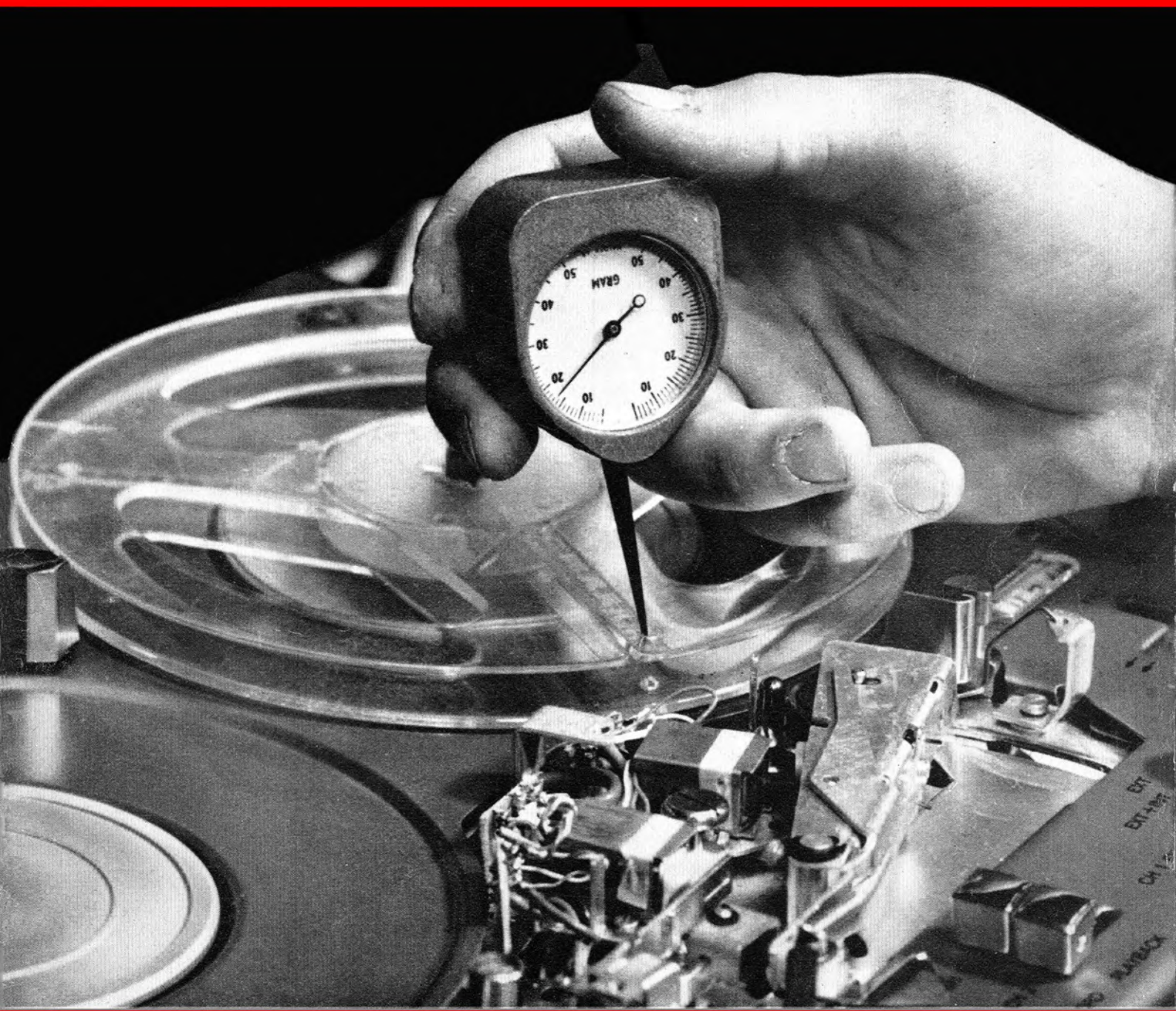
JANUARY 1966 TWO SHILLINGS

tape recorder



LENTHENING CRYSTAL MICROPHONE LEADS — THE SOUND OF SON ET LUMIERE
CHRISTMAS RECORDING HINTS — AMPEX 2073 REVIEW — STARTING A TAPE CIRCLE

Read this carefully, then see if you can guess the actual price of this sparkling new Truvox recorder.

What's the new recorder that everyone's talking about? *The Truvox 'Series 40'*. Why? Because this brilliant new model has at last brought really professional TR standards within the reach of every serious amateur.

Beautifully compact and portable, the Truvox 'Series 40' still gives big-recorder performance, its trouble-free all-transistor circuitry, modular construction, accommodating a large speaker gives a full 3 watts undistorted output. And that's powerful.

It takes 7" reels *without overhang*, so tapes can be left in place during transport; offers three tape speeds of $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i.p.s. and gives the choice of 2 or 4 track recording.

All the components are exactly the same as those used in even our most expensive professional models and, although some of the more complicated features required solely for studio work are eliminated, nothing has been spared to bring truly professional standards to this superb recorder. Even the 'magic eye' found in most popular recorders has been replaced with a professional V.U. recording level meter!

And yet with all this extra performance, extra quality and extra versatility, the Truvox 'Series 40' is simplicity itself to operate.

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NOW—TAKE A GUESS AT THE PRICE. 70 guineas? 59 guineas? 65 guineas? Well, by the sight and sound of it, the Truvox 'Series 40' should certainly be somewhere in this price range. But remember that this amazing new recorder is a real break-through in TR design and development . . . . . the first professional recorder with an amateur price tag!

Give up? Turn to the small ads on Page 554 and read the one headed 'Series 40'. And then head smartly for your nearest Truvox dealer!

The new Truvox

SERIES 40

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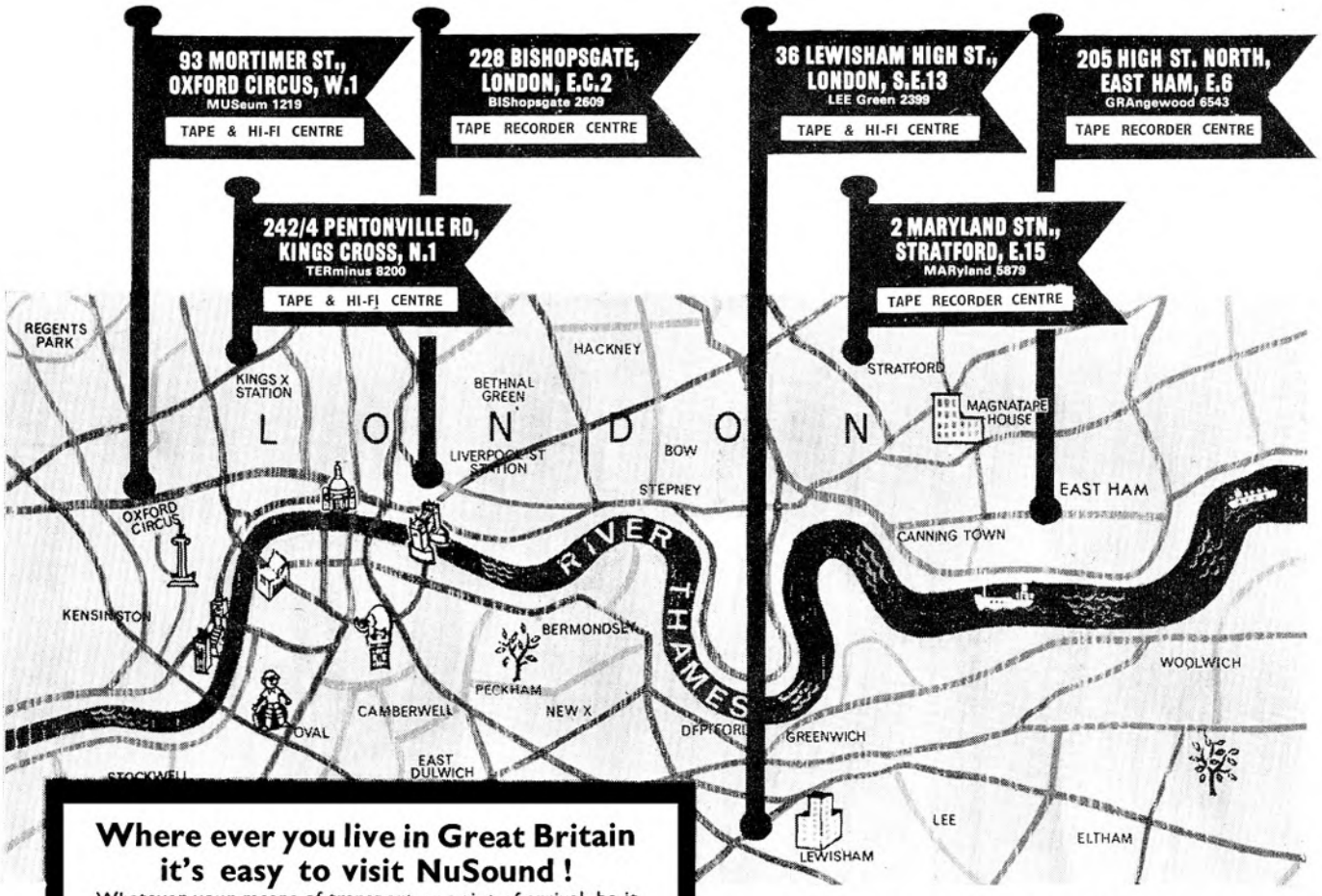
TRUVOX



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THIS MONTH'S NuSound FEATURE

Brenell

Brenell

MARK 5
SERIES 3

BRENELL MARK 5 Series 3 4 speed (1⅞, 3¾, 7½ and 15 i.p.s.) mono tape recorder, 3 Papst motors, low wow and flutter content, 8¼in. dia. reels, fast rewind (1,200ft. in 60 secs.)

Price: 74 gns.

MARK 5
TYPE M—SERIES 3

BRENELL MARK 5 Type M Series 3 Mono tape recorder as Series 3 but with separate record and playback heads and amplifiers, also separate bass and treble controls. Recording level meter.

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STB 2

BRENELL STB2 Mono/stereo, half track (record/playback), quarter track (playback), four heads, two edgewise meters. Designed primarily for use with high fidelity stereo installations.

Price: £150

(All models available for use with spool sizes up to 10¼" N.A.B. at extra cost)

In co-operation with BRENELL ENGINEERING CO. LTD., we are featuring in all our showrooms during the next four weeks the complete BRENELL range. See and hear these wonderful recorders demonstrated under ideal listening conditions. Our expert staff with their extensive knowledge and experience will be pleased to assist you in selecting the BRENELL recorder which best suits your individual requirements.

Come and inspect the special NuSound display of the complete Brenell range

To every NUSOUND customer purchasing a BRENELL tape recorder BRENELL ENGINEERING CO. LTD., are by special arrangements with NUSOUND extending an open invitation to enjoy a conducted tour of the BRENELL factory followed by a lecture and demonstration given by that well known personality of the tape recorder world Mr. Raine.

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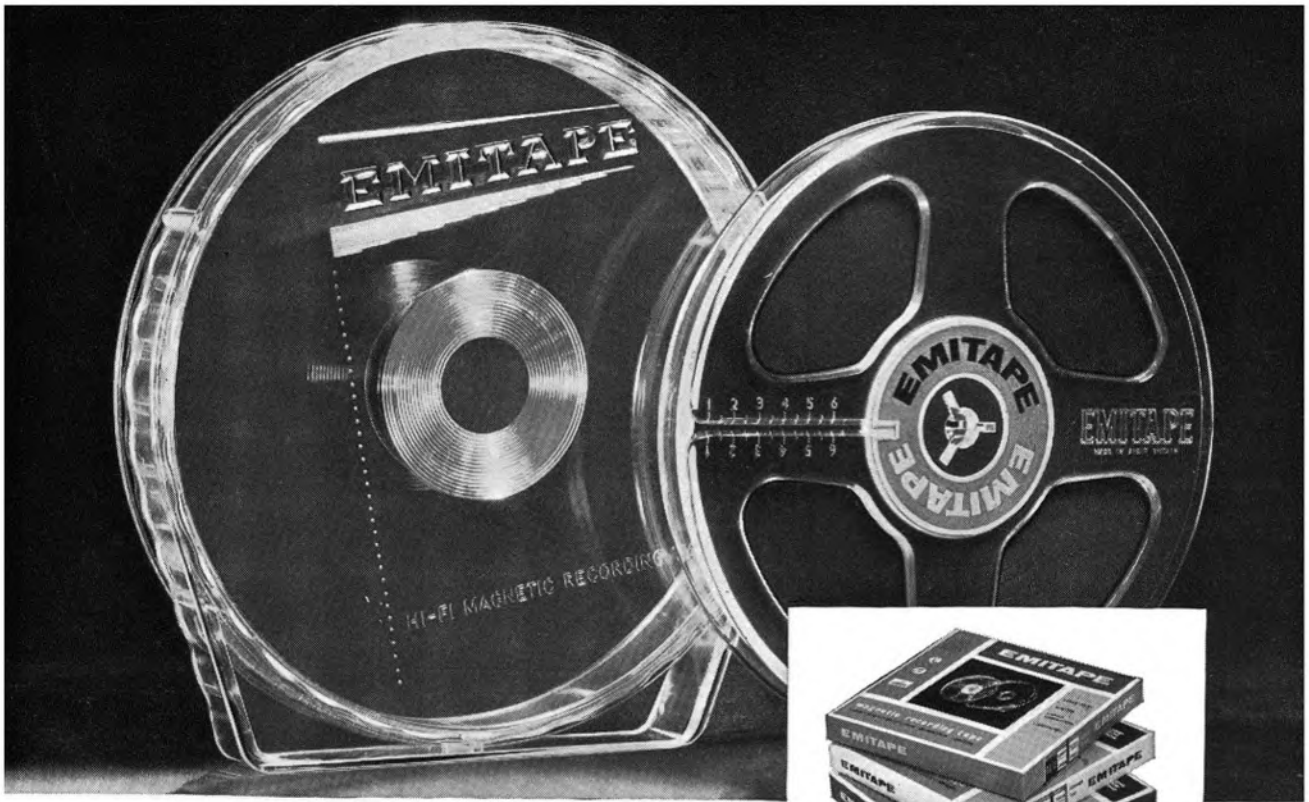
EMITAPE
SETS A NEW SOUND STANDARD



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New magnetic oxide coating techniques, combined with new high strength polyester base films, provide:

★ WIDER FREQUENCY RANGE ★ IMPROVED UNIFORMITY
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All four grades of EMITAPE – Standard, Long, Double, and the new Triple Play are packed in special dustproof library cases at *No Extra Cost.* These library cases have the added advantage of being self-standing for compact storage and transparent for easy reference.

