soft brush such as a baby's tooth brush is the best cleaning instrument. In case of severe clogging the brush may be wetted with methylated spirit. Polish off with soft cotton cloth.

These tips are abstracted by permission from "How to get the Best out of your Tape Recorder" by Percival J. Guy. Norman Price (Publishers) Ltd. 1958. 8s. 6d. net.

NEWS AND PICTURES FROM



The display of "Hi-Fi News" and "The Tape Recorder" current issues attracted a great deal of attention at the Herbert & Lascelles 12th Exhibition in the Reading Town Halls. This year practically the whole of the smaller hall was devoted to tape recording equipment and accessories. Reading Cine and Tape Recording Society built and manned their own stand, giving an excellent demonstration of how tape recording can be used to add sound to slide projection. Demonstrations were given every hour, using a Paximat automatic projector controlled by a sync unit from a Telefunken Tape Recorder. One member printed an informative leaflet giving the history of the Society and full details of membership, etc. Anyone interested in obtaining a copy of this leaflet should forward a stamped addressed envelope to the Secretary who will be pleased to forward one, complete with full details of future meetings.

Affiliated to the Institute of Amateur Cinematographers, the club has already won several National contests with films produced by members. They are also proud of the fact that they were the first Club in the country to recognise the importance of linking tape with cine. In the past year the membership has trebled.

The equipment on the Society's stand was very impressive, including a home-made bulk eraser, twin turntables with groove selectors, mixers, titling equipment and a parabolic sound reflector mounted on a tripod. This last piece of equipment was built after reading the articles in "The Tape Recorder".

Secretary: D. M. Noyes, 4, Froxfield Avenue, Reading, Berks.

The Coventry Tape Recording Club have received another piece of equipment for the use of members. This comprises a tape deck and pre-amplifier for dubbing purposes. A robust cabinet will allow members to transport this machine to their own home without damage. Future meetings will be held on 29th September and the 13th October. Visitors will be welcomed and further details will be supplied on request from the Secretary, Mr. R. Reynolds, 1 Thurlestone Road, Coventry.

Visiting Whipsnade Zoo to record sound effects provided members of the West Middlesex Tape Recording Club with the opportunity of testing their portable equipment. However it

appears that very few sounds were recorded due to the poor co-operation of the animals. Nevertheless three portables were used and the results were played back at a later meeting when it was decided to produce a feature tape later in the year. Future meetings will be held on the second and fourth Thursday of each month, any person wishing to attend should contact the Secretary, Mr. H. E. Saunders, 20 Nightingale Road, Hampton, Middlesex.

The Harrow and District Recording Club held its first meeting at their new club premises in North Harrow. 15 members attended the meeting, and the new committee was elected. Future meetings will be held on 29th September and 13th October at St. Georges Hall, Pinner View, North Harrow, commencing 7.30. Further details from the Secretary, Mrs. T. Fisher, 5 Gloucester Road, North Harrow, Middlesex.

Mr. J. C. Webley, 34 Silver Lane, West Wickham, Kent, is anxious to correspond on tape with any person in America and Spain. Anyone interested should contact Mr. Webley at the above address.

Another person interested in correspondence by means of tape is Mr. M. Geldenhuis, P.O. Box 3, Bredasdorp, Cape Province, South Africa. Tapes would be welcome from either sex on matters of everyday interest. Tape speed of 3½ in. only.

Thirty-seven members attended the meeting of the Coventry Tape Recording Club to hear talks on "The Best Ways to Record from the Radio", "Commandments of Conscriptio", and "The Law of Copyright". Mr. Peter Warden produced a recording of an interview with the two British Army Sergeants who spent their leave walking across America—thus proving to members that bringing a tape recorder to a club meeting was simple compared to that Marathon!

Secretary, R. V. Reynolds, 1, Thurlestone Road, Radford, Coventry.

We have received a letter from Tape Aids for the Blind (South Africa) giving details of the free Library Service available to the Blind. A charitable non-profit-making concern, this organisation already has 108 English, 30 Afrikaans and several German books, plus 6 English periodicals and a special selection which are all stored on "master tapes". Copies are dubbed for blind listeners (who must own a tape recorder and at least one reel of tape).

The Studio is equipped with Revox semi-professional recorders, and Lustraphone microphones—in the near future they hope to instal Goldcrown Imperial Professional recorders. By arrangement with the Post Office, the tapes are carried free through the post. All work is done on a voluntary basis, and funds are provided by public subscription. Enquiries should be addressed to R. Davimes (Hon. Librarian), 806/807, Payne's Building, West Street, Durban, South Africa.

A demonstration of equipment including the Ferrograph and Stuzzi recorders, provided the members of the Rugby Amateur Tape Recording Society with an excellent opportunity of comparing their equipment with the recorders on show. Mr. A. W. Dakin, Technical Director of Nottingham Tape Recorders Ltd., and his assistant Mr. A. Lowe, described the main features of the recorders, and ended with a demonstration of the first recording ever made on disc in 1912. Many exciting meetings

THE CLUBS

have been arranged: readers interested in attending a club night should contact the *Secretary*: M. Brown, 219, Clifton Road, Rugby.

Final preparations are being made by the **West Middlesex Tape Recording Club** to provide a person-to-person message scheme for patients in the Hillingdon Hospital. Inter-ward messages are also planned for patients unable to move about the hospital. At a recent meeting, three demonstrations showing the use of cathode ray oscilloscopes, soldering techniques and dubbing, editing and splicing were given. Four members provided equipment for the lectures and extra-keen interest was displayed in the technical side of the subject.

Secretary: H. E. Saunders, 20, Nightingale Road Hampton, Middlesex.

At an inaugural meeting held at the Naval Base on the island of Singapore, it was decided to form a club suitable for tape, disc and hi-fi enthusiasts, to be known as the **Singapore Naval Base Tape and Disc Club**. Plans are already being prepared for future meetings and the secretary would be pleased to hear from any club in this country suggesting suitable and interesting programmes.

Secretary: R. S. Hellyer, c/o R.N.A.D., H.M. Naval Base, Singapore, 27.

Anyone wishing to assist in the formation of local tape clubs in the **East Sussex** and **Dartford** areas should contact the persons named below.

East Sussex area: Mr. H. R. Chapman, "Little Tysoe", Churchland Lane, off Hurst Lane, Sedlescombe, Battle, Sussex.

Dartford area: Mr. E. H. Foreman, 117, Westgate Road, Dartford, Kent.

A Wyndor Tape Recorder, Serial No. 9675, was stolen from the home of Miss M. J. Bather, 43, Whitehall Park, London, N.19., on the 3rd August 1960. Any reader receiving information regarding this machine should contact Miss Bather at the above address.

Members of the **Nottingham Co-operative Amateur Tape Recording Society** visited the City of Nottingham Fire Brigade recently, interviewed the Fire Prevention Officer and recorded sound effects. Other members toured the offices of the "Guardian Journal and Evening Post" whilst a third section interviewed members of the public in the Market Square. At a later meeting the three recordings were edited, and a programme was compiled entitled "Nottingham Newsreel".

Future meetings: September 29th, "Tape in the Theatre"; October 13th, "Recorders in the Raw"; October 27th, Demonstration of W.B. Loudspeakers and Enclosures.

Secretary: N. D. Littlewood, 129, Standhill Road, Carlton Hill, Nottingham.

A ten-minute feature programme on Ilford's talking newspaper for the blind, produced by **Walter Gillings Sound Features**, was broadcast in the Pacific Service of the B.B.C. and included in the fourteenth edition of *What Goes On Here* at Ilford. Walter and Ronald Gillings, the father and son team who produced these programmes, reviewed three weeks' local news for the Blind Social Circle. When interviewed by Mr. Sparke, of *Calling Australia*, Walter Gillings spoke of his plans for a National sound magazine for the blind which will be distributed to groups and individuals throughout the country.

Walter Gillings: 115, Wanstead Park Road, Ilford, Essex.

Hull and District Tape Recording Society are the latest to join the ranks and although they have only been formed for one



The Ilford club gather round to hear their chairman, Dr. P. Ager (bottom left) describe how he uses his Fi-Cord recorder professionally and as a hobby.

month, already 18 members have enrolled. With the co-operation of local dealers they are distributing leaflets throughout the district and new members are joining at each meeting. If any reader in that area would like further details, contact the Chairman:

K. Fulston, 17, Lowfield Road, Anlaby, Hull, East Yorks.

At the General Meeting of the **Ilford and District Tape Recording Society** it was announced that a Tape Recording Course would be held commencing September 13th. The session will be held for the first hour of each meeting and will include lectures beginning with the basic principles of recording. After the business for the future months had been decided, Mr. K. Hartman demonstrated his Fi-Cord, and Mr. Faulkner took photographs. One is reproduced on this page showing members taking keen interest in the machine. This prompts us to remind Club Secretaries that we would like to receive interesting photographs of club meetings and activities. All correspondence should be addressed to the Editor.

It has been suggested by Mr. J. Hone, a reader of *The Tape Recorder*, that Clubs should be formed for certain makes of tape recorders. This certainly is a new approach to consider. It would be styled on the present-day car clubs, i.e. M.G., Lagonda, Bentley car clubs, etc. If any reader has any views on this subject please let us know and we will publish any interesting letters.



OCTOBER NUMBER

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- Building the TWA/1515D Stereo Tape Amplifier
- Readers' Hi-Fi Furniture Designs
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★

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By N. W. Bridge

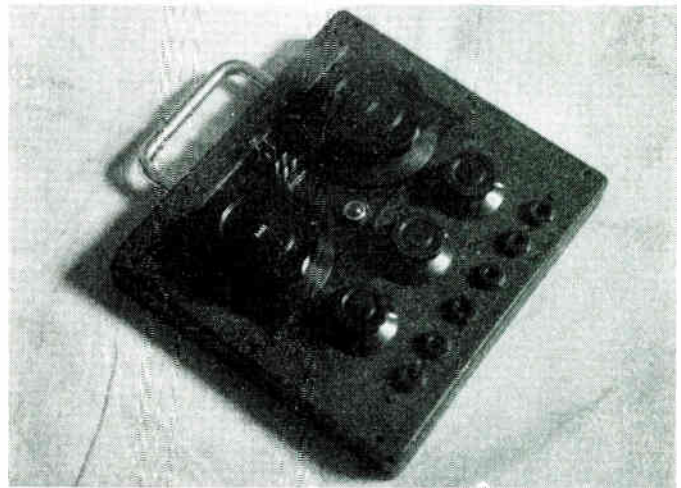
HIGH QUALITY TRANSISTORISED MIXER UNIT

THE writer recently constructed a 15-watt amplifier using OC16 transistors for the output, to a Mullard circuit. The inter-connection arrangements for the amplifier, signal input, loud-speaker and 12 volt DC power supply were arranged to be very simple, and foolproof, with no controls whatever on the power amplifier. The microphone, to be used with it when a P.A. system was required, was housed in an old Tannoy carbon microphone case which contain the first stage transistor amplifier too. The press button switch of the microphone housing was removed, and the volume control put in its place, so that the output is under the immediate control of the speaker. For more involved work, however, it was decided to design a mixer-preamplifier unit with three inputs, each of high or low input impedance, which could be plugged straight into the power amplifier instead of the single microphone, or into any other power amplifier as necessary.

The requirements were that the unit should be small and light, have a fader for each of the three inputs (but no other volume control), and bass and treble tone controls. The inputs should all be jack sockets, arranged so that plugging into one gives a high input impedance and plugging into its neighbour gives a low input impedance. The input signal may be from a few millivolts to 0.1 volts or more, and the output signal up to about 2 volts. The power is derived from the main amplifier supply, and is about 15 mA at 14 volts., plus 60 mA for the pilot light. The frequency response is level to over 50 Kc/s, and down to 50 c/s, being 3 dB down at about 30 c/s. All transistors in the original unit are OC44's, but other types can be used with possible reduction of frequency response and increased noise.

Input circuits

In order to get a high input impedance, an emitter follower is used for each of the input stages, V_1 , V_2 , and V_3 . The three stages are identical except that in the writer's unit, the middle one has a switched fader instead of potentiometers like the other two. This is not essential, of course, but it means that inputs can be increased or decreased by known amounts, and reset exactly at any time. Further, the contact is less noisy (though more expensive). The 11-way switch goes down in steps of 3 dB as far as 21 dB below maximum, then 27 dB, then 39 dB down,



Building the mixer into this rugged metal box produced an eminently portable unit, easy to operate, and only 1¼ in. deep.

and off. It also happens to be continuously rotatable, so that maximum volume may be obtained immediately from zero, and no-one can wreck the switch or loosen the knob by trying to turn it against a stop.

To avoid extra switches for changing the input impedance, two jack sockets were used for each input, J_1 and J_2 , J_3 and J_4 , J_5 and J_6 , and the contacts arranged so that with a plug in J_1 , J_3 , or J_5 , one side was connected straight to the emitter follower input, and the other side earthed through the contacts on J_2 , J_4 , or J_6 respectively. If a plug was in J_1 , say, and another in J_2 , neither would produce a signal, because that connected to J_1 would not be earthed, and the signal side of the transformer secondary would be disconnected from the amplifier.

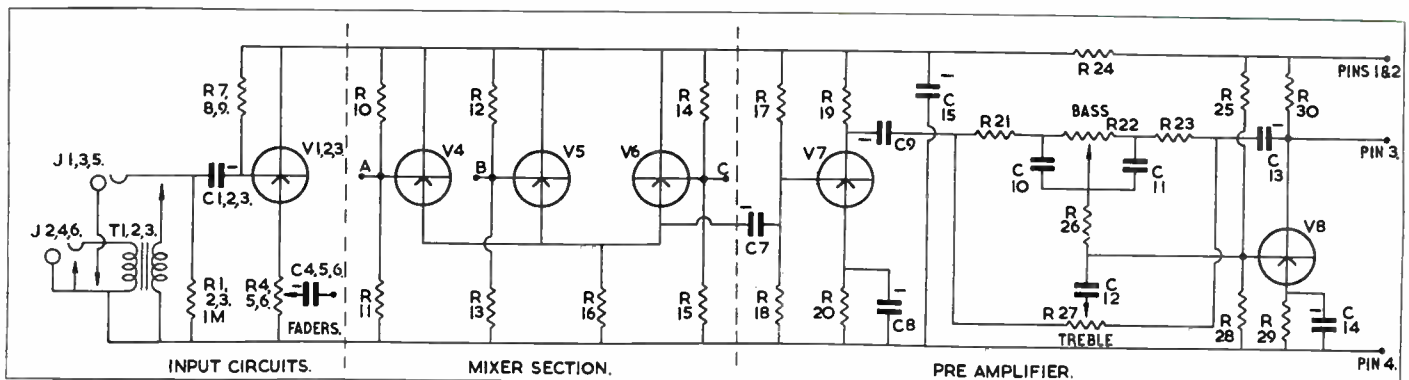
With a jack plug in either J_1 or J_2 alone, the signal gets through either direct, or via the step-up transformer, as necessary. The impedance of the microphone, pickup, etc., is not critical, over a wide range, for each input. The easiest way to explain its use to the non-technical is to say, "Plug it into whichever hole gives the louder output!" The three fader outputs then go to the mixer.

