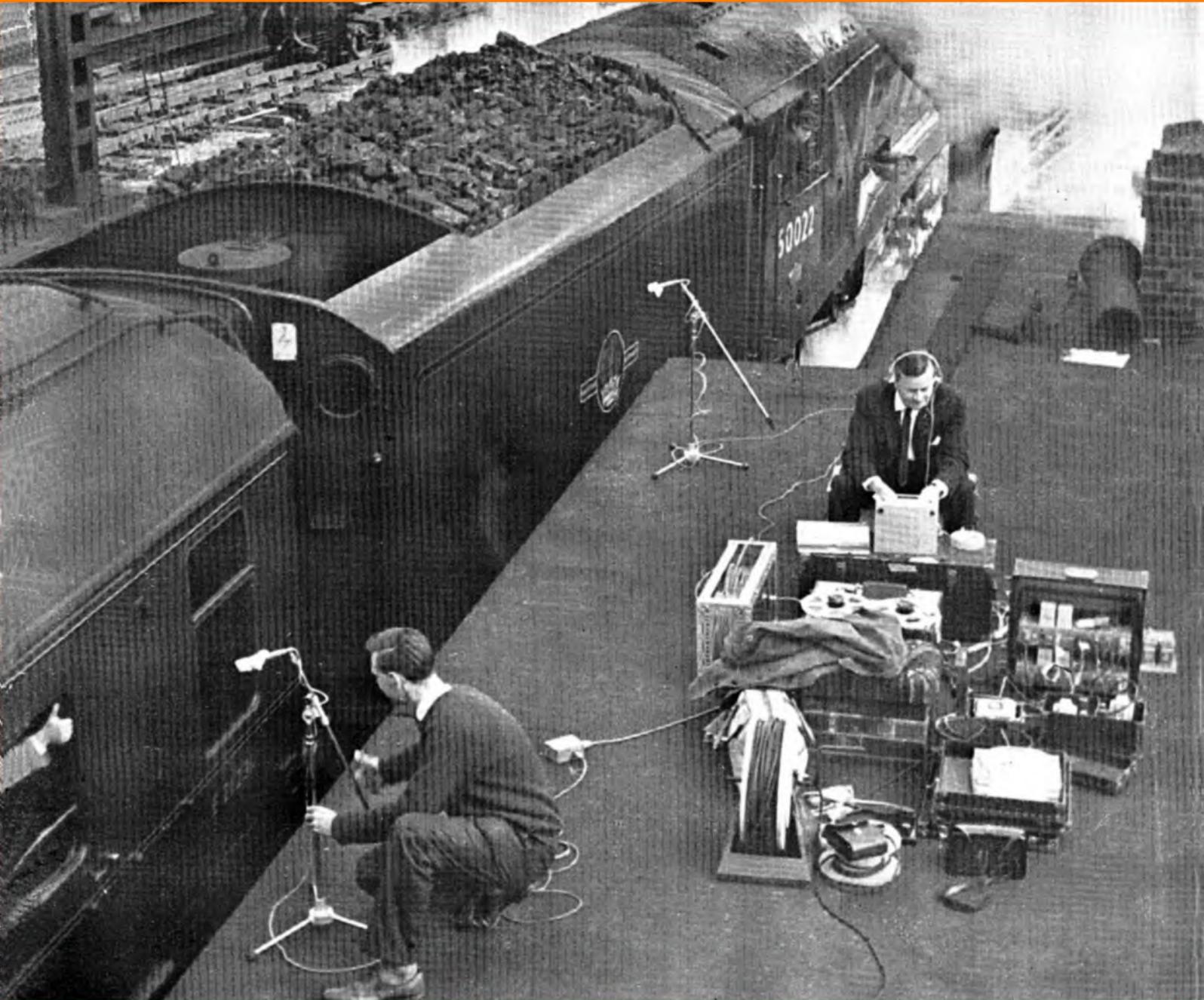


# the TAPE

PRICE 1/6

August 1962  
Vol. 4 No. 7

# RECORDER



## — IN THIS NUMBER —

- Tape Recorder Service
- Equipment Reviewed
- Building Round the Harting Deck
- Details of New Products
- Sound and Cine
- Our Readers Write
- Design Requirements and Circuits for Peak Programme Meters
- Good Service - and the Manufacturer
- Here and There and Everyway

# To the man who already owns a Tape Recorder

A recent Survey among Ferrograph owners has disclosed one rather astonishing fact—how few of them chose the Ferrograph as their first Tape Recorder. On the contrary, they *changed* to the Ferrograph as they became more experienced and, therefore, more critical. As one owner recently wrote “Your machine is really beyond praise. I’m pleased to have bought it even though it means discarding many of my previous recordings”.

Yet, perhaps, not so astonishing after all. For the Ferrograph has never been advertised in the newspapers and its distribution is limited to those few dealers specialising in and demonstrating High Fidelity equipment.

And such is the almost legendary reputation of the Ferrograph

eagerly passed on by word of mouth and personal recommendation that we have never been able to satisfy the demand. For as users know the Ferrograph is no ordinary Tape Recorder. It is *not* mass produced. Behind it stands the accumulated experience of over twelve years specialisation in Tape Recording. Those engaged in its manufacture are experts dedicated to the art of high fidelity sound reproduction. All that we ask of them is that they make each instrument to satisfy their own exacting standards as if, in fact, they were going to own it themselves.

We believe—and those who change to Ferrograph appear to endorse it—that the Ferrograph sets a standard which is in accord with the highest traditions of British engineering skill.

It is, in fact, a Tape Recorder you’ll be proud to now and one that will be the envy of your friends.



## Series A/N

With standard Monaural recording and playback facilities at  $3\frac{1}{2}/7\frac{1}{2}$  i.p.s.

81 GNS

## Series 420

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110 GNS

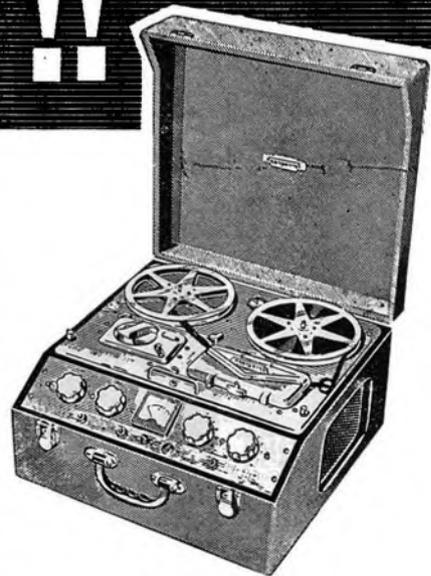
Three Independent Motors · Synchronous Capstan Motor · Recording Level Meter · Brief Stop Interchangeable Plug-in Heads · Switch Speed Change with Compensated Correction Network Separate Tone Controls · High Fidelity  $2\frac{1}{2}$  Watts Output Stage · Uses  $8\frac{1}{2}$ " Tape Spools Gear-Driven Turns Counter · Automatic Switch Cuts Motors at end of Spool · Endless loop Cassette (optional Extra)

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 ..... TELEPHONE No.....  
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 RECORDERS YOU WISH TO HEAR. (Max. 3).....  
 IF YOU WISH TO PART EXCHANGE STATE DETAILS BELOW.....  
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 ADJOINING MARYLAND STATION    MAR 5879

205 HIGH ST. NTH., EAST HAM, E.6  
 OPPOSITE EAST HAM STATION    GRA 6543

## CITY & ESSEX TAPE RECORDER CENTRES

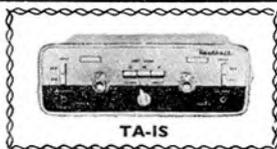
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**HI-FI STEREO 6-WATT AMPLIFIER Model S-33.** Attractively styled, completely self-contained. Printed circuit makes it easy to build. Only 0.3% distortion at 2½ W/chal. 20 dB N.F.B.; sensitivity 200 mV. U/L output, ganged controls. £12.8.6



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S-99



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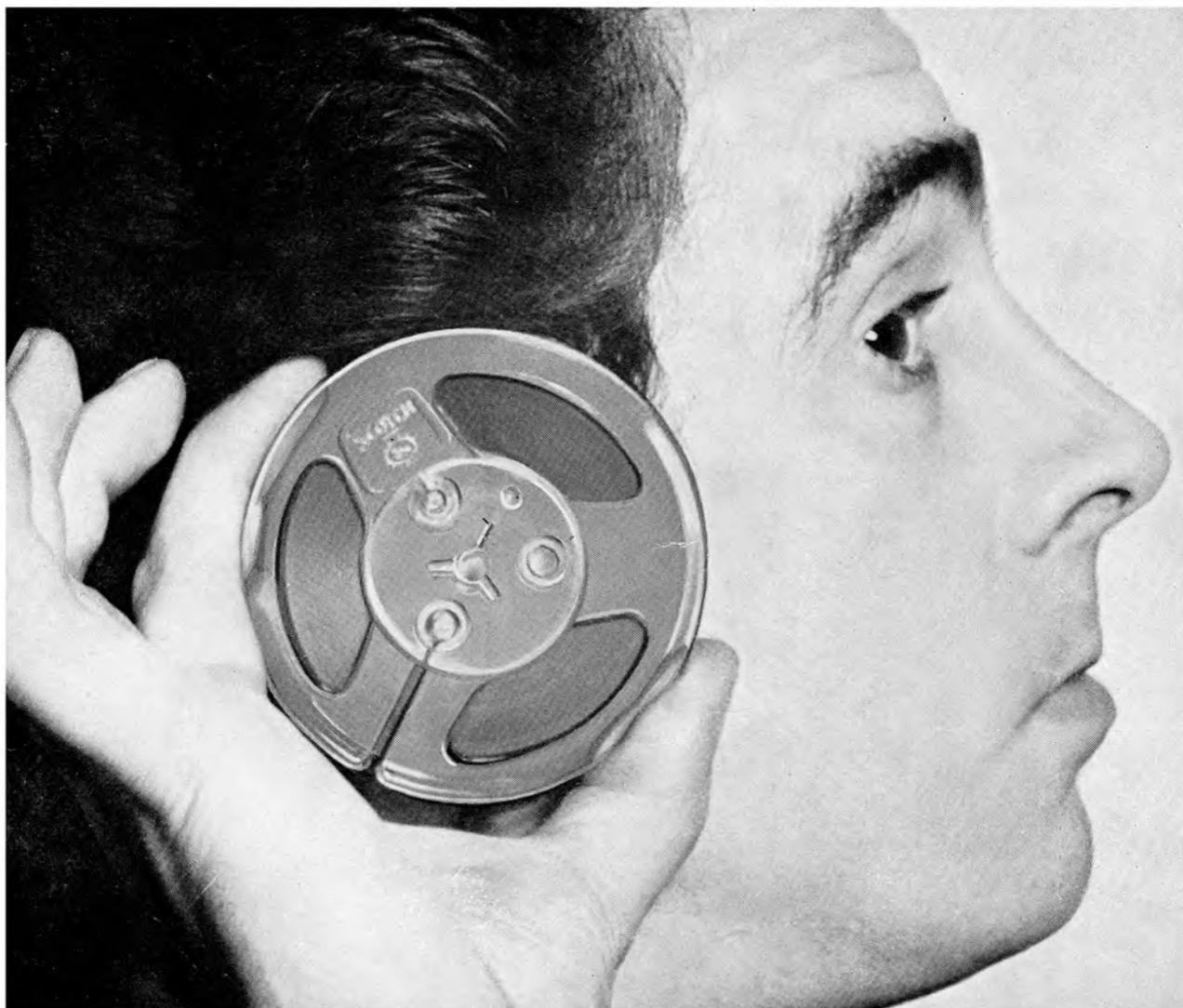
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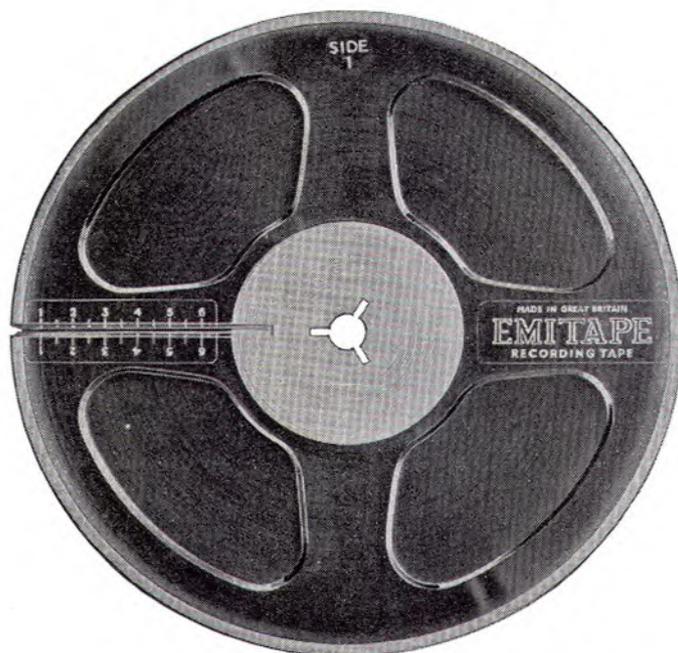
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## Double-play Emitape 100 is now easy to get

Emitape 100 *was* hard to get. So many people wanted it. And this is the reason for the big demand. Emitape 100 gives twice the normal playing time, superb frequency response, minimum head wear—in fact, the best results for low-speed operation. The same research that produced Emitape for Video Recording (the most difficult tape of all to manufacture) also produced Emitape 100. Which means that Emitape 100

doesn't just make big claims. It keeps them.

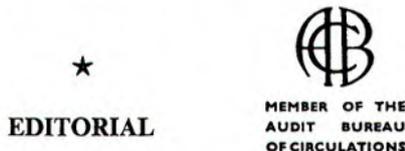
Today, new production techniques are turning it out in even larger quantities. So although it's still wanted (more and more), the search can be called off. Emitape 100's everywhere—*now*.

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# the TAPE RECORDER

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## EDITORIAL

AN interesting paper has just reached us from the Press Offices of the British Radio Equipment Manufacturer's Association and the Audio Manufacturers' Group. These two organisations, jointly, have drawn up a number of recommendations for the standardisation of circuitry and inter-connection for radio receivers and tape recorders, and they have circulated the recommendations to manufacturers of both these products. Any move towards a standardisation of this nature is a good thing, and we hope that it will help to speed the day when all such units can be swiftly and simply unpacked, put together, and switched on—not only by the semi-skilled amateur, but by the complete novice. The time, trouble and frustration, and the postbags of unnecessary letters of bewilderment that would be saved, are immeasurable.

Is there a family in these islands without its "junk box" of ordinary, everyday household plugs and adaptors—three-pin, two-pin, round pin, flat pin, and in two, five, ten and fifteen "amp" varieties? Standardisation in this field, even a matter of twenty-five years ago, would have saved all this. As it is, the radio set, the electric iron and the reading lamp must often be used in specific rooms, because each has a plug that will not fit the socket in the room down the corridor! Those who have visited some of the Continental countries must wonder why and how our own system of confusion ever grew up!

Visitors to the Continent may also have had occasion to marvel at the apparent ease and punctuality which surrounds some repair and maintenance jobs—when the shop assistant says, "Tomorrow evening at about 5.30", or even, "This afternoon at 3.0, and it will cost so-and-so". This used to be the case in England, too, but rather a long time ago. Standardisation plays quite an important part in such service; but the main factor is the thorough and practical training of the people who do the job—which includes a good all-round knowledge of the various items which have to be handled.

We do not know what plans—if any—are being discussed by the two organisations mentioned above for an all-round improvement in after-sales-service of tape recorders. Any move in this direction would be of tremendous value. We know that tape recorders represent only a small proportion of the electric and electronic equipment on sale to the public, but they demand special attention on two counts. In the first instance, being a comparatively recent development, they do not yet enjoy the same familiarity, in service depots, as even the far more complicated television receivers. Again, being of an electro-mechanical nature, they fall into a class of their own. The bodies referred to in our opening paragraph can only recommend and urge—but they can nevertheless exert a considerable influence, both on manufacturers who could simplify matters by producing clear and comprehensive service manuals for the dealers, and on those dealers who would

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benefit very much by concentrating upon those products which are so covered. Some scheme, too, whereby service personnel could be encouraged to make a special study of tape recorder servicing, would be an exceptionally worthwhile step.

The service position has improved a lot during the past twelve months. The standardisation of connections and plugs will certainly be a great help towards its further improvement. Tape is increasing in popularity by leaps and bounds, and it must be adequately backed by good service facilities, and as soon as possible, so that it can fit properly into the pattern, with other domestic equipment.

## COVER PICTURE

THE last non-stop steam train to run from King's Cross to Edinburgh was too much of an opportunity for recording engineers of the Decca Record Co. Ltd. to miss. After recording the commencement of the journey at King's Cross, the recording team packed the equipment in double-quick time and flew by helicopter to Edinburgh to record the arrival. Eventually these recordings will be incorporated into a disc. Peter Handford in charge of the recording unit is well known for his recordings of train sounds, some of which are now unique due to the fact that many lines have either been closed, or taken over by diesel or electric trains.

## NEXT MONTH

IT is most difficult to forecast at the time of going to press with this issue just what will be included in the September number. Contributors manage to take time off from their constructional labours to build up enough resistance to the winter colds and chills that affect them working in cold and draughty workshops. However, readers can be assured of some interesting pages of news and pictures—of the third part of "Building Round the Harting Deck", and one of special interest to those anxious to use 10½ in. NARTB spools on a standard tape recorder. All the usual features will be included, so be certain to place an order for your copy now!

### 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).

# HERE AND THERE AND EVERYWHERE



**A**LTHOUGH he now lives in Walsall, Staffs., Australian-born Mr. Patrick "Topper" Browne can be found "down under" almost any night of the week. The probability is that fellow members of **Walsall and District Tape Recording Club** will be with him. For Mr. Browne is the only club member with a sound studio, which he calls "Shangri-La", and which, like the country of his birth is very much "down under".

A converted garden shed, his 10 ft. by 7 ft. studio has been erected in the cellar of the town-centre premises where he is caretaker. All the comforts of home are there, and inter-comm with which to contact his Swiss wife, Elsa, in their nearby home above. Between them, they speak six languages and much of Mr. Browne's large library is recorded speech in a variety of tongues.

## Fi-Cord 101 receives award

**I**N view of the already large number of dictating machines on the market, and with new machines arriving in increasing numbers, The Dictating Machine Centre has set up a standard for judging the values of machines in relation to the task they are expected to perform.