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tape recorder

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editorial

TO THE CONSUMERS' ASSOCIATION, publishers of the magazine *Which?*, we extend our warmest congratulation. Their November 1965 publication contains the most comprehensive, honest, accurate and down-to-earth survey of domestic tape recorders that we have ever seen. Past experience in preparing such surveys has not been forgotten and the Association cannot be accused of repeating earlier mistakes. On this occasion, twenty-one mains-powered recorders with retail prices between £25 and £45 were subjected to a comprehensive series of electrical and practical tests. The results were printed, complete with a resumé of the recording process, in a manner that could have been understood by *anyone* ; as we are all too well aware, this in itself is no mean accomplishment.

Considerable thought must have been given to the original selection of machines tested in the *Which?* report, for they do seem to reflect comparative design popularity—in so far as this can be estimated when few manufacturers will release their sales figures. It may seem a little thoughtless that nearly half the recorders tested employ *BSR* tape decks, but glancing an eye over almost any High Street electrical retailer's window shows that this is by no means an excessive fraction. Six of the twenty-one tested machines were produced on the European mainland, while four of the British models incorporate mechanisms designed specifically for the manufacturer ; three of these were from the same group of companies.

It was gratifying to find that our own views were reflected in the *Which?* findings. This rather suggests that production tolerances between recorders of the same design are narrower than manufacturers' published comments on some of our past reviews would have us think. A particularly interesting factor revealed by the photographs in the report was that external appearance *is* a good guide to quality of performance : with some notable exceptions (and remembering that we are merely expressing a biased journalistic opinion) the law of the audio jungle seems to be—the uglier the better !

None of the equipment tested fell down really badly, and it was mildly reassuring that the model named as best in many respects was, in fact, the most expensive of the twenty-one. Also, the machine awarded the honour of being good value for money was at the bottom end of the price scale.

The report concerned itself with technical performance—frequency response, wow-and-flutter and background noise—and also with operating convenience. It was not clear whether wow and flutter had been assessed by ear, or measured electrically, but not one of the tested recorders received really high praise for temporary or long-term speed consistency.

All recorders but one were found to have efficient brakes, though the exception was praised for its comparatively fast wind. We feel the allowance of three-and-a-half minutes to rewind a 5½in. reel of LP tape was a little excessive to qualify for the term 'adequate', but admit that slow rewind is an almost universal feature of single-motor deck designs. Similarly, one would not expect a recorder to stop dead from a one-minute rewind (for the same tape length and thickness). Perhaps the Consumers' Association will angle a similar accusation at us when we say that it is all too easy for the professional critic to criticise.

Which? included instruction booklets in its survey and found that these were insubstantial on most of the Continental models. We agree that multi-lingual instructions *can* be a nightmare to read, but would be only too pleased to see more British manufacturers taking some trouble over such small points as language when exporting tape recorders (or anything else).

Only one manufacturer was found to supply what appeared to be consistently faulty equipment ; two identical recorders bought under different trade-marks were found to have inaccurately aligned heads.

Having the advantage that we can occasionally handle equipment for a period after it has been reviewed, our personal feelings as to *A* versus *B* are sometimes modified with the passage of time. Perhaps the *Which?* report does lack the detailed performance measurements we try to provide, but its advice is no less sound at a 'field trial' sort of level. Our private, and their published, views are nearly identical. A twelve-month subscription to *Which?* costs thirty shillings ; the November issue alone is almost worth that.

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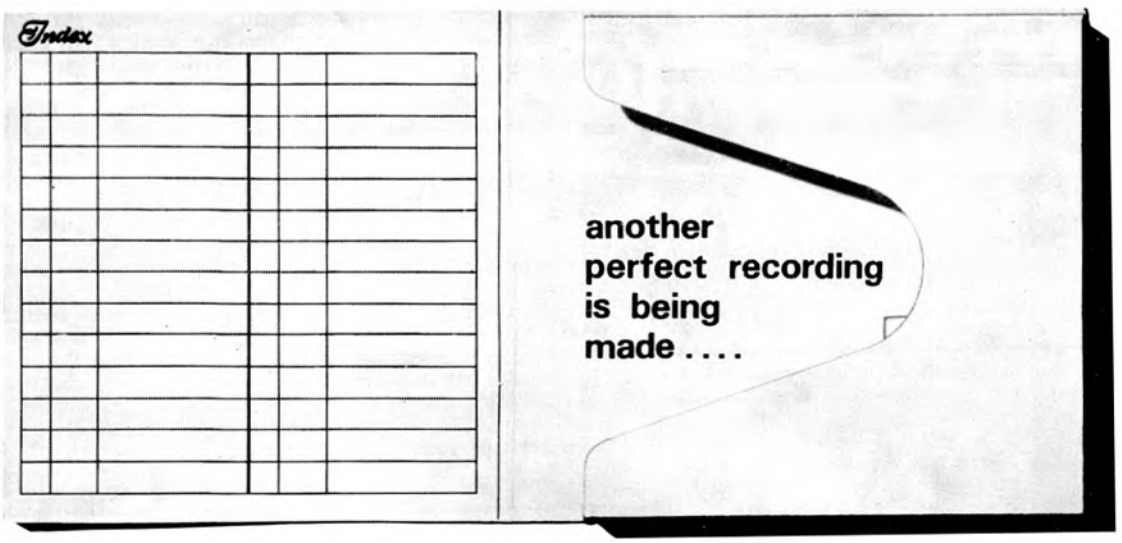
COVER PICTURE

"It's not what you do, but the way that you do it," quoted Alec Tutchings after describing the superficially ordinary electronic and mechanical design of the *Tandberg 3B*, during its review in 1962. The meticulous testing and alignment that impressed him in those days have by no means fallen foul of currently increasing demands in mass production. Our cover shows the take-up torque of a *Series 7* undergoing measurement.

SUBSCRIPTION RATES

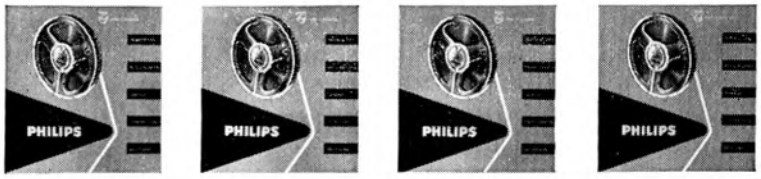
Annual subscription to *Tape Recorder* and its associated journal *Hi-Fi News* are 30s. and 32s. 6d. respectively in the U.K. Overseas rates are 32s. 6d. (U.S.A. $4.50) for each magazine, from Link House Publications Ltd., Dingwall Avenue, Croydon, Surrey.

Tape Recorder is published on the 14th of the preceding month unless that date falls on a Sunday, when it appears on the Saturday.



on Philips tape, naturally. Soon the tape will be filled with melodies, happy memories. Pleasure for years to come – perfectly stored on the perfect tape. It has high resistance to stretching, snapping, tearing. It has powerful magnetic coat adhesion for durability. It has polished magnetic coating for minimum head wear, maximum tape-head contact. It has high remanence, high sensitivity, low noise level. It gives lasting high quality performance. Even the box it comes in is built to last. Designed like a book for easy storage, it has a title space on the spine, and is colour coded to indicate type. It pays to get the best. Ask for Philips tape by name, whatever your recorder.

Choose green for standard play, red for long play, blue for double play, grey for triple play.



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world of tape

IT WILL LAST FOR A YEAR

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The Audio Diary is no weighty tome and fits neatly in an inside pocket. Nevertheless, over 50 pages of reference data are included, plus a standard diary section, for a selling price of 7s. 6d. including postage. Postal orders or cheques should be addressed to: **Link House Publications Ltd., Link House, Dingwall Avenue, Croydon, Surrey.** This being its first year of publication, the Diary is not obtainable from newsagents or bookstalls, though larger print order and more extensive distribution may follow next year.

TANDBERG MINI-LAB

TANDBERG MINI-LAB

ELSTONE Electronics, who have for some time supplied equipment for language tuition and general educational purposes, are now handling the *Tandberg Mini-Lab*, a version of the *Model 72B*. The Mini-Lab has several features intended specifically for the educational market including a safety lock to prevent erasure of a pre-recorded master track, a substantial accessory compartment within a wooden cabinet, and GPO jack input and output connections. The latter connections have become more or less standard in the educational field, even if not in general audio circles. Mini-Labs are being sold direct to educational bodies for £120, but are not available to private individuals or through retail channels.

DANSETTE TAKE OVER PERDIO

HARD on the heels of their entry into the tape recording field, with the introduction of a three-speed tape recorder, *Perdio Electronics Ltd.* found themselves in a state of liquidation. It has been announced, however, that the company is being taken over by *Dansette Products Ltd.*, subject to the approval of the Official Receiver.

NEXT MONTH

The February issue of *Tape Recorder* will be published on Friday, 14th January and will include a field test of the *Hammond M.100* condenser microphone, prepared by M. F. Woodward, and reviews of the *Philips EL 3552* and *Ampex 863* recorders. G. T. Rogers will describe some general principles of microphones, while L. J. Bishop details construction of a low-price stereo tape replay preamplifier.

BBC COVER THE CONTEST

EXCERPTS from prize winning tapes in the International Recording Contest, with a linking commentary by Douglas Brown, were broadcast at 9.30 p.m., 3rd November, on the BBC Home Service. Listeners, enthusiasts amongst them, must have been surprised by the incredibly high standard of the tapes, many of which were indistinguishable, in terms of quality, from professional recordings. Language proved no barrier to enjoyment of tapes produced overseas, which included material from Switzerland, South Africa, Germany and Holland, An intriguing recording by John Bradley proved a very effective demonstration of how subject shyness may be conquered. The programme conveyed, with interviews of several successful enthusiasts, both the meaning and the means of creativity.

NEW RANGE OF TAPE RECORDS

PRODUCED on *Lyrec* duplicating equipment, the *Tempotape* tape records now being handled by *A. C. Farnell* are claimed to be of exceptionally high standard and very low price. Recorded on one track only at 3¾ i/s, the tapes are 600ft. in length and retail at 21s. A full list of titles is available from: **A. C. Farnell Ltd., Hereford House, North Court, Vicar Lane, Leeds, 2.**

MUSIC BEFORE DINNER

A SINGLE *Grundig* tape recorder has, until recently, brought pleasure to an audience of some 4,000 at a Christmas Dinner Factory in Farnborough. The audience, in this case, consisted of a large number of turkeys who, on still nights before the approaching slaughter, were frequently frightened by the atmosphere of desolation and sometimes ran wild. Music and speech, recorded by Mr. Chapman, owner of the Easedale Turkey Farm, were relayed from the recorder through a number of remote loudspeakers. In this way, he was able to obtain a higher selling price for the birds, which showed no sign of the bruising or scratching that they previously inflicted on each other when frightened. Mr. Chapman is experimenting further with his equipment and next year's Christmas Dinner may have enjoyed other forms of programme material from an endless tape cassette.

LENGTHENING CRYSTAL MICROPHONE LEADS

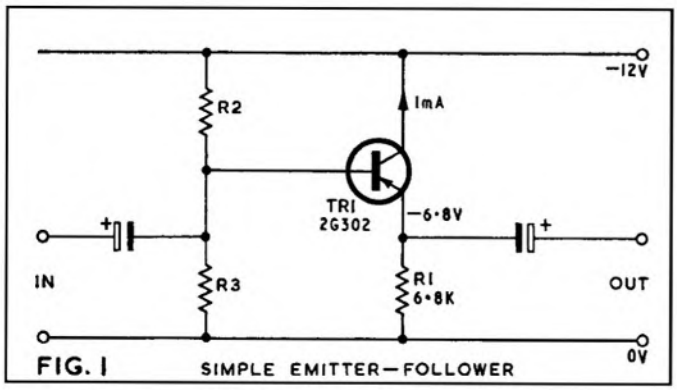

FIG. 1 SIMPLE EMITTER—FOLLOWER

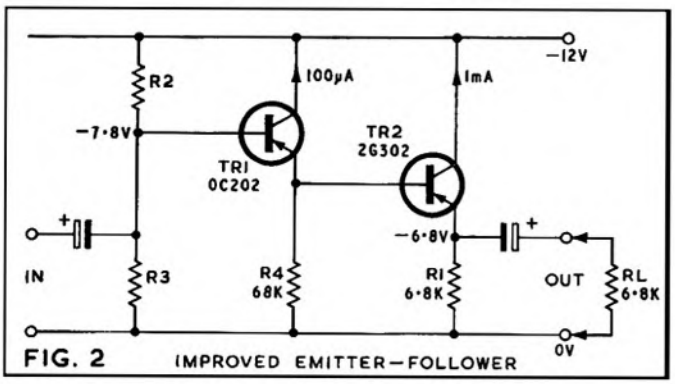

FIG. 2 IMPROVED EMITTER—FOLLOWER

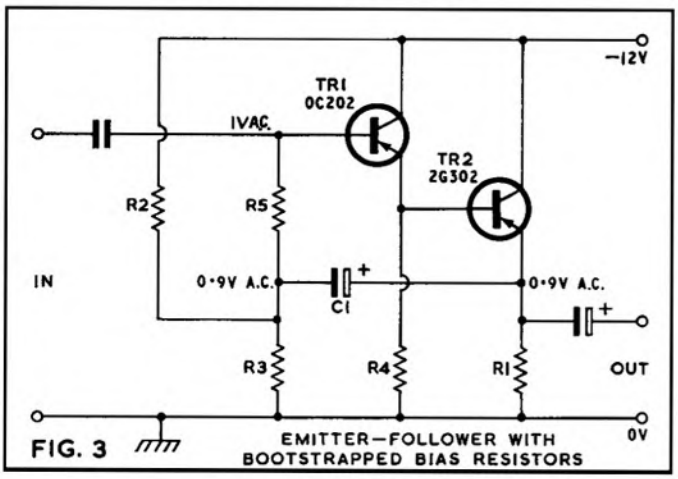

FIG. 3 EMITTER—FOLLOWER WITH BOOTSTRAPPED BIAS RESISTORS

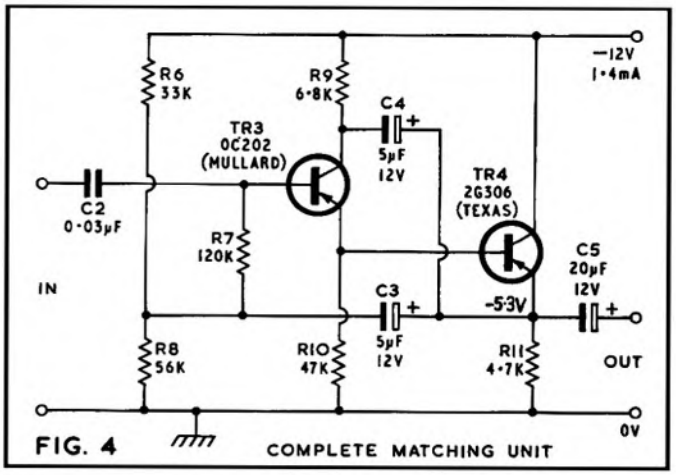

FIG. 4 COMPLETE MATCHING UNIT

IN ordinary domestic tape recording the microphone normally employed is a crystal type, for reasons of economy and sensitivity. One disadvantage of a crystal microphone is its high impedance. This excludes the use of long leads or a transistorised mixing unit after the microphone. In order to match the crystal microphone to a lower impedance we can use either a matching transformer or a transistorised matching unit. This article describes the development of three different matching units. The start of our development is the simple emitter-follower circuit of **fig. 1.** In order to obtain a reasonable gain from the transistor, we must operate with a collector current of about 1mA. Suppose we make the emitter −6.8V and I_c equal 1mA. Then R1 will need to be 6.8K. If we neglect the shunting effect of R2 and R3, the input impedance of our circuit is given by :

$Z_{in} = \beta_1 \times R1$ where β_1 is the transistor current gain.