Mixer

This is simply three transistors with a common emitter resistance R_{16} , and individual biasing resistors R_{10} , R_{11} ; R_{12} , R_{13} ; R_{14} , R_{15} . No doubt a common collector resistance would be just as good here, but has not been tried since the first arrangement works well. The crosstalk is kept down to a negligible level, and rotating any fader (with no signal on that channel) has no noticeable effect on the output signal from any other channel, which is as it should be. Each of the mixer transistors passes about 2 mA collector current.

Pre-amplifier and tone control circuits

Having decided long ago that the Baxendall tone control circuit is the best in valve amplifiers, the author decided to make a transistorised version. This worked very well, so is used in





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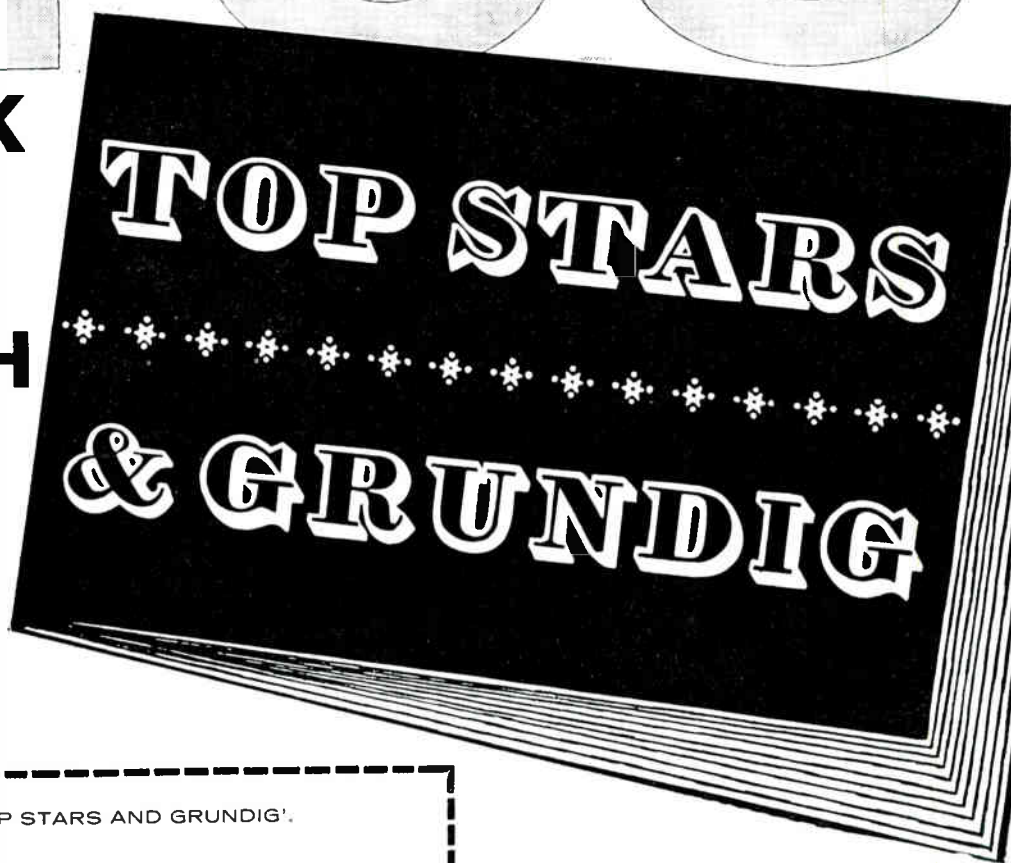
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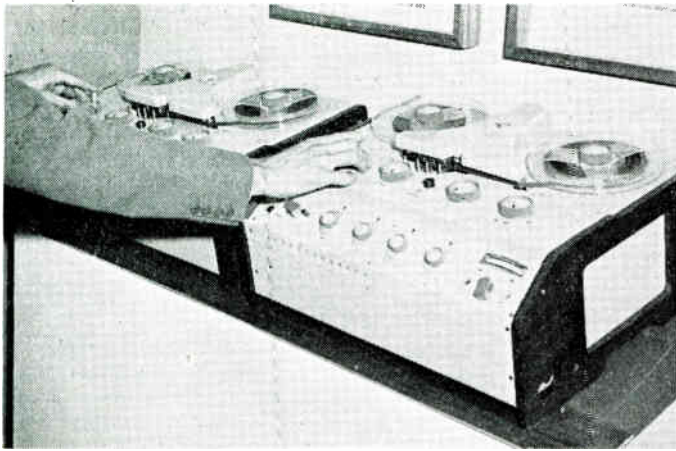
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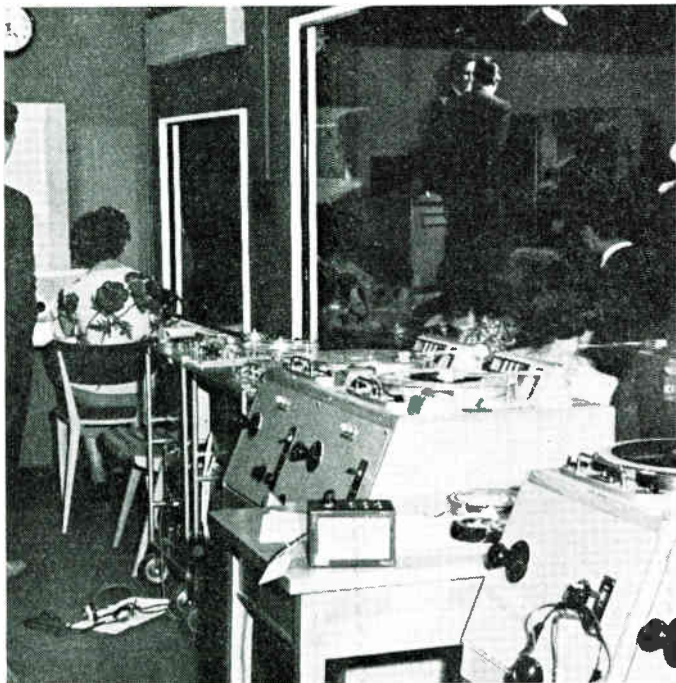
The new Reflectograph Model "D" playback machine (left) was producing fidelity dubbings to the Model "A".

THE Audio Hall was much less representative than in previous years and was, therefore, to our minds, much more disappointing. The fact that practically all the large radio manufacturers have now produced at least one tape recorder in some way compensated, but since these new machines are all in the lowest price bracket it must be admitted that there is a certain sameness about them.

All together 31 exhibitors were demonstrating tape recorders and, perhaps, the most important development was the appearance of 4-track machines—noticeably those of **Elizabethan**, **Multicore**, **Sound**, and **Fidelity**. The greatest argument for these 4-track tapes (see the discussion by James Moir elsewhere in this issue) is, of course, the 50 per cent. saving in tape for a given length of playing time. This saving will apply to monaural as well as stereo tapes, and it is expected that 4-track tape records will soon be available in this country in large quantities.

Elizabethan 4-track

An ingenious approach to the 4-track idea was shown by **Elizabethan**. Here the FT3 recorder, which is 4-track monaural only, may be converted to stereo replay by the addition of an auxiliary amplifier and loudspeaker unit. This extra device is



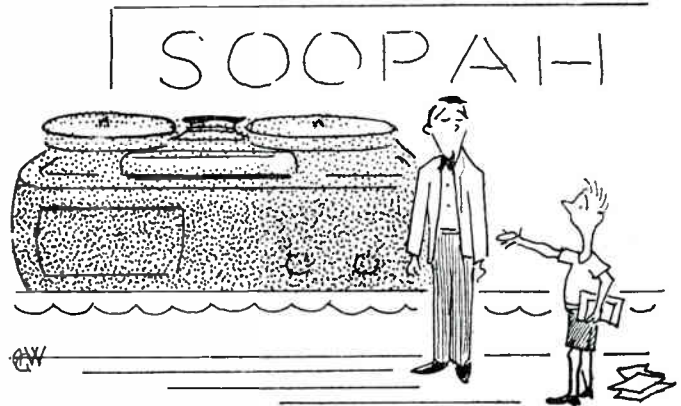
Behind the scenes at the BBC Gramstand we were privileged to see the Engineers and Studio Managers at work.

TAPE AT THE

An Exhibition Round-Up

• We always enjoy our annual Pilgrimage to the Radio Show at Earls Court and in company with David Wedgebury (photographer) and Alan Watling (cartoonist) we covered most of the 11 acres and 156 demonstration stands. This was a year of consolidation rather than of startling new inventions, but nevertheless there were all together 31 exhibitors of tape machines. Our report has not attempted to be exhaustive but confines itself to a few highlights.

shown in one of our photographs, the 2 halves being easily fitted together to form a carrying case identical in size and appearance to the main recorder. It was emphasised that in this way customers may convert to stereo at any time after



"Could you play this message tape for my mum?"

purchasing the recorder and need never feel that their equipment will become out of date.

The latest addition to the **Reflectograph** range is the Model D. This is a playback only instrument and costs 55 guineas. Our photograph shows a Model D and Model A in use for the quality dubbing of tapes. Instantaneous comparison between the input and recorded signal allows copies to be made which are indistinguishable from the original tape. We were able to examine also the new "Bib" accessories, which include a useful tape calculator and a tape labelling system.

Gainsborough giant

On the **Gainsborough** Stand a giant model of the Gainsborough Mark 1 came in for a lot of attention, and we heard someone remark "I've heard of midget recorders, but this is ridiculous!" Gainsborough have been doing a great deal of development work of late and their Mark 2 and Mark 4 recorders were given convincing demonstrations. The latter is described as a semi-professional machine and incorporates separate record and playback amplifiers and three speakers.

Other complete recorders whose names are well known to readers were on show at the stands of **Brenell**, **Ferguson**, **HMV**, **Lee Products** (Elpico), **Perth**, **Regentone**, **Trix**, **Truvox**, and **Walter**. Amongst those which are perhaps less familiar were tape recorders by **Alba**, **Amplion**, **Argosy**, **Defiant**, **Dynatron**, **EAR**, **Echo**, **Ferranti**, **Kolster-Brandes**, **Murphy**, **Peto-Scott**, **RGD**, **Redicord**, and **Symphony Amplifiers**.

The only recorded tapes at the Show were those of **E.M.I. Records**, but every possible tape accessory could be seen in one guise or another. For example, an excellent opportunity was

A CUSTOM-BUILT STEREO RECORDER

DESCRIBING THE CONSTRUCTION OF A HANDSOME MACHINE OF UNIQUE DESIGN

Part Two — The Circuitry

AFTER the brief description in Part 1, you will realise that this is no poor man's recorder. That is unfortunately one of the Laws of Hi-Fi—repeated, in many advertisements, but nevertheless inexorable—"The higher you go the mucher". To meet the specification at a lower cost one may cut corners in raw materials (like the old TV chassis used here) or "double up" on parts of the circuit by appropriate switching, making playback amplifiers become microphone preamps and output amplifiers become recording amplifiers. This undoubtedly saves money, but increases the fault liability and makes quick fault location difficult. There is an easing of construction problems too, when each part of the circuit is designed for one job alone.

Plan of action

The Block Diagram shown was the start of things, and soon gave an idea of the problems involved. Earth connections, power supplies and use of the deck selector switch arcs were worked out on this. Small neons were used for pilot lights to indicate the presence of HT, and to avoid 6.3v AC supplies wandering about the deck switches near sensitive leads. An unexpected bonus was the discovery that a neon "struck" satisfactorily from the high impedance tap of a Mullard oscillator coil, thus showing that Erase volts were, in fact, being generated. (An oscilloscope check confirmed that waveform from the lower tap was unaffected). A corresponding pilot

on the oscillator HT gives double reassurance when recording, and a visual check on the voltage available, judged by the brightness of glow.

The playback amplifiers

These were constructed on home-made printed (etched) circuits, mounted in die-cast screening boxes at the rear of the chassis. The advantages of this type of construction were discussed in an article in *Hi-Fi News* February, 1960, with photographs of the assembly. The two boxes were mounted on 1-inch plastic foam to avoid microphony (the individual valves are rigidly mounted in the etched board). The circuit is two stages of straight amplification followed by a high-slope valve round which is the feedback equaliser—bass boost to CCIR limits, and a treble boost to overcome head losses. The output from this stage, via a series resistor, goes to a balance potentiometer between the two channels and then to preset output controls to feed external amplifier equipment. At this point the two earth circuits from the heads are brought together for the first time, and also connected to the chassis.

The mixer

This is a modified version (really two two-channel mixers put together) of Mr. Reginald Williamson's circuit (*Hi-Fi News*, December 1959). It consists of three double triodes on another home-etched circuit. The first ECC83 is the microphone ampli-

• Last month we gave details of the particularly handsome "stag" dressing table into which the author has built his "no compromise" stereo tape recorder. The construction is described here, and will be concluded next month.

fier for each channel, fed from balanced transformers. The high impedance grid circuit of the original was changed to direct transformer feed, with cathode bias, as it was found difficult to keep the hum-level low enough on the etched board. The second ECC83 mixes in the auxiliary input from each channel. Then comes the master gain control (a two-gang potentiometer) the outputs of which feed the last ECC83, either as a two-channel signal or combined (with the "4/2+2" switch on the control panel) to the left channel only. This flexibility avoids wasting half of the mixer when switched to "Mono." The position of the mixer, upside-down under the control panel, can be seen in fig. 4. The printed board allows connections to be made to potentiometers and jacks which have been positioned for the best control panel layout—the importance of which was stressed in the first article.

The recording amplifiers

These are based on the published Mullard circuit, using treble-lift inductors for pre-emphasis at the higher audio frequencies and an EF86 with cathode feedback to deliver 18v signal to the recording-head transformer. A pre-set gain control and a separate valve/meter level circuit is incorporated for each channel. The level to the meters must also be adjustable, although this can be done at the lining-up stage with fixed resistors.