The complex grading system takes into account many factors among them being efficiency in operation, mechanical design, robustness in use, servicing facilities, layout of controls etc. and each factor qualifies in varying proportions depending on the classification for which the machine is being graded.

The Fi-Cord 101 has been given the top award in "the most efficient portable" classification.

## Walter Tape Recorder Service

**W**HEN Walter Instruments Limited went out of production in 1961, arrangements were made with the Receiver by the Technical and Commercial Managers of the Tape Recorder Service Department in conjunction with the Secretary of the group, to purchase the Service Department Stock and Equipment. Additionally the Receiver agreed to pass on all orders for spares and enquiries for service addressed to the manufacturers.

A company named The Walter Headquarters Service Centre Limited was formed to continue comprehensive service to owners of all models of Walter Tape Recorders except the Metropolitan and the Transitor (for which the full range of spares had not been issued).

The company operates from 154 Merton Hall Road, Merton Park, London, S.W.19.—CHerrywood 6402—under Mr. A. J.

Short who managed the technical service staff at Walters for a number of years. Mr. Short has exceptional experience of Walter tape recorder service problems and is an experienced electronics engineer. The actual test gear employed by the manufacturers is used by the company.

## A New Language Teaching Laboratory

**A**LONDON teaching college has just installed a language teaching laboratory using eight special two-track recorders developed by our contributor Alec Tutchings of Tutchings Electronics Ltd., Christchurch, in consultation with the language teaching staff of the college.

The top track of each recorder carries the master or sample track which can only be erased by the tutor. The student has access to the bottom track which can be erased as often as desired and on which the student imitates or translates the material on the master track.

Headphones are used and each recorder is installed in a semi-sound-proof cubicle. Full inter-com facilities are provided between each student and the tutor so that a student may call for help or advice or the tutor may break in to correct a student who is mispronouncing a word or phrase.

Since the installation was completed nearly 40 other colleges from all parts of the country have visited the college and arrangements have now been made to produce the student recorder, master recorder, control unit, and connecting cables in sufficient quantities to meet the ever-growing demand for this new application of magnetic recording.

Sales and installation will be carried out by Connevans Ltd. of Leatherhead.

## Company Magazine for Blind Workers

**A**NEW service for the 30 blind workers of Philips in Eindhoven enables them to "read" their own individual copy of the Koerier, the house magazine, each week. Volunteers from among the employees read an hour's selected items from the contents of the magazine on to tape. This "mother tape" is then sent to The Hague where 30 copies are made in time to be posted to the workers on Friday afternoons.

As the recordings are made when the magazine is at page proof stage on Wednesdays the blind members receive their own "copy" of the magazine at the same time as the rest of the workers—Saturday morning. The tapes are later returned for re-recording.

The service is provided free by the company and it is hoped in time to expand the service to the company's blind workers throughout the Netherlands.

## New Address

At the end of June R. H. Cole (Overseas) Ltd., importers of Bogen tape heads, moved office and showrooms to a new building at 26-32 Caxton Street, London, S.W.1, exclusively occupied by the R. H. Cole Group of Companies. The telephone and telex numbers will remain unchanged.

## Slow-Scan Television Works on 'Phone Lines

A low-priced T.V. system, designed to transmit still images rather than moving figures, was demonstrated recently by Westinghouse Electric Corporation in America. The system uses a new

# HERE AND THERE AND EVERYWHERE

slow-scan vidicon T.V. camera tube type 7290. The camera produces one frame every 8 seconds, turning the video information into audio frequencies. This picture can be recorded with an ordinary tape recorder, sent over standard 'phone lines, or transmitted by any radio capable of transmitting voice. With it, televised pictures for education, business purposes or newspaper work can be transmitted at low cost, with a minimum of equipment and installation work.

The camera's lens focuses the live image on the vidicon screen. An electronic shutter then freezes the image, which is scanned at the 8-second rate. At the end of the scan, another frame is frozen on the screen.

\* \* \*

## New Company Formed

A NEW move to intensify the sale and exploitation of tape records has been made by the formation of Tape Recordings London Ltd. This company will distribute tape records, background music and playback equipment, the latter for use in hotels, restaurants, hairdressing salons, etc.

At the moment the company is solely concerned with "Music on Tape" and "Esoteric" tape records, but will also carry other labels as they come on the market.

Market research carried out by Sales Manager A. R. Jackson has revealed, apart from tape specialist shops, a marked lack of interest and knowledge about tape records in the trade, although tape recorders are a much carried line.

It must be emphasised that tape records can materially and substantially assist the sales of recorders, both from the viewpoint of demonstration and after-sales use, if buyers are reminded that high-quality recordings do exist which can be played and enjoyed long after the initial novelty of home recording has worn off. If this fact is borne in mind, and emphasised, by dealers, there is no reason why tape records, with their superior reproduction and durability, should not equal discs in popularity among the general public as distinct from the coterie of tape enthusiasts.

Recordings at present carried by Tape Recordings London Ltd., drawn from the Top Rank, Colrich Audio, Omega and Caprice (U.S.A.) catalogues, include a wide variety of musical styles, i.e. pops, jazz, light classics, C. and W., piano and orchestral mood music, and the Spoken Word, in both mono and 4-track stereo at  $3\frac{1}{2}$  and  $7\frac{1}{2}$  i/s.

Enquiries should be addressed to A. Jackson, 59a Edgware Road, London, W.2.

\* \* \*

## Miniature Recorder in Space

A MAGNETIC tape recording of the voice of Colonel John Glenn will be played on one of the two special miniature tape recorders which accompanied him into space. The recorder was shown recently by Consolidated Electrodynamics Corporation (U.K.) Ltd., 14 Commercial Road, Woking, Surrey.

The two miniature tape recorders aboard the "Friendship Seven" and "Aurora Seven" capsules, recorded Col. Glenn's and Col. Scott Carpenter's voices, physiological reactions, such as respiration, heart beat, and blood pressure, the environmental conditions of the capsules, such as temperatures, pressures, acceleration and shock, and other parameters. C.E.C. transducers measured these vital parameters, including suit pressure and cabin pressure.

Before the capsule was launched it was tested for extremely minute leaks by the most accurate leak detection instrument in the world, which is manufactured by C.E.C.'s Analytical and



Recording enthusiasts always welcome the opportunity of practising their recording techniques with live artists. The instrument being used in this picture is the Loewe-Opta 403 two-track recorder.

\* \* \*

Control Division. It can detect a leak so small that only a thimbleful of air could escape through that leak in 2,000 years.

The miniature tape recorders have a tape speed of  $1\frac{1}{2}$  i/s and record continuously for eight hours or intermittently as desired. Without tape they weigh only 9 lb., and measure 11 in. by 13 in. by  $3\frac{1}{2}$  in., and operate on low voltage consuming less than eight watts of power.

C.E.C. is now developing an advanced miniature magnetic tape recorder to be used in the Surveyor Project which will land an instrumented capsule on the moon next year.

\* \* \*

WE have been requested by readers, from time to time, to publish addresses of organisations dealing with tape recordings in other countries. We would like to point out that this magazine cannot be responsible for the authenticity of these clubs but we print them as a service to our readers. Further names and addresses will be printed from time to time.

Tapeworms International Tape Recording Club, Marion Chism, Co-ordinator, 129 South Broad Street, Carlinville, Illinois.

World Tape Pals, Inc., Marjorie Matthews, Secretary, P.O. Box 9211, Dallas 15, Texas.

American Tape Exchange, Cortlandt Parent, Director, Box 324, Shrub Oak, N.Y.

Club Du Ruban Sonore, J. A. Freddy Masson, Secretary, Grosse Ile, Cte, Montmagny, P. Quebec, Canada.

Australian Tape Recordists Assoc., Bob Nardi, Hon. Sec./Treas., P.O. Box 67, Eastwood, New South Wales, Australia.

# NEWS AND PICTURES FROM THE CLUBS



John Wells, member of the Walthamstow and District Tape Recording Club, interviews Carnival Queen, Doreen Birch and her Maid of Honour. Colin Stares is the Butoba operator.

ONLY a short time after the opening of the Forty Hill Rose Fayre, one of Enfield's largest fêtes, visitors to the event were hearing through headphones a taped programme of interviews with stallholders and sound effects recorded there the same afternoon. The Fayre programme was one of several attractions offered on a 10 ft. long stand run by members of the **North London Tape and Hi-Fi Club**.

On display at the stall was a wide variety of equipment, including tape recorders, a tuner, mixer unit, loudspeaker and defluxer, together with press cuttings about the club. One set of headphones offered a continuously-playing six-minute tape recorded of familiar sounds in Enfield—at the market place, the local park and a restaurant.

Simultaneously, an opportunity was given to members of the public to record their own voices through a microphone at one end of the stand while their friends heard the playback through headphones at the other end a second after the recording was made on a Brenell M. Much interest was created by the addition of echo to some of the voices.

Immediately the Fayre was opened by last year's Rose Queen, Miss Margaret Head, of Enfield, members of the club went out to record interviews. Back at the club's stand show tapes were edited into a programme for continuous playback during the afternoon, and as further events took place, recordings of them were added to the main tape.

The finished product included interviews with Miss Head, as well as this year's Queen, Miss Maureen Talbot, of Cheshunt, and the music from a 46-key fairground organ, driven by a 1912 steam engine. Further details of club activities can be obtained from R. Collinson, 30 Ridler Road, Forty Hill, Enfield, Middlesex.

THE **Boston Soundhunters** had their first regular fortnightly meetings at Pilgrim College on June 12th and 26th. Membership has more than doubled since the inaugural meeting in May, and now includes one lady. All the local dealers had

welcomed the formation of the group, and promised assistance.

The first meeting was devoted to basic principles of tape recording, and the speaker was the group leader, Philip Towell. He illustrated his talk with a wide range of tapes, demonstrating the versatility of the recordist's art; from a child's first words, an interview with a weight-guesser at the May Fair, to Amsterdam street sounds (including police car sirens!) and the Beatniks playing jazz round the fountain in Greenwich Village. Types of microphones and tapes were briefly discussed, and advice on editing and regular servicing was given.

At the second meeting, members brought their own recorders for cleaning and de-fluxing of the heads. The surprising result was the remarkable absence of oxide deposit, though one member's machine came complete with cobweb and two spiders! A specially prepared test tape was played on each recorder in turn at various speeds, and one of the new EMI tape record issues was demonstrated.

Further details can be obtained from P. P. Towell, 107 Spilby Road, Boston, Lincs.

THE **Tufnell Park Tape Recording Club** has continued to enlarge its membership although there is still room for more. In view of the success of recent meetings it has been decided to meet every week, though many members gather in other members' homes on different nights constructing various pieces of recording equipment.

A very interesting evening was spent recently visiting the Friern Barnet Tape Recording Club. General recording activities were discussed, and members were invited to attend at a later date when machines would be tested with a wow and flutter meter.

Prospective members should contact the secretary, G. Wilgrove, 38 Highgate Road, London, N.W.5.

A VERY happy change took place recently in the **York Tape Recording Society** when the chairman and secretary were married. Tape secretary John Hunt, assisted by his sister Wendy, also a club member, recorded the ceremony and the reception on a Philips 4-track recorder.

A coloured cine film was also taken and Mr. and Mrs. Machen have since had the opportunity of hearing the recording and seeing the film.

Letters to the Tape Recording Club should now be sent direct to J. I. Machen, 17 Melbourne Street, Fishergate, York.

THE management committee of the **Rugby Amateur Tape Recording Society** have agreed to include a tape recording course in the current club year programme and details of this will be arranged shortly, in conjunction with the programmes for club meetings for the period August 1962-May 1963.

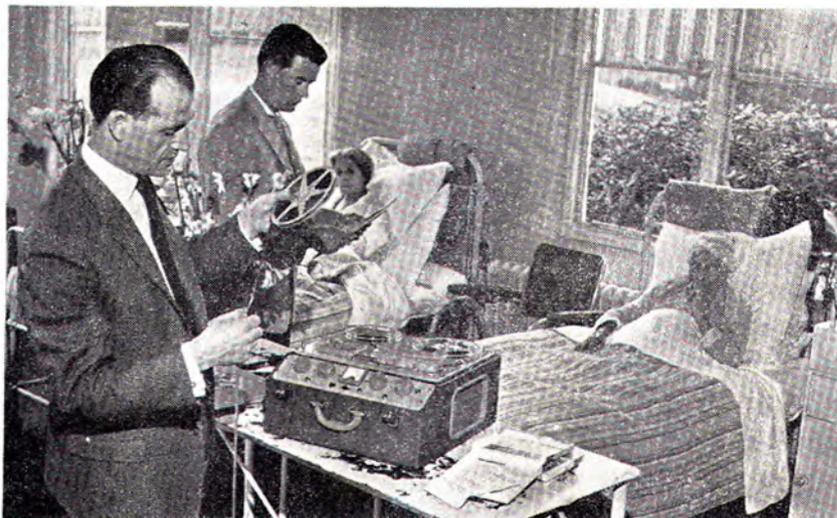
Such a course will cater mainly for introducing tape recorder owners to the aspects in which their equipment can be devoted—as opposed to the simple facility of merely recording pop music from the radio, etc. A tape recording course was organised in February 1960, when a series of six lectures on most aspects of tape recording were arranged, namely, history and development of recording; how to choose a tape recorder; maintenance of equipment; microphones; the use of tape; interviewing; and general matters. It is possible that the coming course may be on the same lines but the actual dates, duration, choice of items and speakers has to be decided by the committee.

As well as seeking to attract the owners of such equipment, it will also be available to interested persons without equipment,

# NEWS AND PICTURES FROM THE CLUBS

Visits to local hospitals with a tape recorder to replay local news and other items of interest are generally very much appreciated by the patients. Many hours must be spent beforehand preparing the material to be used. One group, the Forth Radio Network, spends many hours a week producing tapes on its own elaborate equipment. Norman Lowe (left) and George Holmes were recently photographed during their visit to the Royal Victoria Hospital, Edinburgh.

Photo: Edinburgh Evening News



for the club has its own tape recorder which is available free of charge to members, and will aid the present members who require some basic tuition to obtain this as a facility of club membership. Full details can be obtained from M. Brown, 219 Clifton Road, Rugby.

**T**HE first June meeting of the Whitstable and District Tape Recording Club was devoted entirely to a demonstration of the Simon SP5 by Mr. Allen of Simon Equipment Ltd. A number of mono and stereo tapes were played, and members commented favourably on the simplicity of operation, particularly of the EMI deck, but the general feeling was that the machine, fully equipped for stereo record and playback, was rather expensive.

The second June meeting saw things back to normal, or at least almost to normal. Holidays had thinned out the numbers but it was good to see the hard core of enthusiasts still coming faithfully to meetings, and thirteen were present. First item was a playback of a lecture tape received from Derek Worman, of Johannesburg, on the subject "Microphones". Descriptions and examples were given of all kinds of mikes, from the cheapest crystals to the near-£200 condensers. A most entertaining and informative programme. Main item was Part Three of chairman Bill Blake's documentary "A Generation of Sound". Dealing with the eventful years 1935-6-7, older members heard again, and younger members heard for the first time, the voices of King George V and VI, of Clara Butt, of Robb Wilton, of the (now) Duke of Windsor's abdication speech, of Stanley Baldwin, and many other famous voices of that time. Further information about club activities can be obtained from T. Robinson, 17a St. Anne's Road, Whitstable, Kent.

**B**ECAUSE some members found it increasingly difficult to attend on Tuesday and several people wanted to join, but could not come on that day, the club has changed its day and place of meeting. It now meets every Thursday at 7.30 p.m., at the Rising Sun, East Parade, Hastings.

Before the Hastings and District Tape Recording Club moved its headquarters, Mr. Monks gave a demonstration of the Fi-Cord International. He showed the members the new 202 model which astounded everybody as to its quality; and also the very small pocket recorder and miniature lapel microphone, together with the new range of Beyer microphones, but the lightweight headphones, which everybody tried, really astounded listeners with the quality of reproduction.

A special meeting was held on June 12th for the club's honorary member, Mr. Cecil Costlow and his family from Preston, Lancashire. Mr. Costlow, well known to the members of the club, is a very prolific tape recording enthusiast and exchanges tapes with several members of the club and with many other people both in this country and abroad.

At the meeting of the club on June 21st, many friends and guests were present, including the secretary, Mr. O'Hara, and

several members of the Hastings Cine Club, to see the wonderful film, "This is the BBC". Although the majority of people present had probably seen the film on television, they were all delighted to see it again and were enthralled to see the complexity of recorders, mixers, wires, mic's, etc., and to compare them with their own equipment. Several new members enrolled during the evening.

It is hoped to start a hospitals and homes programme in the near future, any club with any suggestions for such a service should contact J. F. M. Aitchison, 62 Vicarage Road, Hastings, Sussex.

**D**URING the month of June the Ilford and District Tape Recording Society enrolled four new members. Two prospective members intended joining in July bringing the total up to fifty-seven.

On June 26th the second contest in the Club Quiz Championship was held to decide who will join K. Hartman in the finals to be held later in the year. This resulted in a tie for first place between A. Forrester and N. Walker. A discussion followed on the subject of defluxing heads and a member offered to loan his defluxer to any member. Further details can be obtained by contacting D. Bolton, 97 Seventh Avenue, Manor Park, London, E.12.

**T**HE meeting of The Tape Recording and High Fidelity Society of South Africa due to be held on Monday, June 25th, was postponed to July 2nd. This was to enable Mr. Bernard Wilson, Director of B.A.S.F. London, visiting South Africa at that time, to attend the Meeting and give a lecture on "The latest development in magnetic Recording Tape".

In view of the occasion the Council decided, after consultation with Tauber & Corssen (Pty) Ltd., representatives for B.A.S.F., that the Meeting should be held at African Life Building, Rissik Street. The lecture was followed by a film show entitled "The Magic Tape".

The "Wharfedale" Slimline Speakers were also on display and members had the opportunity of judging their capabilities.

**A** NEW club has just been formed and will be known as the Solent Tape and Audio Club. Meetings will be held on the 2nd and 4th Thursday of each month at Gosport Community Association.

Details can be obtained from the Secretary R. Temlett, 30 Blake Court, South Street, Gosport.

**W**ILL all interested in Tape Recording in the Dundee area, please note that the Dundee Tape Recording Club will commence its autumn session in the Salvation Army Hostel, Ward Road, Dundee, at 7.30 p.m. on Monday, August 27th, 1962. The A.G.M. will be held on Monday, September 10th, 1962, and meetings will be fortnightly thereafter. Further details from the Secretary—Robert Taylor, 9 Baffin Street, Dundee.