If we take the minimum β of the 2G302 as 45 times, then we obtain:

$$Z_{in} = \beta_1 \times R1 = 6.8K \times 45 = 306K.$$

In practice R1 is reduced in value because it is shunted by a load resistor, and R2 and R3 also reduce the input impedance. Clearly we cannot obtain a very high input impedance (which needs to be of the order of 1M) with this simple circuit. How can we improve it? By reducing the collector current of Tr1, we can increase R1, which helps. Unfortunately the transistor current gain now *reduces* with the decrease in collector current, so we are still not much better off. We can, however, use two transistors in cascade, as shown in **fig. 2.**

Suppose we take R_1 as 6.8K, then as far as the emitter of Tr2 is concerned its effective load is $\frac{6.8K}{2}$ or 3.4K. When this is reflected back to the base of Tr2 it becomes R x β_2 or 3.4 x 45K or 153K. We are using a silicon transistor for Tr1 so that we can keep its collector current low. Let us make R4=68K, so that Tr1 passes 100μA. The effective load at Tr1's emitter is 68K in parallel with 153K, or 47K.

THREE CIRCUITS FOR TRANSISTORISED HIGH TO LOW IMPEDANCE MATCHING UNITS

BY A. FOORD

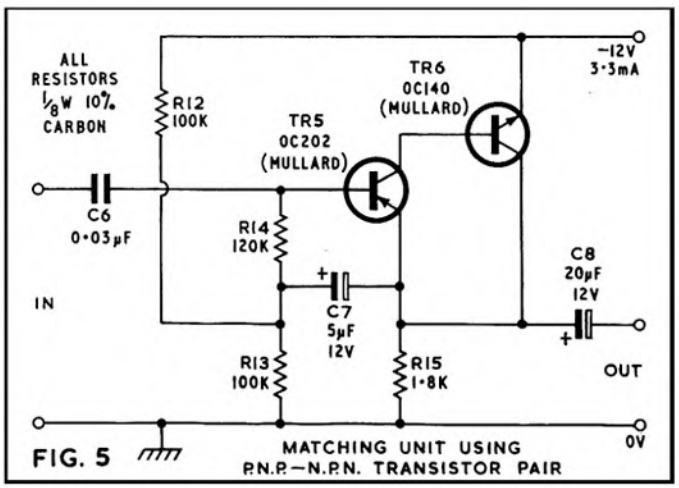

FIG. 5 MATCHING UNIT USING P.N.P—N.P.N. TRANSISTOR PAIR

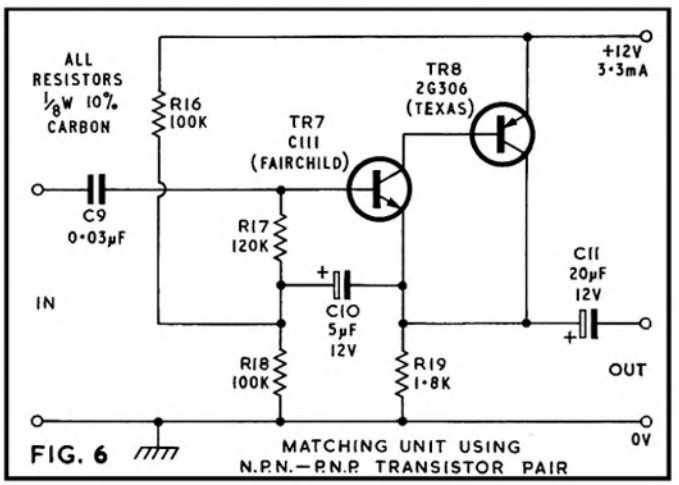

FIG. 6 MATCHING UNIT USING N.P.N.—P.N.P. TRANSISTOR PAIR

a complete circuit : the input impedance will fall off at the high end of the audio band due to the internal capacitance of the transistors. The boot-strapping of Tr1's collector will help to offset this capacitance, and extend the midband impedance to 20 Kc/s or so.

For the resulting complete circuit of **fig. 4**, performance details are :

Input impedance greater than 1M from 20 c/s to 10 Kc/s.

Input impedance greater than 750K at 20 Kc/s.

Maximum output voltage = 250mV with 10K load.

In leading up to the circuit of **fig. 4**, we have used two *p-n-p* transistors in a boot-strapped circuit, where the boot-strap connection provides signal feedback to the input. By using a *p-n-p* and an *n-p-n* transistor, the simpler arrangement of **fig. 5** is possible. The signal is fed into Tr5 which acts as a common-emitter amplifier. From Tr5 the signal feeds into the *n-p-n* transistor Tr6 which also acts as a common-emitter amplifier. From the collector of Tr6 the signal passes to the output and also to R15. The signal from the input across R15, due to the emitter-follower action of Tr5, is in antiphase to the amplifier signal received via Tr6. From input to output the transistors act as an amplifier with 100% negative feedback which gives an overall gain of one and a high input impedance. Again, the bias resistors are boot-strapped via C7.

Then, neglecting R2 and R3, our input impedance Z_{in} is 47 x β_1K. Now because our collector current is only 100μA, β_1 will be about 30 times. Then : $Z_{in} = 30 \times 47K = 1.4M$.

This is a *minimum* value, based on minimum gain transistors. In practice Z_{in} may well be higher than this. We have achieved an input impedance of the order we require, and must consider the values of R2 and R3. Tr1 passes 100μA so that with a β of 30 the base current of Tr1 is 3.3μA. Allowing for the base-emitter voltage drops of Tr1 and Tr2, the junction of R2 and R3 will be approximately –7.8V.

Then R2 needs to be $\frac{12-7.8}{0.03}$ K or 140K.

We need go no further to see that these values of R2 and R3 will have a disastrous effect on our computed input impedance. What we would like to do is to decrease the shunt effect of R2 and R3 to AC signals, while retaining their DC bias values. This can be done by the technique known as 'boot-strapping'. This is illustrated in **fig. 3**, where C1 and R5 are the components added to **fig. 2.** Its effect can easily be seen. Suppose we apply a 1V signal to the base of Tr1. If we take for the moment R5 as zero, then 1V appears across R2 and R3 as in the previous case of **fig. 2.** If we now take R5 as 100K, then a different set of conditions exists. For 1V applied to the base of Tr1 we will have an in-phase signal of 0.9V at Tr2's emitter due to the emitter-follower action of Tr1 and Tr2. There will also be a corresponding voltage at the junction of R2/R3/R5 due to C1. This means that for an input voltage of 1V the effective signal voltage across R5 is 1–0.9=0.1V.

From the signal point of view, R5 has become ten times its original value and now represents 1M to signal voltages. It is this value which appears in parallel with our calculated value of input impedance. The figures used in these examples, achieved with an arrangement like **fig. 3,** can be over 1M. There is only one small point before I can give

The disadvantage with this circuit is that above a few Kc/s, the loop gain drops, and input impedance falls rapidly. The transistors specified in **fig. 5** were used because they are readily available, but constructors wishing to improve on the HF performance of **fig. 5** should consider using more expensive RF transistors. Transistor Tr5 should be silicon because of the low collector current involved. We are not restricted to using the *p-n-p* transistor first, and by using a positive rail we can employ an *n-p-n*/*p-n-p* arrangement. We can then use an *n-p-n* transistor such as the *Fairchild C111* first, and follow it with a high-gain *p-n-p* transistor. This is done in **fig. 6.** Here a high input impedance is achieved up to 20 Kc/s. The arrangements of **fig. 5** and **fig. 6** are simpler and more compact than that of **fig. 4,** but do cost more. Performance details of **fig. 5** are :

Input impedance at 1 Kc/s is 3M, and at 20 Kc/s is 150K.

Performance details of **fig. 6** are :

Input impedance at 1 Kc/s is 3M, and at 20 Kc/s is 1M.

Fig. 6 gives a higher input impedance than **fig. 4** or **fig. 5,** but the extra cost is only justified on a high quality crystal microphone. The leads between the microphone and the matching unit should be kept short, say a few feet, but the lead between the matching unit and the mixer or tape recorder can be long, as the matching units all have low output impedances. Loads of the order of 10K are suitable for the units, which are designed to feed into a normal common-emitter amplifier stage.

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tape reviews

CLASSICS **GEORGE GOODALL**
JAZZ & FOLK **TONY FARSKY**
SPOKEN WORD **MAURICE PODBREY**

WAGNER OVERTURES Philharmonia Orchestra conducted by Otto Klemperer.
Columbia TA-33CX 1697. 3¾ i/s twin-track mono. 40s.

THE name of Wagner is well known even amongst people not interested in music, and not without reason, for his music made enormous impact on music in general at the time of its composition, and its influence has been felt ever since. Strange, then, that his almost entire output was operatic, for most of the great composers have proved their worth in many fields. Wagner's reputation rests on some eleven operas and one orchestral work (the *Siegfried Idyll*). Concert goers know him through his long and powerful orchestral overtures, written for the operas, or the preludes introducing the acts. The selection given to us on this tape includes the two best known overtures, *The Flying Dutchman*, and *Tannhauser*.

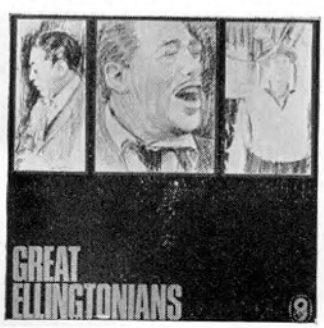
Needless to say, the performance of the whole selection given here by Klemperer and the Philharmonia Orchestra is very satisfying. The recorded tone is warm and there is a good dynamic range. There is some restriction in frequency range which has a deadening effect on triangles and other percussion instruments. The review copy also has some slight patches of drop-out at the beginning of the second track. Even so, this is an enjoyable tape. **G.G.**

GREAT ELLINGTONIANS Booty Wood, Harry Carney, Paul Gonsalves and others.
World Record Club TT 479/480. 3¾ i/s twin-track mono. 55s.

DURING the past forty years, musicians from the Ellington orchestra have recorded a large amount of very fine jazz with small groups. Three such groups are featured here, Booty Wood and his *All Stars*, Harry Carney and the *Duke's Men*, and a group led by Paul Gonsalves and Harold Ashby.

Not all the players are drawn from the Ellington band; notably Sir Charles Thompson, that most mainstream of pianists, contributes much to the excellence of the performances. Ellington material is restricted to *Jeeps Blues*, *Just Squeeze Me*, *Hand Me Down Love* and *Five o'clock Drag*, and these are the least satisfying of the sixteen items —the fact is that despite the presence of mainly Ellingtonians in the front line, the sound comes out as good straight mainstream.

The seven numbers by the Booty Wood 'All Stars' set a very high standard ; the ensemble playing is bright and bouncy and very well knit together. Booty, who joined Ellington fairly recently, shows himself to be an outstanding trombone player in the Ellington tradition, especially with the plunger mute. Many fine solos are provided by Shorty Baker (trumpet), Johnny Hodges (alto), Paul Gonsalves (tenor) and Sir Charles Thompson (piano). For *Ohso*, *Snowstorm* and *Our Delight*, two traditional trombones are added to make up a trombone trio required for the special arrangements written by Booty. It is not possible to single out any one of the 'All Star' numbers: *Hang on There*, *New Cambridge Blues*, *Easin' on Down Piccadilly* and *Sunday* are all fine mainstream performances.



It is difficult in a short review to do justice to this tape, which has so many good things on it and runs for over eighty minutes; it is worthwhile for the 'All Stars' alone.

The Paul. Gonsalves/Harold Ashby group gives us some nice contrasts in tenor styles on *Midnight Sun* and *Out of Nowhere*, but it is with Kenny Graham's *Swallowin' the Blues* that this group shows up best.

The remaining numbers by the Harry Carney group also feature material by British jazzmen: Stan Tracey's *Baby Blue*, and *Rock Me Gently* which was written specially for Harry Carney by Kenny Graham.

Highly recommended, an excellent addition to a number of Ellington tapes previously issued by World Record Club. **T.F.**

AT THE EMBERS Tyree Glenn (trombone and vibraphone) with Hank Jones (piano) and others.
World Record Club TT 430. 3¾ i/s twin-track mono. 29s. 6d.