Cathode follower

From the same point as the meter, a cathode-follower valve supplies a monitor signal for headphone use. The input impedance exceeds 10 megohms, so there is no shunting effect on the recorded signal. Although stereo monitoring with headphones gives an exaggerated stereo effect, it also exaggerates faults in balance and perspective, which is quite valuable. As

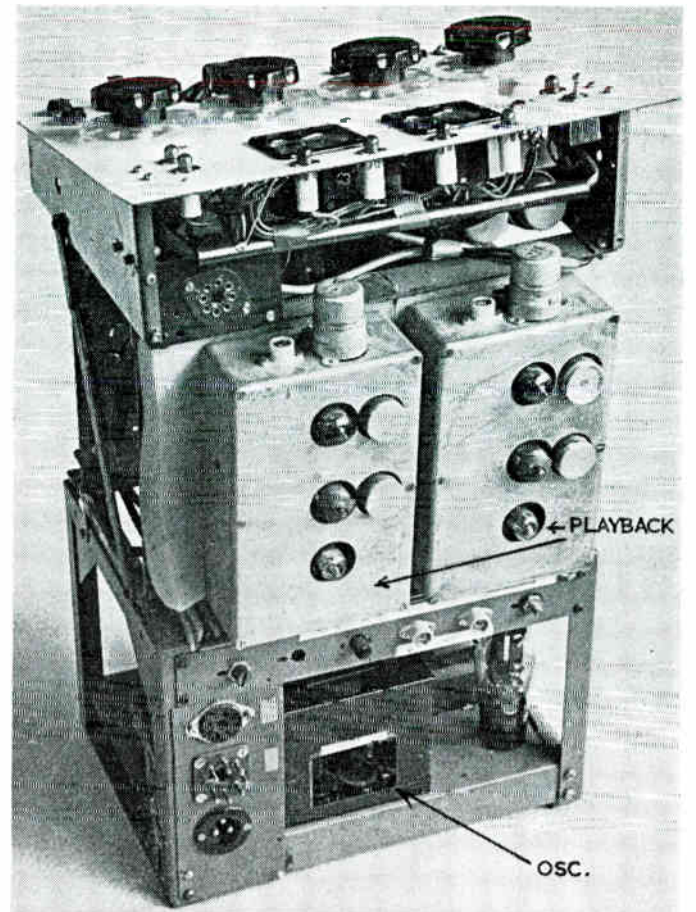
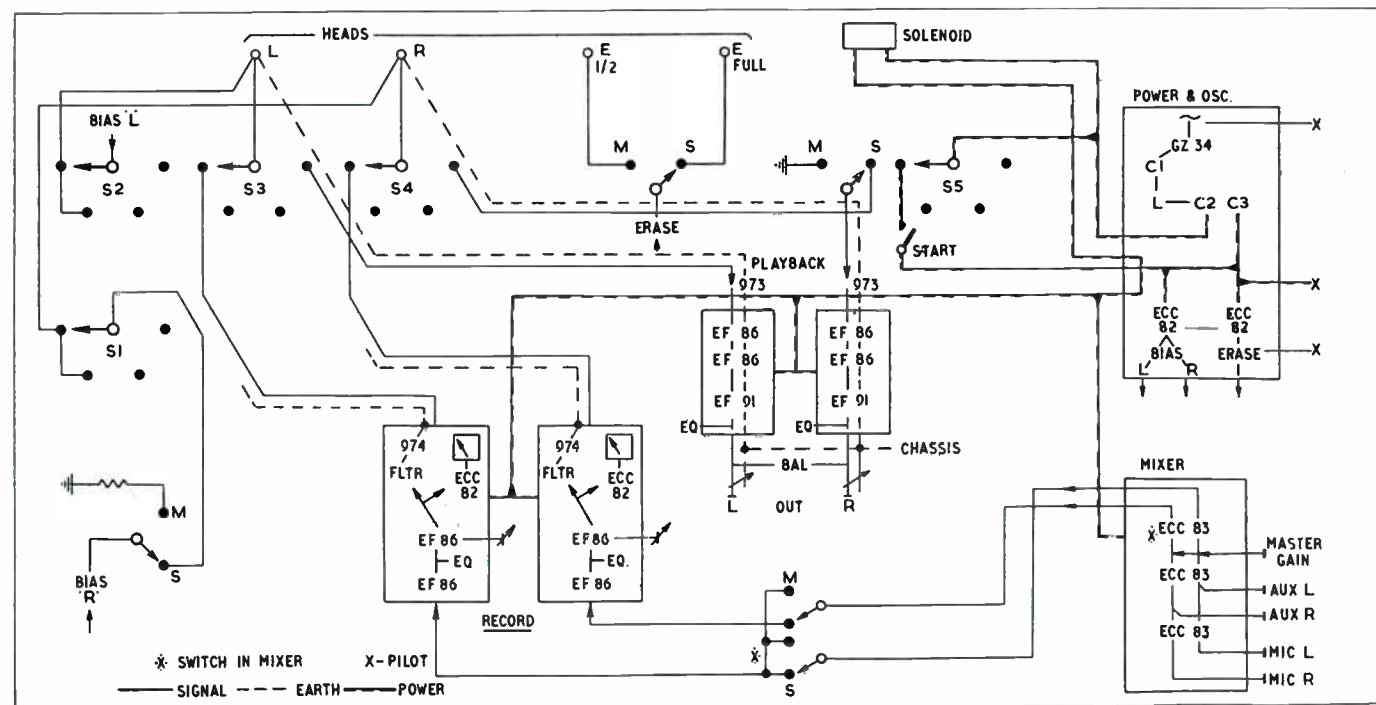


Fig 3. Rear view of main chassis.

will be seen from the photographs, the recording amplifiers were assembled on a conventional chassis (albeit rather crowded!) to allow experimental work to be done from the front while lining up. In particular, several types of pre-emphasis were tried.

The power pack and oscillator

The power supply presented no difficulty, as all the dodges of providing a low-ripple HT supply are well-known by now. The distribution of HT supplies had to be carefully thought out as the oscillator HT is switched at the deck, and a capacitor (C3 on the block diagram) must be tied to the oscillator to allow it to die slowly on switch-off. The deck solenoid has



The above diagram was worked out before the actual assembly was started on. (See text).

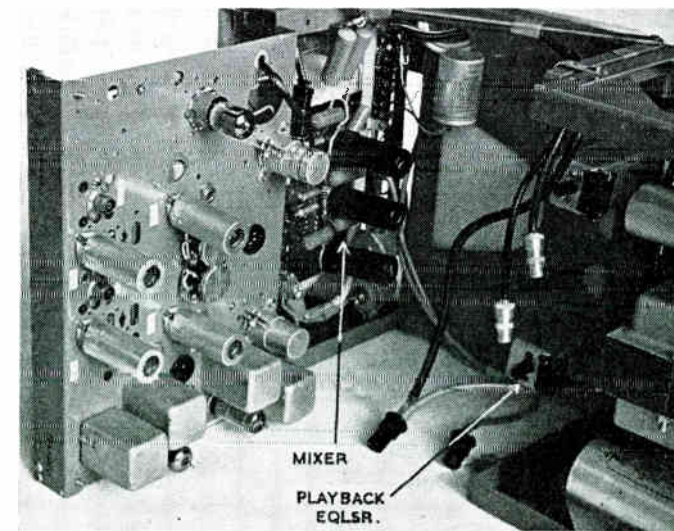


Fig. 4. Record chassis showing mixer on printed board.

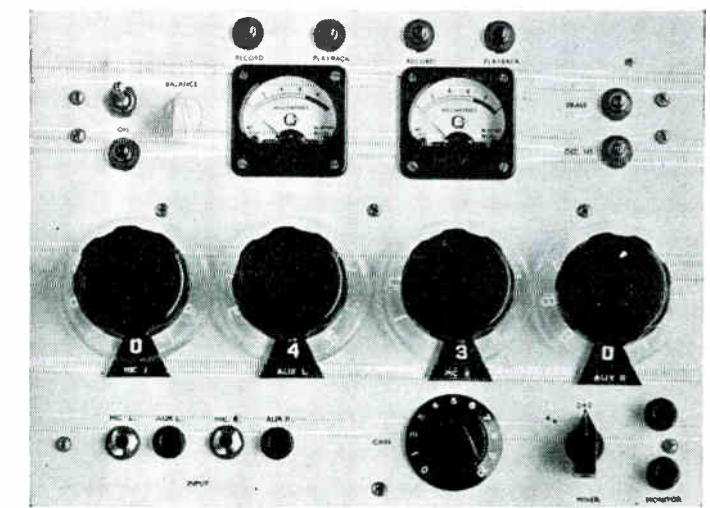


Fig. 5. The skirts on the control knobs are the author's own design.

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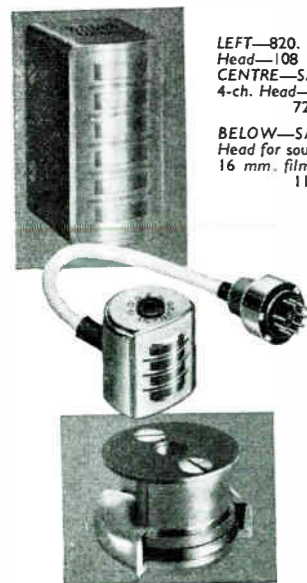
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CUSTOM-BUILT RECORDER—(Continued)

also to be supplied with at least 30mA, and can be used as an additional smoothing choke.

The oscillator

The oscillator proved to be the biggest problem, and could not be solved without an oscilloscope. Mullard's push-pull ECC82 oscillator was favoured, but did not deliver sufficient power to drive the full-track erase head and two bias supplies. I first decided to use one oscillator to give two stable bias supplies and a second one to supply erase volts—synchronising

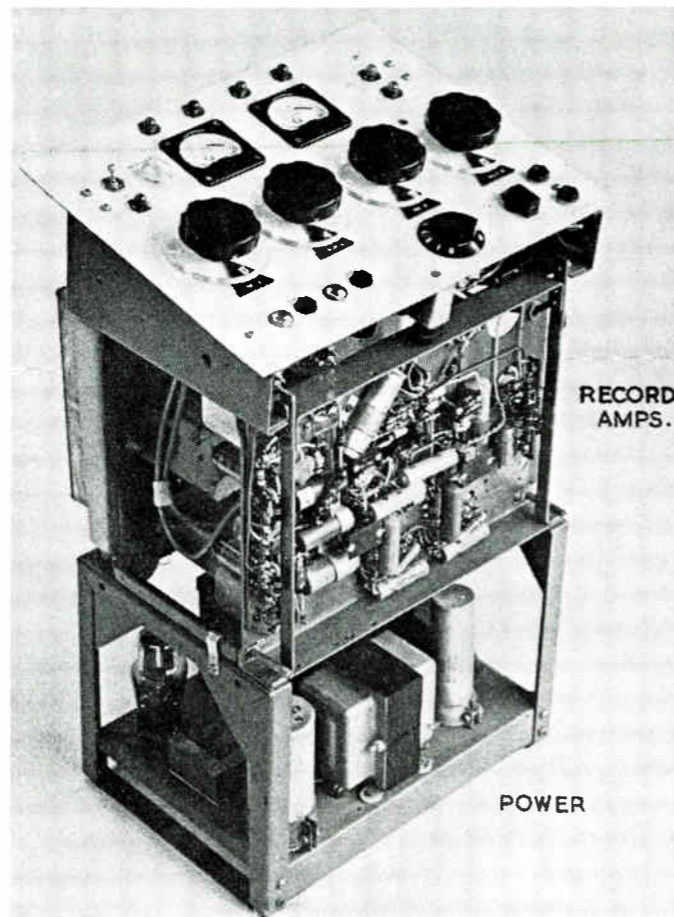


Fig. 2. View of the main chassis showing the record amplifiers.

the two to avoid "beats" (which are not just theory!). However, the erase head itself affects the tuning of the oscillator which drives it, and switching from a full-track to 1/4-track erase desynchronised everything! The oscilloscope showed that quite conclusively. Thus I came back to the scheme of driving the second oscillator from the first as a tuned push-pull amplifier, which has worked well. It is worth pointing out that an ECC82 has to work hard on full-track erase and a 6V6, or equivalent, would probably have been a better proposition. Some commercial circuits use the two valve circuit feeding two separate 1/4-track erase heads (upper and lower track). (Note: Always use silver mica capacitors to tune the oscillator coils. Ceramics often smoke—however young they are!)

The chassis

The general construction is clear from the pictures. The points to watch are accessibility (the resistor that burns out is always under something), ventilation and a foolproof system of connections to the deck. Label everything you can—it will be blessed a hundred times when you come to "Testing and Lining-up", the subject of the next article. **A. G. Watling.**

RADIO SHOW

in Words, Photos and Cartoons

afforded to examine the workings of the various popular tape decks, e.g. those of Brenell, Collaro, Garrard, Multicore, and Truvox. Lustraphone had their usual display of microphones to suit every application and we were particularly interested in their new £15 15s. stereo microphone.

Professionals at work

Although we must confess to a certain amount of disappointment at the tape coverage at this year's Radio Show—compared, for example, with the London Audio Fair (This is no doubt,



"... and for stereo, Sir, you just need..."

brought about by the public's preoccupation with television sets)—there were the usual unique opportunities to see professionals at work in the BBC Gramophone and Television exhibits as well as those of Independent Television. The slick manner in which tape exhibits and sound effects, etc., were introduced into programme items would make the average tape enthusiast green with envy, and the special Equipment Servicing Exhibit gave many useful ideas on getting down to this important aspect of the hobby.

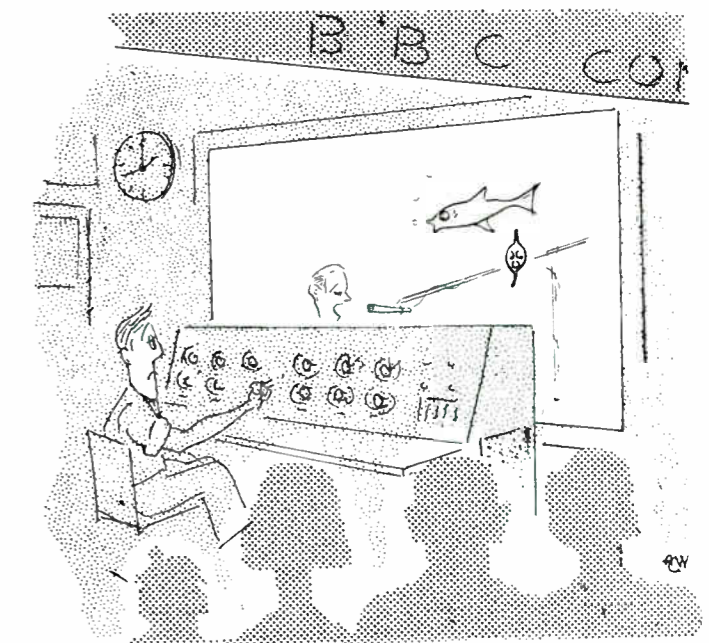


Purchasers of the new Elizabethan FT3 4-track recorder may convert to stereo simply by adding the neat units on the right.