# MORE NEWS FROM THE CLUBS

AT the end of the last academic year, the membership of the **Cambridge University Tape Recording Society** stood at about forty, including a committee of six. Since then the number has grown to ninety-five. The club started this year with a stand at the Cambridge University Societies Fair to attract new members. On display was a selection of recorders made by members of the society, and those interested could hear recordings made by the society in the previous year.

Our lecture programme included: A lecture on recording by Mr. P. J. Guy, of the BBC; "Recording Techniques", by the Reverend M. O. Chadwick, M.A.; "Choosing a Tape Recorder", by R. D. Lord, technical secretary; "Microphones", by J. L. Goodwin, of S.T. and C. Ltd.; "Ampex Tape Recorders", by C. T. Malone, of Ampex; "BASF", by Mr. Wilson, managing director; "Professional Tape Recording", by E. W. Berth Jones, of EMI Ltd.

The society has arranged many recording activities during the year, including the University Musical Society concerts, concerts by some of the colleges' Musical Societies, a series of Organ Recitals, and the music for the Beaumont Folk Mass.

A full lecture and recording programme is being arranged for next year. Further information can be obtained from *T. J. Wade, Selwyn College, Cambridge.*

SEVERAL members of the **Reading Cine and Tape Recording Society** produced a number of test recordings which were played back at a recent meeting and the results were discussed.

The first test was to check the constancy of speed of the recording machines. The second—to test linearity of the record/replay amplifier, for this purpose the BBC timing signal had been recorded for one minute, recordings being played back into an oscilloscope.

Test number three consisted of recordings of a piano note (Middle C) in order to check for "wow" or "flutter" on the recording machine.

The fourth and last test was to examine the variety of effects obtained from making speech recordings under differing conditions. This provided a striking demonstration of how the positioning of the microphone and the choice of environment can add "colour" to a recording. Further details can be obtained from *T. F. Fisher, 5 Mapledurham Drive, Purley, Nr. Reading, Berks.*

ONE of the members of the **Clacton Tape Recording Society** is assisting, with representatives of other well-known organisations in Clacton, with the care and entertainment of the old people. A church hall has been acquired where they can have a cup of tea, a talk and a rest.

Other members have also been busy producing Hospital Tapes, which the chairman, Mr. Norman Turner, plays at the local hospital every Wednesday. Quite recently two of our members recorded the local production of "The Dancing Years" by Ivor Novello; extracts will be heard soon by the local hospital patients.

The club has just been given the use of a garage, which members are turning into a sound studio with its own control room and recorder work-bench. It can also be used for editing and showing Cine films. Quite a lot of work has got to be done, but a start has been made, with the sound-proofing and construction of a three channel mixer. Further details can be obtained from *J. Heavens, 39a Oxford Crescent, Clacton-on-Sea, Essex.*

AT the **Cotswold Tape Recording Society (Cheltenham)** meeting on May 17th, members welcomed Mr. K. Monks, of Fi-Cord International, who demonstrated the new 202 battery-mains recorder. The recently-imported range of Beyer microphones, from West Germany, was also shown.

After the interval, some test recordings were made in the hall, and a group of members then went out into the streets of

Cheltenham to see what the 202 could do for them. In the Royal Well bus station they surrounded an astonished Inspector, while Peter Turner interviewed him on his job. Some recordings were then made of exhaust- and engine-noises of the buses, and the group then went back to the club to play back the tape, reporting that the 202 was extremely easy to use, although rather heavier than its tiny predecessor.

Peter Duddridge has continued his recent series of BBC broadcasts, and has interviewed Al Read, the Clitherow Kid, Max Bygraves, Saveen and Daisy May and other stars, on behalf of the Society's Hospitals' Service. A typical message was recorded from Spike Milligan to the patients: "Stay in as long as you can chaps: it's hell outside!". Further details from *P. D. Turner, Cave Cottage, Oakriage Lynch, Stroud, Glos.*

ONE more of the many happy thoughts so common to the members of the **Walthamstow and District Tape Recording Society**, was the description of the idea of a running commentary on the Carnival to Connaught hospital patients by Ald. E. C. Redhead, J.P., M.P. at a special meeting after the monthly Council meeting last Friday.

At the Mayor's request after she had heard the tape privately in company with the Mayoress and Town Clerk, the exceptional meeting was called and Aldermen and Councillors invited to attend in a Committee Room at the Town Hall. "Together with the hospital programme of requests which is now so regular a feature of the Connaught hospital's life the Society provided an afternoon's entertainment with a particularly local flavour and which must have given great pleasure to listeners," commented Ald. Redhead.

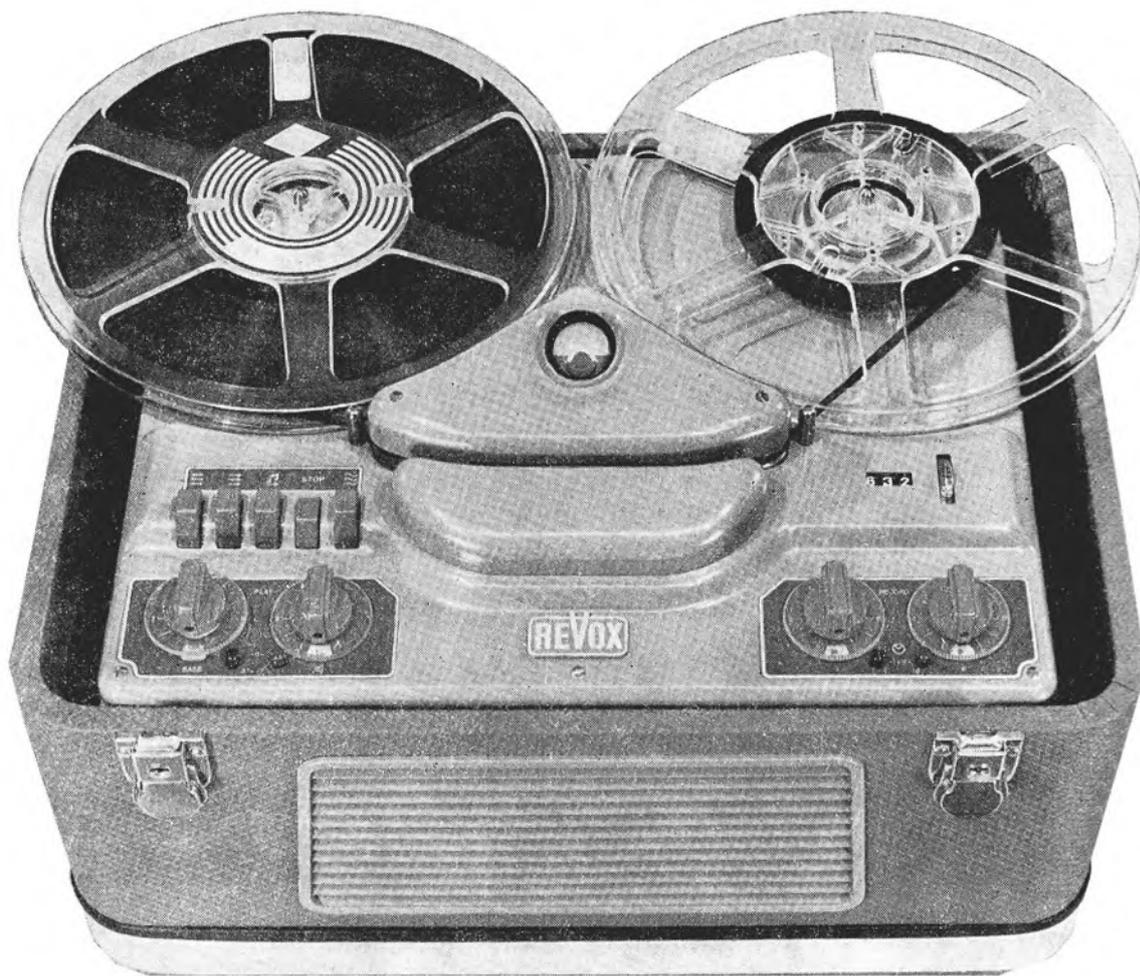
A wallet containing prints of the event was presented to the Mayor, Ald. Miss Dorothy Wrigley by Society Secretary Ken Perks. "Not only have we all enjoyed listening to this production again—I heard it before—but I have an idea now of the teamwork that went into the production," commented Ald. Baldwin, Chairman of the Carnival Week Committee. "This is worthy of a much wider audience and I really feel that the Walthamstow Tape enthusiasts have excelled themselves. We shall certainly be interested in the edited version for the Borough archives to which the Society has already contributed a number of interesting features."

Thanking the Mayor, Aldermen and Councillors, Producer/Director Maurice Dudley said, "Had it not been for the co-operation of the Council, the Carnival Authorities, Walthamstow Police and many other local bodies and companies, we should have had a much harder job. To the team who worked so hard and undertook all the training for the difficult job, I must publicly convey my grateful thanks for a magnificent effort." Details of club activities can be obtained from *M. R. Dudley, 38 Edward Road, Walthamstow, London, E.17.*

THE Edinburgh Tape Recording Club now meet within the premises of the Edinburgh Social Club for the Blind at No. 82 Newbattle Terrace, Edinburgh 10. An open invitation is extended to all interested in the art of tape recording to attend meetings held on the 1st and 3rd Wednesday of each month at 7.30 p.m. Details can be obtained from *A. Forbes, 70 Marchmont Crescent, Edinburgh 9.*

## Magnetic Rubber

THE material described in the article "Magnetic Rubber" is normally sold only in bulk amounts of several hundred feet. However, the author has obtained a large drum of this material and will supply it to any reader. To cover postage, packing and time, the charge is 2s. 6d. for a 4 in. length. Letters should be addressed to A. Tutchings, c/o The Tape Recorder, 99 Mortimer Street, London, W.1.



**THIS IS A REVOX** This is the machine that has three Papst motors, three heads, no pressure pads or tensioning pins, takes up to 25 cm. spools and winds 2,400 feet of tape in less than 80 seconds. Hum level is negligible due to the use of screened heads and face covers, DC heated pre-amplifiers and transistors. Stereophonic recordings may be made, replayed and amplified to cathode follower level (1 volt). A monitoring amplifier is provided which may be switched into any one of the two input and two playback pre-amplifiers or to the combined output of both channels. This monitor amplifier is of real Hi-Fi quality, and has an output of more than 6 watts (push-pull) with very low distortion content. More detailed information available on request.

PRICE: 110 gns. in portable case, 105 gns. chassis only.

Please send details of Revox E.36, and Local stockist to:

Mr .....

Address .....

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REVOX (U.K. Concessionaires) Ltd.  
296 Kensington High Street, W.14 WES 4342

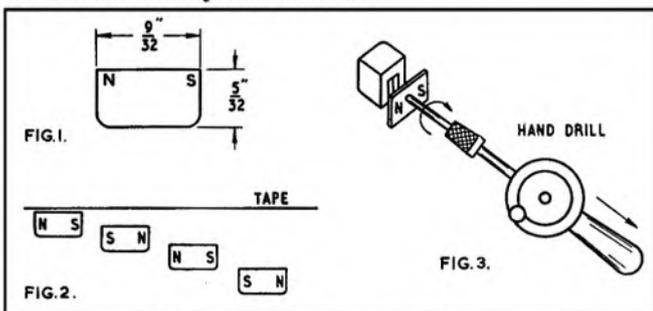
**REVOX** —for the quality you desire but so seldom find.

# MAGNETIC RUBBER

A FEW months ago I found a new material which seemed to have a thousand uses for the experimenter in magnetic recording. Since then, in odd moments, I have been trying it out in various applications and, although I have far from exhausted its possibilities, I think I have now accumulated enough material for an interesting article.

The material is called *Bonded Feroba*. It is a novel permanent magnet material, like cab-tyre cable in appearance. It comprises a suitable base impregnated with *Feroba* ferrite powder. It is mechanically different from any other permanent magnet in being semi-flexible and soft. It can be cut with a knife or razor blade or drilled without affecting its magnetic characteristics.

Magnetically, it has a low remanence and energy content but a very high coercivity. Electrically, it is a good insulator. The specific gravity is of the order of 3.5. Remanence is 1,400 Gauss, and Coercivity 1,150 Oersteds. It is extruded in continuous lengths and has a cross section as shown in fig. 1. It is magnetised across the width of the strip on the flat side.



It is very akin to magnetic tape in that it consists of an insulating plastic base impregnated with a magnetic powder, but due to the extremely high coercivity it is virtually impossible to erase a "recording" or pre-magnetising without special, very high intensity equipment. A piece of this material can be placed on a normal bulk eraser and the magnetism is hardly affected unless it is left there for some considerable time. Maximum recommended working temperature is 120° C., at this temperature the magnetisation drops by about 20 per cent., but it fully recovers its original value when the material cools.

In a short article like this I can only deal very briefly with its applications to magnetic recording, but I hope I can say enough to start some of my readers experimenting to uncover the full potentialities of this very promising new tool.

## Erasing

The magnetic field available is more than adequate to completely erase a fully modulated tape, even when placed on the base, or non-coated side of the tape. So that, if you do not possess a bulk eraser, a reel of tape can be fast spooled over a piece of this material with the assurance that every scrap of recorded material will be wiped from the tape and so prevent those annoying little snippets of old recordings turning up in the intervals between new ones, or the even more annoying very faint background of a previous recording which has not been fully erased by the recorder. If you interchange recordings with your friends, this cleaning of the tape is almost essential because even if your erase head is fully efficient it only wipes part of the tape surface, and vertical misplacement of erase or record heads can leave a narrow strip of tape recorded which can cause interference. With four-track tapes this trouble can be serious.

It is not, of course, necessary to make a separate operation of this erasing; it can be done while the first track of a new recording is being made on the tape. But be sure the eraser is removed before starting the second track, otherwise you will find that track number one has disappeared also! It would be a good

idea to combine the eraser with a tape cleaner consisting of two felt pads to wipe dust and dirt also from the tape and so reduce the incidence of "drop outs" from this cause.

A single piece of magnetic rubber will leave the tape "saturated" so that a slight hiss will be noticed if the tape is played immediately without first passing over the normal erase and record heads of the recorder. By using several magnets of alternating polarity and diminishing intensity (fig. 2), the tape can be completely demagnetised and be made as quiet as A.C. erased tape. About four magnets should suffice, and the reduction of field can be done either by spacing successive magnets further and further from the tape or by using a bulk eraser to reduce the flux from successive magnets by longer and longer application of the degaussing field. As a third alternative, magnetic shunts of steel, stalloy, or mu-metal may be used to reduce the intensity of the weaker magnets.

## Spot Erasing

It is sometimes handy to be able to erase a very short length of tape to get rid of switching clicks or other short duration noises. An alternative to an A.C. "degausser" is to spin a small piece of our rubber on, say, a hand drill, placing it first in very close proximity to the section of tape to be treated, and then, while it is still revolving, remove it slowly so that the tape oxide is subjected to an alternating slowly decreasing field, exactly as with an A.C. eraser. This same technique can be used to deal with a magnetised head (fig. 3).

## Fades

If a superimposing facility is provided on your recorder, it is sometimes useful to be able to fade down a pre-recorded programme while a superimposed announcement is being made. Such a fade may be made by sliding a piece of our rubber on to the tape while it is moving so that more and more of the track is erased; if a faint background of the first recording is desired, the eraser must not quite cover the track. If such a device is to be used often, it may be worth making it up into a unit with tape guides and vernier adjustment of the erasing strip so that pre-determined levels may be left on the tape. A little experimenting with a hand held eraser will demonstrate the possibilities of such a device.

## Print Through Reduction

Some years ago a gadget appeared on the American market to reduce the effects of print through from one turn of tape to the next. You may have heard the effect on thin E.P. and D.P. tapes as a "pre-echo" of a loud recording on the tape. It appears that such printing is very much a surface effect and a very weak magnet, which will "scrape" the top layer off the recording, does the trick without introducing too much top loss. The American gadget, highly nickel plated and costing several dollars, was just such a weak magnet mounted in an imposing fitment. A piece of almost demagnetised rubber will do the same trick—but I warn you "beating" the magnetism out of it by long sessions on a powerful bulk eraser can be quite a job. It might be possible to create a weak magnet by slicing the rubber along its length parallel to the flat magnetised face, but I haven't tried this myself.

## Other Jobs

Very narrow magnets, obtained by slicing thin sections of the strip can be very useful for erasing narrow tracks on the tape.

As mentioned above, it often happens that a faint slice of an early recording gets left on a tape due to a slight movement of a head or guide and is an ever-present source of vexation each time the tape is played, particularly if it is a precious recording which cannot be repeated. A thin slice of rubber placed near a guide may be the answer!

If someone sends you a four-track recording, and you have only a two-track recorder on which to play it, you can again get away with it by erasing the unwanted track although this means sacrificing some of the material on the tape—but it may be the lesser of two evils.

As you will see I have a lot of experiments still to do—all I have to find is the time!

# BUILDING ROUND THE HARTING DECK

## PART 2—CIRCUITS AND CONSTRUCTION

THE layout is divided into three parts; playback amplifier, microphone pre-amp + mixer + record amplifier, and oscillator + power pack. These are quite conventional groupings, but they have the advantage that power supplies, switching input and output leads can be arranged for easy wiring and access. The only "odd man out" is the ganging of the switch that changes the record and playback equalisations. Since this is coupled mechanically to the speed-change switch on the deck its position is fixed, and one of the equalisation networks must be fed by a comparatively long lead. The logical choice is the recording network, as it works at a higher signal level.

### Playback

The playback amplifier thus appears next to the equaliser switch (top left in fig. 1). It is built on a small tag board, holes in which fit over the valveholder tags. The circuit (fig. 2) consists of two EF 86 pentodes with an equalising network between them. This includes a Mullard WF 816 (or WF 1932) inductor for residual equalisation in the 10 Kc/s region, although with the first-class head fitted to the Harting deck it is only called upon for a dB or two at the higher tape speed. The 3K resistor adjusts the response around 2,000 c/s and the .05 capacitor can be padded slightly to affect the 100 c/s region. The high-stability resistors and three large electrolytics really do make this a noise-free circuit, so don't be tempted to economise here.

### Recording Section

Fig. 3 shows the circuits involved. Half a double-triode is used as a crystal microphone amplifier with a high input impedance to obtain a good bass response. This makes it particularly sensitive to hum pickup, and great care must be taken with the siting of the lead from the input jack to the grid, laying it close to the chassis and well away from the mains lead and switch. The lead on the microphone itself should be kept to about ten feet long, and if you doubt the need for all these precautions, try the effect of a single loop in the lead near the recorder—you will soon find where the mains transformer is! A space was

left on the tag board for an additional valve when the owner acquires a ribbon mike. The 1.5 M resistor will then be removed and the cathode resistor bypassed with 50 mf.