SOME years ago *Tyree's Tune*, one of the items on this tape, was used as theme music to introduce the BBC Saturday jazz record half-hour. It must have become quite familiar to large numbers of people, but despite this plug, Tyree Glenn was at the time largely unknown. Today he may be a little better known as a result of his recent appearances with the Armstrong All Stars.

Tyree's Tune is the outstanding number on this recording ; it has much that is typical of good jazz. It is relaxed, bright, very bouncy, has a touch of humour, and of course excellent musicianship— the boys sound as though they are having quite a ball. Well to the fore but not dominating the proceedings, is Glenn's fine trombone playing; his technique with the plunger mute being a hallmark of his period with Ellington. On the swinging original *Sinbad the Sailor*, he plays some pleasing vibraphone.

On seven of eleven numbers he is joined by another Ellingtonian, Harold Baker who also lacks due recognition. Baker plays some lyrical trumpet—listen to his fine phrasing in *What Will I Tell My Heart* and *Too Marvellous for Words*.

The programme of swingers and ballads also includes *Lonely Moments*, *After the Rain*, *I Thought about You* and *How High the Moon*. Apart from the rather gimmicky treatment of *Without a Song*, it is all very enjoyable—the kind of recording which should give pleasure to jazz fans, and also to many who are not.

An impressive rhythm section made up of Jo Jones (drums), Hank Jones (piano), Tommy Potter (bass) and Mary Osborne (guitar), makes a very big contribution to the enjoyment of this tape. Your enjoyment is further enhanced by the excellent balance of the recording, which comes across very crisply when played back through good equipment. **T.F.**

MAHLER Symphony No 7 in B Minor Vienna State Opera Orchestra conducted by Hermann Scherchen.
World Record Club TCM 63/64, 3¾ i/s twin-track mono.

ONE often confers respect on what is not completely understood. This, I confess, is rather my attitude to Mahler's music. Here are no closely knit classical forms with their closely related tonalities. Forms are only vaguely outlined, and tonality, though diatonic, shifts from key-centre in often alarming directions.

On listening to a Mahler symphony one feels as if one were being shown over a large, rambling stately home in a guided party. It is all very wonderful but one is never quite sure of one's orientation. Occasional glimpses through outside windows reveal, not the vista one expected, but an aspect which makes a readjustment necessary. Chamber follows chamber in splendid profusion, and whilst there is much that commands attention, often our guide seems slow of foot and spends over long drawing our attention to what one had noticed already. After being delighted by what seems a splendid piece of carving, we wonder if perhaps after all it were merely a plastic moulding. At the end of the tour one feels that it was a long route, but worth it. Repeated visits over the same ground provoke the same reactions— one is never quite sure of one's own judgement.

This seventh symphony of Mahler's is a vast romantic structure full of unexpected changes of key, rhythm and texture. Mahler was. Bruckner's pupil for a time and obvious influences can be detected. In fact it is rewarding to compare this symphony directly with Bruckner's fourth.

I found the performance and recording given here both very satisfying, warm sonorities being presented to one's ears with impeccable continuity. **G.G.**

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A NOVEL USE FOR THE TAPE RECORDER

BY DAVID HAINES

IMAGINE you are a Victorian papa. Your many children, in their pretty curls and velvet suits, have few diversions. What can you purchase (cheaply) to keep them preoccupied? A toy theatre. The various scenes and characters are cut out (using Nanny's scissors) from specially printed paper sheets. These cost you a penny for the plain and twopence for the coloured.

Back in the twentieth century, it is difficult to realize that an industry once existed to meet the demands of Juvenile Drama—to give it the proper term. There were 48 publishers of theatrical sheets over the period 1811-1890. Many shops throughout the country ('theatrical stationers') existed entirely for selling toy theatres and accessories: tinsel, gelatine, colza oil, glazed calico. But the boom was over in 1890. Few people today are aware that Juvenile Drama ever existed.

Fortunately, one of these quaint little shops still survives—*Pollock's, 44 Monmouth Street, London, W.C.2.* ("If you love art, folly, and the bright eyes of children," wrote Robert Louis Stevenson in 1884, "speed to Pollock's.")

Here are the same gay sheets, the same attractive toy theatres, the same scripts, of the Victorian heyday. You still have a choice of buying them plain—or (to quote the catalogue) "hand-coloured in the traditional manner, using the traditional and secret paint recipes". But the price has been raised over the years—the cheapest theatre, complete with coloured characters and pantomime-script, costs 7s. 6d.

If, like me, you are the busy parent of young children, it is worth supporting this trade—and harnessing tape to the child's presentation. The child's delight is then doubly assured.

The Pollock issues are chiefly based on old-time melodrama, e.g., *Black-Eyed Susan* (1829), *Richard Turpin* (1840), *The Corsican Brothers* (1845). Script, scenery and costume are miniature duplications of real performances—which today seem absurd in their grandiloquence. But it is this very absurdity that make the plays so fascinating. Their sheer spectacle, if presented today, would rival *Cinerama* in impact; modern plays would be miserable in comparison—which is why modern plays are unsuitable for toy theatres. The child wants battlefields, shipwrecks and opulent vistas—as did our forefathers. And here, on the toy stage, the child has them—wings, back drops, set pieces, backcloths—all beautifully drawn by artists who have long since departed.

The child performs the plays simply by sliding the paper characters on stage—on wire 'slides'—and reading off the dialogue 'altering the voice a little for each character' (to quote the hints on production). He can also 'create theatrical atmosphere' by playing a musical-box.

But it will be obvious to readers of *Tape Recorder* that tape is ideal for supplying the necessary sound-effects. And there is no other form of stage drama where sound-effects are so spectacular. For example, *The Battle of Waterloo* (1842) has 'shells thrown from each side of the stage'. The air is filled with shouts, galloping hooves, musket-fire and artillery. After the final clash of Napoleon's *Cuirassiers* and the Life Guards, Wellington then enters to clear matters up. "Gentlemen", he

(*continued on page 546*)

SOUND AND CINE

from tape to stripe

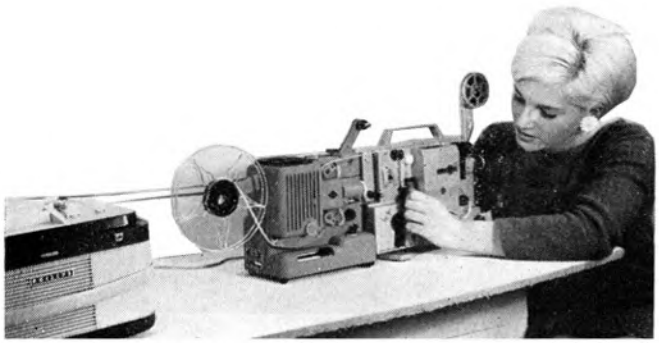
BY ANTHONY WIGENS

IF you began by making films with a synchronised tape sound track and then switched to recording on edge-stripe, you have a problem : how to transfer your existing tape tracks to stripe.

There are ingenious methods involving variable speed tape recorders —if you possess such an instrument. There are crafty modifications you can carry out on projectors, fitting film sprockets with toothed wheels for sprocketed tape. But there is no easy road.

Bearing in mind that more tape is synchronised with *Eumig 8mm* projectors than any other, and that Eumig have also the stripe sound projector which is likely to take the biggest slice of the magnetic stripe business, it seemed a problem that should concern them. So, while in Austria for the press conference on Eumig's *Super 8* equipment programme, I raised the subject of sound transfer with their technical advisors.

Yes, they said, they had considered the problem, but they were not keen to provide an approved method themselves. They would prefer the idea to be put forward by an outside agency. Like me. This suggested that all was not plain sailing and they did not want to carry the can. Last night, working on the problem with tape recorder, silent projector and sound projector yoked together in a harness of film and tape, I could see their point. Suddenly smoke rose from the projector in the middle—switched on, but restrained by the tape in its loop synchroniser—and I decided to give it up. But a random thought



as I headed towards bed sent me back to try again. Maybe the now damaged projector had only heated up enough to burn off the oil? I re-oiled it and it was working again.

So thanks to that midnight oil, here is the transfer method with the thorns pruned off. It does not necessarily work—it depends on the minimum speed setting of the stripe projector—but it can, and it is worth trying.

First problem is how to operate three controls simultaneously : start recorder, start stripe projector, depress record button. I solved this one with Sellotape—sticking a marble hard down against the record button to keep it depressed before the stripe projector is started. With the Eumig *Mark S* it will only stay down when the machine is running. The remaining two controls are a hand-stretch away and can be managed by one operator.

The method is to thread up the tape recorder around the synchroniser of the silent projector conventionally. But instead of lacing up the film with the synchronising mark in the gate of the silent projector, it is laced up in the sound stripe projector first, and then through the sprockets and gate of the silent projector. The two must be in a straight line and it is convenient to have them as close together as possible.

The photograph shows that the take-up arm of the sound projector is not used and can be folded down. Now the front of the silent projector can be leaned in against the object depressing the record button to ensure that it stays in. It is not really necessary to warm up the equipment first, as you will almost certainly want to have a trial run to check the rig. Before switching anything on, see that each piece of equipment is firmly lodged. Movement of recorder or silent projector will move the rocker arm of the synchroniser and this is what caused my overheating I fear. Movement between the two projectors can easily snap the leader.

You will need extra leader on the film to stretch the long distance, and the film of course must previously have been edge-striped. This should extend over at least 56 frames of the leader to take any of the track that accompanies the opening frames of film.

Recording link between my *Philips* stereo tape recorder and the Eumig Mark S was easily provided by the lead with the recorder, which I plugged into the diode socket and took across to the phono/radio connection on the projector. The Philips continental plug matched the Eumig socket.

Careful checking is necessary if you wish to avoid wasting time. Check sound transfer : recorder switched on to 3¾ i/s playback, held in check on pause. Volume up. Transfer lead in position and linked with sound projector. Power to sound projector, running speed at N (normal, 16-18 frames per second), record button depressed and sound switched on (red warning light on) with volume up.

Check that the silent projector is switched on, variable speed set to maximum. All sprocket guards must be snapped closed.

This is the point where you murmur a prayer and simultaneously punch the pause button on the recorder as you switch the sound projector on to forward projection. In fact, if you set the tape/silent projector mechanism going too soon there is a snatch on the film leader from the sound projector which will snap the film. If you are nervous, allow a little slack between the projectors.

The aim, indeed the whole essence of the operation, is to keep the tension at this link point unaltered throughout the entire transfer session. Your control here is the variable running control on the sound projector. With mine I just could not make it run slowly enough ;

production tolerance on this assembly detail, however, will almost certainly result in a goodly number of Mark S machines which will run at the minimum speed required. I'm going to have to make a modification it seems. If you see the film looping higher between the two projectors, slacken speed on the front one. But watch for the rebound effect which can result in a rapid increase in tension, and—SNAP !

When you can monitor the sound from the recorder and see the picture projected, it is immediately clear whether your efforts at transferring the sound in sync are proving successful or not. However, it is only on playback that you can check the quality of the recording as heard on the sound projector's speaker.

Remember to switch off the silent projector before unlacing the tape from the synchroniser, otherwise it will start up when the rocker is released. You can use the sound projector's re-wind system to bring the film back from the silent projector's take-up reel.

abc of tape recording

PART TEN

TAPE TRACKS AND EDITING

BY DAVID KIRK

NEWCOMERS to tape recording frequently have the problem of whether to purchase a two-track or four-track machine. On the face of it, there would seem to be little reason for using less than four tracks, since they give twice the playing time for a given length of tape. The newcomer has no qualms about signal-to-noise ratio and is quite prepared to tolerate a little background hiss and dropout if he thinks he will save on tape. Has he made the right decision? If the recorder in question is a relatively cheap monophonic model, in my opinion, he has.

The two-track tape recorder is so named for its ability to divide magnetic tape into two paths, each being a little under half the width of the tape, and record entirely separate signals on each. This might be likened to the two sides of a gramophone record—but there is an important distinction: the tracks are not located on opposite sides of the tape, but run parallel along the oxide-coated side. The ½-track head is therefore aligned to scan the top half of the ¼in. wide tape. To scan the bottom track, it is necessary either to move the head down or turn the tape upside-down. Since accurate head-moving mechanisms are difficult and costly to manufacture, it is normal to change from one track to another by placing the left-hand spool of the right-hand turntable and the right-hand spool on the left-hand turntable, rethreading the tape in its new position—upside-down but *not* inside-out.

A similar state of affairs applies with the four-track recorder, but here four paths are arranged side-by-side along the tape. Two tape heads are combined in one metal housing to track the topmost and third-from-top paths simultaneously. Changing from *Track A* to *Track C*, as we shall label them for convenience, thus involves merely pressing a switch and selecting one or other of the two head windings. Re-threading the tape upside-down gives access to *Tracks D* (top) and *B* (third from top), again selecting electrically.

Although each track, whether covering one half or one quarter of the tape width, is independent of adjacent tracks, it is theoretically possible for magnetic patterns recorded on a track close to that being scanned by the replay head to induce a small signal in that head. The resultant sound is known as *crosstalk* and usually takes the form of a barely audible background interference, becoming most obstrusive during quiet passages on the track nominally being scanned. Crosstalk can also be induced through interaction between the two windings of a stacked head. There are two types of stacked head employed in domestic audio recorders: the ¼-track head (used in both mono and stereo machines) and the ½-track stereo. **Fig. 1** shows these, diagrammatically, plus the ½-track mono—and the full-track mono head. The latter head is nowadays found only on professional recorders, and even the BBC find ½-track machines adequate for their purposes. This is not because they have relaxed their standards, of course; it has been made possible by recent improvements in design and manufacturing techniques. The illustration shows the various types of audio tape heads and their applications. The cutaway pieces of tape to the left and right of the drawing should be imagined to pass across the front of the heads in the direction, if we keep to international standards, of left to right. A ¼-track head is shown on the left and is depicted in use as a mono device—the shaded segment representing the part in use. It will be seen that the lower segment is idle when the top track is recorded, though on replay it will pick up any signals in its path (on *Track C*). These signals are converted into electrical impulses but, since the record replay amplifier is connected to the top segment, the signals are unable to travel further than the head winding. A similar situation applies when the lower segment is used for monophonic recording; this time the upper head is idle. Third from left is yet another ¼-track head, this time being employed for stereo recording. It will be seen that *both* segments are working (being powered by two separate tape amplifiers within the recorder). On replay, both segments feed separate pre-amplifiers and continue either to headphones or via two power amplifiers to loudspeakers which may be in or outside the recorder cabinet.