The R10 is the latest recruit to the Reps range of recorders, and in addition to the standard portable version was shown in an attractive console.

The only battery-operated tape recorders to be seen were those at the Casian and Walter Stands. The Casian "Trav-ler", price 29 guineas, was the subject of our field trial in July and is now available with a built-in radio. The latter is also to be produced as a plug-in unit. Just in time for the show Casian had also produced the "Trav-ler Professional". This is a transistorised machine operating at 7 1/2 i/s with no erasing facilities. It is priced at £89 5s., tax paid. We have referred previously to the Walter mains/battery recorder in these pages, and have been promised one for review purposes very shortly. It operates at 3 1/2 i/s and has many facilities normally associated with mains machines, such as superimposing and tone controls, while being fully transistorised and capable of being used anywhere. Its dimensions are 17 x 15 1/2 x 5 1/2 in. and it weighs 17 1/2 lb. Yet another recorder whose power supply arrangements are unusual is the aptly-named "Marine" of Amplion Ltd. To make it suitable for use on board ships this recorder will operate from DC supplies over the wide range of 100-250 volts as well as from standard AC mains. The price is 45 guineas and a standard AC model is also available, price 26 guineas.



4-TRACK RECORDING

A PROFIT-AND-LOSS ACCOUNT—By JAMES MOIR



FOUR track recordings appear to be the next development in the tape field, and as the first four track machines are now appearing, it may be well worth looking at some of the advantages and disadvantages of the new standard.

An increase in playing time, or what is more to the point, a reduction in the cost per hour of recording time, is the obvious advantage in doubling the number of tracks. The initial cost of recordings has undoubtedly been one of the reasons why tape has failed to displace records as the primary medium of home entertainment. The use of four tracks instead of two on standard $\frac{1}{4}$ in. tape removes the price handicap in a single step. What are the disadvantages?

Track dimensions

Four tracks each 0.043 in. wide separated by unrecorded lands 0.025 in. wide, will now be used instead of two tracks each 0.110 in. wide with a 0.03 in. land between them. There is an obvious loss in signal, for all other parameters remaining the same, the signal that can be obtained from a tape is directly proportional to track width. The reduction from 0.110 to 0.043 implies a signal loss of $20 \log 0.110/0.043 = 7.8$ dB. However, the signal obtained depends on the width of the recorded track that is actually scanned by the reply head. Two

That 4-track recording has really "arrived" is confirmed by the appearance of 4-track machines from many makers, e.g., the Elizabethan FT3 (right) and FT1 (top of page).



track machines use heads 0.09 in. wide, the full track width of 0.110 in. not being scanned to allow for some weave of the tape under the head. No information on the width of head to be used with four track tape appears to be available, but if the same margin of 0.01 in. is allowed on each side of the head, it would only leave a width of 0.025 in., and the signal would be 11 dB below that obtained from the standard two track head. Efforts to decrease the allowance for weave will presumably be made and we may expect that the head will be designed to scan the same fraction of the recorded track as does the head on a two track machine, and the signal will be 8 dB lower on replay.

Noise level

Though the signal obtained on replay is reduced about 8 dB by the reduction in track width, the same change also reduces the noise produced by the track, and thus the signal/noise ratio decreases by less than 8 dB. The noise components being randomly distributed in frequency are not reduced in proportion to the track width reduction, but in proportion to the square root of the track width change. Thus the noise is reduced by $20 \log 110/45 = 4$ dB and signal/noise ratio by $8 - 4 = 4$ dB. It has been claimed that measurement has shown that the reduction is in fact only 3 dB, but no explanation

has been offered for the one dB discrepancy. It might be expected that the sources of noise other than the tape, such as hum pickup in the leads, noise introduced by the first valve, etc., would stay constant and thus the signal/noise ratio would decrease by a dB or so more than the calculated figure (4 dB) rather than a dB less than calculated.

Table 1 indicates the signal/noise ratios that have been claimed for the tape speeds in general use, while Table 2 gives my views on the acceptability of typical signal/noise ratios.

TABLE 1—SIGNAL/NOISE RATIO VERSUS TRACK WIDTH

Track Width	Tape Speed (i/s)	dB
0.25	15	68
0.09	15	61
0.09	$7\frac{1}{2}$	61
0.09	$3\frac{3}{4}$	58
0.045	$3\frac{3}{4}$	55

It should be noted that the basic signal/noise ratio is independent of tape speed but secondary differences arise due to the difference in recording and replay characteristics.

Professional standards

It should be emphasised that the signal/noise figures quoted in Table 1 are values of signal/tape noise obtained under laboratory conditions and represent ceilings which domestic machines can approach, but at the moment are not likely to exceed.

If the value of 55 dB claimed for four track recordings is achieved, it is adequate for almost all purposes. I would suggest that the recording companies will have to do something about their signal/noise ratio, for at present the signal/recording studio noise ratio is well below 55 dB. I have several tapes in which the noise level decreases by some 6-10 dB as soon as the microphones are faded down, well after the end of the

TABLE 2—SIGNAL NOISE RATIO RATING

30 dB	Pre-war 78 r.p.m. records. Tolerable to the non-critical.
40 dB	Acceptable if the programme volume range is low, or the room noise level high.
50 dB	Very good, acceptable to most listeners.
60 dB	Excellent, completely acceptable except when noise is concentrated in a narrow band, i.e. single frequency noise.
70 dB	Acceptable to a very critical listener in a very quiet room.

orchestral performance when the recorded noise is only that from the recording equipment and the studio.

Apart from the problem of keeping the amplifier noise down to a very low level, the designer of a machine faces another problem, satisfactory tracking of the tape. All tapes tend to curl up slightly at the edges and thus lose contact with the head, but while the tracks are wide this is not of great consequence, for an

(continued on page 455)

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adequate proportion of the tracks remain in contact with the head. First experience seems to indicate that the trouble is much more serious with four track tapes when using ordinary thick tape but is almost non-existent when using the thinner "long play" and "double play" tapes. As the thick tapes have a performance superior to that of thin tapes only in respect of "print through" they may cease to appeal to the amateur.

Heads for four track use will clearly be more expensive than two track heads for they contain four separate units but the extra cost is small in comparison to the savings on tape. There is some saving in using smaller spools, and an indirect saving in that small spools permit a smaller machine. The reduced signal obtainable on replay will necessitate even greater care in shielding and layout if the stray hum pickups, that occur all too easily, are to be kept to acceptable limits.

In summary it will be seen that the potential performance of a four track machine is technically adequate for all domestic needs and given an improvement in tape performance of perhaps 6 dB, it would be adequate for most semi-professional work. It will be interesting to see from the subsequent review of machines whether the potential performance is realised in practice.

Owners of twin track machines and lots of twin track tapes, will get some comfort from the knowledge that the recording standards for four track recordings have been so arranged that existing twin track tapes can be played on four track machines without any modification. An in-line arrangement of heads has been adopted as for stereo tapes, tracks 1 and 3, and, 2 and 4 being paired for stereo playing. When playing single channel, track 1 is recorded with the tape running left to right, track 3 when running right to left, while 4 and 2 are available when the tape spools are reversed in the machine. Four tracks tapes cannot be played on two track machines however.

James Moir

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READERS' PROBLEMS

Tape hiss

Dear Sir:—Perhaps you will be kind enough to supply a little information on a subject which I have never seen clearly explained in any of the magazines devoted to tape recording.

When a tape becomes "hissy" due to its travelling past magnetised heads, can this hiss be effectively erased when next used for recording? In other words—will the erase head erase hiss? If so, would a second, or third erasure assist in reducing any remaining after one trip past the erase head? I understand, of course, that the heads, etc., should be properly de-fluxed before trying the first method.

May I take this opportunity of saying how much I enjoy the pages of *The Tape Recorder* and *Hi-Fi News*. Can you recommend a good reference book on tape recording, or has no one got around to writing one yet? *Yours faithfully, J.S.B. Liverpool.*

Tape hiss, which occurs due to the use of accidentally magnetised heads and other causes, is completely eliminated by a bulk eraser, and will normally be wiped out by the action of the erase head. Of course, when tape hiss occurs on a recording which is to be retained, then there is no method of eliminating it. There have been a number of excellent books on tape recording and one which we feel would meet your purposes as a permanent reference is "Magnetic Recording Handbook" by R. A. B. Hickman, published by George Newnes.

Tone Controls

Dear Sir:—My recorder boasts separate tone controls for treble and bass, and I feel sure that they might be very useful. Strangely enough, however, I get the feeling that they work sometimes and not others. Do you think it could be something wrong with the controls, or with the way that I'm using them? They are meant to give a lift to the treble or bass as well as cut, and there is a small dot on the controls which I take to indicate the normal position. Any suggestions you have to offer will be most welcome.

Yours faithfully, J. K., Harlow, Essex.

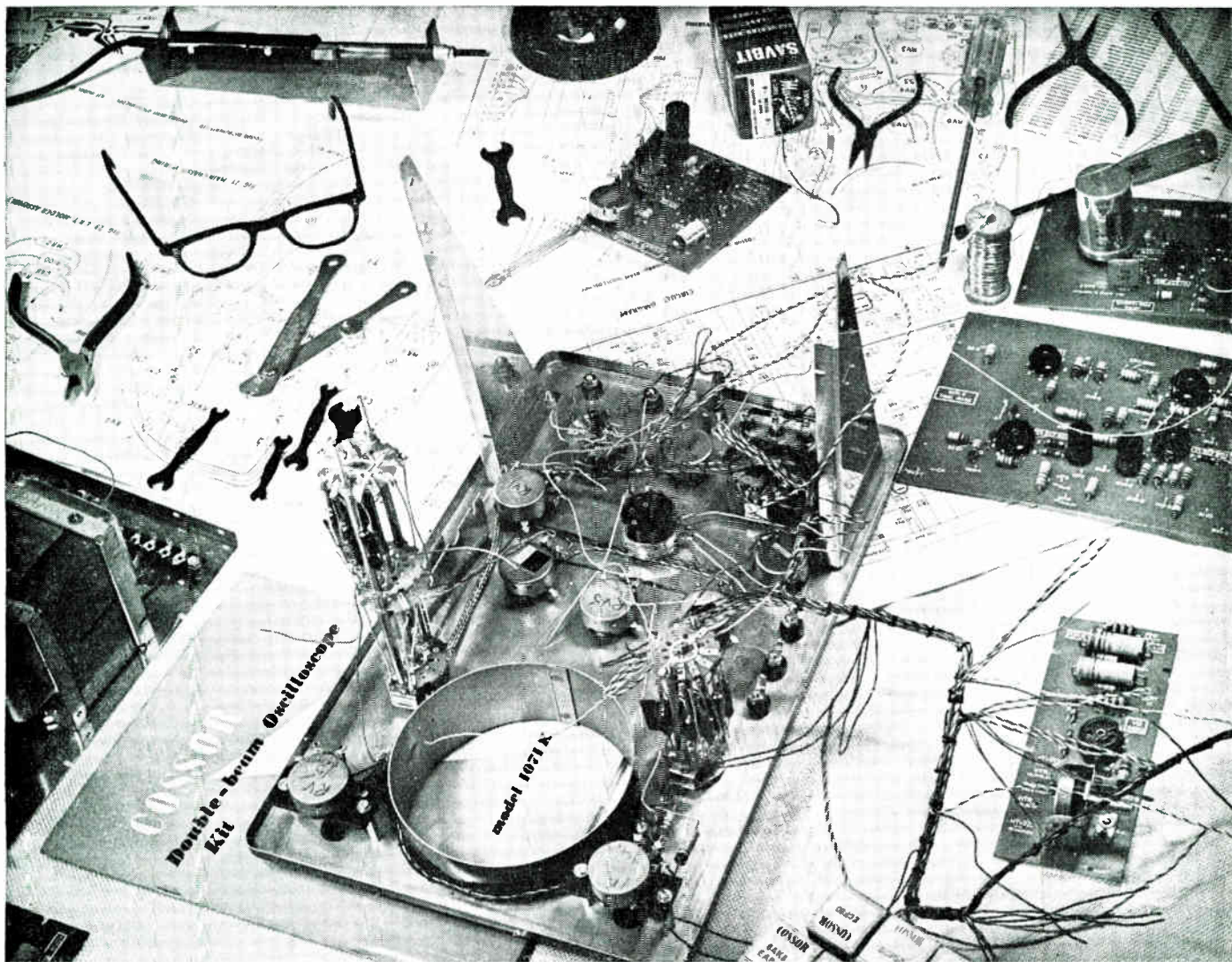
The tone controls on 95 per cent. of tape recorders—whether separate bass and treble, or the simple Top Cut variety—are situated in the playback amplifier, and have no effect during recording. This may account for your erratic results. If you think about it for a moment, you will see that this is a highly sensible arrangement.

If they operate on recording also, and we juggled about with the tone controls at the time of recording, or accidentally left them at an odd setting, we should be chasing the recorded quality on playback, and never be quite sure where we were. With the normal arrangement, at least the quality from microphone, disc, radio, etc., is transferred to tape through a circuit of constant characteristic.

We may then utilise the controls to correct, on playback, any recordings which appear to emphasise or attenuate one end of the frequency scale or the other. Of course no tone control is a cure for all ills, and it will be better to stick to the Normal setting in many cases.

Actually a principal use of the tone controls is to compensate for possible shortcomings of the loudspeaker—an external one or that built into the recorder—or perhaps the acoustic environment. This use is quite logical, and once the best settings are discovered for a particular room, etc., they should seldom require re-adjustment.

There is one type of tone control which is often fixed in the recording circuit, at least in expensive recorders. This takes the form of a two or three position hiss cut switch. It is intended to eliminate the steep rise in low frequencies which is experienced when recording speech at a close position relative to ribbon microphones.