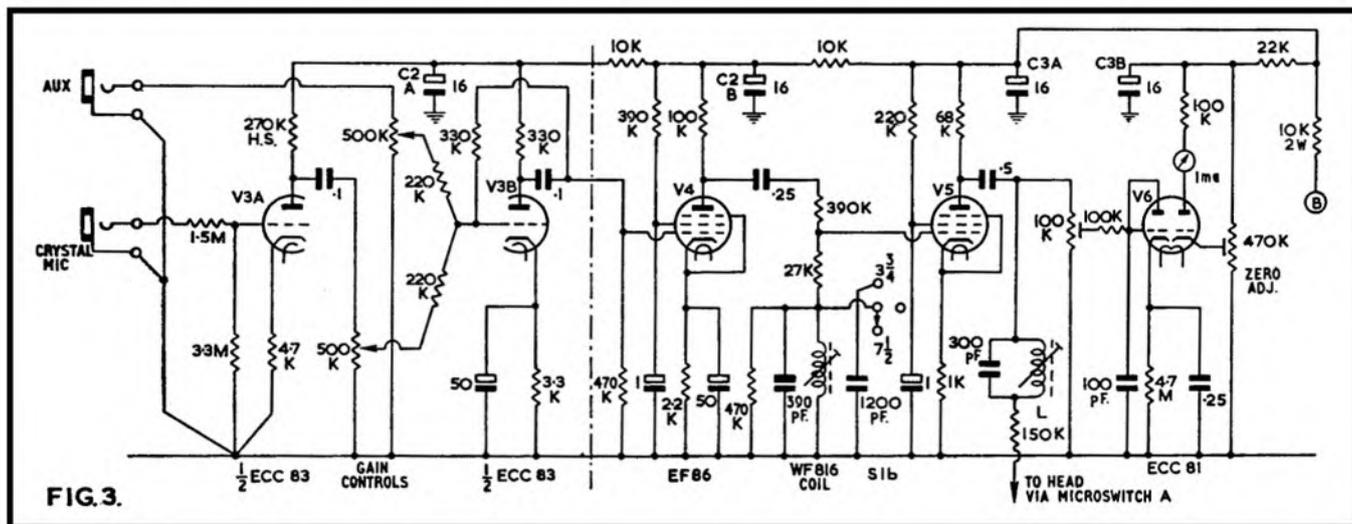
On to the second half of the valve, which acts as a feedback mixer for the two inputs (see R. Williamson's article, *Hi-Fi News*, December 1959) and feeds the recording equaliser stage. This provides the necessary treble boost at either speed with a simple potentiometer circuit and drives the recording output valve<sup>1</sup>.

The bias blocking filter in series with the lead to the head is a bit of a problem unless you are prepared to buy one ready-made and tuned to the bias frequency you are using (60 Kc/s in this case). So here are the details for winding one, using a dust-iron core 13/32 in. diameter, which is a type of former widely used in early T.V. and radio sets. A commercially available type is an Aladdin FP 5892. On this former slide, two coil "cheeks" of cardboard 1½ in diameter and spaced 1 in. apart, fixing them in position with wax or rubber adhesive. The wire to be used can be from an old choke or transformer, say 38 S.W.G. enamelled copper. Wind on 1,500 turns, having terminated the leading end on one of the former tags. This will nearly fill the available space. Finish off with wax or plastic tape and terminate the wire without strain. This coil should tune to 60 Kc/s with about 330 pf, and if you have no means of checking it you should wait until the lining-up stage before settling on the exact capacitance. A Wearite coil Type 666 will tune with about 350 pf to the same frequency.

The meter circuit is conventional, with the Japanese meter previously mentioned in the anode circuit of the second half of an ECC 81. The cathode components in the first half determine the "hang" of the needle on peaks, and this is a matter of taste in amateur equipment. I prefer a fairly long one, but the 4.7 M can be reduced to your own needs.

### Oscillator and Power Supply

For the oscillator circuit we are back to Mullard again<sup>1</sup>, with their circuit based on an ECC 82 working in push-pull at 60 Kc/s. This is one of the sure ways to that silent background. I under-







# TAPE RECORDER SERVICE

By H. W. HELLYER

## No. 8 GRUNDIG RECORDERS

A WIDE selection of tape recorders, varying from the inexpensive "popular" machine to the semi-professional type of equipment, has been marketed by Messrs. Grundig since the early days of domestic tape recording. It says much for the quality of these products that very many of the original models are still giving good service.

They have passed through numerous hands; sold and resold as owners hanker after something more ambitious. They have survived a good deal of rough treatment. Yet, after an overhaul and facelift, they emerge from the workshop as good as new, capable of excellent performance. "Serviceability" is a characteristic of the Grundig machine that may not feature in the advertisements, but can be vouched for by any busy service department.

To the average owner, however, the Grundig can present a problem. In appearance it is rather more complicated than its contemporaries, and functional processes may seem at first obscure. Test and adjustment procedures can be difficult on first acquaintance. The following notes are an attempt to pick out those features that have given rise to the most queries, rather than to deal comprehensively with the whole Grundig range.

### Switching

The complications mentioned above usually centre around the switching arrangements. We have had several readers remarking that they found difficulty in interpreting even those detailed switching charts in the maker's service manuals. Let us, therefore, take a closer look at a particular one, the Selector Switch diagram of the Grundig TK5. This is reproduced in fig. 1.

To interpret the chart: the diagram on the left is a bottom view of the three-tiered switch. Contacts are numbered from the lower fixing post *A*, and the prefix in the table refers to the switch wafer, the uppermost (nearest deck) being 3 and the lowest wafer numbered 1. Thus, 2/21 is the second contact to the right of the lower fixing post on the middle wafer of the switch.

The function of each rotary position of the switch is clearly marked above the deck, by the switch-knob. The chart of fig. 1 shows which contacts close when a particular function is selected. The black dot is an operative closure, the open dot merely indicates that this pair of contacts closes but is not part of the operative circuit. This information can be useful if circuit-tracing becomes necessary during fault-finding.

We see that the two pairs, 2/22, 2/1 and 3/18, 3/20, close when the switch is in its *Off* position. In the circuit, 2/1 goes to chassis, 2/22 to the output circuit of the second half of the ECC81 double-triode valve. This point also feeds the recording head, via the filter components, and has another pair of contacts, 2/22, 2/20 shunted across it. Reference to the chart will show that this pair "makes" during *Fast Wind*. Thus, we can deduce that these switches are used to bypass the output of the recording amplifier in the *Off* and *Fast Wind* positions.

### Auto-stop

Taking another small example: the auto-stop relay. This device consists of a split, insulated guidepost which the metallised tape leader short-circuits, thus closing the return circuit of a relay with two pairs of contacts. The one pair switches the motor supply and is normally closed when the relay is inactive, i.e. non-energised. But it is necessary for an auto-stop to be a kind of non-return valve. Once operated, it should be necessary to fulfil some new operation to resume working of the machine.

So the second pair of contacts of the relay closes in the energised condition and acts as a *hold* device to keep the relay closed as long as current is supplied by the rectifier.

In series with this pair of holding contacts is an opening switch for returning the circuits to neutral when the machine is *Off*. This consists of the pair 2/3, 2/1 closing during *Fast Wind* and *Playback*, and the link to 2/21, which closes the circuit during *Record*. This is obvious from the chart.

### Drive Mechanisms

Although there are a number of minor variations between models, if we deal in detail with a typical example, some idea of Grundig design principles should be gained, and differences can be cleared up afterwards.

An excellent guide is the mechanical layout of the TK20, TM20 and TK25 series. Principal features, with extraneous matter omitted for ease of explanation, are illustrated in figs. 2 and 3. These features are common to the models named above. Differ-

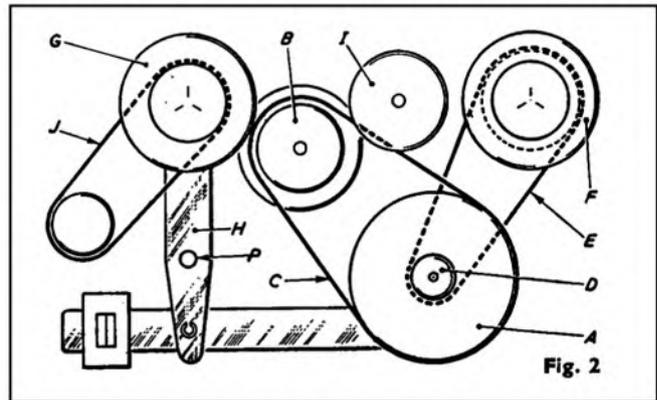


Fig. 2

ences lie in the additional speed of the TK25 (which has a  $1\frac{1}{2}$  i/s as well as the standard  $3\frac{1}{4}$  i/s), and the fact that the TM20 is a "basic" machine, with no cabinet, and a slightly different input panel. No loudspeaker and output stage is supplied with the TM20, which has a connecting cable to facilitate hooking up to other audio equipment.

These are half-track machines, recording from left to right, top track, to international standards. The motor is of the outer rotating cage split phase induction type, and is used to drive a precision, balanced flywheel, as described below.

### Belts

The view of fig. 2 is from above the deck, with the main plate removed. A stepped pulley *B* on the motor, rotating anti-clockwise, has a belt drive to the outer circumference of the flywheel on which the capstan spindle is mounted for tape drive. A small pulley below the flywheel provides the coupling *D* for belt *E*, driving the right-hand take-up clutch *F*.

Both these belts are of circular section and earlier models used belts of a plastic material which tended to harden with disuse. The characteristic "knocking" of a belt which has developed a "shape" may indicate the need for replacement, but if the trouble is not too far advanced, and if future regular running is anticipated, it may be possible to soften these belts by application of gentle heat. The best way of doing this is to remove belts, let them soak in hot water, dry and refit, then allow the machine to run in the *Playback* function for an hour or so.

# TAPE RECORDER SERVICE

By H. W. HELLYER

## No. 8 GRUNDIG RECORDERS

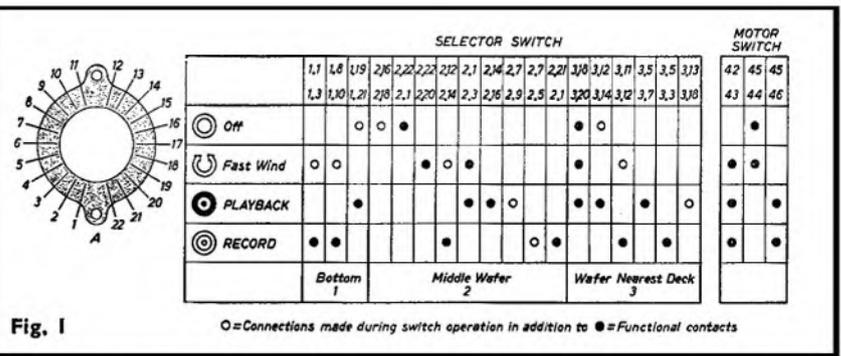


Fig. 1

If there is a tendency to irregular take-up when the machine is first switched on, improving as time passes, it is almost certain that the belt *E* is faulty. Replacement belts, of rubber material, are not so prone to this effect.

The take-up drive is designed to provide sufficient tension to reel in slack tape, in conjunction with the friction clutch, a felt ring on the lower face of the upper clutch half. This should be checked for softness, and cleaned with methylated spirit if there is a tendency to slack spooling at the commencement of a tape.

Full drive is obtained by a swivel action of the right-hand clutch lever, which brings the clutch drum *F* (upper part) to bear against the idler wheel *I*, which is in turn engaged with a step on the motor pulley. A strong spring on a rod assists this movement and should be checked for correct tension if spooling slackens when a nearly full spool is on the right-hand carrier.

*Fast Rewind* is effected by movement of the swivel lever *H* about its pivot *P*, bringing the clutch drum *G* against the motor pulley. The belt *J* is the drive to the digital tape position indicator.

### Speed Changing

Speed changing on those machines where more than one speed is provided is simply carried out by a fork lever that guides the main drive belt *C* to an appropriate step on the motor pulley. An intermittent light knock can sometimes be caused by a slack belt from the right-hand clutch fouling on this lever, which should be checked for excess play.

Braking is simple, consisting merely of felt pads on angle arms, engaged by outer circumference of the clutch drums. Correct adjustment is for minimum effective clearance when the machine is in the *Rewind* function. Note that braking is obtained by the clutches engaging the static brakes, and not, as is more usual, the brakes moving into engagement. For this reason, it is essential to check that brake pads are secure and square to clutch edges, and that lever swivel action is positive, bringing the clutch drums correctly into position.

### Tape Transport

The pressure roller assembly has two main adjustments and several noteworthy features. Reference to fig. 3 shows that a pivot at point *P* provides the fulcrum about which the angled plate turns. At the left-hand side is the lever mounting and spring *S*, which assists engagement. Correct pressure of pinch wheel with capstan spindle is approximately 900 grams (about 2 lb., to non-Common Marketeters). Fine adjustment of this pressure is made by alteration of the outer screw *J*, while the inner screw *K* is eccentrically mounted to enable vertical alignment of pinch wheel with spindle.

Pressure pad is mounted on an angle which has a fixed spring around the pillar *G*, and this should be checked for approximately 30 grams pressure tape to head. Note that the pad enters cleanly in the cutaway of the mumetal shield and that its face is clean.

The capstan spindle *L* is mounted in a plastic bearing *M*; its aperture shaped in such a way that there is some lateral play. This is normal. The arrangement of serrations in the spindle bearing aperture is to assist stabilisation, in conjunction with the long spindle below the flywheel and a self-centring device in the lower mounting.

Azimuth alignment is quite conventional. A central nut locks the central fulcrum and the two-screw system of alignment is used, one being spring-loaded. Both are adjusted for maximum

playback, the correct height being when the top edge of the head is about .1 mm above the edge of the tape. The erase head is mounted on a separate sub-assembly.

### Relays

As mentioned at the outset of this article, switching sequences are likely to cause heartache to those not familiar with relay-operated devices. On the TK20, a Record/Play relay is provided. This makes with a positive click when the machine is switched to either of the two operative positions, and opens with a definite click a little after the machine is neutralised. The reason for this is that the relay is energised through a high-wattage 11,000 ohm resistor, easily identifiable on inspection, and as the relay is energised during playback, de-energised for record, an absence of clicks will indicate that this resistor is likely to be open-circuited.

The TK25 has a further relay, which switches the R/P head to its appropriate selector position and is in series with the R/P relay. A pair of contacts operated by the record button serve to open-circuit the dual-relay chain when the button is pressed. A further contact on the erase cut-out switch is in series with this chain. This superimposition facility is not provided on the TK20, nor is the frequency correction circuit to allow for equalisation at the two speeds of the TK25.

### Cleaning Contacts

Poor playback, whistles, or motor-boating can often be traced to faulty contacts on these relays, when machines have been in operation for some time. This is especially notable when operating conditions have been adverse; very dusty, exceptionally humid or in widely varying temperature. Cleaning the contacts requires the utmost care, and it is definitely not advised that contact springs should be bent in an effort to obtain a more positive closure. All that is normally necessary is a brush over the

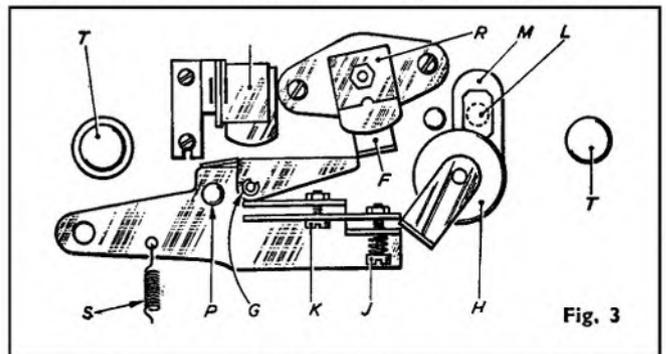


Fig. 3

points with a fine camel-hair brush dipped in methylated spirit, then a slight treatment with one of the better class, oil-impregnated switch-cleaners, allowing the switch to stand until the spirit is fully evaporated before current is again allowed to pass. A slight spot of oil at the mechanical pivot may help, but always avoid oiling around the contact points—which is the primary cause of sticking, relay pressures being very delicate on this type of mechanism.

More observations on relay care and adjustment will crop up as we progress to the more complicated models, in forthcoming articles of this series.

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# our readers write . . . . .

## . . . about articles

**From:**—Lt. Col. Carl V. Ashworth, U.S.A.F., 2700 John Marshall Drive, Arlington, Virginia.

*Dear Sir:*—In the years that I have been receiving your magazine, I have never seen an article on the mechanical side of tape recorders. I don't mean how to *build* a tape deck, but the whys and wherefores of the selection of the components going into a machine and the system of motion selected.

To explain further, but certainly not intended to limit the information included, I would like to see answers to such questions as: Why was a certain type of *motor* selected? Why is it better to have the *outside turn* than the *armature*? Why not use *ball bearings* throughout? What are the advantages of *nylon bearings*. Why use a *fly-wheel* with the *capstan*? What is the best way to connect *power* to a *fly-wheel*—belt or pulley-wheel? And why, why are certain *designs* chosen? Why not have tape guides made of rollers or ball bearings to lessen friction? What are the best ways to "take up" the tape, slipping clutch or other manner? How important are tolerances and why? Why is a pinch roller chosen to be a certain size? Why is a certain size capstan chosen rather than some other size, turning at a different speed? What are the best braking systems used and why? Which is best for fidelity as far as tape-to-head contact is concerned; pressure pads, wrap-around, or pressure roller?

I would like very much to see a series of two or three articles covering the subject of tape decks alone. Such a series would prove immensely interesting to nearly all tape recorder owners, in my opinion, for the reason that most folks can understand the mechanics if not the electronics. It would also give those interested a very good idea of how a machine works and how to maintain it.

*Yours faithfully,*

\* \* \*

## . . . about tape speeds

**From:**—J. Edward, 20 Eldon Street, Sunderland.

*Dear Sir:*—I must take up Mr. K. F. Jefferson when he writes that "even on a Ferrograph" the slower speed reproduction is markedly inferior to that at  $7\frac{1}{2}$  i/s.

I too use a Ferrograph, having learned the hard way with three other machines, before finally deciding that, in my opinion, the British product was "the daddy of them all", and I can vouch for the fact that at least the pre-recorded tapes from World Record Club are indistinguishable from others played at  $7\frac{1}{2}$  i/s.

For playback, I use a *Blaupunkt* stereo-box unit—"woofer and tweeter" with self-contained amplifier, and the results are eminently satisfactory.