The difference between a mono tape recorder and a stereo model is simply that the first has one, while the latter has two, record/replay amplifier systems. It will be seen, therefore, that converting a ¼-track mono recorder to play pre-recorded stereo tapes merely entails connecting the idle head segment (top or bottom) to an external pre-amplifier, the output of this being fed to a power amplifier and speaker, or to the pickup input of a radio receiver. Many manufacturers of ¼-track machines supply matching preamplifiers as accessories (they cost about £6) while one or two (notably *Ferguson*) supply a complete preamplifier, power amplifier and loudspeaker unit. We shall return to this device later.

Continuing to the fourth-from-left head in **fig. 1,** we find the ½-track mono version. This scans the top half of the tape and has the advantage of covering a wider area of oxide than a single ¼-track segment. Whereas the ½-track mono is very slightly cheaper to manufacture than the ¼-track, the ½-track stereo head (fourth from right) is very expensive indeed. The reason is that the two head windings are so close together that interaction between upper and lower segments can occur very easily, unless elaborate precautions are taken in design and choice of materials. The alternative would be a very high crosstalk level. The space between segments on a ¼-track head is only a little greater, but it is sufficient to prevent crosstalk on all but the worst head designs. However, whatever the crosstalk figure, the ½-track stereo head is capable of giving finer quality than any other domestic system.

As the drawings on the fourth and third from right of **fig. 1** show, the head can be used for ½-track mono scanning or made to cover the entire tape width, less a small area of 'no man's oxide' between the two tracks. Half-track stereo recorders are almost equal, in terms of signal-to-noise ratio, to the full-track scanning system that was, it will be remembered, totally rejected by the non-professional as being 'too good'. For the sake of completeness, the full-track head is depicted on the far right.

Returning to the accessory preamplifier without which the ¼-track recorder would be no more versatile than the ½-track machine, we see in **fig. 2** how it may be employed to give a sophisticated method of superimposition. The block diagram shows a microphone plugged into a mixing circuit (which may either be incorporated inside the recorder or be a separate unit). The mixer feeds the recording amplifier which, in turn, supplies a signal to one segment (in this case the lower) of a ¼-track record/replay head. The microphone can thus be used to make a mono recording while the upper head segment simultaneously replays the top track, passing its signal to the accessory preamplifier and thence into the high level input of the mixer.

The operator is in this way able to monitor (through headphones connected either to the mixer or to a socket on the recorder) both the pre-recorded top track and the sound entering the microphone. The resultant signals are recorded together on to the lower track. *Inter-track transcription*, as the system is called, can be employed by a single talented musician to build up a one-man band or even, if he has the patience, a one-man orchestra. A piece of music played on one instrument might be recorded on the top track in the usual manner and then dubbed on to the lower track, using the **fig. 2** system, in synchronism with a live accompaniment. The process may then be repeated in the opposite direction (namely, from the lower to the upper track) while a third instrument is added. Going beyond a trio brings in two more factors, however: background noise tends to build up on the earlier dubbings, while distortion causes signal deterioration.

Fig. 3 shows an equally interesting, but rather less creative, employment of the accessory preamplifier. The system shown here may be used to play stereo tapes—one channel feeding through the recorder and the other going through the spare head segment to external amplifiers and speakers. The device does not *record*, of course, and the user is limited to commercial tapes (or to being a 'sleeping' member of a stereo tape correspondence society!)

For experimental purposes, both the **fig. 2** and **fig. 3** systems may be duplicated by marrying the head connections of two separate tape

recorders. In the former case, nevertheless, it would be pointless to dub from track to track when one could copy from one recorder to another. Which brings us, conveniently, to our second topic this month—tape editing.

The purpose of editing is to reposition or remove superfluous sound, pictures or words, depending on whether an audio tape, video recording or a handwritten article is being examined. Just as an article can be edited either by re-typing the required passages or by deleting unwanted material on the original copy, so magnetic sound recordings can either be dubbed in part on to a second tape or man-handled with scissors and adhesive. Copying from one recorder to another is unsatisfactory, if only because it involves slight loss of quality. It is also time-consuming, tedious and inaccurate. On domestic equipment at least, clicks and bangs occurring whenever equipment is switched on or off make splice-less copying impossible.

Tape editing is one of the most enjoyable facets of magnetic recording, since it enables the skilled amateur to achieve a slick 'polished' finish to his work. The required equipment is both cheap and simple, but should be selected carefully on purchase. Many devices have been manufactured to 'simplify' the task of cutting and joining recording tape though, in my own experience, few have proved as easy to use as the simple splicing block; the *EMI Editall* is one of the finest. Adhesive tape can be purchased in quarter- and half-inch widths, the former being best suited to editing blocks. It is possible to purchase non-magnetic scissors that, according to the makers, will not impart an audible click to the tape. In fact, however, these rather expensive accessories *can* interfere with the recorded signals, even though they do not themselves store magnetic fields. Ordinary scissors given 'the once over' with a head de-gausser will be quite harmless in practice. There is, of course, always the possibility that mankind will invent, in the far-distant future, a *sharp* pair of plastic scissors!

The four major tools in tape editing are an editing block, reel of ¼in. splicing tape, a pair of sharp non-magnetised scissors, and a sharp single-edged blade. It is essential that domestic adhesives such as *Sellotape*, paper tape and (yes, I've seen it done) *Elastoplast* should not be used for jointing recording tape, since their sticky compositions can ooze out on to the capstan, guides and adjacent tape windings. Commercial splicing tape employs a 'hard' adhesive composition that will not ooze in this manner.

There are three methods of parting and joining a tape. The first, if it can be called a 'method', is a simple ragged break which sometimes follows a mishap during, for example, fast wind. Possibly the broken tape had already been edited and the break occurred in the middle of a completed programme. In this case, the editor would wish to repair the joint, incurring the minimum possible interference with the tape. If the tape base is acetate he will probably experience no difficulty, since that material snaps very easily. Had the accident occurred with PVC or *Polyester* tape it might have been more serious, since these base substances are inclined to stretch prior to breaking.

The top drawing of **fig. 4** depicts such a break and it will be seen that any deformations in the tear will be exactly contrasted by a deformation in the opposing tape end. Re-joining the tape is thus a simple matter of butting the two jagged ends with the very slightest overlap (the replay head must not 'see' the adhesive tape when the splice runs through the recorder). The butt, if there is one, should be almost imperceptible to the eye; the resultant splice should be quite undetectable to the ear.

Reference to **fig. 5** illustrates the position of the jointing tape, while also showing faulty overlaps which should be removed carefully with scissors. This trimming action should be undertaken with great care, since chopping excessive quantities of tape from each side may cause a wow as the splice passes through the recorder. It is also possible to cut into the recorded track, unless care is taken, causing a 'drop-out'. Great accuracy is needed when editing tapes recorded on ¼-track (mono or stereo) equipment, since the tracks may 'jump' slightly across the tape as they meet at the splice, again causing a slight drop-out and, even worse, causing momentary breakthrough from adjacent tracks.

Returning to **fig. 4**, we see, in the centre diagram, a diagonal cut. This is the finest type of cut for general editing, since the two tapes almost fade into each other at the splice. Assuming the recording to have been made across the entire width of the tape, one might theoretically get away with ⅛in. of space between the two tapes before the splice became noticeable as a dropout. This is because, at distances up to that figure, the foremost point of the trailing tape would have reached the head before the leading tape had completely passed. With half and ¼-track working, however, greater accuracy is needed.

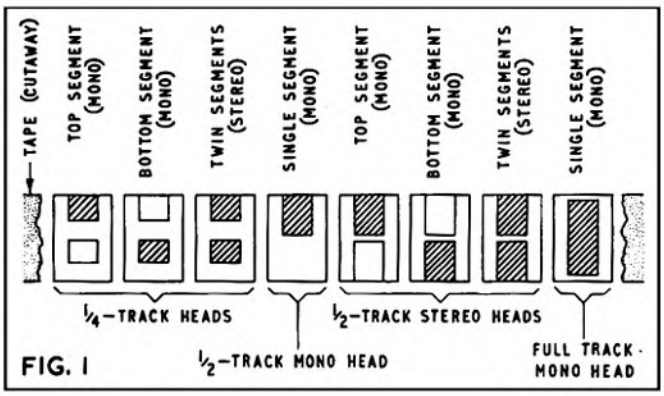


FIG. 1

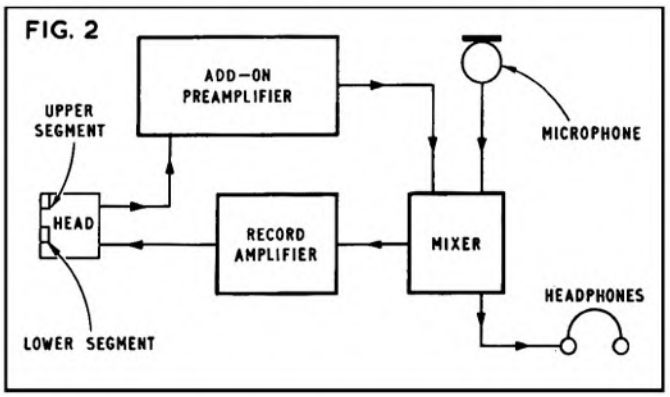


FIG. 2

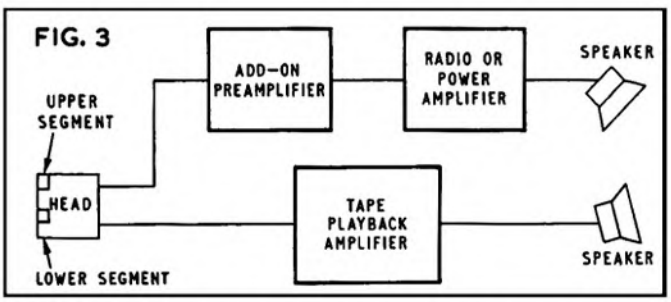


FIG. 3

The vertical cut (bottom of **fig. 4**) is employed only as a last resort when the tape is tightly crammed with data. Supposing, for example, we wished to edit a short clatter out of a fast dialogue (a chair toppling, perhaps). Removing the noise might actually involve cutting into the two words surrounding the clatter. If the recording was made at 15i/s there would be no problem, but with our 7½, 3¾, or even 1⅞ i/s equipment, we might be unable to spare the space taken up by a diagonal cut. This is one reason, of course, why the prophets amongst us have never looked to the day when the BBC will use ⅛ i/s tape equipment! The problem is solved by employing a 90° cut, which effectively takes up an infinitely small space. Such a splice requires a little more experience than the diagonal cut, but can be made completely silent with a little care.

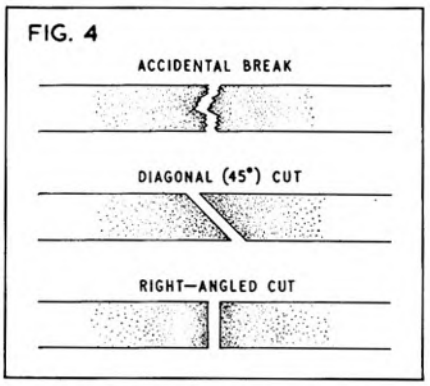
The diagonal and vertical cuts are made by pressing the tape into the editing block and locating the chinagraph or ball-point mark that shows where the cut is to be located, across the razor channel. This channel is merely a slot running across the splicing block, providing a guide for the razor. Most blocks incorporate separate slots for diagonal and right-angled cuts. The problem of tape anchoring is solved in the Editall by extending the upper surface of the tape channel out fractionally, overlapping the base. The tape is then locked into place by pressing it into the slightly concave base of the tape channel. Pulling the tape straight up, when removing it after the joint (**fig. 5**) has been made, often results in tearing or distortion of the tape edges. Removal from the Editall is therefore achieved by pulling the tape at an angle.

Most of the skill in editing is needed, not in the scissor and razor

(*continued overleaf*)

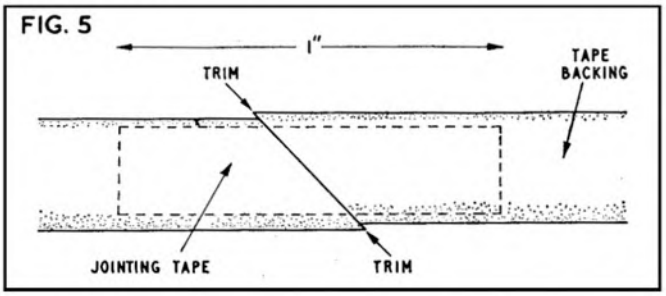
work, but in determining which section of the tape should be cut. Editing tapes produced at very low speeds, as has already been said, is both difficult and inaccurate. If a documentary, for example, is to include a number of interviews recorded at 3¾ i/s on a battery machine, the producer would do better to transcribe the interviews to his 7½ i/s mains machine—even allowing for the consequent slight loss in quality—than to restrict the entire recording to the low speed. Once dubbed to a reasonably high speed, the phrase "My name is Edward Henry" could be spliced into "My name is Hedward Enry" (where have I seen that before?). To put it simply: even individual 'letters' and syllables can be transposed using a 7½ i/s master.

Determining the exact position of a word or syllable entails use of a technique known as 'rocking'. Once the phrase in which the word is contained has been found, the recorder is switched to neutral and the tape rethreaded past—not through—the capstan and pinchwheel. On most recorders, re-routing behind the capstan is a simple matter, though on some models the head covers and plastic trimmings may need to be removed first. Battery recorders, being generally of very compact design, frequently do not lend themselves to this technique.



Having freed the tape from the capstan pull, the machine can be switched to play, with the gain control at a suitable level, and the tape drawn past the replay head by hand. The motion can be applied direct to the tape, or by rotating the spools. Initial fairly quick jerks will show where the section to be removed is located. The ear having grown accustomed to this short passage of noise, it will be able to identify it even when the rocking speed has reduced to such an extent that the words are no longer intelligible. Having located the exact position of, perhaps, the "H" in "Henry" (which will resemble not an 'aich' but a howling wind), a white chinagraph pencil can be used to mark the tape coating at the opening and closing section of the 'wind'. (Chinagraph pencils may be obtained from office-equipment stores or stationers.) These two marks provide accurate guides when the tape is placed on the editing block. Removing the tape between the two marks (which would be an estimated 1½in. apart) and joining the remaining ends, will thus turn "Henry" into "Enry". A little care in marking and splicing is needed to ensure that "HenEdward-nry "does not result on completion of the joints.