Notice to Manufacturers

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Tape recoil

by STANLEY UNWIN

● Readers will be indebted to Stanley Unwin for drawing their attention to this problem. It is something that no one appears to have considered. We do not necessarily share the author's views, and we cannot undertake to answer technical queries on the subject.

THE importance of standardisation in terms of tape speeds, frequency characteristics and other tolerances must be obvious, but how can the layman with the limited means at his disposal achieve this? Firstly he must have a standard reproducing tape covering frequencies from thrifty up to several thousand cycloads or twelve C.C.I.R. Characteristics with a constant spiel through the capstan and pinch willy. The take-up must be a little more and no less to assist the latent strain so that there is no take-over bid for a gabbly in the voices. Reverse take-up should be sufficient to keep a tension of inch ounces or back-lode. This helps to keep a nice flat and face on the heads and proximity for the azimuth. This is very important for the playing on other machines where small variables add or subtract the errors. Having adjusted the azimuth, and assuming the same heads are used for recording the bias should be adjusted for a droppy half dB over the hill of the peak and not far away.

Do have a de-gausser handy. It will save many a hiss, grumble and dirty backgrove noise which in any case should be better, than minus fortyfido.

Erasing

Good wave fordyform is important and a reference to oscillators would not be a mistress. Self oscillating erase circuits are good if grid currents are limited by a therm (Mr). A push-pull dopple trilode is recommended however as simple to make and good for a sinus wave.

The choice of a microphobia is always difficult. A ribbon is usually expensive and booms if bitterne, while a crystal ball may foretell hum especially if it has a high impedance output. This brings us to hum problems which can give quite



"Professor" Stanley Unwin, beloved of radio and TV audiences alike, also writes in this month's "Hi-Fi News".

a troubload in high gain amplifies. The hum pick up in heads and head transformers, inductors and motors demands careful in the layout and earthing of the heatery wire and screened leady most. Oh yes. Earthy wire round the bolves concerned must seek the shortest way to the kathyhode.

Mixers

High or low level mixey? There is a deprecale on the low road on account of the high gain after the movie contacts. In any case use a cathy folly-o for your outpost. This allows many inputs for a loadymost without upsetting the import.

The absorbing interest of a time most taken, shows a worth while for all this, definitely and the firstjoys experienced of hearing your symphold, must be an improvement over the repeating grube of a rotatey diskier and no worn needles either!

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"Sound" re-opens on Network Three

AS we go to press, our Technical Editor has given us news of the re-opening of the B.B.C.'s Network Three programmes specially aimed at tape recorder enthusiasts. He has just recorded the opening programme in company with John Kirby (Chairman), Donald Aldous, R. D. Brown, and Ken Blake (of the London Tape Recording Club). This first edition of "Sound" took the form of a discussion on how the programme itself can best supplement the work of the printed magazines, through its ability to illustrate aurally what the periodicals cover in words and pictures. Its broadcast dates are Sunday 18th September, 3-3.30 p.m., with a repeat on Monday 26th September at 6.40 p.m. The series proper commences at its regular time of 2.40 p.m. on Sunday, 2nd October.

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MODEL T4 (Illustrated) 19 GUINEAS

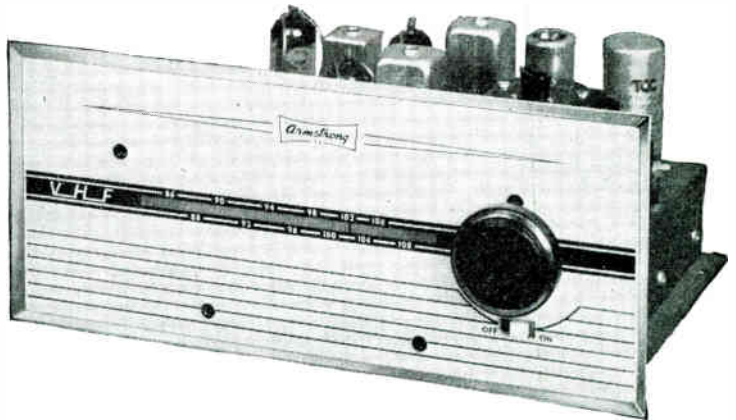
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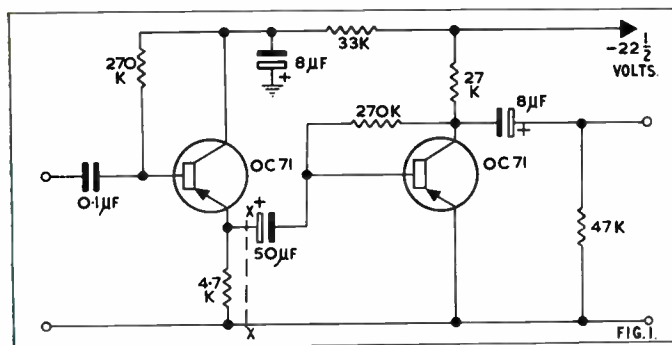
Practical suggestions for the tape handyman _____ by A. Bartlett Still

No. 16 – BUILDING A MIXER

THE transistor pre-amplifier circuit that I promised last month appears as fig. 1. Comparing this with the valve pre-amplifier given last month it will immediately be noticed that two stages have been used, against the single valve. The reason for this is that a transistor voltage amplifier arrangement invariably results in a low input impedance, of the order of a few hundred ohms only. The playback head which we wish to connect, will however most probably have an impedance of the order of 50 K ohms, so an impedance transfer is necessary.

My circuit, then, consists of two transistors, the first, a "grounded collector" stage, performing a similar function to a valve cathode follower, while the second, "grounded emitter", stage gives voltage amplification. The overall gain will probably be of the order of 30-40 times. If greater gain is needed it will be necessary to add a further stage. For those who wish to experiment with transistors I cannot do better than recommend the helpful leaflets and other literature produced by Mullard, Ltd.

My main subject for this month concerns the mixing of inputs to your tape recorder, assuming that your machine is not already fitted with this facility. It is not possible, in my opinion, to design a simple mixer that will suit the various



purposes that different readers might have in mind. Therefore I will try to describe principles rather than concrete designs, although both the circuits I give can be used as they stand.

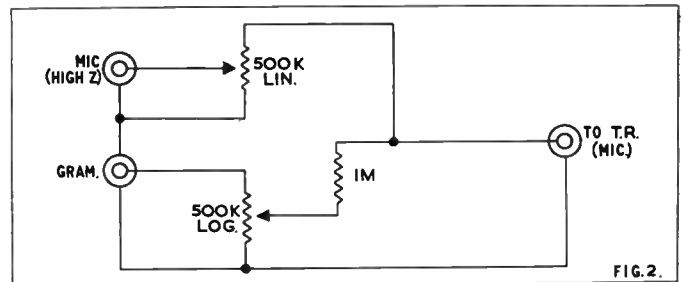
Fig. 2 represents about the simplest way of mixing two inputs—say a high impedance microphone, and a gramophone pickup or radio having a greater output. This is a passive circuit (i.e. no amplification) and so care has to be taken to lose as little as possible of the low level microphone signal. The 1 Megohm resistor should prevent any of this signal being lost into the "Gram" circuit, and it represents the usual way of decoupling the various channels. Quite obviously if it were not there the mic signal would be short-circuited when the Gram control was turned down. The inclusion of this resistor also results in attenuation of the Gram signal to an extent that cannot be allowed on the Mic channel.

Losses not serious

Since we still have to avoid the short-circuiting effect, the Mic gain control has been turned round, and it will be found that a linear law potentiometer will give a smoother control with this arrangement. Very little of the microphone signal is lost on this mixer, at the expense of some variation of Gram level with movement of the Mic control, and change in the Mic frequency response with control setting. Admittedly not up to BBC standards, but it is doubtful if the home recording enthusiast need worry, considering how cheap and simple the

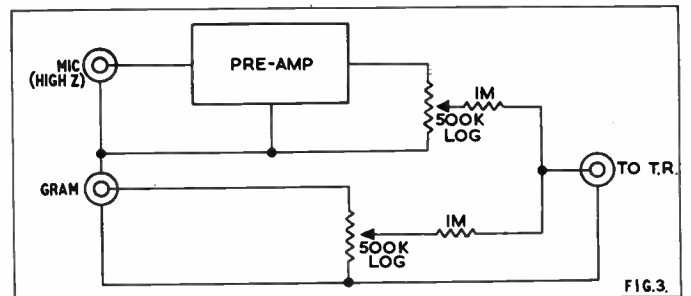
unit is. Additional channels of either type can be added, but it is advisable not to press your luck too far!

For a more ambitious design of mixer, capable of handling the low level signals obtained from a microphone, pre-amplification is essential. Not only does it prevent the loss of precious millivolts, but the effect of noise that can be introduced by operation of the potentiometers is reduced, by virtue of the fact that the wanted signal is that much larger. Fig. 3 will be seen to be, in effect, two 'Gram' channels from fig. 2, with the



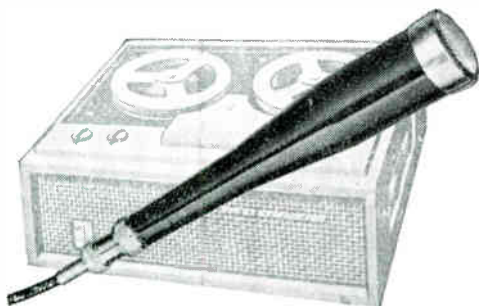
addition of a pre-amplifier stage shown in diagram form. Here we return to the valve circuits given last month or the transistor unit of fig. 1. It should be noted that all three circuits as drawn, are arranged for the connection of high impedance microphones, i.e. crystal, or moving coil and ribbon types which have built-in transformers. If low impedance mics are to be used, and they can offer distinct advantages, then a microphone input transformer will have to be used with the valve circuits. With the transistor circuit, however, we can make use of the low input impedance and connect at "X-X", leaving out the first stage. The output voltage available will not be as great as if an input transformer had been used, because of the effective voltage gain it gives, but the signal will be brought to a level that allows normal mixer attenuation while still delivering a reasonable signal to the input of the tape recorder.

As many as five or six channels can be used in the arrangement shown in fig. 3, with amplifiers in those channels that have to handle the lower signals. Screened cable should be used to connect from the mixer to the tape machine, and for



all High Z input leads. Using a metal box to house the mixer itself will be helpful and, in the case of valve amplifiers, the heater wiring should be kept well clear of the signal circuits. The power requirements for the valve stages are 200 mA @ 6.3V, and 1 mA @ 250V each. Components to make up a power unit to supply 4 or 5 stages can be readily obtained from any radio component shop. You would be well advised to keep the power unit separate in order to avoid hum troubles, unless you are prepared to experiment with the positioning of the transformer and rectifier, which can be of the metal, contact-cooled, type.

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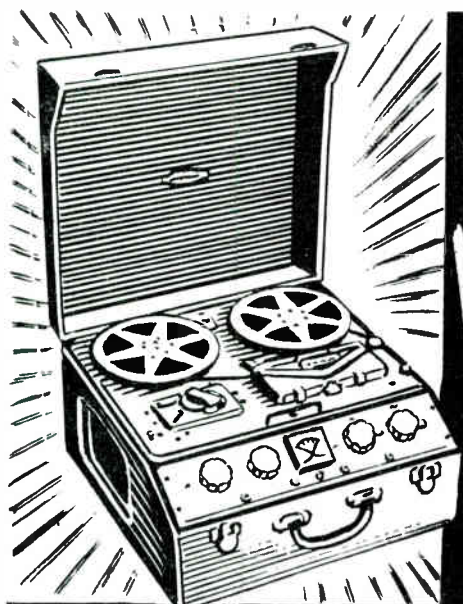


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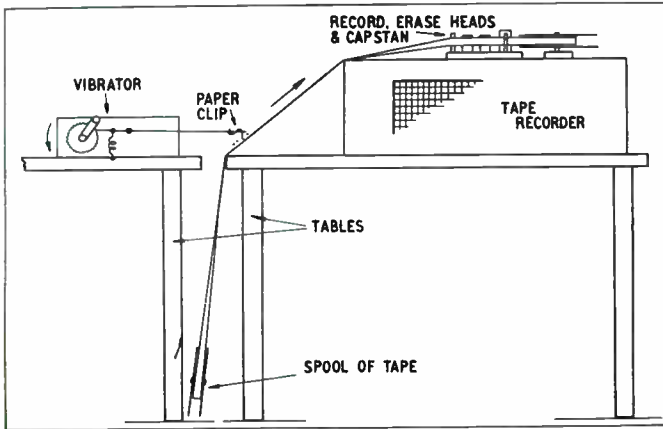
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our readers write

. . . about magnetic writing

From:—Charles Platt, 34 Baldock Road, Letchworth, Herts.

Dear Sir:—The letter you published from Mr. Kay intrigued me, and I decided to carry out one or two minor experiments in "Artificial Recording" myself (i.e., producing sound effects by drawing on tape). My first attempt was as basic as possible: I magnetised a piece of metal tapering to a fine point, and, while pulling the tape manually under it, I moved the metal back and forth at varying degrees. Playing back the resulting recording



produced noises which I have christened "blups". As far as I could see, whether one played the tape at $1\frac{1}{8}$, $3\frac{1}{2}$, or $7\frac{1}{2}$ i/s, forwards or backwards, the blups were of no use to anyone, unless you happened to like listening to a "wupph-wupph" noise produced at irregular intervals.

I had obviously not realised the high frequency needed. Short of taking a day to draw over a reasonable length of tape, I could see no other method of increasing the number of oscillations per inch than by making a form of vibrator. I quickly threw together something of that description, using a "Meccano" construction kit. I enclose a sketch of the machine. It consists simply of a cogwheel rotated by a handle; a strip rubs against the cogwheel, and on the end of the former I attached loosely a magnetised bent paper clip, which handily converted the vertical vibrations to horizontal ones.

This time I let the recorder pull the tape (partly because I needed two hands to work the vibrator), and I left it on playback at $1\frac{1}{8}$ i/s. Thus I could monitor the noise I was drawing. The result was a trifle disappointing. The noise I had produced was a whole succession of blups at fast speed, rather like interference on a television set. When greatly speeded up, this still failed to produce an actual noise, and so still faster vibrations did not seem to be an answer. This marks the end of my "research" to date. Has anyone any ideas? Or any successes? I would be glad to know. Yours sincerely,

. . . about specifications

From:—J. R. Cross, 8 Chaucer Way, Addlestone, Weybridge, Surrey.