Lest it should be thought that I am an easily-impressed amateur, may I say that having been an organist for 34 years, and being one of those queer birds blessed with "absolute pitch" (I can tune a violin correctly without the use of an "A" from another instrument), it takes a very high standard to satisfy me, and the slightest defection irritates me beyond measure.

And thus far, on my Ferrograph at  $3\frac{1}{2}$  i/s I have never been near the point of irritation.

*Yours faithfully,*

\* \* \*

## . . . about fitting another head

**From:**—H. Leather, Paynters Lane End, Illogan, Redruth, Cornwall.

*Dear Sir:*—I would be interested to know if any of your readers have had any success with fitting an additional superimposing head to a Ferrograph tape recorder.

*Yours faithfully,*

\* \* \*

## . . . about four-track recording

**From:**—G. Warner Allen, Iden House, Scotwell, Wallingford, Berks.

*Dear Sir:*—May I suggest that Mr. Jefferson has missed the point of Mr. Casburn's letter. Surely it is better to lose a few of those rather silly high frequencies which he never notices in a concert and not lose part of Wagner's Ring or a Mahler

symphony. I would suggest that he should have his Ferrograph overhauled. I have had three and had no difficulty in recording piano music except when I forgot to clean the capstan.

*Yours faithfully,*

**From:**—D. Casburn, 63 Roseville Road, Leeds, 8.

*Dear Sir:*—Reading Mr. Jefferson's letter in the June issue of *The Tape Recorder*, one might be excused for thinking that I am very uncritical and easily pleased. I am in fact quite the reverse, but I do think that many owners of high-fidelity equipment go to extremes.

If Mr. Jefferson desires real high-fidelity, I suggest that, rather than use full track recorders, etc., he should engage a full symphony orchestra to play for him in the palace which I presume he must possess. This, in my opinion, is the only way in which true domestic "high-fidelity" will ever be achieved. No reproducing apparatus I have yet heard has been able to make a recording of a symphony sound exactly like the real thing playing in a concert hall. To believe that such equipment exists at least for domestic use, is to delude oneself.

What prompted me to write my first letter was the fact that four-track recorders are very much maligned these days, and I sought to put in a good word for them. I realise, of course, that such recorders have a lower signal to noise ratio compared with a two-track or full-track, but I contend that this should not worry any ordinary non-technical listener. After all, normal people do not listen to music with their ears two inches from the loudspeaker, trying to decide whether the background noise is excessive. Such things would only worry the high-fidelity fanatics, who, it seems to me, are striving after a perfection that will never be realised.

*Yours faithfully,*

\* \* \*

## . . . about service

**From:** R.C.A. (Great Britain) Ltd., 274 Deansgate, Manchester, 3.

*Dear Sir:*—Your editorial in the February issue of *The Tape Recorder* covers the whole question of Tape Recorder Service in a strictly unbiased manner and at the same time makes it clear to the public and dealers that they can get satisfaction only if they deal with a good service organisation.

Our service engineers are specialists in this class of work and we have all the equipment necessary for first class service in the Manchester area.

*Yours faithfully,*

F. R. Phillips, Area Supervisor.

\* \* \*

## . . . about assistance

**From:**—W. H. Talbot, 280, St. Mary Avenue, Winnipeg 1, Manitoba.

*Dear Sir:*—I am most desirous of obtaining, on tape, as many peals of bells as I can get, for instance Westminster Abbey, St. Paul's Cathedral, St. Clement Danes, etc., etc. I am willing either to purchase said tapes or to exchange other tapes with interested persons. I might mention that my tape recorders are Philips with speeds of  $1\frac{1}{2}$ ,  $3\frac{1}{2}$  and  $7\frac{1}{2}$  i/s.

I also have one of the largest private libraries of military band records, covering a period of 50 years. Some are collectors' items.

*Yours truly,*

**From:**—P. Julian, "Carracawen", Sunny Corner, Malpas, Truro.

*Dear Sir:*—I recently purchased a Traveller battery-operated tape deck, and I am now unable to obtain any circuits for transistor oscillators. Could any reader please assist me?

*Yours faithfully,*

**From:**—G. F. Griffin, 3 Shenstone Avenue, Norton Estate, Stourbridge, Worcs.

*Dear Sir:*—I wondered if it would be possible to borrow films on tape recording or tape recorders or anything connected in any way with tape recording. I have just started a tape recorder club in Stourbridge and we are running short of ideas. Any assistance from readers would greatly assist us.

*Yours faithfully,*

# DESIGN REQUIREMENTS AND CIRCUITS

## BY GRAHAM BALMAIN

### PEAK PROGRAMME METERS

THE advantages of using peak-reading modulation indicators for tape recording were set out at length in the March 1962 issue of this journal, so I shall not list them again here. My purpose in this article is to describe the performance required of a professional (e.g. BBC) peak programme meter circuit, and to suggest how the professional type of circuit can be modified to reduce its cost to the amateur without sacrificing performance unduly. This first part will describe such a circuit, and enough of its operation to enable more experienced readers to construct and use it.

Fig. 1 shows a simplified professional *ppm* circuit (not BBC) which works broadly as follows: After amplification in V1a and impedance transformation in V1b, the incoming signal is bi-phase rectified by V2 and charges C2 to its own peak value of voltage. The direct voltage appearing at the control grid of V3 alters the anode current and thus deflects the *ppm* pointer according to the peak value of the input.

#### Performance

To explain the performance in more detail it is best to work backwards from the meter. Programme engineers find it convenient to observe programme levels, over the upper part of the range at least, on a substantially linear deciBel scale, so the *ppm* is marked in roughly equal steps which are arbitrarily numbered from 1 to 7 (fig. 2). Each step between 2 and 7 normally represents 4 dB, and that from 1 to 2 covers about 6 dB, making a total useful range of 26 dB.

Obviously such a scale requires that the anode current of V3 should respond logarithmically to the voltage applied to the grid, whereas the natural forward characteristic of most valves tends to be either linear or a curve following some power law. However, the anode current of a variable mu pentode (V3) can be made to approximate an inverse logarithmic (exponential) law quite closely if the screen and bias voltages are suitably chosen relative to the anode voltage. Used in reverse, by arranging that the anode current is at maximum when no signal is present and decreasing it progressively as the signal increases, this gives the required logarithmic response. The meter must therefore have a right-hand mechanical zero (as in fig. 2) and be deflected to an electrical left-hand "zero" position by the maximum "no signal" anode current. Any signal must thus drive the grid of V3 more negative to deflect the *ppm* to the right.

#### Another important requirement

A further important requirement for programme engineers, is, naturally, that salient peak levels should be both readable and individually distinguishable. The *ppm* pointer must therefore stay at or near a reading long enough for it to be recognised easily and yet fall from it quickly enough to prevent masking the next important reading. In practice a fall time-constant of 1 second is found to be the best compromise between the two. This is determined by the product of C2 and R4 (microfarads  $\times$  megohms = time-constant in seconds) which in this case allows the grid voltage to rise and the pointer to fall at the rate of about 8½ dB/second after a peak has passed.

Even with such outside electronic help, the *ppm* itself must respond pretty smartly to an input peak if the pointer is to reach its intended position before the voltage on C2 has decayed appreciably from the peak value. The movement is therefore very light, being able to reach full scale deflection in 30-40 milliseconds, and has only sufficient damping to prevent it overshooting by more than 5 per cent. A comparable average general-purpose meter takes at least 5 times as long to reach f.s.d. by which time the voltage across C2 has decayed by 2 dB or more; it would never get there, in fact, or to any true peak reading, unless the decay rate were decreased considerably. More of

that later. The *ppm*, on the other hand, always gets there before the voltage has decayed by 0.3 dB, which is enough for programme purposes.

#### Purpose—to avoid distortion

Choosing the speed of response to incoming peaks is also a matter of importance. The meter circuit from C2 to the right is quite capable of registering peaks lasting only a few microseconds. If it is allowed

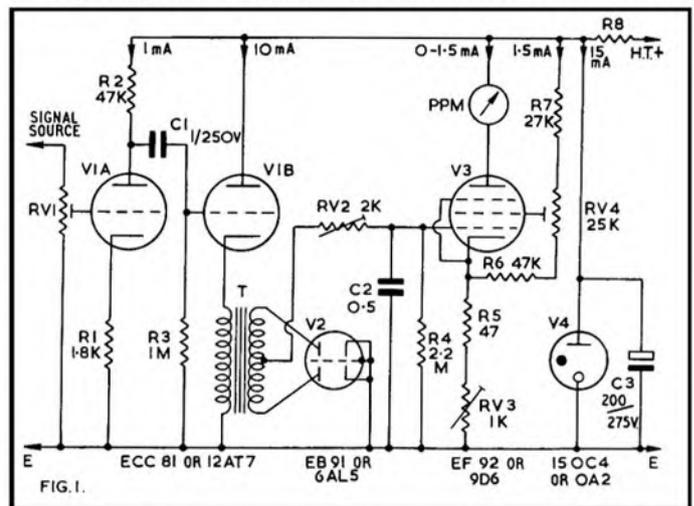


Fig. 1. Simplified professional PPM circuit. All resistors  $\pm 10\%$ ,  $\frac{1}{4}$  watt. RV1—up to 1 Mohm as necessary. T—Primary inductance not less than 4H at 10mA d.c.; resistance about 200 ohms. Ratios 1:1+1 or 1:1CT. Secondary resistance up to 1 kohm each half PPM—0.15mA moving coil, right-hand zero. BBC spec. ED 1415/4. R8=(HT—150)/30 Kohm; (HT—150)  $\times$  0.03 watts. HT—at least 200V at 30mA.

to do so, however, the general modulation level of a programme for a given maximum reading is found to be unnecessarily low. This is for two reasons; it is low because the shortest peaks, when they occur, tend to be the largest in amplitude; and it is unnecessarily so because the audible effect of clipping peaks which last for less than about 5 milliseconds decreases progressively with the duration of the peak.

To be sure, the whole purpose of a peak meter is to avoid distorting peaks, but there is no point in avoiding distortion which is not appreciable anyway. To do so only means reducing the effective range of your transmitter or the signal/noise ratio of your recording to no real purpose. So it is sufficient to be able fully to register peaks which last longer than 5 mS, and to discriminate progressively against shorter ones, which is achieved by making the charging time-constant of the peak-storage circuit Rs—C2 2.5 mS. The series resistance Rs is composed of the output source resistance of the amplifier V1b, the resistance of the transformer secondary winding, the forward resistance of the diodes in V2 and the trimming resistor RV2, which is adjusted to make up the necessary total of (in this case) 5,000 ohms.

Readers may well be asking by this time why it is necessary to use a biphasic rectifier, since there would be no need for an expensive and awkward transformer if a  $\frac{1}{2}$ -wave rectifier were used. The answer is simply that the waveforms of some types of programme material may not be symmetrical: notably speech, in which the positive and

# DESIGN REQUIREMENTS AND CIRCUITS

## BY GRAHAM BALMAIN

### PEAK PROGRAMME METERS

negative peak values can differ by as much as 8 dB. Since we do not know beforehand which peak will be the greater we must look at both, although only the larger one registers, of course.

#### Economising

It will now be obvious that nothing less than a proper *ppm* will do if we want full BBC performance. Since this is likely to cost £4-£6, any reduction in expense elsewhere is welcome. The obvious point of attack is that transformer; it is not a standard type and will probably cost £2 or more if you can get one. The alternative is some form of phase-splitter such as precedes push-pull output valves in a power amplifier. The two simplest and most suitable types are the Schmitt cathode-coupled inverter (shown in fig. 3) and the "concertina" split-load type shown as V1b in fig. 4.

At first sight the former is more attractive because the signal currents in the two sections are practically equal, which reduces h.t. decoupling and hum problems, and because the two output source impedances are also equal. It also has a much better high-frequency response. Using the same type of double-triode for both, their overall gains in practical circuits are similar. However, the Schmitt does use one or two components more than the other and—much more serious—it unbalances rather badly on some kinds of pulses when the input source impedance is high; for instance, when the input gain control has to have a high value and to be set much away from the ends of its range. The importance of this point will be made clear later. The Schmitt can nevertheless be useful if you can feed it from a low impedance, say up to 10 K ohms, since its good h.f. response (up to 100 Kc/s or more in this example) enables it to be used for measuring bias and erase signals also.

The main disadvantage of the concertina inverter (fig. 4) is that the two output impedances are unequal; that of the anode output approximates to the value of the anode load (10 K ohms) and at the cathode to 2/gm, in this case about 600 ohms. The charging time-constants of the two signal paths and C4 must therefore be equalised

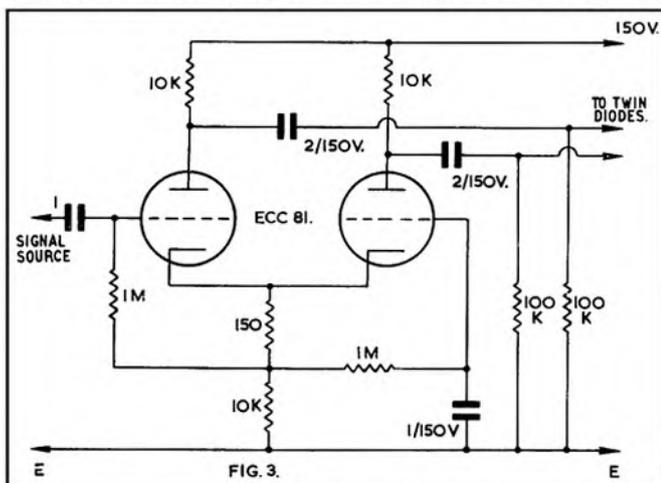


Fig. 3. Schmitt cathode coupled phase inverter.

by padding out the cathode output to 10 K ohms with a series resistor. The decoupling problem mentioned earlier can be eased by arranging that the amplifier stage V1a draws the same signal-frequency current from the supply as V1b does. The consequent small reduction in gain

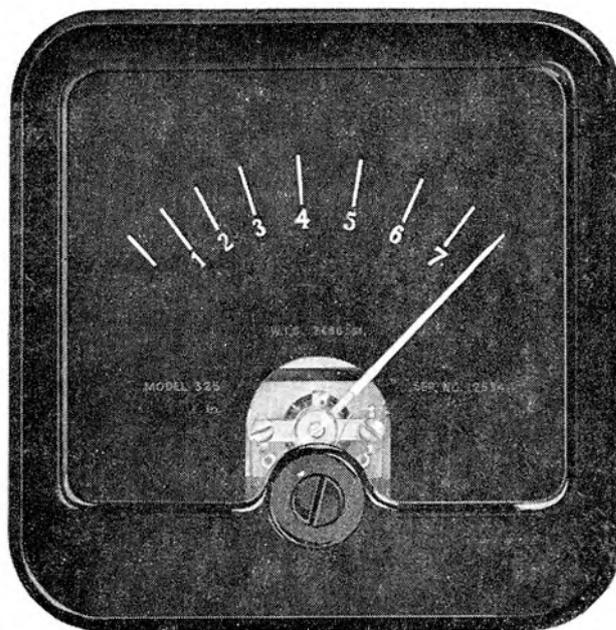


Fig. 2. BBC peak programme meter (Photo by Ernest Turner Instruments Ltd).

compared to V1a in fig. 1 and the 2 mA increase in h.t. current (little enough among the total consumption) is a fair exchange for the extra 200 mF capacitor which is otherwise needed for efficient h.t. decoupling. As it is, the stabiliser tube V4 alone is enough. Do not worry, by the way, about the apparent lack of bias in the inverter stage; it is biasing itself quite efficiently by virtue of grid current through R3, and no appreciable distortion of the signal wave-form results from this arrangement. C4 does cause slight peak clipping, of course.

#### Back resistance

The thermionic twin-diode V2 has been retained mainly because it will cost you about half as much as the two silicon diodes which could replace it. Two points here may cause confusion, however. The back-resistance of a thermionic diode at low reverse voltages, such as exist in this circuit, is not constant, nor as high as would be expected at high reverse voltages, because of a standing "space-charge" current which flows even when no voltage is deliberately applied. As the back-voltage falls towards zero, the back resistance decreases to a limiting value, progressively shunting R9 and shortening the effective decay time-constant of the circuit.

The voltage decay across C4 is thus not truly exponential, and the *ppm* pointer will reach zero rather more quickly than it ought according to its initial rate of fall. This does not affect normal working unduly as the shunting is here appreciable only below deflections of 2-3. But the standing current may also be misleading during setting-up, since it flows through R9 and results in a steady negative bias on the grid of V3. The electrical zero (with no signal input) must therefore be set when V2 is operative.

I have also retained the variable- $\mu$  pentode. There are other ways of producing a logarithmic current response but all those I have tried are either more expensive, less accurate or less stable than this. Although this part of the circuit is still the most sensitive to variations in valve characteristics and h.t. voltage (hence the stabiliser) a logarithmic response within  $\frac{1}{2}$  dB of the *ppm* scale can nevertheless be obtained from any valve within the normal manufacturers' tolerances by judicious adjustment of the cathode and screen controls RV3 and RV4. These controls are often named "law" and "zero" (or "zero" and "law") respectively, but this tends to be confusing because altering one means that the other must be reset anyway; they are not as independent as such names might suggest. The important thing is to reserve one of them as a "zero" control for routine adjustment of the inevitable small short-term drifts, and stick to it.

The overall stability of the circuit seems surprisingly good. On my prototype, the overall zero drift after 10 minutes warming-up

# HERE IT IS!!! HIGHEST QUALITY RECORDING AT LOW COST



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\* Supplied complete with sensitive moving coil microphone, 5" reel of L.P. tape, empty 5" spool, and screened connecting lead.

**ONLY 28 gns.**  
(Made in Holland)



## STELLAPHONE ST 456 ALL TRANSISTOR 4-TRACK

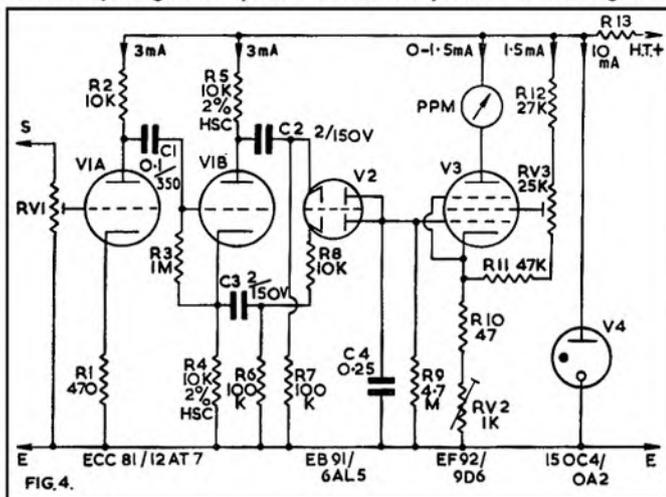
Here's a 4-track machine for enthusiast and beginner alike—at a price for everyone! The Stella ST 456 gives big-machine realism of reproduction with complete ease of operation, and it's so economical to run, too. Four-track recording at  $3\frac{3}{4}$ "/i.p.s. on a  $5\frac{1}{2}$ " reel of double-play tape gives six hours of playing time. See this superb new Stella Tape Recorder at your Stella dealer, NOW!