All things considered, the tape enthusiast has only scratched the surface of his hobby until he has taken a razor into his hands and commenced slicing sound. For only then does he begin to realise the versatility of the magnetic recording medium and the true meaning of the word 'creative'.



Left: Armour of Sir Thomas Scot spotlit against a decorated column.

the sound OF SON ET LUMIÈRE

AN AMBITIOUS AMATEUR PRODUCTION BY R. A. SHEEKEY

SINCE the spectacle of *Son et Lumière* was introduced into England in 1958, many productions have taken place in castles, cathedrals and stately homes. All of them owe a great deal to the tape recorder and it is probably true to say that without it, there would be no Son et Lumière.

The major outdoor productions have been the work of professional companies; but amateurs are seldom to be outdone and the writer knows of at least three productions where enthusiasm and ingenuity have won the day. One of the smallest but most successful was held last year in the 12th Century Church of Brabourne in Kent. Each night for three weeks the little country church was filled as its history was unfolded through the media of sound and light. Behind the scenes lay four months of intensive work, but surprisingly little frustration. It is one of the great advantages of the tape recorder that if things do not go right, you can always erase and start again.

The initial work started with a script visualising narration, dramatic sections, sound effects and the appropriate lighting plot. From the outset it was planned that the sound should appear to come from several different locations, and of course, the use of stereo was envisaged.

Once the script was written, the work of collecting sound effects started. Here the tape recorder really came into its own, and with some necessary research a library of sounds required in the production was built up. It involved such diverse sounds as music for a lute to a terrifying thunderstorm sufficient to demolish a Church tower. Not all the sounds were easy to achieve. In a year of drought the sound of a babbling brook was elusive. A hose pipe playing on a garden pond was a good substitute, but even sitting on a dewy lawn at 5.30 a.m. it was possible to produce only thirty seconds of tape that was free from traffic and train noise.

Meanwhile, rehearsals were going on with the drama side to perfect this part. Each section was recorded and played back so that the actors could learn by their mistakes. A cast of twenty was involved and a time for the final recording had to be fixed when all could be present for a considerable period, a difficult task during the holiday season.

Experiments had shown that the church itself provided a natural acoustic for recording, if echoing arches were avoided. It is not perhaps, realised how many hours of work go into recording an hour of run on tape. Originally it was intended to record the script strictly in order, but this was found to be time consuming and eventually it was left to a tape splicer to produce the final order.

The recording was made on a *Grundig TK46*, with a *TK41* being used to produce the pre-recorded sound effects through a Grundig mixer. With the aid of the mixer, three sources of sound could be recorded simultaneously on either of the two tracks of the TK*46*.

After a whole day's recording, all the speech and sound effects were safely on tape, and the cast of actors was dismissed. Now came the exacting task of editing and splicing. This again, was more than a full day's work. It involved splicing together all the separate items and the addition of suitable 'bridge' music. Narration had all been kept on one track, appropriate music being added to the other track, to fade in and out at the required moment. Such intricate work can be exhausting, especially when done against a tight time schedule; but there was a tremendous sense of achievement when the final tape was played back. All that was required now was a fair copy to be made of the tape, which was done with the aid of another TK46. In a production that was to be as professional as an amateur could make it, there could be no chance taken of a splice breaking during a performance.

The control centre for both sound and light was set up on a staging in the Church tower, so that it was out of sight yet commanded a view of the whole Church. The TK46 was connected to five speakers through a simple control box, so that either channel could be switched to any speaker. One speaker, positioned in the pulpit, was reserved entirely for narration, whilst two speakers at the east end of the Church were used for left and right-hand stereo. This was particularly effective in a witchcraft trial scene, where the voice of the judge came from one side and the witnesses from the other. Speakers were also placed in the porch and the tower.

The most intricate scene to operate was that in which villagers were portrayed seeking refuge in the church during a violent thunderstorm. Their terrified voices were heard in the porch, whilst the comforting voice of a priest was heard on the right-hand channel. It was desirable that the sound of the crashing of the tower should come from this direction and this was accomplished by using the TK41 feeding the tower speaker and being switched on at the crucial moment. With 'lightning' flashing all over the Church, the effect was so realistic that many jumped out of their seats when the tower finally 'crashed' behind them.

The carefully made recording, together with imaginative lighting effects, involving over 80 spots and floods, won high praise on all sides for its technical perfection, but tribute must be paid to Grundig for their generous help and co-operation. It was their initial encouragement that paved the way to a highly successful production of Son et Lumière, and which was instrumental in raising £760 for the restoration of the church.

battery powered tape recorders

LAST month we investigated the various types of batteries giving portable electricity to the new generation of transistor tape recorders. The power so delivered must be adequate to supply not only the solid-state electronic sections, but also to operate the drive motor at a constant speed under load. The drive motor side of the exercise presents one of the biggest problems of the portable tape recorder.

Speed control is automatic with AC mains operated machines, since the shaded pole or synchronous nature of their drive motors 'lock' to a large extent to the frequency of the mains power supply. That is to say, the top speed of the motor is controlled by the mains frequency. Of course, it is necessary to couple such capstan drive motors through a massive flywheel to iron-out any irregularity of load. The capstan flywheel, in effect, stores energy from the drive motor and holds sufficient in reserve so that more or less can be delivered to the mechanism as required. In that way the capstan speed is held substantially constant.

The attribute of a synchronous drive motor is dispelled so far as small DC motors are concerned, and whether they be shunt or series wound they fail to run at a sufficiently constant speed for serious tape recording. This problem is basically resolved by the employment of a centrifugal drive motor governor.

The elementary aspects of the governor switch are revealed in **fig. 1.** The complete assembly is mounted on the motor spindle and thus revolves with it. Within the assembly is a pair of contacts. One contact is fixed, but adjustable, while the other is terminated on a weight-loaded arm and is normally held in contact with the fixed one under the pressure of a piece of spring metal.

The contacts are wired in series with the drive motor, and across them is placed a resistor, as shown in **fig. 2.** Now, when the assembly revolves, the weight-loaded arm develops a centrifugal force which tries to open the contacts. This is opposed, however, by the reverse force of the metal spring, and the design is such that the contacts open only when the motor reaches a pre-determined speed.

The resistor across the contacts then reduces the motor current and its speed drops, causing the contacts to close again. This, of course, bypasses the resistor and applies full current to the motor. Its speed then rises until the centrifugal action brings in the current limiting resistor again. This action continues at a very rapid rate, the effect being that the motor is energised by pulsed unidirectional current from the battery.

The governor and resistor are adjusted so that when the contacts are open and the recorder is running on a new battery the motor speed is too low for correct operation of the tape deck. This condition may not be satisfied on a new battery should the value of the resistor be too low. A small degree of speed adjustment is possible by the contact adjusting screw, but as this is accurately set at the factory it should not normally be re-adjusted by the user.

The biggest problem of this arrangement is that of sparking at the contacts, encouraged by the unidirectional current and by the back-EMF from the inductive elements of the motor. Such sparking causes not only pitting of the contacts—akin to contact troubles in car ignition systems—but also interference which may be picked up by the amplifiers, causing a rough buzz on playback at high volume control settings, when the programme material is at a low level.

In an endeavour to combat the short life of sparking governor contacts, early battery-operated tape recorders employed very small drive motors to reduce the current handled by the contacts. This is a poor solution, since insufficient reserve of drive power leads to speed inconsistency troubles. The latest machines, however, embody battery-operated drive motors of remarkably high power for their size, and wow and flutter is no longer the problem that it used to be. Interference is minimised by suppression devices at the motor and contacts. Some machines use an independent battery for the drive motor, leaving a lower capacity battery for the solid-state electronics.

Fig. 3: Some of the many shapes of *Magloy* magnets

Centrifugal governor controlling speed of small DC motor either direct or through transistor circuit.

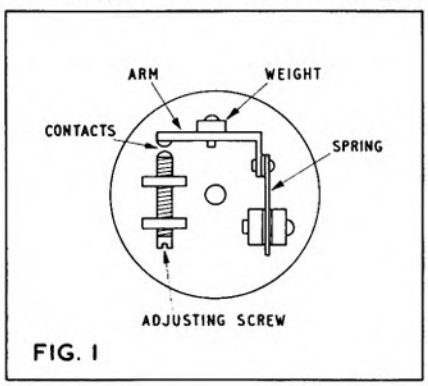


FIG. 1

A current limiting resistor is often connected across the governor contacts.

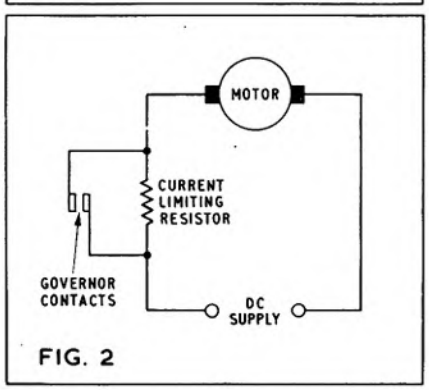
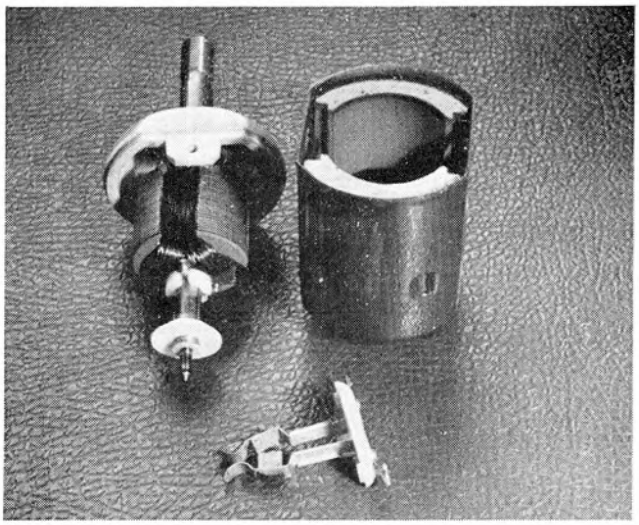


FIG. 2

Fig. 5: A small DC motor of high power to weight ratio



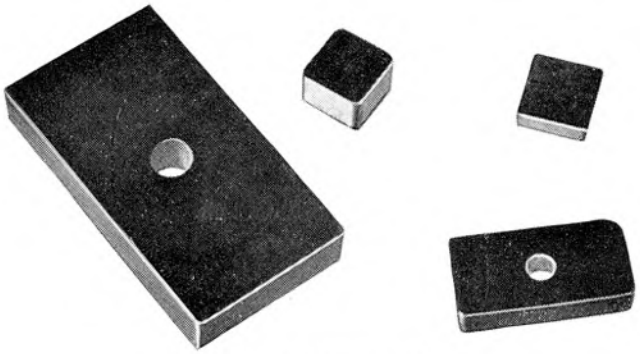


Fig. 4: *Magnadur* ceramic magnets produced by *Mullard*

battery powered tape recorders

PART TWO

DC DRIVE SYSTEMS

BY MICHAEL GORDON

This, at one time, was also an aid towards interference suppression.

The latest DC drive motors owe their increased efficiency to the new ceramic magnets, which go under such trade names as *Magnadur* (Mullard) and *Magloy* (Plessey). These magnets are produced in a similar way to ordinary ceramic materials and can thus be moulded into almost any shape. Typical shapes of Magloy and Magnadur magnets are shown in **figs. 3** and **4** respectively. Apart from in small DC motors, these sorts of magnets are finding application in many other branches of electronics.

They differ in several ways from the old type of metal alloy magnet that we know so well. For one thing they are non-conductive, and they are lighter than metal alloy magnets of similar dimensions. They cannot act as an electrical short-circuit or absorb energy as induced current. They can be magnetised in bulk along almost any axis, and they possess the great advantage of retaining their magnetism tenaciously. Ordinary metal alloy magnets can quickly diminish in field strength if not preserved by 'keepers'.

The basic ceramic magnet is a compound of barium, iron and oxygen, giving a hard and brittle material known as $BaFe_{12}O_{19}$, or barium ferrite. Iron oxide and barium carbonate are mixed in the correct proportions and then heated. The compound is powered by a ball-milling process and a binder is added to facilitate moulding to the required shape and size. Finally, the material is 'sintered' in a kiln, as in all ceramic (pottery) processes.

A small DC motor using this type of magnet is shown in **fig. 5.** This is very neat and small and has an incredible power-to-weight ratio.

Since the advent of the battery-powered tape recorder a number of ingenious devices have been evolved to minimise the sparking at the governor contacts, and thus to increase their life without reducing motor power. Sparking and its effects result from the current of the supply into the motor, the smaller the current the less the sparking and interference, and the greater the life of the contacts. A method introduced by Grundig a year or two ago employs a transistor to supply the motor current and the governor to control the transistor current. The circuit of the motor control arrangement is given in **fig. 6.** There are two transistors, the first operates as an oscillator and the second as the motor current control. This is how it works:

Tr1 is arranged in a simple feedback circuit with L1. This oscillatory signal is fed via L2, to the rectifier R1 and a positive bias is applied to the base of the control transistor Tr2. Now, a third winding, L3, is connected across the governor contacts. When the contacts are closed, the oscillatory circuit is short-circuited and no rectifier bias is present at Tr2 base. This transistor is, however, biased in the normal manner by R1, and current flows into the motor through the collector circuit. A smaller current flows to the motor through R2, but when Tr2 is conducting it is mostly the collector current that operates the motor.

This, then, would be the 'speed build-up' condition with the governor's contacts closed. When the motor reaches the correct predetermined speed the contacts open, starting the oscillator. A positive bias is then applied to Tr2 base, causing this transistor to cut-off (due to its standing bias being neutralised). The motor current is consequently reduced by its passage through R2, and the subsequent action is similar to that described earlier.

However, since the governor contacts are not called upon to pass the motor current, there is no sparking and the contacts have almost unlimited life—electrically, that is.