Dear Sir:—In your columns recently there seems to be great controversy over tape speeds and frequency responses, generally to the exclusion of other inter-relating facts. May I be as bold as to say just this: In order to make a tape recording that will reproduce as near as possible to the original sound a balance must be sought between the following factors:—frequency response, harmonic distortion, transient response, dynamic range and background noise, for one can be improved at the expense of another. When all these important facts are taken into consideration a frequency response of 50-12,000 c/s \pm 3 dB at a

speed of $7\frac{1}{2}$ i/s is achieved. So when considering such things as $1\frac{1}{8}$, extra narrow gap heads and responses of 30-25,000, think again. Yours sincerely,

. . . about choosing tape

From:—R. Day, 59 Oaklands Avenue, Brookmans Park, Hatfield, Herts.

Dear Sir:—The technical articles of your magazine have been of great interest, and the requirements of a good tape recorder and its maintenance are beginning to take shape. There have been articles on wow and flutter, signal to noise, gain frequency response, etc., but no mention of tape.

What is to be looked for when buying tape? What makes for a good frequency response and low background noise? One manufacturer of tape heads claims a frequency response of up to 10 Kc/s at $1\frac{1}{8}$ i/s when using "high quality" tape. Does long playing tape which is thinner than normal playing tape require a lower level of magnetizing force, if so what about distortion occurring when working to normal recording levels as indicated by the magic eye indicator? An article on tape would be most

Yours truly,

We'll see what we can do. (Editor)

. . . about professional recorders

From:—E. W. Berth-Jones, Chief Engineer, Recording and Relay Equipment Division, The Gramophone Company Limited, Hayes, Middlesex.

Dear Sir:—The remarks of your correspondent Mr. Rae of Carlisle, in your July issue, on Mr. Moir's review of the E.M.I. Model TR52 Professional Transportable Stereo Tape Recorder, deserve some comment, and we should like to try to clarify some of the points raised.

In the first place, the performance figures quoted for professional type equipment are factory test figures, which each and every machine must pass before being issued. With domestic class equipment, the specification often describes the best which has been achieved on the prototype, and all too frequently is little more than the wildest hopes of the designer's imagination! However, this latter accusation cannot be levelled at the more reputable instruments, and here the differences lie less in what is stated than in what is left unsaid.

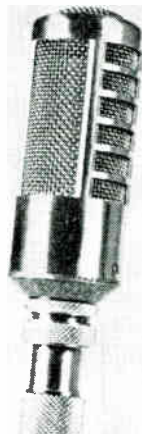
Mr. Rae quoted upper frequency range figures without reference to other factors. In professional equipment, a much more significant factor is the signal/noise ratio. In normal professional usage, the maximum signal level is taken as that which produces about 2 per cent. of total harmonic distortion in the output, this point lying about 10 dB below the saturation level of the tape. In typical amateur usage, considerably higher signal levels are commonplace, allowing the distortion to rise to some 10-15 per cent. or more for short periods. This is often not intolerable, provided that the signals do not have to be re-recorded or broadcast, but for really high quality work the levels must be restricted. This means that for the same, or better, signal/noise ratio, the background noise level of the professional tape recorder must be drastically reduced, and the distortion contribution of the amplifiers, particularly the replay first stage, must be carefully watched.

As is well-known, the standard reproducing amplifier has a response rising at high frequencies relative to the basic 6 dB/octave characteristic, and the higher the response is taken the greater the rise. This increases the high frequency noise output from both tape and first valve stage and, thus other things being equal, extension of frequency range increases measured noise. True, this increase may not be very noticeable on the small built-in monitor loudspeaker, but it will soon make itself obvious when reproduced on a wide range high fidelity system.

Furthermore, extension of the frequency range at the low end

(continued on page 463)

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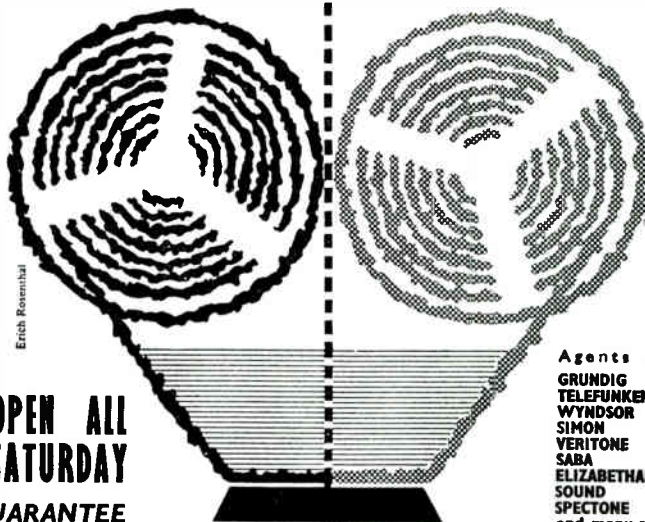
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READERS' LETTERS—(continued)

leads to serious design problems of both noise and distortion, and is, in fact, more difficult than extension of the upper end. The problem of high frequency noise would be much simplified if we could use high frequency pre-emphasis when recording, but this involved special quality tape and a change in the standard recording and replay characteristics.

The curves published by Mr. Moir as a result of his tests are not, in fact, typical of this model, which normally has a response flat within $\pm 2\text{dB}$ up to at least 12 Kc/s at $7\frac{1}{2}$ i/s and higher at 15 i/s. The reason for the discrepancy in this case is being investigated. However, the sales specification is limited to 10 Kc/s in order to be sure that the machine will still meet requirements after long periods of continuous usage under professional conditions. As an analogy, a very expensive motor car may well have a top speed no higher than that of a much cheaper model, but it is likely that its performance will be maintained longer, more consistently, and with less attention, when given hard usage.

On the subject of the use of very short replay head gaps to improve high frequency response, it should not be forgotten that, with a short gap, a large proportion of the useful flux is short-circuited across the pole faces, without passing through the pick-up coils, and hence the signal output of the head is reduced, leading to first stage noise troubles. Apparently the only practical way of avoiding this is, at the same time, to reduce the depth and hence the area of the abutting pole faces, which are already fairly small. This leaves little room for wear on the heads, which is important to the professional who may run thousands of feet of tape over the heads every day.

In addition, tolerances are more difficult to maintain on short-gap heads, so that the production of heads to the precision required becomes very expensive. Head gaps of .00015 in. or .0002 in. are commonly used, but shorter gaps than this to the precision required by the professional user become a costly proposition.

In short, the matter boils down to a problem in "Information Theory". A given area of tape will hold just so much information, and the machine designer can choose his own compromise between frequency range, signal/noise ratio, and freedom from distortion. In general, the professional requires low distortion and low noise, with reasonable frequency response, all of which must be maintained from month to month and from machine to machine with high precision, if necessary at the expense of increased running cost in terms of tape consumption.

The average amateur requires, above all, low running cost, implying low tape speed, and often prefers an extended though perhaps variable frequency range at the expense of noise and/or distortion. The really serious amateur having first-class reproducing equipment and good recording conditions from original sound sources will, however, often side with the professional in his requirements.

Two points of fact arise from Mr. Rae's letter: the capstan speed of the Model TR52 is 1,500 rpm or 750 rpm, direct coupled to a 2-speed synchronous motor, and the price is £245 not £285, as stated.

In conclusion, it may be of interest to many readers to know that, as a result of the interest shown in this machine following the publication of Mr. Moir's review in *The Tape Recorder*, the Gramophone Company Limited is considering the marketing of the tape deck as a separate item, for the benefit of those enthusiasts who prefer to build their own electronic units and mounting arrangements. More information will be available shortly.

Yours faithfully,

... about 4-track recording

From:—Andre Lemaire, 20 Rue Hanotte, Wasmuel, Hainaut, Belgium.

Dear Sir:—In your issue of July, the four-track recorder was presented as a very economic machine by the fact that the tracks are twice narrower. But, if, with this new conception, the frequency scale becomes smaller, I do not think that this model is better.

For a serious amateur of music, what is most important: High fidelity or long play? I would like to know the variations of

the frequency scale with a twin-track recorder and with a four-track one.

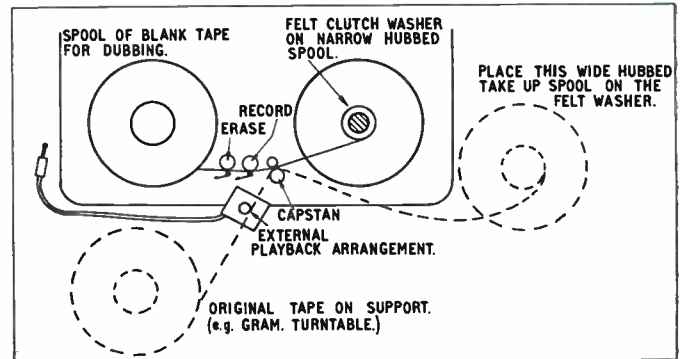
The pros and cons of four-track recording are discussed by James Moir on page 453, (Editor).

... about dubbing on one machine

From:—Donald J. Squire, Ashley Clinto School, R.O. Takapau, Hawke's Bay, New Zealand.

Dear Sir:—H. J. Anstey and others who would like, but can't afford, two recorders for dubbing, may be interested in an idea that makes high quality dubbing possible with only one recorder.

Set your tape recorder up threaded ready for recording. Use an externally-mounted replay head, compensated and pre-amplified (e.g. Tutchings transistor arrangement). Place the spool of tape



containing the original programme on a holder of some sort (gram turntable?). Lead this tape past the external PB arrangement, on to and past the capstan (or pinch wheel) and finally to a take up spool of greater hub diameter than that being used for the dubbing tape. Place the programme take up spool on top of the dubbing tape spool, separated by a felt washer to act as separator and clutch.

When the machine is started, both tapes will move simultaneously, and the signal from the external PB arrangement can be fed into one of the recorder's input sockets and treated in the usual recording fashion. One or two guides will be needed to help the programme tape move "upstairs" to its take up spool and/or to provide tension on its magazine spool.

The system has obvious limitations—inability to change speed by dubbing, no wind on or rewind facilities without swapping the places of both tapes, etc., but it is a cheap idea for a fairly handy man. P.S. Please thank the editor of *Hi-Fi News* for the article on biasing various tapes.* It was just what the doctor ordered.

Yours sincerely,

*Issue dated December, 1959, page 491. (Editor)

... more about the Time Switch

From:—A. H. Uden, 7 Carrington Road, Aylesbury, Bucks.

Dear Sir:—I have just been reading the first part of the interesting article, "A Delayed Action Time Switch" by R. E. Steele in the July issue. From this, I gather that the idea is to pre-set the controls on the tape machine, etc., and use the clocks to switch ON and OFF from the "mains". It occurs to me that this arrangement will present some important difficulties with at least one tape recorder.

On the well-known Wright & Weare (Ferrograph) recorder, the machine is started by drawing a spring loaded control forward into contact with an energised solenoid. In order to set up this deck in advance, it will be necessary to have some means of keeping the start control forward against the solenoid, so that the machine will start when the timing device switches the electricity supply ON.

I tried using two chinagraph pencils to wedge the start control, but found that they did not bring it sufficiently far forward to the solenoid to start the machine running.

Even if the start control is successfully wedged, a further difficulty arises when the timing device switches the electricity supply OFF. The solenoid will be de-energised but the start

(continued overleaf)

Chitnis 4-TRACK STEREOPHONIC RECORDER

9/S4K



*truest to
the original*

There is no doubt about which recorder you will buy when you see and hear this 4-track Stereophonic Model. It has so much to offer both to professional and domestic users alike. The incorporation of world-famous Bogen heads with an advanced powerful twin amplifier system provide sensationally brilliant standards of reproduction at a tape speed of only $3\frac{3}{4}$ inches per second.

Mechanically, too, the Chitnis 9/S4K is a masterpiece of efficiency and dependability. Response to all controls is instantaneous; a self-locking arrangement prevents accidental erasure of wanted material. YOU

CAN USE THIS RECORDER FOR STEREO OR MONO AS REQUIRED, and four track facilities double the playing time of each reel and halve your tape costs. Controls are very well positioned, and the complete instrument (with its own built-in loudspeaker for monitoring, etc.) is housed within a case of remarkable compactness and elegant modernity.

- **RESPONSE** 30-16,000c/s \pm 3dB at $3\frac{3}{4}$ i.p.s.
- **INPUTS** Radio (2) Pick-up (2) Microphone (2).
- **OUTPUTS** 2 at 15 ohms; 2 at 5 ohms; two low level.
- **SIGNAL-NOISE RATIO** better than 55 dB.
- Counter, recording level indicator, pause, superimpose, etc., etc. Size $13\frac{1}{2} \times 10\frac{1}{2} \times 6$ ".

62
GNS

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15-ohm OUTLETS

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READERS' LETTERS—(continued)

control unable to spring back to its 'off' position if it has been wedged. This is most important, for if the control cannot return to the "off" position, no braking will be applied to the spools. There is a considerable risk of not only the tape over-running, but also of snatching or even a break occurring. The latter remarks particularly apply when the machine is switched on and off several times or running at one of the higher tape speeds.

"Flats" may also develop on the pulley wheels etc. and this applies to nearly all recorders which use this system of tape drive.

R. E. Steele replies as follows:—

Yours sincerely,

Some makes of tape recorder employ what is known as solenoid switching, and readers using the delayed action time switch described will find difficulties due to the start control not staying in the START position. The object of this is to prevent the tape recorder from actually recording until the amplifier has warmed up. However no harm can possibly occur if the start control is held in this position—other than about 15 seconds of unrecorded tape (this being the time to warm up). The control could be held in various ways depending on the type of deck employed. A simple way would be to attach a strong rubber band (or a number of thin ones) around the control and stretch them to some convenient point on the tape recorder.

A more permanent method and of better appearance would be to make a hinged clip that swung over on to the start control engaging a hole drilled in the appropriate position. This will not of course allow the control to release and apply the braking mechanism. This is not serious as the tape will only be travelling at a maximum of $7\frac{1}{2}$ i/s for the majority of recording, and the amount of spill will be very small.

The use of the brake is mainly made use of in stopping the machine when using the fast rewind. There is little or no risk of snatch because the tape is driven by the capstan, the take off reel being free. The take up reel usually employs a slipping clutch, and any increase in tension between the capstan and take up reel will allow it to slip.

A few readers have queried the possibility of flats occurring on the pinch wheel of their recorders. Now, flats could appear in two ways, (1) due to the pinch wheel being pressed hard against the capstan of the flywheel thereby flattening the surface, and (2) due to the tape being gripped by the capstan and pinch wheel and then snatched by the take up reel and abrading the surface of the pinch wheel in the process.