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**DESIGN REQUIREMENTS—(continued)**

amounted to less than 1/2 dB in each of 15 seven-hour periods, and the gain variation to a similar amount. Various combinations of the worst and best valves of each type to be expected resulted in a range of input sensitivity for full output (a deflection of 7) of 0.6-0.8 V r.m.s. The meter can thus be worked from a normal 600 ohm line, with 16 dB up to gain to spare if the normal practice of treating 6 as



**FIG. 4.** Transformer-less PPM circuit with performance equal to that of fig. 1. All resistor  $\pm 10\%$ , 1/4W, V.O.S. R.V.I. up to 1 Mohm as necessary. P.P.M. as fig. 1.  $R_{13} = (HT - 150)/20$  Kohm;  $(HT - 150) \times 0.02$  watts. HT, at least 200V at 20 mA.

“full modulation” is followed, and from most other outputs where it is likely to be used. The frequency response is flat from 20 c/s to 10 Kc/s and 1 dB down at 15-20 Kc/s.

One caution before I end this month; a peak programme meter is not the panacea for overmodulation; it cannot think or adjust the recorder gain control for you, nor can it foresee peak levels which are about to occur. But it *does* measure peaks and it will enable you to make a more intelligent guess at a reasonable control setting than I believe, any other kind of indicator except perhaps a good magic eye.

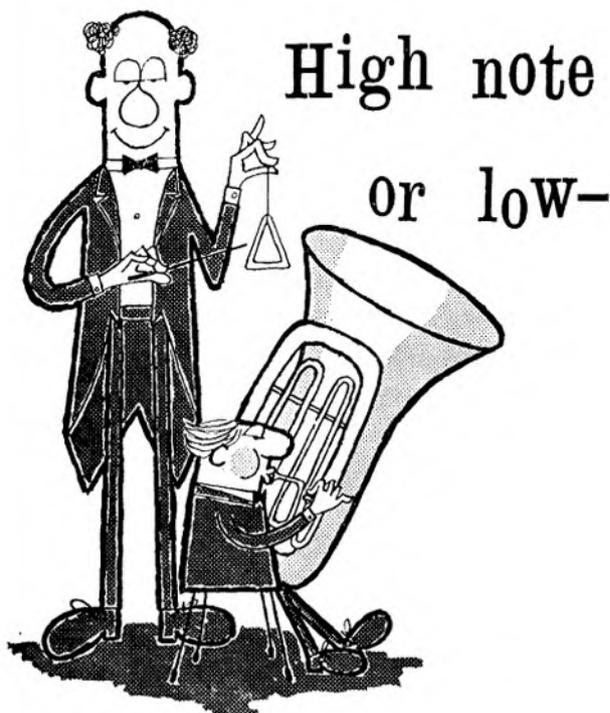
The second part of this article will contain data on testing and setting-up the circuit.

**TABLE OF METERS FOR PPM CIRCUIT**

Manufacturer	Model	Size of Face	Speed	Price	Delivery
Taylor Electrical Instruments, Ltd., Montrose Avenue, Slough, Bucks.	50	5" x 4"	Rapid	£ 6 0 0	8 weeks (approx.)
	30	2 1/2" x 2 1/2"	Rapid	5 0 0	8 weeks (approx.)
	220	3 1/2" x 1 1/2" (edgewise)	Rapid*	2 5 0	8 weeks (approx.)
	30	2 1/2" x 2 1/2"	Medium	3 0 0	8 weeks (approx.)
Measuring Instruments (Pullin) Ltd., Winchester Street, Acton, London, W.3.	35	3 1/2" square	Rapid	5 11 6	6 weeks
	20	2" round or square	Rapid	3 18 0	6 weeks
	35	3 1/2" square	Medium	4 18 6	6 weeks
Ernest Turner Electrical Instruments, Ltd., High Wycombe, Bucks.	325	3 1/2" square	Rapid	6 6 0	12 weeks (max.)
	505	2 1/2" round	Rapid	5 16 6	12 weeks (max.)
	W15	1 1/2" square	Rapid	5 15 0	12 weeks (max.)
	W15	1 1/2" square	Medium	3 11 6	12 weeks (max.)

\* The Taylor edgewise meter has a satisfactorily short rise time but overshoots by 1-2 dB and thus takes longer to come to rest.

Rapid meters are for direct use in the circuit of fig. 4. Medium meters can be used in this circuit if R9 is increased to 10-20 megohms, giving correspondingly longer fall times and some masking of closely-following peaks. When ordering, specify the following for all types: 0-1.5 mA dc, right hand zero; scaled white on black, BBC old scale marks (unnumbered at 0 and 1.5 mA, numbered 1-7 from left to right in between); white knife or lance pointer. For “rapid” movements specify also transit times to BBC spec. ED 1415, issue 4. For “medium” movements specify rise time of 0.1-0.2 seconds.



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# SOUND and CINE

THE amazing Stuart Wynn Jones has now come up with yet another winner, for his very latest effort—*The Rejected Rose*—a fully-animated cartoon with a Musique Concrète soundtrack, and the result of three years' lone and concentrated work, is a worthy successor to his earlier *Raving Waving* and *Bellowing Billowing*. *The Rejected Rose*, however, is more than just a clever play of undulating shape and colour to a witty track, for it deals with the human situation.

The story line is uncomplicated and simply tells of frustrated love finding other means of expression. The main character is a sensitive young man who, after being turned down by the girl of his choice, turns all his force towards painting roses in many shapes and forms. This young man, in turn, is pursued by another woman (sub-plot) but he rejects her. The woman finds solace in her music (this is a delightful caricature). In the end both these frustrated characters find tremendous success

which led him to develop a simple system for converting sound waves into light waves without recourse to the expense of an oscillograph.

My diagram shows his set-up. The first essential is a shallow pool of liquid (5) covering a taut elastic diaphragm and this can be effected by having a wafer-thin sheet of polythene stretched over a frame about a foot wide. This frame is then placed over the loudspeaker (4) with cone in upright position, carefully levelled so that the liquid does not spill over, and fastened to the ground (6) for extra support. The surface of the liquid will be found to break up into multiple ripples in response to the signal (3)—leads to amplifier.

The next step is to make these ripples filmable, and two ways are open. First, a narrow beam from a projector or spot lamp (1) can be directed on to the surface of the liquid and then reflected to the screen (7). This diffused image result can then be modified by placing a colour wheel (2) in front of the light source or by running any odd scrap of colour film through the projector. The second method is to film the ripples direct from the screen position and as seen lit by a single source of light with the screen removed.

The variations that may be tried out are without number and, indeed, it is quite possible to create both sound and picture from a single Musique Concrète source.

## Lip-sync Inserts

The *Eumig T5* tape recorder is now on sale in several Continental countries and it is hoped that supplies will shortly be introduced here. The two unusual features are: (1) a quick change cassette to hold the tape and (2) a built-in sync link for start of both recorder and camera. The T5 is a very light portable machine and should be invaluable for lip-sync inserts on location.

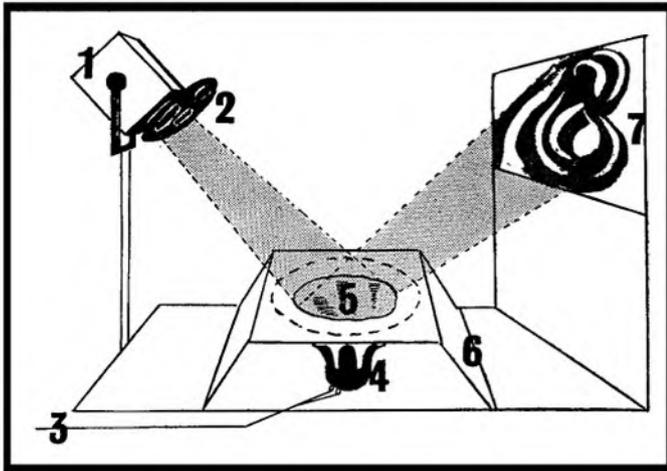
The essential for the short insert is a synchronised start (and this is the basis of the *Cinecorder* system) for spring-wound cameras can be calibrated to run afterwards in sync for at least a couple of sentences. Battery-driven cameras, theoretically, should be more efficient as there should be no run down at the end of the wind.

Whether using the *Eumig*, *Cinecorder* or your own modified recorder with remote control at camera position, the calibration procedure is quite simple. The camera is loaded with a timing loop of film and adjusted to run in sync with the recorder.

If sprocketed tape, a sprocketed capstan, and some measuring device such as an add-on tape indicator attached to the capstan are used, then both machines can be stopped and started together at various intervals, the number of frames passing through the gate being checked against the indicator until a camera speed control setting is found that will correspond with the perforated tape speed. If the camera has a frame counter the work is simplified, otherwise it will be necessary to open the camera door for each check and to count the number of frames that have passed through on that take.

## Perforated Tape

Without the perforated tape refinements the calibration may be carried out with ordinary tape marked off in parts of one second with a grease pencil rather than relying on the normal tape recorder footage counter which will certainly not be critical enough on its own. Strobe tape, with its 52 bars to every 3½ in. of tape, would give a greater degree of accuracy, the ratio being 16/52, 18/52, or 24/52 according to the film speed



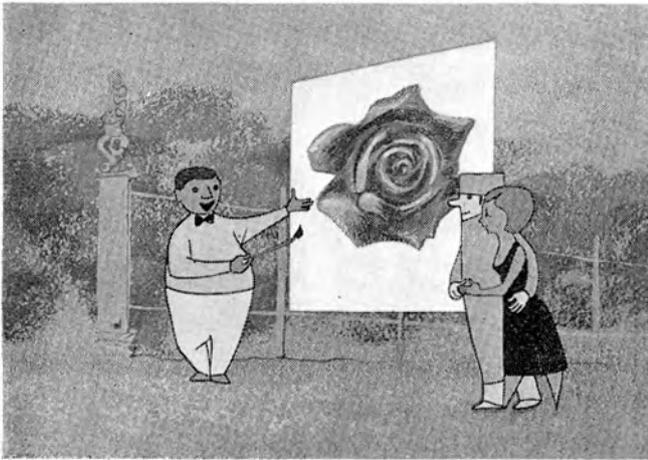
Abstract sound and colour filming diagram.

in the outlets they have chosen, but neither is quite complete. The girl, on the other hand, is completely happy with the ordinary existence she has chosen and seeks nothing more.

The half dozen characters each have their own theme music, and these themes are subtly blended to provide a Musique Concrète track of great variety throughout this seven-minute film. To achieve this, Stuart employed his well-tried method of assembling various lengths of tape, each containing a basic sound pattern, and running each loop continuously on one tape recorder and re-recording on a second. The basic pattern was piano changed by speeding up or slowing down, playing backwards and superimposing (his Brenell allowing the use of eight separate capstans of varying size). The art work and animation are well up to standard and he can feel justified in spending these three years on just one opus.

## "Instant" abstract filming

Gordon Rowley, the well-known gadgeteer and double "Oscar" winner of this year, seems, on the other hand to regard three weeks as the limit to be spent on any film, short or long, and I am indebted to him for this "instant" method of creating visual patterns from sound vibrations. The idea was originated while Gordon was watching pattern play on a wall from sunlight reflected from the skin on a cup of coffee



An illustration from Stuart Wynn Jones's latest animated cartoon —"The Rejected Rose".

required. A scale may be drawn up as an editing aid to make physical cutting a possibility and could be based on the following:

#### 8 mm Film Speeds

16 f/s equals 2.4 ins. of film passing through the gate per second.

18	..	2.7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	..	3.6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	3.75	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

#### 16 mm Film Speeds

16	..	4.8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	..	5.4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
24	..	7.2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
25	..	7.5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

From this table it will be seen that tape running at  $3\frac{1}{2}$  i/s will match length for length 8 mm film running at 25 f/s and that tape running at  $7\frac{1}{2}$  i/s will match length for length 16 mm film running at 25 f/s but unless designed for television, a sound change in pitch of about a semi-tone will occur if played back at the one f/s slower. Some 8 mm cameras (and these seem to be mainly Japanese at the moment) have a  $12\frac{1}{2}$  f/s setting for television only showing.

In regard to the actual take, although there is no interlock between the machines, if both units can keep to a constant speed then there should be no discrepancy. Things never work out quite like this, however, and manual adjustment may be needed when re-recording against picture. This is completely at the discretion of the tape recorder owner and merely consists in braking the feed reel or in speeding up the take-up reel with the fingers each time the picture threatens to lose sync. At first this may be a little tricky to effect but after a time you will find that a slight touch here or there will make all the difference and, in some cases, may be the only way to find the desired correspondence.

A variable tape recorder may be used quite efficiently with a motor driven camera with no interlock, provided that the camera start and finish are signalled on the tape by means of a frame contact on the camera (a simplification of the pulse system but needing no extra track on the tape). The advantage is that the tape can be running and up to speed when the camera starts and that the end of the take can be pin-pointed in editing.

#### Boom swinging

Even with short inserts the correct sound muffling methods and microphone procedure should be carried out, and a useful accessory is a mike boom with operator. The critical position may be determined by headset, although a working rule is that a moving coil mike may generally be used a little closer than a ribbon; but unless the room sound is unusually high it should never be less than a foot away from the actor. A safe distance

with a ribbon is about 18 inches and a shorter range than this would tend to distort the bass frequencies of the voice.

There should always be a natural sound perspective between the various camera angles—long shot, medium shot and close shot but not too much. If the dialogue is to be continued through some angle changes, this sound perspective may have to be thoroughly worked out in advance, and may indicate some holding off in close shots. In a long shot, where the actors are some distance apart, the mike may be placed at an equal distance between the actors and rotated towards each speaker in turn. This same technique may be used for a two-shot medium close-up, but when recording a scene where one of the actors is off screen it may be better to direct the microphone on the visible actor all the time.

Where the angle is to change immediately after the take, it is important that the action of the actor at the end of the take should register exactly with his action at the start of the next shot. If this rule is not observed then cutting on action will be difficult to effect in editing. A way around this is to overlap a part of the dialogue and to have the actor repeat the last few words together with the appropriate action before beginning his new action and new lines.

The boom swinger himself must be prepared for some quite usual snags; if the mike catches light from the floods or spots it can throw shadow on to the actors or on to the background; dipping into picture occurs often with actors' movement; sound fading can be caused by the characters moving away and the boom swinger being too slow to catch them up or to pan with them. All these can be prevented to some extent by having adequate rehearsal periods with the boom operator being allowed full scope by the director and cameraman and by having some good understanding between the crew.

Where the use of a boom is prevented by a need to show all of the set in a wide shot, a stationary mike should be hidden near the actors and placed in some stage property such as a vase of flowers (when the Shure Unidyne microphones—uniform cardioid directional characteristics—are used for televised services in Llandarf Cathedral they are placed in the 17th century candlesticks on either side of the altar and are invisible from the front of the Sanctuary).

#### Check Levels

Where movement on the part of the actors is required for the take, and more than one stationary mike is in use, the levels should be watched throughout.

All this may sound complicated and quite unnecessary to the beginner, especially if only a very short insert is required, but the insert is worth tackling at all then it should be well done. A badly handled insert defeats the very object of having one at all. A final word on boom swinging—don't be misled by people who tell you how to make up a simple mike pole from a broomstick or length of tubing. You really need a floorstand for accurate control and to save those aching muscles. The very least you should attempt is a conversion of a lightstand with adjustable arm.

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MAGNETIC RECORDING TAPE



## . . . tape recorder workbench

No. 37

by A. Bartlett Still

SOME tape recorder manufacturers do not take a great deal of trouble in preparation of the instruction booklets they issue with their machines, judging by some of the reviews that have appeared in the past. But when it is considered that many new owners will not even take the time to read any instructions, good or bad, this may not be so surprising.

The other day a friend of mine complained that his machine was faulty, and had, in fact, never been correct since he had purchased it. He was a little abashed to find that it was his mistake—one that could have been avoided so very easily. After I had pointed out that reading the instructions supplied was the *First Rule*, he wanted to know the next, if there was one. This set me thinking about “*Dos*” and “*Don'ts*,” some of which will not be found in any maker's instructions.

### Check the Mains Voltage

It will perhaps be stating the obvious to say “Check the mains tap setting,” but this is something to be remembered if you have taken your machine away from home, and again when you bring it back.

Take pains with every recording you make, and watch the magic eye (or meter). Making recordings as good as your equipment will allow can become a habit, as it should be, if you force yourself into it. When and if you have made a recording that is not up to standard—find out what went wrong. Try to produce the same mistake again, until you know what caused it. You should never be ashamed of making a mistake, but you should be ashamed of making an avoidable mistake twice.

Because you do not want to spoil any important recordings, do not be afraid to experiment. Learn to use your microphone in all sorts of conditions and distances from the sound source. This will help you to gain an appreciation of different acoustic conditions that will be invaluable when you are recording away from home. It will also help you to get to know your machine and get the utmost from it; but bear in mind that it will have limitations and do not expect miracles.

Remember *never* to connect directly to a television set or AC/DC radio. If you do not know how to connect correctly to such equipment, find out from someone who is qualified to tell you the proper way. This warning has often appeared in this column and elsewhere in the pages of *The Tape Recorder*, but I make no apologies—it cannot be stressed too often that a wrong connection of this sort can be very dangerous.

Now for another “*Do*”, but one whose importance is not always appreciated. Always use the correct brand of tape, or one that you have found, by deliberate experiment, to be as good or better. The manufacturer of your machine sets the recording bias to be correct for the tape he recommends, results need not be the same with any other.

### A Word of Warning

Finally a word of warning. It has been the aim of this column to assist those enthusiasts who like to “take the lid off”. Those who, perhaps, have their own workshop and are of a practical turn of mind. There is quite a lot in the way of servicing and useful modification that can be carried out in the home workshop—after all, some of us build our complete machines—provided the know-how exists. But if you don't really know what you are attempting to do, and exactly how you are going to do it, down to the last detail, don't do it. It may well be a job easily within your capabilities, but find out first. Ask me if you like and I'll help you if I can, but, by the same token, I'll refer you to the manufacturer for advice if I cannot find all the details.