A somewhat less sophisticated arrangement is shown in **fig. 7.** This is from the Grundig *Electronic Notebook* battery recorder. Here, again, a transistor is biased to provide the motor current with the governor's contacts closed. Bias is provided by R1.

When the motor tends to run fast the contacts open and the bias to the base is removed. Current gradually dies in the motor as the base capacitors, C1 and C2, discharge. The motor thus reduces in speed until the contacts once again close and the motor is fully energised. Capacitor C2 and the equivalent capacitor in **fig. 6** suppress motor interference.

For those readers not fully conversant with the operation of transistors, the following will be of assistance. The collector current of a transistor is governed by the forward current in the emitter/base

(*continued overleaf*)

junction. The greater the emitter/base junction current, the greater the collector current (within limits). With zero emitter/base current, the collector current is very small indeed, it generally being microamperes of 'leakage current'. However, the collector current rises to many milliamperes (sufficient to energise a motor) when the emitter/base current is of the order of microamperes. Thus, it can be seen that the governor contacts in **fig. 7** circuit are passing only microamperes of current to give a motor control current in the order of many milliamperes. The emitter/base current is sometimes referred to as 'base current' or 'base bias'.

Other machines incorporate the transistor motor control principle. The Austrian *Stuzzi Magnette*, for instance, embodied the idea way back in 1958. This machine features an OC302 motor-control transistor which, like that in **fig. 7,** is biased off when the governor contacts open. However, this transistor is in series with the motor armature winding and is shunted by a 100-ohm resistor. The contacts operate at a supersonic frequency and hold the speed constant within about 2%—which was very good for battery models of the early days.

Portable machines are subject to speed variations with movement, and the motor control is basically unable to counter this trouble. Heavy single flywheels are not always the absolute answer. Heavy twin contra-rotating flywheels, however, have been found to give considerable freedom from the disturbance, and such an artifice is found in the *Telefunken M.300* of 1964.

Normally, of course, one may not be unduly concerned about using the machine under conditions of vigorous motion, in which case the latest techniques coupled with a reasonable single flywheel are all that may be needed.

Of late there have been trends to eliminating the brushes from small DC motors, and a German development in this respect will be described next month.

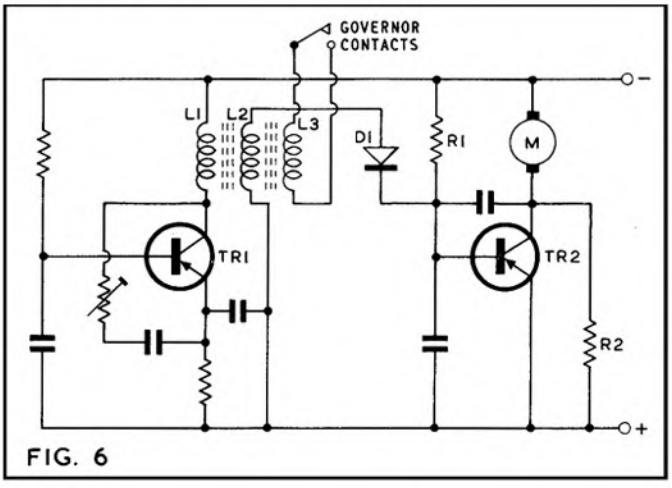


FIG. 6

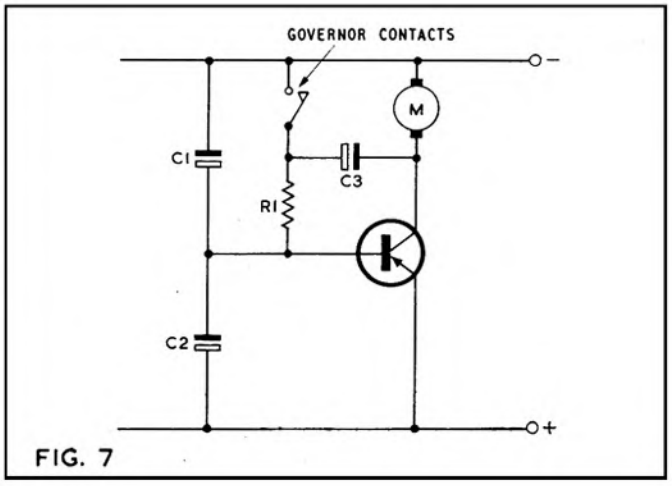


FIG. 7

YOU have corresponded occasionally by tape. Sometimes you have helped others make a complete recording of a Civic ceremony. You have tackled weddings, parties, fireside plays, mock interviews and documentary programmes. You may even have had a go at Hospital Sound and Tape Services for the Blind. Like thousands of others you have used your machine in a variety of ways, but without any real set purpose. Now you feel that you need something more than just this ; you want to merge your skill and your equipment with that of local recording enthusiasts, but you are not too sure just how to go about it. Your problem is not so unusual and it is not difficult to find a solution.

If all you envisage is a small circle, then a notice placed in the public library and in the window of a local dealer will bring your ambition to the notice of other recorder owners. The local press, unless you live in a town where murder and vice are rife, will be only too pleased to report on your scheme, and there is certainly no need to

starting a tape circle

RICHARD GOLDING GIVES SOME PRACTICAL HINTS

purchase advertising space. The ensuing letters and visitors will convince you that, even in the most out-of-the-way village, there is no lack of potential members for your organisation. Long before the problems of finding a meeting place are experienced, you will have made keen friends whose drive and enthusiasm will ultimately bring new life to the community.

Internal bureaucracy has been the downfall of many amateur recording organisations, and it is wise to appoint a small committee from the outset, comprising the most enthusiastic members of the circle. Most important is the secretary, around whom the club will revolve until it is well off the ground. It is he who will reply to potential members, he who will conceive schemes for future activities, he who will need to be prepared to steer the newborn club clear of a course to apathy. You will probably find yourself in this role to begin with. A nominal Treasurer and Publicity Officer might also be appointed, though they will have little to do in the early days, the former keeping check only of the odd fourpenny stamp and packet of envelopes. Keep a record of your expenditure as secretary if you wish, but do not foist it on the club until things are well under way. If the Publicity Officer is keen, you will have no problem in increasing membership. If he is not, take over his job until a more suitable member is found to replace him.

Sooner or later you will need a Chairman, and if the owner of the local audio retailing establishment can be persuaded to fill this vacancy, you may have pulled off a master stroke.

Next, you prepare to hold an open meeting but, before publicly declaring any such intentions, you should try to get an idea of the size of your potential membership. Certain retailers may be able and willing to give an indication of the number of tape recorder sales they have made in the past couple of years. They may even be able to supply addresses of the owners. (As the formation of a club in their area can do them nothing but good they may act up accordingly.)

Having found out by various means of research that you stand a fair chance of success you can now look around for suitable premises. Do not forget that you need adequate power supplies, tables for equipment stands, enough chairs, and a cupboard that you can reserve for your own use. Book well ahead as you still have plenty to do. If you like the look of the place then you can make provisional bookings for the rest of the year, and a firm booking as soon as you are able.

You can now set to work to draw up, separately, membership application forms, membership cards, and the notices for the open meeting. The membership form can be a printed or duplicated brochure beginning with a persuasive passage on the joys of your hobby. Then should follow the aims of the organisation, the annual subscription, and enough space for the interested party to fill in details of his name and address, his machine, if any, his recording experience, age if under 21, and his occupation.

Try to work out the subscription so that you cover the rent at least. Extra finance can be provided by having a Saturday Show once a month where members will pay for admission and will be able to bring along friends. This will both help the Treasurer to keep his sanity and help the social side of the club along.

Publicity notices for the first meeting should be prepared several weeks in advance and should contain full details of date and place of the open meeting and the programme for the evening. This could well be as follows : (1) Demonstration of equipment and recording techniques ; (2) Discussion of the aims of the Club ; (3) Discussion of future programmes ; (4) Election of the Committee (Members only allowed to vote).

Don't let this fourth point frighten you. You will not be voted out of your job. Your difficulty may be in getting enough nominations to fill the empty posts anyway !

The publicity machine must now go to work. If possible, libraries and dealers persuaded to display notices should be supplied with a quantity of membership forms. All known tape recorder owners should be contacted personally or by post. A few days before the date of the meeting, a column reporting the proposed event should appear in the local Press. This must be arranged several weeks in advance and should be accompanied by a whole-plate photograph publicity still.

You will now have a few weeks grace in which to get fully organised so that everything goes with a swing. Already through the efforts of your Publicity Officer you may have gained extra members and these may be able to supply a wealth of material such as local effects, musique concrete, and dubbing loops, etc. You may even have a film with a really good soundtrack. Remember that your purpose is to entertain and to inspire at the same time.

For the actual night, the display equipment and the demonstration machines should be set up and ready to go at least thirty minutes before commencement, and the Treasurer should be seated by the door ready to enrol new members as they come in (if they are prepared to join at this point). Background music should be playing up to the point when the acting Chairman opens the meeting.

The Chairman will describe the immense pleasure to be had from using the medium to its full extent and he will set the demonstration into motion. After this, he can discuss the aims of the Club and talk something of the finance involved and then run through the proposed Club programme for the season.

He will make a point of announcing that a special meeting will be called in the near future to discuss and adopt a Constitution. He will then supervise the election of Officers and Committee. After this he can close the meeting with a vote of thanks to all who have worked so hard to make the meeting a success and to all those who have attended it.

On the close of these formalities perhaps coffee could be served, thus giving an extra opportunity for people to get together and to talk about and inspect the equipment once again.

There is an important point that I would like to stress. Do not be too deadly serious or too dedicated in your approach. Be friendly and put the new members at their ease. Do not forget that the organisation was formed to promote sound recording—not to promote petty officialdom.

Once the committee is born, it should go about its work discreetly. Club politics should *not* be the major subject of future meetings.

After the first meeting, the organisation becomes a going concern, lacking only stability. To give it both a symbol of your status in the community and a handy book of rules to work to at the same time, the club now needs a Constitution. Remember, it is very useful to have one to present to any Authority about to grant money.

Here is a ready-made Constitution that may be taken with or without alterations and amendments. It has five points :

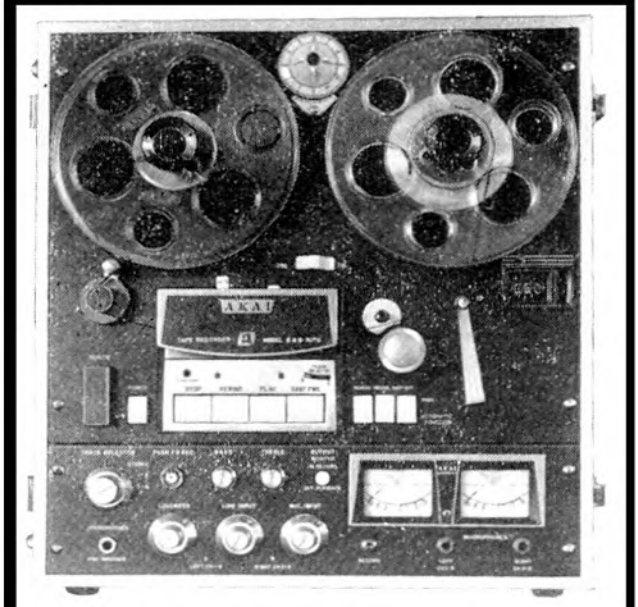
(1) NAME: The Club shall be known as the ..... Club, hereinafter referred to as the Club. (As many members will have cine cameras you may be tempted to call yourselves the such and such Tape and Cine Club. Be warned. Do not do it at this point. Later on you may care to extend your aims but wait for the demand rather than force it.)

(2) AIMS. The aim of the Club shall be to encourage the production of, and to promote knowledge and interest in, all forms of sound recording. To further this aim, the Club shall :

(a) Provide, as far as means allow, a suitable centre where members may meet regularly to engage together in the pursuit of sound recording.

(continued on page 546)

tape recorder service



BY H. W. HELLYER

NO. 49 AKAI 345 AUTOMATIC

PERHAPS it was the influence of the Motor Show : all those gleaming models, temporarily within reach. Or perhaps a reaction against working so much with bread-and-butter machines—often with the crumbs still in the bearings ! Again, it may have been sheer cussedness in the face of requests for information on decks already described in previous contributions.

Whatever the reason, when sorting out my notes on *Akai* machines with a view to devoting one, or maybe two, articles to the range, I fell to browsing over the intricacies of this *Silver Shadow* of the tape recorder world. From this it was a short step to inflicting my envy and admiration on you, patient reader.

It is not every day that one has a semi-professional automatic stereo tape recorder costing well over two hundred pounds cluttering up the workshop bench. Hence my appeal to the distributor, *Pullin Optical Ltd.*, for some background information to augment my paltry, and largely illegible notes. They came through handsomely, with a profusely illustrated manual, so those of you still with me need have no fear that you will be advocated to bend this and twist that in an effort to overcome discrepancies of design. The adjustments and tests are those laid down by the makers. Space considerations alone would prevent a full run-down on the machine, and readers are referred to the review which appeared in the September 1964 issue of this magazine.

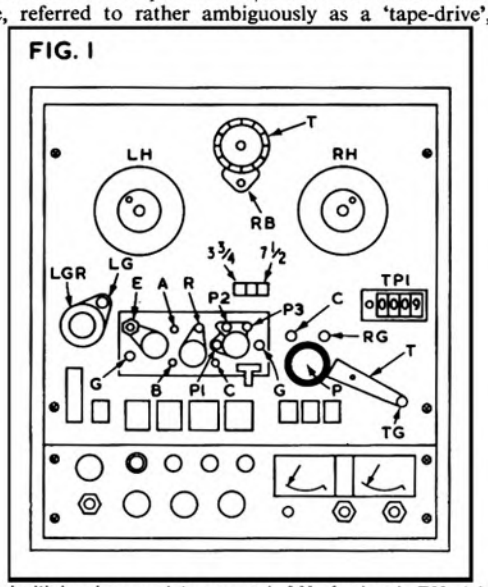
The 'Automatic' in the title does not refer to the now accepted definition, of controlled gain of recording level, but to the preselected reversing and replaying system, which is quite complicated and will be described later.