If we consider (1) this is most unlikely to occur because the rubber in the pinch wheel—like a spring—has resilience and when compressed (providing it is not overstressed, i.e. pressed too hard) will retain its original shape when the pinch wheel is pulled away from the capstan. The pinch wheel is usually kept in contact with the capstan by a fairly light spring—certainly not strong enough to overstress the rubber. Taking case (2):—Although the tape is gripped by the capstan and pinch wheel, the tape will not be snatched because the tape between the capstan and the take up spool is tensioned then, upon starting, the capstan and take up spool will start at the same instant—or nearly—causing the tape to start moving. Even if the take up spool starts just before the capstan, the moving tape would merely cause the flywheel to turn until it was taken up by the drive of the motor.

... about recording in South Africa

From:—W. J. Botha, 5 Breanith Court, Stirling, East London, South Africa.

Dear Sir:—I build all my own equipment purely as a hobby and have recorded a number of South African artists as well as overseas visitors. I must admit that I go to some lengths to get these recordings in view of restrictions, but then a collector pays such a price, which price really amounts to what others would call "inconvenience", "hardship", etc.

I shall be happy to interchange or swap tapes with anyone in the British Isles. Our native and coloured people have a talent which is unique.

Yours sincerely,

TAPE, RECORDERS & ACCESSORIES

FIRST DETAILS OF NEW PRODUCTS

● We remind our readers that notices of equipment listed and illustrated in this monthly feature are in no sense reviews. When figures, specifications and diagrams are published, these data are extractions from manufacturers' lists. When samples of this equipment are submitted for test, they are passed to our technical contributors, whose reports are published in a separate section.

★

PARABOLIC REFLECTOR FOR OUTDOOR RECORDINGS

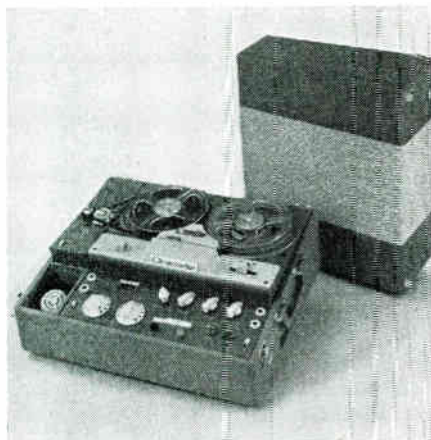
★



Grampian Parabolic Reflector

THE recent articles by E. D. H. Johnson on *Designing and Using a Parabolic Reflector* have raised a great deal of interest, and we have been most interested to receive details of a unit now in production by Grampian Reproducers Ltd. It consists of an aluminium dish accurately formed to give the maximum pickup of distant sounds, and the whole assembly is arranged for mounting on any heavy duty cine tripod fitted with a pan-and-tilt head. The reflector is approximately 24 in. in diameter and 5 in. deep. It is finished in dark green matt, and weighs 5½ lbs. including Grampian DP/4 microphone, which is the recommended type.

A sighting tube is fitted and focusing is achieved by adjusting the distance between the microphone grille and the Parabola. The gain of the reflector is of the order of 14dB over the frequency range of 500—5,000 c/s. The retail price has been fixed at £5 5s. complete with fittings and instructions, less microphone and tripod. We shall be publishing a full scale report by E. D. H. Johnson in the very near future, and in the meantime readers may obtain further particulars by writing to **Grampian Reproducers Ltd., Hanworth Trading Estate, Feltham, Middx.**



★

CINECORDER DESIGNED TO SIMPLIFY THE SYNCHRONISING OF SOUND AND CINE

★

AN instrument designed especially with the needs of the Cine amateur in mind has been produced by K.G.M. Electronics Ltd. Known as the Cinecorder it makes possible lip-synchronisation inserts with existing camera equipment. Using perforated

tape, and with a special remote control, it is intended for use with the Eumig Imperial 8 mm cine projectors, but may be used with certain other makes of constant-speed or controlled-speed projectors.

Facilities include: (1) Separate capstan tape position indicator, measuring tape length in terms of time in seconds. (2) A Tape Lift Lever which lifts the tape away from the recording head, enabling sound to be inserted without clicks or other noises being recorded. (3) A "Varitrack" Tape control permitting multi-track recording. (4) A fully-controllable Bias Control allowing fading and superimposition. (5) Switched inputs on both the mixing channels allowing the volume levels to be pre-set and the sound "keyed in" instantaneously. Also available at a later date will be a Synchronising Unit which will be suitable for perforated tape, and will thus allow a wider variety of projectors, 8 mm, 9.5 mm and 16 mm, to be operated with 100 per cent. synchronisation. Available from photographic dealers and direct from the manufacturers it is priced at 55 guineas. Write for details to: **K.G.M. Electronics Ltd., Bardolph Road, Richmond, Surrey.**

★

NEW "STICK" MICROPHONE FROM SUPER ELECTRONICS AVAILABLE WITH DYNAMIC OR CRYSTAL INSERTS

★



AS shown for the first time in the microphone survey in the August issue of *The Tape Recorder*, Super Electronics Ltd. have introduced a new selection of microphones. The Crystal Stick Microphone (Type S.E.101), has a claimed frequency range of 30-12,000 c/s. Sensitivity is 1 mV μ b. at 1,000 c/s, and the unit is High Impedance (Capacity 2,000 pf) with a recommended load resistance of 1 Megohm. The retail price is £1 15s. with the jack plug an extra 5s. This microphone is also available fitted with a Dynamic insert at £3. The other microphones announced are the Diana with magnetic base—fitted with a crystal unit—at £3 3s., and with Dynamic insert £4 4s. Manufacturers: **Super Electronics Ltd., 5, Violet Hill, London, N.W.8.**

New "Bib" accessories

THREE new Bib Tape Accessories are announced by Multicore Solders Ltd., manufacturers of the Bib Tape Splicer. The first is a sheet containing 24 self-adhesive tape reel labels packed in a two-colour printed envelope. These labels can be detached easily from the backing sheet and pressed on the tape reel. They will fit most types of reel from 5 in. upward. Each label

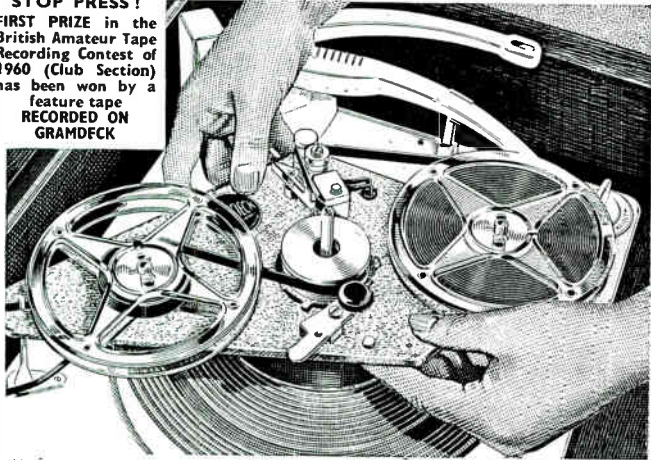
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GRAMOPHONE TAPE RECORDER

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FIRST PRIZE in the
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SUMS OF 13/-.**

Ready to record, complete with
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twin-track tape. Special moving
coil microphone extra.

EASY TERMS

- ★ Plays at 7½" per sec. or three other speeds
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—and back into a
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Gramdeck is completely new . . . a revolutionary invention that instantly turns your gramophone into a tape-recorder and back into a gramophone at will! You simply slip it on to your turntable and you are ready to record direct from radio or microphone . . . the voices of your family . . . radio programmes . . . your favourite music—and you can instantly play it back through your own gramophone or radio with Lifelike Fidelity. Made by the firm that makes radar runs for Viscounts and Britannias, the amazing Gramdeck brings full tape recording and playing facilities to every gramophone owner, at little extra cost.

Send for informative free book

This wonderful new invention means that any gramophone owner can now add superbly good tape-recording facilities to existing equipment at a fraction of the usual cost. Full details, photos, specifications, Easy Terms, etc., are given in the Gramdeck Book. Send for your copy today—FREE and entirely without obligation.

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"Real hi-fi results . . . reproduction excellent."—Radio & T/V Retailers' Review. "Provides the same recording and playback quality as many high priced tape recorders."—Radio Review. Results better than those obtainable from many tape recorders in the £50-£60 price range."—Amateur Stage. "Better than many so-called hi-fi recorders."—Amateur Cine World.

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GRAMDECK TURNS A TURNTABLE INTO A TAPE-RECORDER

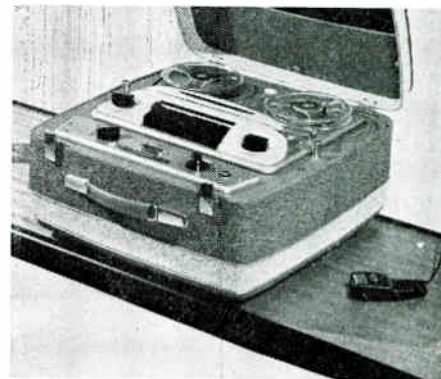
NEW PRODUCTS—(continued)

provides space for title, composer, artist, reel number, speed, date and type of tape used. Price 2s. 6d. per packet.

A Calculator which gives the recording times of one, two and four track machines, with twelve different reel sizes and five speeds, is the second new accessory available. The range of speeds covered are 15, 7½, 3¾, 1¾ and 15/16th i/s, and each speed forms the subject of a separate table. On the reverse side the calculator gives the approximate performance times of 48 of the most popular classical works, which should be of great interest to recording enthusiasts for timing broadcast concerts. The price is 2s.

The final item is the Bib Tape Splicer Kit. Contained in a hinged box, with a recess for each item, it is claimed to be the most comprehensive range of accessories available to the tape recording enthusiast. The Kit includes Bib Tape Splicer and Cutter, complete on baseboard with instruction leaflet, 6 spare blades, a reel of splicing tape on a dispenser, and a package of 24 Bib Tape Reel Labels with a Data Calculator. The complete Kit is available at 28s. 6d. Manufacturers: Multicore Solders Ltd., Multicore Works, Hemel Hempstead, Hertfordshire.

★
**NEW
"CORDOVA"
RECORDER
FROM
DYNATRON
RADIO**



DYNATRON have presented their first Tape Recorder known as the Cordova. This instrument has incorporated the Collaro Studio Deck, with pause control, superimposition, three speeds, revolution counter, and safety switch. It can be used for amplifying inputs from Radio or Crystal Pick-up, and the power output of 2½ watts is fed into a 10 × 4½ in. elliptical speaker. Supplied complete with microphone and tape, the Cordova is priced at 39 guineas. Manufactured by Dynatron Radio Ltd., Maidenhead, Bucks.

New Lustraphone products

L USTRAPHONE have added two new components to their range of equipment. The first is an entirely new Tubular Pencil Switch Adaptor, which incorporates a silent-action switch. Designed for the standard switch requirements, it can be adapted for various combinations including Double-Pole change over. The second item is a simplified version of the VR/65 "Stereomic" Ribbon velocity microphone. Known as the VR/65NS "Stereolus" it differs only in such details as the omitting of the phase switching and other mechanical features, yet the performance characteristics have been fully maintained. The "Stereolus" microphone is now available, price 15 guineas. Manufactured by Lustraphone Ltd., St. George's Works, Regent's Park Road, London, N.W.1.

EASYSPLICE, guaranteed for easy accurate tape splicing, spring clamps hold tape while splicing. Thousands sold & exported
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EQUIPMENT REVIEWED

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**WYNSOR
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 ★

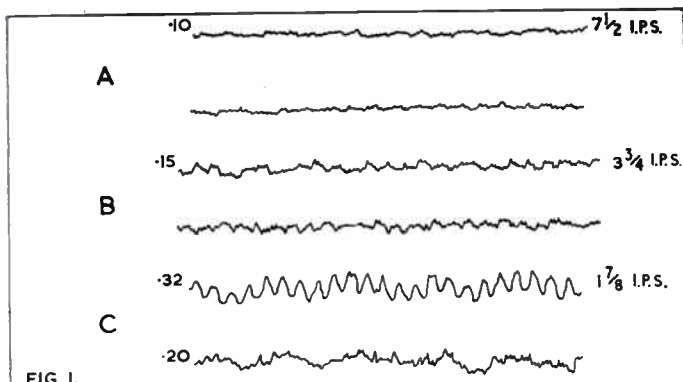


Manufacturer's Specification

Deck: Collaro Studio. **Frequency Response:** $7\frac{1}{2}$ i/s, 50-15,000 c/s; $3\frac{3}{4}$ i/s, 50-9,000 c/s, all within ± 3 dB. **Level Indicator:** magic eye. **Recording sense:** Standard half track. **Hum and Noise:** -40 dB. **Wow and Flutter:** less than 0.1 per cent. **Loudspeaker:** 10 in. \times 6 in. unit in detachable lid. **Monitoring:** with independent volume control. Mixing, tone, and pause controls. **Size:** $14\frac{1}{2} \times 12\frac{1}{8} \times 9$ in. **Weight:** 29 lb. **Price,** with tape and crystal microphone, £47 5s.

Manufactured by Wynsor Recording Co. Ltd., Wynsor Works, 2, Bellevue Road, Friern Barnet, London, N.11.

I LOOKED forward to testing this machine, which has a larger than usual speaker in the detachable lid, and I must admit that playing a $7\frac{1}{2}$ i/s pre-recorded tape fulfilled all my expectations. The quality and musical balance was markedly better than that obtained from other units with small speakers built into their cabinets and speech was crisp and clean with no cabinet boom to spoil it. I recorded speech and music from microphone and FM tuner, but this time I was much less happy; the quality was thin and edgy, and fatiguing to listen to. One felt the need constantly to alter the volume and tone



controls, but no combination gave the desired result. I guessed what the trouble might be, but pressed on with the instrumental tests to see how much of the story they told.