Even if this prevents you trying out a pet idea, I hope you will agree that it makes sense. After all, some mistakes can be expensive. Next month I shall try to strike a more constructive note!

## GOOD SERVICE—AND THE MANUFACTURER

SINCE the series of articles on *Tape Recorder Service* commenced, the author has received a number of letters from readers. Most give details of specific faults and ask for advice; some request service data and spare parts; others list complaints. Where the fault symptoms are described, and complete make and model information given, an attempt at diagnosis can be made. Professional experience, plus access to service data which the average owner does not possess, enables a fairly high percentage of cures to be attained. Requests for service manuals and spares, however, must be politely refused. Published data on commercial equipment is limited, and manufacturers generally follow the policy of supplying spares only through the correct trade channels, i.e. via dealers or service agents.

Complaints are a different matter. They vary from the peevish to the downright vitriolic—and often turn out to be ill-founded, maybe groundless. Although the campaign for Good Service (which has brought *The Tape Recorder* congratulations from several trade sources) is aided by information from readers, such vague complaints serve little useful purpose. It is, for example, unreasonable to condemn a manufacturer because a particular model, among many, develops a perplexing fault, or because spare parts for a machine not in current production take a little while to obtain. Complaining that a valve fails on Messrs. Blank's “Superstar” is rather like cursing your new car because a tyre goes flat.

On the whole, tape recorder manufacturers are remarkably co-operative. (Though their service departments have a lot to put up with; taking all the knocks and seldom receiving any praise!) To give some concrete examples, and cite names:

The case of Mr. W. J. Webber, of Cardiff, was reported in the March 1962 issue of *The Tape Recorder*. He had expensive trouble with an incompetent dealer: we investigated and reported. A sequel to our report came when Messrs. Philips Electrical Ltd., sent their engineer to redeem the honour of their firm—with no delay, and without being asked. The same firm was appealed to more recently, when a reader reported trouble on a long out-of-date model for which no service data was available. Back came the necessary information by return of post, plus a long and very helpful letter from the Philips service department.

Just as quick, and as co-operative was the service department of Combined Radio and Television Service (CRTS), Ltd., who handle such well-known lines as *Regentone*, *R.G.D.*, *Argosy* and *Emerson*. Reader A. H., of Atherton, Lancs., had trouble with his R.G.D. Mk. 102 tape recorder and could neither obtain replacement belts, nor get service from any local dealer. This model incorporates a *Korting* deck, which may have deterred some engineers. We passed A.H.'s problem to CRTS, who promptly offered to supply both the necessary spares and full service information to the author, even though the request was originally for the address of an agent who could be trusted to handle the job. Full marks for swift service.

Full marks, too, were earned by the Ferrograph Co. Ltd., who are understandably reluctant to have untrained hands dabbling with their machines, yet who twice supplied detailed and specific information when readers D.S.B., of Saffron Walden, and J.G., of Watford, ran into difficulties. Much of the technical detail is being assimilated into an article covering these fine machines, which will appear in a future issue of *The Tape Recorder*.

Other manufacturers have been equally helpful. Information has been readily supplied to the author by Messrs. Robuk Ltd., makers of the *Motek* deck, the service departments of *Stuzzi*, *Grundig*, *BSR*, *Collaro*, and several others, when informed that this was needed to assist readers of *The Tape Recorder*. There is a welcome changing of attitude toward users of modern audio equipment, many of whom are now recognised to be knowledgeable enthusiasts, not merely dabblers on the electronic fringe.

It is pleasant to reflect that the influence of responsible publications, such as *The Tape Recorder* has done much to bring about this improvement in customer-manufacturer relations. Long may it continue, and long may we hear from you, not only when in trouble, but also in appreciation of good service. H. W. Hellyer

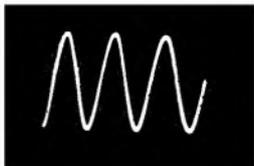
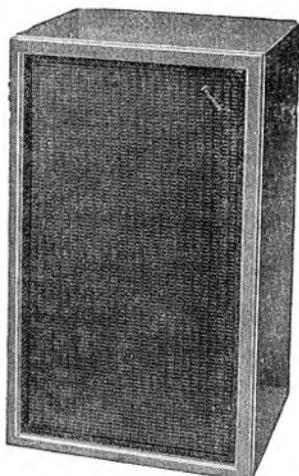
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# TAPE, RECORDERS & ACCESSORIES

## 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.



★  
FERGUSON  
MODEL 3202  
FOUR-TRACK  
RECORDER  
★

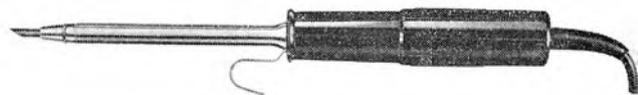
ANOTHER new tape recorder—using the new Ferguson tape deck designed and built by their own engineers—is announced this week by Ferguson.

Using 4 tracks, the model 3202 has two tape speeds ( $3\frac{1}{2}$  and  $1\frac{1}{2}$  i/s) and has an audio output of 3 watts. Easy action piano-key controls are fitted for recording, replay and tape wind, and a "pause" key is fitted to give instant "stop" or "start" without resetting the controls. The crystal-type microphone also has a built-in remote control switch which operates the pause key and permits interruption of recording or playback, as desired. The play-through button may also be used when recording to achieve superimposition of the recording on another, e.g. commentary on music. A digital tape position indicator with reset button is provided, and tape inching is, of course, possible. Another feature is an electromagnetic relay which gives automatic "stop" either using metal foil inserts or when the metallic strip "leader" at the end of the tape is reached. A powered socket is provided for the connection of accessories, which considerably enhances the scope of the recorder.

Frequency range is 60-10,000 c/s (at  $3\frac{1}{2}$  i/s) and signal to noise ratio is better than 40 dB. Spools up to  $5\frac{1}{2}$  in. diameter can be used, and the rewind time is 850 feet in less than  $2\frac{1}{2}$  minutes. Using double-play tape at  $1\frac{1}{2}$  i/s per sec. gives 12 hours playing time. All the controls are delightfully easy to operate, and the function of each control is indicated so simply that the instrument can be used with the minimum of instruction. A high sensitivity 7 in. x  $3\frac{1}{2}$  in. elliptical permanent magnet loudspeaker is fitted and there is also an extension speaker socket.

The price is £34 13s. inclusive of crystal microphone with remote control switch, 850-foot reel of standard tape, take-up spool and connecting leads, stored in a compartment at the rear of the cabinet. **Manufacturers:—Ferguson Radio Corporation Ltd., Thorn House, Upper St. Martins Lane, London, W.C.2.**

★ \* \*  
AEI 15-watt soldering iron



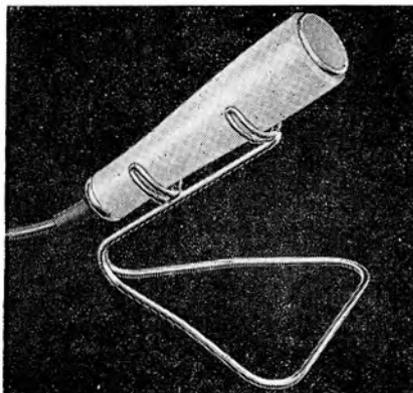
A 15-WATT mains-operated soldering iron, only  $8\frac{1}{2}$  inches long and weighing 3 ounces, has been added to the AEI range. It becomes the smallest member of the Solon family of irons and, available for operation from 200/220V and 220/240V, retails for £1 3s. 4d. in the United Kingdom.

The chromium-copper bit, retained in its aluminium holder by an aluminium pin whose ends lie in a groove round the holder,

is only  $\frac{1}{4}$  inch in diameter, while the stem is only  $\frac{5}{16}$  inch in diameter and completely free from projections. The iron is, therefore, suitable for use in confined spaces and for soldering to miniature components liable to be damaged by the application of too much heat.

The iron heats to working temperature in  $1\frac{1}{2}$  minutes. It is fitted with a removable hook so that it can be hung in a convenient place when not in use. The two-piece black moulded handle houses all internal connections between heating element tails and mains flex. A 6 ft. length of three-core flex is supplied with each iron.

Bits are easily replaced as required. If replacement of the bit holder, heating element or stem becomes necessary, these three components are replaced as one unit. **Manufacturers:—Associated Electrical Industries Ltd, Crown House, Aldwych, London, W.C.2.**



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DYNAMIC  
MICROPHONE  
★

THE Acos Mic 39 microphone is now available with a dynamic insert. The original Acos Mic 39 crystal microphone is a familiar sight to many amateurs throughout the country and abroad. The crystal version continues in production. As an alternative, Mic 39 is now being made with the same handsome styling, with an advanced dynamic insert, incorporating a transformer to provide high and low impedance matching. The new Dynamic Mic 39 microphone thus is suitable for a still greater variety of recording conditions, particularly where long leads are used.

The new microphone also has omnidirectional response, and has a frequency response: of 80-10,000 c/s,  $\pm 3$  dB, and approx. 10 dB down at 50 c/s and 15 Kc/s. The sensitivity: Low impedance connection (nominal 200) /80 dB ref IV/dyne/cm<sup>2</sup> on open circuit or high impedance connection (nominal 50 k) /54 dB ref IV/dyne/cm<sup>2</sup> on open circuit. The price is: £7 10s. **Manufacturers:—Cosmocord Ltd., Eleanor Cross Road, Waltham Cross, Herts.**

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# EQUIPMENT REVIEWED



★  
**REVOX  
E.36  
TWO-TRACK  
RECORDER**  
★

**Manufacturer's Specification:** Speeds:  $3\frac{1}{2}$  and  $7\frac{1}{2}$  i/s. Pole switching capstan drive (outside rotor) with switch off provision when recorder is used as amplifier. **Wow and flutter:** 0.1% rms max. measured at either 5,000 or 3,000 c/s and including all sources. **Max. playing time** (with 2 track machine): Monaural: 2 times 90 min. at  $7\frac{1}{2}$  i/s or 2 times 180 min. at  $3\frac{1}{2}$  i/s. Stereo: 90 min. at  $7\frac{1}{2}$  i/s or 180 min. at  $3\frac{1}{2}$  i/s, when using 3,600 ft. of tape on 25 cm reel. **Winding time:** 80 sec. for 2,400 ft. **Frequency response via tape:** at  $7\frac{1}{2}$  i/s 40-15,000 c/s, at  $3\frac{1}{2}$  i/s 40-10,000 c/s within plus 2 or minus 3 db. **Equalisation:** N.A.R.T.B. for recording, N.A.R.T.B. or C.C.I.R. for playback. **Erase and bias frequency:** 70 Kc/s. **Amplifier output:** 6 watts at less than 1% distortion. **Signal to noise ratio:** 50 dB at normal recording levels. **Channel separation:** Monaural: 55 dB or better. Stereo: 50 dB at 1 Kc/s, 50 dB at 100 c/s and 40 dB at 10 Kc/s. **Inputs:** Microphone 3 millivolts, impedance 2 megs. Radio: 250 millivolts, impedance 100 K. Auxiliary (diode): 10-500 millivolts with separate rear panel mounted gain control. **Outputs:** 1 cathode follower output for each channel, 1 volt. 1 connection for 5-10 ohm external speaker with automatic disconnection of built-in speaker. **Tubes:** 3 ECC83, 2 ECC81, 2 ECL82, 2 ECL80, 1 EM71, plus 3 selenium rectifiers. **Mains voltage:** 110, 125, 145, 220 volts at 50 cycles. **Power requirements:** 120 watts. **Fuses:** 110-145 volts: 0.2 amp. 220 volts: 0.6 amp. 5 by 200 mm time delay fuse. **Price:** £115 10s. **Distributors:** Revox (U.K. Concessionaires) Ltd., 296 Kensington High Street, London, W.14.

REVOX tape recorders are manufactured in Switzerland by Willi Studer who has previously specialised in professional recorders and the E.36 and the R.36 stereo recorders bear many of the earmarks of their parentage. They feel as if the cabinet is filled with concrete—the D.36 weighs 50 lbs.—and every part is solid and robust and designed to stand up to “twenty-four hours a day” use if necessary. The main deck plate, for example is a heavy steel pressing, and the two columns supporting the head assembly are of solid aluminium nearly three-quarters of an inch in diameter.

Ten inch reels, holding 2,400 ft. of standard play tape, can be used so that even the longest musical work can be recorded without a break by appropriate choice of tape and speed.

The controls are simple and straightforward; all tape motion is controlled by a row of push buttons which seem to operate through relays as only the lightest touch is required to move them. Recording controls for the two channels are grouped on a small panel on the right hand side, and all playback controls are on a matching panel on the left hand side. The magic eye record level indicator is mounted on the head dress cover and is angled forward slightly for maximum visibility.

An auto switch is controlled by the tape tension. If the tape breaks or leaves the end of the spool, or if the tape tension slackens for any reason, the microswitch energises the stop key and the tape is brought to rest.

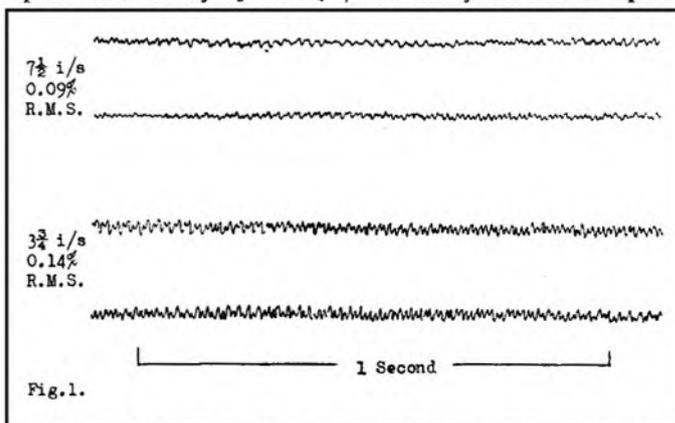
An A-B switching facility is provided, although it is not

labelled in this way. In other words it is possible to make an instantaneous comparison between the incoming signal and the recorded signal from the tape a small fraction of a second later. This facility is available on either track.

## Speed Wow and Flutter

A Papst outside rotor motor is used and the ground shaft of the motor drives a flywheel. The two to one speed change is effected by doubling the number of poles acting on the rotor by appropriate switching of the stator windings. The two motor speeds so obtained are 1,500 r.p.m. and 750 r.p.m. giving capstan rotation speeds of 25 and  $12\frac{1}{2}$  c/s at  $7\frac{1}{2}$  i/s and  $3\frac{1}{2}$  i/s respectively.

The fluttergrams of fig. 1 show no trace of capstan frequency flutter at either speed and the meter reading is rock steady showing that long term speed variation, or wow, is completely negligible. Close examination of the pen recordings show traces of 100 c/s and 50 c/s flutter but I would put this down to slight vibration rather than actual speed variations. The mass of the outside rotor is very effective at these speeds and it is almost certain that such relatively high frequencies would be smoothed out by the flywheel action of the motor. The measured tape speeds were exactly  $7\frac{1}{2}$  and  $3\frac{1}{2}$  i/s within my test limits of plus



or minus 0.5%—which is just as well for my peace of mind as I would be inclined to believe the machine, with this direct drive, rather than the most carefully calibrated test equipment!

## Play Only Response

100 and 200 microsecond test tapes were run through the machine and the responses of fig. 2 confirm that the C.C.I.R. equalisation is within plus or minus 1 dB over the range 50 to 10,000 c/s. Once again, this is as much a check of the test tape as a test of the recorder.

Noise and hum were 41 dB below test tape level, and this reading did not change when the motor was switched on or off. C.R.O. examination of the noise showed it to contain almost equal amounts of 50 c/s hum, hiss, and very low frequency emission fluctuation noise. Altering the polarity of the mains plug, or earthing the machine, made not the slightest difference to the hum or noise. This would indicate that the mains transformer contains an electrostatic screen between primary and secondary windings to reduce random capacitive couplings—another heritage from the fully-professional recorder.

## Record Play Tests

Overload tests proved that a level 15 dB above test tape level could be recorded with less than 5% harmonic distortion. The magic eye beams closed at exactly 12 dB above test tape level where the tape harmonic distortion is about 3%.

Record replay responses were taken at the two tape speeds and these are shown in fig. 3. And here we come to the first—and

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The Mk. 2 has two controls and two inputs, in addition to pre-set potentiometer connected to the "music" channel, allowing for differing output voltages from tuners etc. to be balanced with the Microphone channel.

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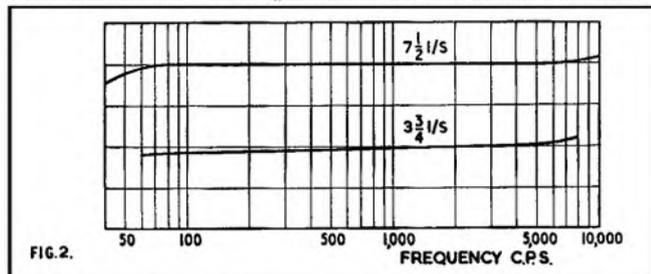
35 CRAVEN STREET, W.C.2.

TELEPHONE TRA 2080

## EQUIPMENT REVIEWED—(continued)

only—deviation “from the book”: these responses were obtained with C.C.I.R. playback equalisation, whereas the instruction book and specification tells us that the recording characteristic is to N.A.R.T.B. standards.

The first tests were done with a good sample of British tape. As a check, a sample of a Continental tape, known to

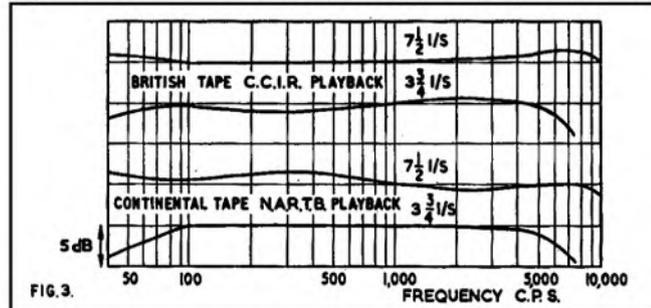


be more efficient at high frequencies, was tried, and this gave the lower responses of fig. 3 when reproduced with the N.A.R.T.B. equalisation.

This shows that the American recording characteristic is only obtained on Continental tapes, and that the C.C.I.R. playback response is more nearly level when British tapes are used. In other words “suck it and see”, if a recording sounds “dull” with N.A.R.T.B. equalisation, switch over to the C.C.I.R. playback response.