Wow and Flutter

The wow and flutter at $7\frac{1}{2}$ i/s and $3\frac{3}{4}$ i/s were beyond reproach (fig. 1, A and B), but at $1\frac{7}{8}$ i/s, 24 c/s flutter from the driving

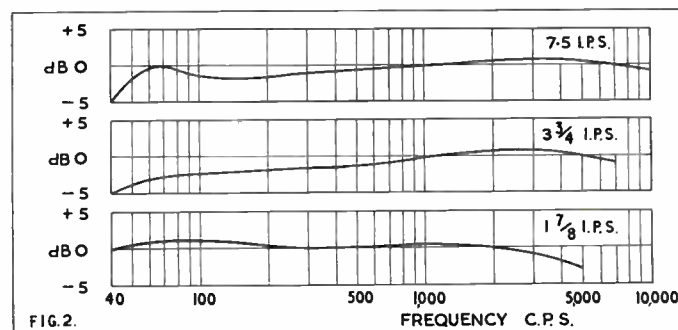
motor showed up intermittently as the recorded and playback flutters came into phase; the adding and cancelling effects are shown in fig. 1 C. The same 24 c/s flutter can just be seen in the $3\frac{3}{4}$ i/s fluttergram, and a very slight suspicion of it is visible at $7\frac{1}{2}$ i/s. The improved smoothing effect at the higher flywheel speeds is very evident. No cyclical disturbances from capstan, pressure roller, or idler roller could be distinguished, and at the two higher speeds the flutter bridge readings remained remarkably steady.

Playback responses

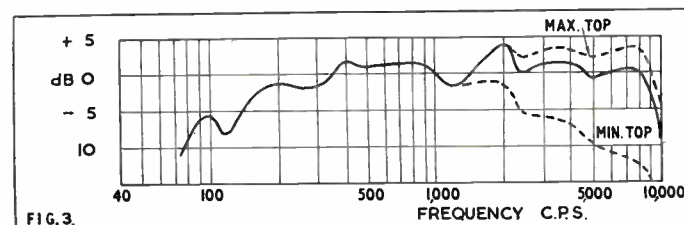
C.C.I.R. test tapes having surface induction characteristics of 100 microseconds, 200 microseconds and 400 microseconds were played at the three speeds and responses plotted from the low level output jack. Fig. 2 shows that playback equalisation follows the C.C.I.R. recommendations to very fine limits.

Acoustic response

A $7\frac{1}{2}$ i/s White Noise test tape was next played, and the sound output measured at a distance of one foot from the speaker



● Low level jack output—C.C.I.R. test tapes



● Acoustic output— $7\frac{1}{2}$ i/s white noise test tape

grill The solid line curve of Fig. 3 was obtained with the tone control set about half way; this also corresponded to the preferred setting when playing the pre-recorded tape. Turning the control to one extreme gave a slight increase in top response, and turning it in the other direction resulted in a fairly vigorous top cut.

Peak output

The maximum undistorted acoustic power output at one foot from the loudspeaker was 106 phons; this corresponds very closely to that of other domestic recorders recently reviewed. Waveform distortion was just visible on a C.T.R. when the voltage across the 3-ohm speaker voice coil terminals reached 2.2 volts R.M.S.; this corresponds to an electrical power output of 1.6 watts.

Signal noise ratio

Hum level depended somewhat on the setting of the gain control. At normal listening level it was 36 dB below test tape level, but at higher and lower settings of the control the ratio

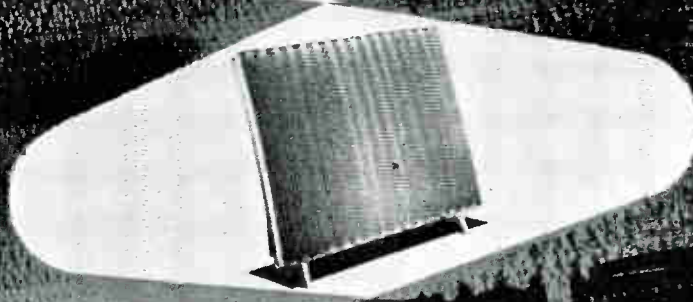
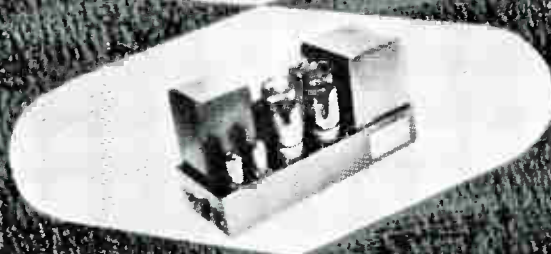
(continued on page 469)

1960

Hi Fi

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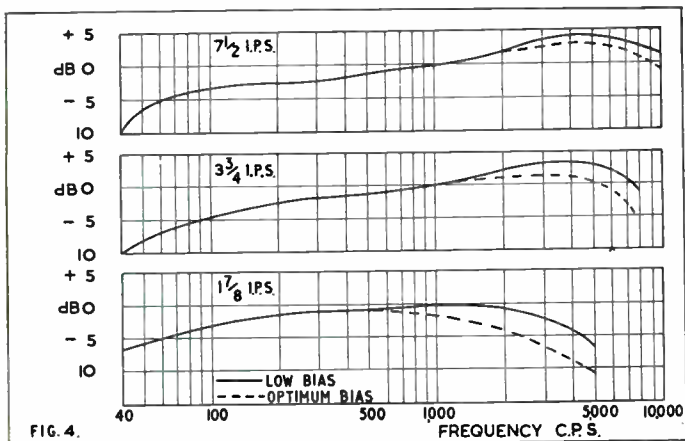
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99, Mortimer St., London, W.1.

dropped to 30 dB. This indicates that some cancellation is taking place between head pickup hum and output stage hum. Thus the hum is between 42 dB and 48 dB below tape peak recording level, and is perfectly adequate for this class of instrument. Hiss and tape noise was commendably low, which points to good waveform in the erase and bias oscillator.

Record/replay tests

The tests so far have confirmed that there is little cause for complaint on the playback side. The solid line curves of fig. 4 show the record/play responses for the three speeds; apart from a slight top lift, which can be reduced by the tone control, they give no indication of the cause of the trouble mentioned in the opening paragraph. Further recording tests at 1 Kc/s showed that test tape level, which is 12 dB below tape peak recording level, was recorded with the cathode ray beams of the volume indicator moved about 1/4 in. from the zero position; the recorded waveform at this level was relatively clean. Turning up the gain control to close the indicator beams to the blue cursor resulted in extreme distortion of the recorded signal, and serious distortion commenced at a level only 6 dB above test tape level, when the indicator beams were half closed. This explains the edgy distorted sound obtained during the early recording tests, and readers of my other reviews will guess that such results are caused by under-biasing. The bias was measured and found to be barely 30 volts at 68 Kc/s which is rather low for a Collaro head.

To avoid removing the amplifier from its cabinet, I disconnected the erase head so that the bias voltage was increased to 40 volts, and continued tests using bulk-erased tapes. Recordings were much improved, and were comparable to pre-recorded tape quality in every way. The record/play responses were re-checked and are shown as the dotted curves of fig. 4. Closing the volume indicator beams now resulted in a recorded level 10 dB above test tape level, with just perceptible distortion. This shows that



● Low level jack output—record/replay

the bias should be increased still further for minimum distortion, but with a three-speed machine one is tempted to seek a compromise bias which will allow enough top response to be recorded at 1 7/8 i/s without causing audible distortion at the higher speeds.

Personally I would prefer to raise the bias to prevent any possibility of harmonic distortion at any tape speed, and then peak the 1 7/8 i/s pre-emphasis correction circuit at a lower frequency; but such is the power of advertising that extended frequency response is still put before "deep down cleanness".

Comment

I like the functional styling of the cabinet, and the close grouping of the controls. The edge-operated controls should be calibrated in some way so that preferred settings can be repeated. Also, with one going up, one down, and one across for increase of gain, my recordings were marred by occasional

blasts of sound caused by turning the controls the wrong way and too far!

The low bias on this particular recorder may have been the result of adverse component tolerances, but the recorded quality is so vastly improved with optimum bias that a pre-set bias control would be a worthwhile refinement. The large speaker, mounted on what is in effect an open baffle, contributes markedly to the very fine sound quality of this recorder, and offers the added advantage that it may be placed for maximum acoustic effect without reference to the operating position of the recorder proper.

With correct bias the recorded quality does full justice to the excellent playback characteristics, and I have no hesitation in recommending this machine where a compact self-contained unit of better-than-average tone quality is required.

A. Tutchings

**FIDELITY RADIO
"ARGYLL"
PORTABLE
TAPE RECORDER**



Manufacturer's Specification

Tape speed: 3 1/4 i/s. **Frequency range:** 60-10,000 c/s. **Fast winding or rewinding:** for 850 ft. of tape, 3 mins. **Built-in loudspeaker:** Permanent magnet 7 x 4 in. high flux. **Output impedance:** 3-5 ohms. **Amplifier power:** 4 watts. **Mains voltage:** AC only, 200/250 volts. **Overall dimensions of case:** 17 x 13 1/2 x 7 1/4 in. **Net weight:** without reels and mic., 21 lb. **Signal to noise ratio:** 50 dB down. **Wow and flutter:** Total 0.4% R.M.S. **Price:** £30 9s.

Manufactured by Fidelity Radio Ltd., 11-13 Blechynden Street, London, W.11.

WITH the extremely rapid growth of the popularity of Tape Recorders, it was inevitable that a market would be created for machines that do not offer the ultimate in performance but that do have the right sort of price ticket. In the reviewer's opinion, the "Argyll" is worthy of the consideration of prospective purchasers in that market.

It must be said that the machine reviewed does not quite meet the specification set out above, and thereby earns an unnecessary black mark. Unnecessary, because of a system that seems to have grown up whereby Manufacturers, and they nearly all do it, have to claim a little bit more than the other chap, and, if need be, a little bit more than the machine will do. Unnecessary also, because the performance of the "Argyll" reflects great credit on its price, and upholds the promise of the smart, yet workmanlike appearance.

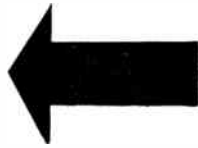
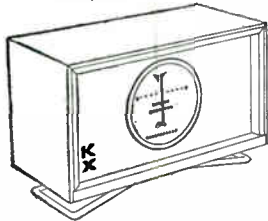
Controls simple

The B.S.R. "Monardeck", used on this machine, has proved to be justly popular, and represents an ideal choice in view of the simplicity of operation of the controls. The makers do not claim a fantastic wow and flutter figure, and I am glad to except them from my previous remarks. Such wow as was present occurred at the frequency of the capstan rotation and, digressing for a moment, one cannot help wondering how much improvement in this direction would cost. (A reviewer must surely strive towards a raising of *real* standards!)

The measured performance figures are shown in the graph and table. In the absence of an "Amplifier" output, all output

(continued on page 471)

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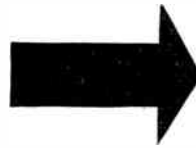
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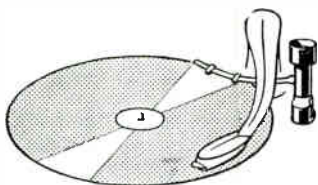
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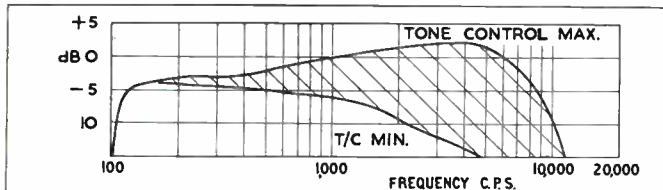
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voltages were measured across the load of the internal loud-speaker, which, incidentally, fulfilled its purpose adequately. The Signal/Noise Ratio quoted was measured below a 1 Kc/s signal level set for 5 per cent. Distortion. Recording at this level the bar type Magic eye was showing about $\frac{1}{4}$ in. gap. With the Magic eye closed, the distortion level was $9\frac{1}{2}$ per cent. The weighted S/N ratio could be improved with attention to the Bias Oscillator, erased tapes tended to be rather noisy, but nevertheless the figure is quite good for a machine in this range.

Table 1

Tape Speed	3 $\frac{3}{4}$ " / sec.—4 $\frac{1}{2}$ %
Fast Forward	3 min. 25 sec.
Fast Rewind	2 min. 55 sec.
Wow and Flutter	within 0.4%
Signal/Noise Ratio	45 dB Unweighted 46 dB Weighted
Input Sensitivity	Mic 1 mV Rad 100 mV

The two inputs have separate gain controls, and can be mixed. The sensitivity of the "Radio" input is of the right order, while that of the "Mic" input, although very good at 1 mV, is marred by hum, which really sets a level of about 3 mV for a clean recording. This was observed using the



microphone supplied with the machine. It may well be that closer attention to screening, or the placement of wiring, would be of advantage here.

The cabinet design merits full marks for appearance, and also for the two pockets, which, I found, allowed me to pack in the mains lead and plug, microphone, recording lead, and two spare reels of tape, and there was still some room to spare. The machine is delivered complete with a reel of tape and spare spool, a microphone of smart design, a recording lead, a usefully long mains lead, and instruction booklet. All, in fact, that is needed to start recording.

The instruction booklet appears to take brevity to the extreme, but, on consideration, I give full marks for just that. The new owner is given full information without being allowed to feel that there is nothing left for him to find out himself.

In conclusion, while I would not attempt to take this machine out of the "Pop music" class, I do believe that it represents its price bracket at the highest level.

A. Bartlett Still

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All advertisements for the November issue must arrive not later than October 10th.

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Armstrong Wireless & Television Co. Ltd.	458
B.A.S.F.	476
British Ferrograph Recorder Co.	475
Chitnis Electronics Ltd.	464
Cosmocord Ltd.	428
Dickinsons of Pall Mall	432
E.M.I. Sales & Service Ltd.	434
Easysplice	466
Elizabethan (Tape Recorders) Ltd.	431
Fi-Cord Ltd.	426
Film Industries Ltd.	462
Francis of Streatham	454
Gopalco Ltd.	452
Gramdeck	466
The Gramophone Co. Ltd.	433
Grampian Reproducers Ltd.	460
Grundig (G.B.) Ltd.	446
H. C. Harridge	470
Hi-Fi Year Book	468
Howard Photographic	473
Lustraphone Ltd.	458
M.S.S. Recording Co. Ltd.	454
Magnegraph	474
Multicore Solders Ltd.	457
Nusound Recording Co.	462
Perth Radios Ltd.	436
Philips Electrical Ltd.	432
R. E. W. Earlsfield Ltd.	458
R.B. Tapes Ltd.	462
Rapid Recording Service	474
Sands Hunter	460
Specto Ltd.	430
Tape Recorder Centre Ltd.	427
Tape Recorder (Electronics) Ltd.	429
Technical Suppliers Ltd.	462
Valradio Ltd	455
Walter Instruments Ltd.	444
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Wilmex (Distributors) Ltd.	470
Wyndors Television Service	471

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