### Signal Noise Ratio

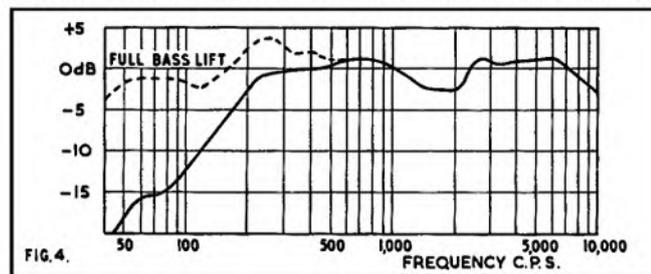
The measured signal noise ratio from the plus 12 dB on test tape level, where the magic eye beams just clash, is 53 dB. This same figure was obtained on both C.C.I.R. and N.A.R.T.B. equalisation, but the subjective impression was that the



N.A.R.T.B. equalisation, with the proper tape, was slightly quieter, but it was extremely difficult to obtain a programme source with enough dynamic range to make a clean cut decision.

### Acoustic Response

Finally the machine was loaded with a white noise test tape containing 25 one-third octave bands of filtered white noise and the sound output of the internal loudspeaker measured on each band. Fig. 4 shows the response with the bass lift control at either extreme. The solid curve is with a level electrical input to the speaker, and shows the bass loss typical for a speaker of this size in a cabinet of this type. The dotted response is with full bass lift, and it will be seen that the



response has been cunningly tailored to the response of the speaker and cabinet so that the overall response is maintained level over the full range of the recorder within limits of about plus or minus 3 dB.

Although I specialise in acoustic measurements, I can not say often enough that the frequency response is *not* the most important characteristic of a loudspeaker, and that there are other factors which we do not yet know how to measure properly—but the sound quality from this amplifier-cabinet-speaker combination is just about the best I have heard in a unit of this size. I should perhaps point out that the tone control only affects the monitoring amplifier output—it does not alter the recorded response.

### Comment

A solid dependable machine of the highest quality which will stand any amount of hard use and which will give recordings of professional quality when used with auxiliary equipment of the same standard.

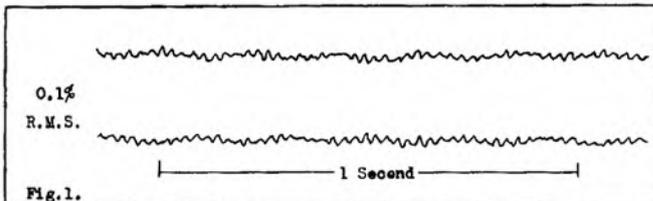
A. Tutchings



STELLA  
MODEL ST 456  
FOUR-TRACK  
RECORDER

**Manufacturer's Specification:** Accommodates all reel sizes up to 5½ in. **Frequency range:** 80-13,000 c/s ±3 dB. **Tape speed:** 3½ i/s Four tracks. Built-in 4 inch diameter high efficiency loudspeaker. **Mains voltages** of 110, 127, 200/250 V., 50 c/s (adjustable to 60 c/s). **Power consumption:** 25 watts. Amplifier all transistor. **Three input channels:** Microphone 1,500 ohms, 0.4 millivolts. Radio 0.02 megs, 2 millivolts. Pickup 0.68 megs, 100 millivolts. **Two output channels:** Radio 0.02 megs, 1.5 volts. **Loudspeaker:** 3-7 ohms, 0.7 watt. **Tropicalised.** **Price:** £29 8s. complete with moving coil microphone and radio lead. **Stella Radio and Television Co. Ltd.,** Astra House, 121/3 Shaftesbury Avenue, London, W.C.2.

THIS is a small compact family style recorder which any member of the family could learn to use in a few minutes. The right hand tab type control is responsible for *all* tape movements: stop, start, fast forward, and rewind. Press it down and the tape



starts; press it again and it stops; turn it to the right and the tape fast spools to the right; turn it to the left and the tape fast rewinds to the left—a most ingenious device!

The other controls are: a press to record button which locks down when the start key is operated; a slide switch to change tracks; and an edge type volume control which also operates the mains on-off switch at its minimum position. I was glad to see that the control was calibrated in numbers from one to ten so that a given setting could be repeated to a high accuracy.

The motor lamination stack acts as a mains transformer and a low voltage winding provides power for the transistor amplifier. The use of transistors offers two tremendous advantages over the orthodox valve amplifier; as there is no heating up time; the recorder is ready for use the instant the mains voltage is applied, and the almost complete absence of mains hum gives a silky quiet

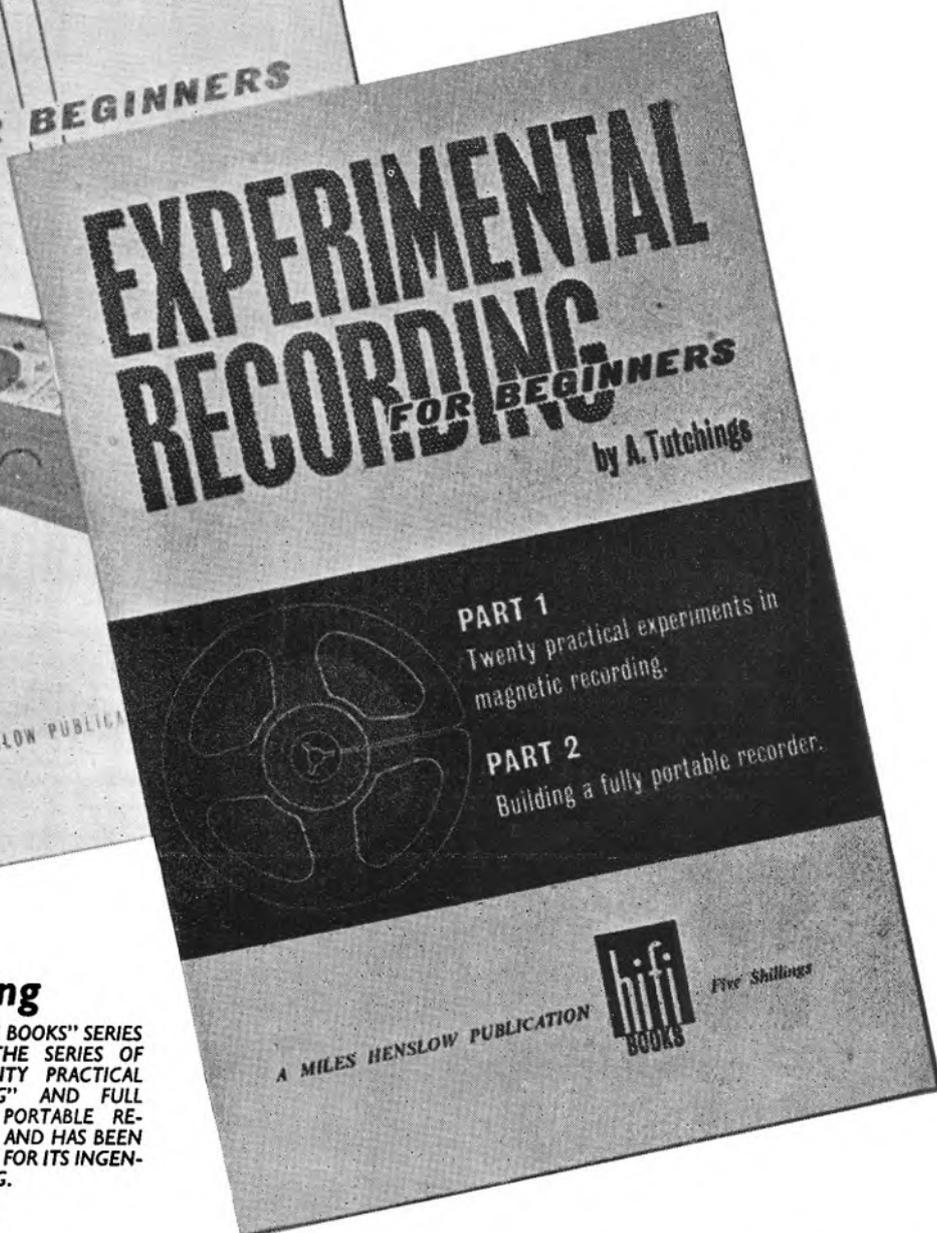
(Continued on page 309)

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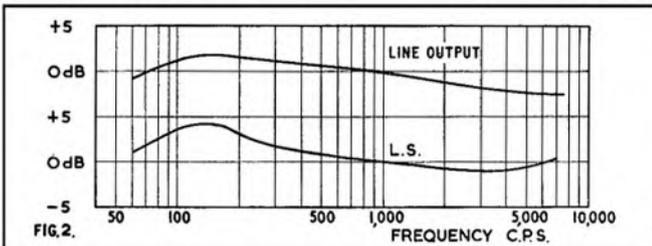
**EQUIPMENT REVIEWED — (continued)**

background which is not fully appreciated until one has lived with it for a little while. I think we all allow for a little mains hum, and are prepared to listen through it, or turn up the level a bit to cover it up. It is only when it is suddenly removed, as in this machine, that we realise that it was subconsciously causing a little strain and background annoyance.

The "instant" music also, for me, removed another frustration: that 20 second wait while a strangled signal slowly builds up to normal level, or that even more agonising wait for the machine to heat up when you want to record an item which is already "on the air" when 20 seconds seems like an hour!

**Speed Wow and Flutter**

On this machine the tape speed was exactly  $3\frac{1}{2}$  i/s within the confidence limits of my test gear. Total integrated wow and flutter remained constant at 0.1 per cent. r.m.s.; fig. 1 shows pen recordings at the beginning and end of a reel. Flutter is mainly from the 3,000 r.p.m. motor shaft and shows up as a very slight



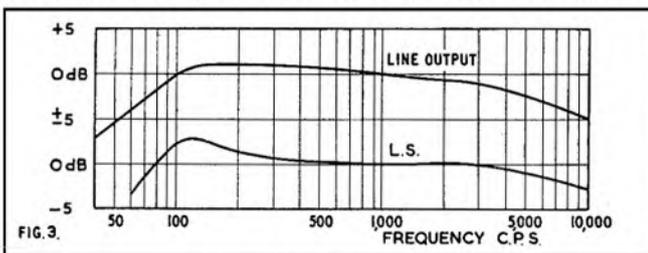
50 c/s trace, and wow is at the capstan rotation frequency of 5 c/s. Tape friction effects are low, and both long and short term speed stability compare favourably with many much more expensive machines.

**Playback Response**

A C.C.I.R. 200 microsecond test tape was played and the response measured at both the low level line output and at the Ext. L.S. sockets. These responses are shown in fig. 2 and indicate that pre-recorded tapes will give a level wide range response. Noise and hum was 40 dB down on test tape level.

**Record Replay Response**

Recording tests showed that a level 12 dB above test tape level could be recorded with negligible waveform distortion, indicating that bias was at optimum for the tape supplied with the recorder. Peak recording level was obtained with the record level meter needle just entering the red sector of the scale. Thus the total



signal noise ratio, obtained by adding 12 dB to 40 dB, gives the truly remarkable figure of 52 dB, and this on a four-track machine! This explains the dead quiet background mentioned in my introduction.

**Record-Play Response**

The responses of fig. 3 show that the overall record-play responses are very close to those from the test tape. The top and bottom tracks were identical in output and response and were also exactly on azimuth.

In contrast to other more expensive recorders tested recently, the output stage was completely insensitive to speaker loading,

(Continued on page 311)

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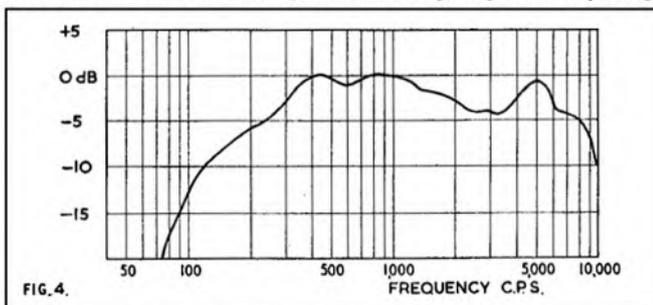
**EQUIPMENT REVIEWED — (continued)**

and a wide range extension speaker demonstrated clearly the wide dynamic range and frequency response of this remarkable little machine.

**Acoustic Responses**

The standard white noise test was applied to this recorder, and the combined response of the recorder, cabinet, and loudspeaker is shown in fig. 4, and that of the microphone in fig. 5.

Such acoustic responses need careful interpretation and they must be backed by critical subjective listening tests. The measured axial response of the loudspeaker gives the impression that it might sound slightly lacking in "presence" due to the fall around 3 Kc/s, but on the contrary, the sound quality was very crisp



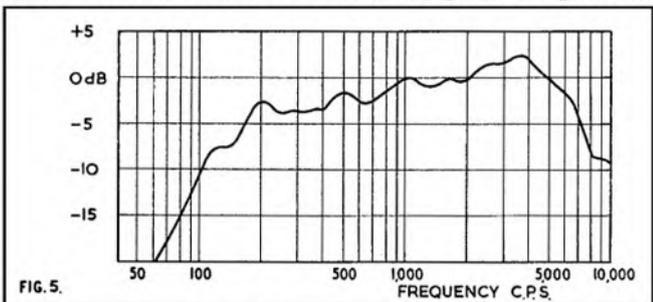
and clean. This, I think, is due to the wide polar response at high frequencies which is a function of the small size of the loudspeaker cone, and which makes it unnecessary to listen on the axis of the speaker for maximum top response.

The microphone supplied with this recorder is omni-directional and picks up equally well from all directions. The response is smooth and free of peaks. A further useful point is that the impedance is low, for use with transistor input circuits, and it may therefore be extended by adding extra screened lead with little chance of hum or curtailed frequency response.

The mechanical noise of the recorder is low so that full advantage may be taken of the sensitive microphone with little possibility of recorded motor noise.

**Comment**

An excellent little machine with a performance which is out of all proportion to its size and price. I had meant to start a points system with this review, but most of my points are plus ones



for this recorder: simple tape control, low wow and flutter, level response, exceedingly good signal noise ratio, well balanced acoustic response, able to feed a wide range external speaker, instant readiness for record or play, and low mechanical noise. If I dig deep down I can find one or two minus points: power output is only 0.7 watt and maximum undistorted acoustic is only 95 phons, so that if you want to dance to it or fill a large hall you will have to feed the line output into a power amplifier, but on all other counts I rate it as highly recommended.

**A. Tutchings.**

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(Continued on page 314)

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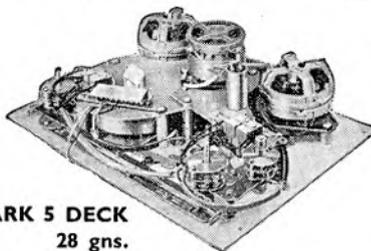
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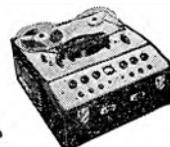
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412

CASH  
45 GNS.

or  
£4.15.0 deposit  
and 12 monthly  
payments of  
£3.10.10



THE tape recorder that can be used indoors on mains and outdoors on batteries without adaptors. Tape speeds  $3\frac{3}{8}$  i.p.s. takes  $4\frac{1}{2}$  in. spools with playing time up to  $1\frac{1}{2}$  hours. Only 45 gns. OPTACORD 412 embodies latest and many expensive features such as push-button control, fast wind and rewind, tape position indicator instantaneous stop, tone control, etc. We shall be pleased to demonstrate—or send fuller details.

- ★ INTEREST FREE terms
- ★ FREE INSURANCE COVERING YOUR PAYMENTS IN THE EVENT OF SICKNESS OR UNEMPLOYMENT
- ★ FREE DELIVERY
- ★ PART EXCHANGES

### 12 Months to Pay

	Deposit	12 Monthly Payments	Cash
	£ s. d.	£ s. d.	Gns.
<b>MAINS TWIN-TRACK</b>			
Argyll Minor ...	2 6 3	1 14 8	22
Grundig TK14 ...	3 13 6	2 15 2	35
Elizabethan TT3 ...	4 2 0	3 1 5	39
Reps. R.10 ...	6 3 11	4 13 0	59
Telefunken 95 ...	6 3 11	4 13 0	59

### 4-TRACK

Scuzzi ...	2 16 6	2 0 10	26
Philips "Scar Maker" ...	2 16 9	2 2 7	27
Argyll 4-T ...	3 4 0	2 6 4	29½
Elizabethan FT1 ...	3 11 5	2 13 7	34
Philips EL3541 ...	3 15 8	2 16 9	36
Stella ST454 ...	3 17 9	2 18 4	37
Sound ...	4 15 0	3 10 10	45
Elizabethan FT3 ...	4 15 0	3 10 10	45
Grundig TK23 ...	4 15 0	3 10 10	45

### BATTERY

Clarion Mk. 1 ...	2 0 0	1 9 11	19
Philips EL3585 ...	2 10 5	1 17 10	24
Stella ST470 ...	2 15 0	1 19 2	25
Clarion Mk. 2 ...	2 16 9	2 2 7	27
Grundig TK.1 ...	3 1 0	2 5 8	29
Optacord Battery/			
Mains			
Stuzzi Magnette ...	4 15 0	3 10 10	45
Butoba MTS ...	6 4 0	4 12 11	59
Butoba MTS ...	7 0 0	5 3 10	66
Ficord 202 ...	7 0 0	5 3 10	66

Open all day Saturday—  
Friday 6.30 p.m.

**THE RECORDER CO.**

If unable to call, write for free brochure or send deposit now for quick delivery.

(Dept. R) 188, WEST END LANE, WEST HAMPSTEAD, LONDON, N.W.6.

Telephone: SW1 4977



## **BASF** Magnetophonband **BASF** tape library boxes in smaller sizes

These exciting swivel-open storage boxes, now available for the smaller spools, are supplied complete with three BASF Double Play Tapes—for the price of the tapes only!

Made in tough rigid plastic, they provide the perfect quick reference library and protect your tapes from dust and damage. In three sizes, pre-packed with  
 Three 3" BASF Double Play Tapes for 42/-  
 Three 4" BASF Double Play Tapes for 75/-  
 Three 4½" BASF Double Play Tapes for 90/-

# NEW

*for portable users!*



## **BASF** triple play tape

Yes, *triple play*—an hour and a half of recording time on a 3" spool to give your twin-track portable a big-machine capacity. BASF Triple Play Tape has treble the playing time of Standard Tape, yet retains all the outstanding BASF qualities—

full frequency response, negligible print-through, dimensional and magnetic stability. Available from your dealer on 3", 4" and 4½" spools, holding 450, 900 and 1200 feet of tape respectively.

with **BASF** you get more for your money



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