This is a two or four-track machine, according to choice, and is normally a two-speed construction. Changing the capstan and pinch-wheel enables use on either 15 and 7½ i/s or 7½ and 3¾ i/s. Moving the heads downwards slightly enables scanning of the middle of ½-track recordings by the ¼-track heads. Thus, ½ or ¼-track stereo or mono can be replayed. Stereo loudspeakers are fitted at each side of the cabinet. Movable metal reflectors enable the sound to be reflected forward when the machine stands, in the usual Akai manner, in a vertical position. Power output is 6W per channel to 6.5in. round speakers of 8-ohm impedance.

From a first sight of the specifications, and from a quick read through Mr. Tutchings's review, it would seem that there is only one motor. This is because of the method of presentation, which has lost something in translation, as too often happens with imported goods. (Do the distributors not have staff capable of vetting data sheets ; or are these completely prepared before the franchise is accepted ?)

Whatever the reason, it should be stated at the outset that this is a three-motor machine. The capstan motor, which belt-drives the flywheel, is a two-speed type, hysteresis synchronous, capacitor start, working at 1500 or 750 r.p.m. at 50 c/s. The belt mentioned above is a flat type, referred to rather ambiguously as a 'tape-drive', which presumably refers to its texture and shape rather than its direct function. The two winding motors are also of the induction type, but are not synchronous, so that winding speed depends on loading. Speed of revolution is 1450 r.p.m. at 50 c/s, giving a rewind time for a 7in. reel of 45 secs. These are also of the capacitor-start type, and in each case a 4μF capacitor is used.

FIG. 1



Front panel with head cover plate removed. **LH**—feed reel. **RH**—take-up reel (both with plain spindle and key locator). **T**—timer dial. **RB**—reset button. **LGR**—left guide flywheel. **LG**—left guide. **RG**—right guide. **C**—capstan spindle. **P**—pinch roller. **T**—tension arm. **TG**—tension arm guide. **TPI**—digital tape position indicator.

Another small discrepancy that should be noted is the reference to the weight of the machine. Our review states 65lb. My specification gives the weight as 33kg., which is some 7½lb. heavier. My kitchen scales are not capable of resolving the difference, but, with Mr. Tutchings who dripped sweat into his typewriter after lugging it 20ft., I can assure readers that the designation 'portable' which appears at the specification heading is somewhat optimistic !

Which makes it all the more important that correct sequence of operations is followed when dismantling the machine. It should be stressed that this is a task not to be undertaken from mere curiosity : Messrs. Pullin Optical are most co-operative, and anyone who can afford this machine should be able to run to the cost of carriage and insurance rather than embarking on an operation that entails the use of at least four different screwdrivers.

Fig. 1 shows the layout of the top deck of the machine (i.e., the vertical face when in operating position). Note the four screws at each side. These must be removed first. Then, take out the four screws (smaller Phillips-headed screwdriver) at the corners of the rear ventilation plate and uncover the mechanism. At the bottom there will be seen a row of relays, plugged into their appropriate sockets. Remove the two nearest the centre of the machine to make it easier to lift away

the quite heavy deckplate and mechanism without doing any damage. The various sections of the machine are interconnected by plug and socket jumpers and these are all marked with their numbers—which is just as well, for some confusion could otherwise easily occur. The relevant plugs we need to disconnect to get the deck and amplifiers free are : 1, 7, 9, 10, 11, 12, 14 and 16.

Note that plug 1 connects to socket 1 and plug 16 to socket 16, despite a mistake in the service manual that would appear to indicate otherwise. Anyway, they cannot be transposed, No. 1 being the 9-pin power amplifier connector and No. 16 the 12-pin, keyed, main power connector. There is one socket in the deckplate, near the left-hand motor, number 16. Other connections are plugs to amplifier and power units as follows : 9, 10, 11, 12, 13 and 14 from deck to pre-amp, 5 and 6 from pre-amp to main amp, 7 from pre-amp to power supply unit, 3 from power unit to output block, 4 from power unit to voltage selector, 8 from power unit to connector board, and 16 from connector board to deck No. 1 is from deck to main amplifier and 2 is the speaker connector plug from the output block.

After the deck has been disconnected and lifted out, supported at the top corners, the chassis can be removed from their neat disposal around the inside of the cabinet. Considering the amount of hardware packed into the 17⅜ x 16 x 12½in. cabinet, this construction is a work of art. Although the power unit and pre-amp employ valves, the main amplifier is transistorised, and this helps reduce the heating and ventilation bogey. If you have enough strength to lift the machine and look, you will also find that access is available to the works beneath the pre-amp deck with it in place, with a little fiddling. This can be a great help.

The pre-amp is held by four screws at the bottom of the deck plate section, as shown in **fig. 1.** Tucked neatly behind it is the main amplifier, held by four similar screws at the rear. Other units are held to the substantial wood blocks around the cabinet in the same way.

Principal mechanical adjustments are : pinch roller pressure, muting switch, tension switch, reel height and brake tension. Electrical : winding motor torque adjustment. Electronic : oscillator frequency, bias and erase output, azimuth adjustment and record level indication. These will be taken in order.

Fig. 2 gives the rudiments of the pinch-roller assembly. A solenoid pulls the roller arm inward at the left (rear view of deck mechanism). The arm is pivoted at X and the outer end thus carries the roller shaft into engagement with the capstan on the flywheel spindle. There are three important points here : first, the setting of the locknut A which compresses the spring B and gives a fine adjustment of the eventual pressure. The nut is screwed on to increase pressure. Correct loading should be between 1400 and 1500 gms. Second, the tension of the curved spring C, which can give rise to curious noises if a good contact between the arm and the solenoid and arm mounting plate is not made and maintained with the arm at its extremes of movement. Third, the mounting of the roller itself, which is held to the shaft by a cross-head screw concealed beneath the cap ; which in turn is held to the arm by a nut and a washer at each side of the arm, which has a recessed hole for the rear end of the shaft. It is imperative that both the top screw be tight, and the nut firm, both washers in place, and the shaft spotlessly clean for free rotation, to obtain that quoted "less than 0.06% wow and flutter at 7½ i/s." Remember that this figure has to be maintained in the reverse direction also, with the capstan 'pushing' the tape toward the left-hand spool. Although the guide 'flywheel' (see **fig. 1**), aids in this running mode, a minimum of torque friction has to be seen at the pinch-wheel spindle.

The muting switch is also to be seen in **fig. 2.** Essentially quite simple, this device consists of an earthing spring, forked at the contact end, which shorts the split, insulated, contacts when the pinch roller is in the OFF position. This takes the output of the second stage of the preamplifier through a 100-ohm resistor to chassis, effectively muting the input. Incorrect adjustment of this spring, or looseness of the split pillar contacts, will cause either intermittent playback or strange noises during fast winding due to the lack of muting.

The tension switch is coupled to the rear of the swing arm (see **fig. 1**) and is in series with the 35V DC needed to operate the relays and solenoids. Thus, the machine cannot operate without tape loaded, or the arm swung into a position roughly between 12 and 3 o'clock. The shaft of the tension arm carries a cam which operates the contacts, as shown in **fig. 3,** and the usual trouble with this type of switch is loss of elasticity in the contact arms, especially after having been bent a couple of times. The mistake is to try to adjust in the operating position, which usually results in one or other blade holding off after one or two actions. The correct method is to set the operating cam to its OFF sector, then gently bend the outer blades towards the cam, using the minimum force and pressing near the 'root', not the tip. Then the cam should operate to make the necessary contacts in its proper position. Better to make one or two easy attempts than have a single hard bash that overdoes things.

Reel height needs little explanation. There are two recessed axial screws in each motor pulley. Slackening these enables the pulley to be moved gently on its shaft by hand. If the pulley is stubborn, a gentle tap or two with a wooden mallet on the larger diameter section of the pulley as the motor is held should do the trick.

Brake adjustment is not quite so simple. The brakes consist of bands which have a servo-wrap to the hubs, and are solenoid operated. Tension to each motor should be 200 to 250gm. (measured with a 5in. reel loaded up to 4¾in.). Adjustment is by two screws in the top of the machine, clearly marked Left and Right ; direction of rotation is clockwise to tighten, and vice-versa. But there are various small refinements. The outer ends of the brake bands are held by two screws with a coupling plate to a mounting bracket, and some play is possible at these ends to give fine adjustment beyond the limits of the two screws. These actually alter the position of spring-carrying plates which couple to points about a third of the way along the brake arm, which is common to both brakes, and is actuated by a pivoted arm to which the relay plunger is pinned. *(Continued overleaf)*

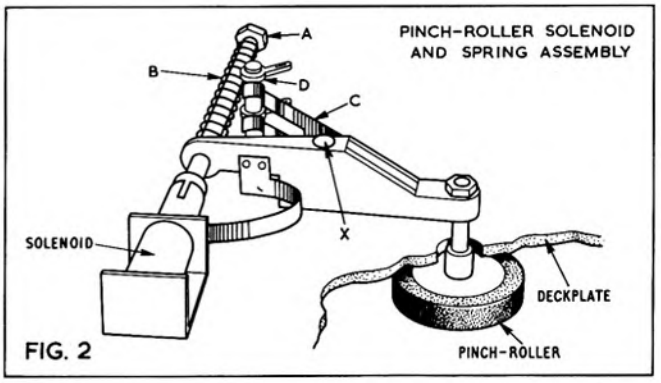
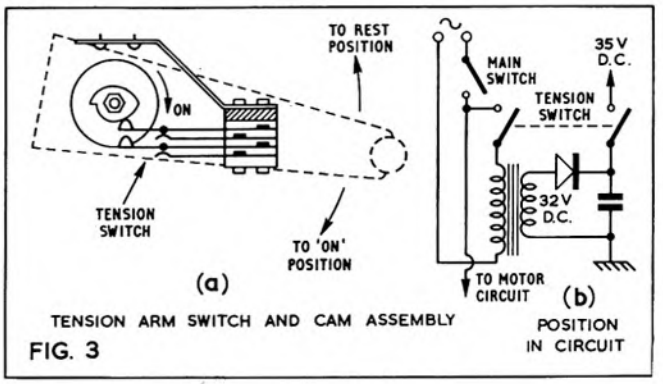
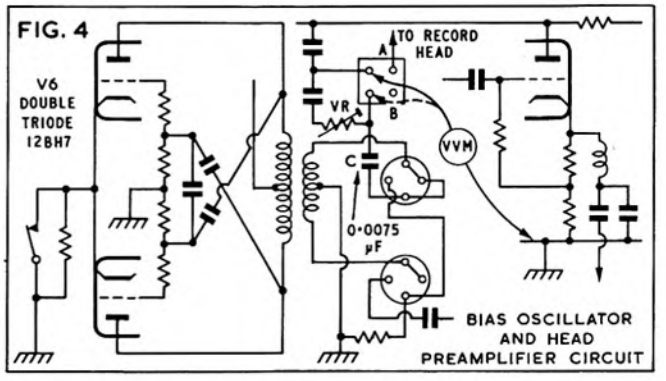


FIG. 2



TENSION ARM SWITCH AND CAM ASSEMBLY
FIG. 3



Points to check here are the split pins and washers at the ends of the brake adjusting screws, the two small plates and both their compression springs, and the tension springs to the brake coupling arm. Also, the freedom (to pivot) of the brake operating lever and the pivot pin that runs transversely through two lugs turned up at the lower end of the solenoid mounting plate. Obviously, the bands and their felt mountings must be kept clean and free from hardening grit.

The motor winding torque adjustments consist of tapped resistors, using the apparently crude but actually quite effective method of a clamped band on a wirewound ceramic former. The take-up motor has less voltage applied, actually 65V AC, against the 80V applied to the feed motor. Adjustment involves sliding the tapping bands along to obtain the correct voltages ; but note that the take-up motor uses a 200-ohm resistor, with only two connections, to obtain an approximate 150-ohm tap, whereas the left-hand motor uses a 350-ohm resistor with a tapping at about 100-ohms from one end. This is so that the conditions for 'reverse play' can be obtained. During normal play about 40% of the rated voltage is applied—some 43 to 45V AC. During reverse play, this motor takes up, and the 80V AC feed is applied, using slippage in the usual way for correct torque. As this machine has no pressure pads, and relies on the freedom of the pinch-wheel plus the flywheel action of the left guide against the tape tensioning action of the tension arm, it will be appreciated that very exact motor tappings are needed to get the best wow and flutter figures.

Before touching upon the electronics, a word, as promised, about this automatic cycling action. The vernier scale, manual button and setting dial can be seen in **fig. 1.** By setting the index points of the inner and outer scales in accordance with the vernier marking of the lower segment, then operating the machine, one of several cycling conditions can be selected. The simplest function is 'repeat play', when, after a preset time of playing, the machine automatically rewinds and repeats the section of tape. As all functions are relay-operated, this sequence simply requires selection of switching and the use of charged capacitors to hold and release the appropriate relays and solenoids. The complete switching circuit, including six relays, a head solenoid, and brake and pinch roller solenoids, makes a very imposing picture. Little purpose is served in reproducing it—although the author has spent several hours in redrawing the labyrinth to attempt a graphic description, and merely ended with a tangled mass of contradictory arrows ! The manual uses twelve identical circuits with red and black circuit 'paths' to do the same thing—a luxury which our Editor would hardly permit.

In addition to the simple 'rewind and repeat play', other operations are 'reverse play' and 'normal and reverse, with rewind'. The terms are self-explanatory, the main difference being that for reverse operation, besides changing the direction of the main motor rotation, the head plate is lowered and the playback head changes tracks. The cycle continues to repeat until cancelled by the zero button. From the servicing point of view, the cycling procedure can be disregarded until all other functions are tested, and logical fault-finding will soon prove at which point the sequence breaks down, provided the manual operation of the machine is normal.

Head alignment is exacting, should not be necessary unless changes have been made, and depends both on the individual head settings and the main plate, which is raised and lowered to bring the heads into position for track changing. The sequence of operations is as follows: release screws A, B and C. Operate 'normal play' and adjust A and B to keep the tape in constant height position with the roller LGR. Operate 'reverse play' and adjust the guide RG and screw C for constant tape height. Check the correct operation of the tension arm guide TG.

Operate 'normal play' and check that erase head is 0.15mm. above upper edge of tape : adjust E. Adjust R for recording head level so that upper edge of top gap is level with upper edge of tape. With track selector in 4-track position, adjust P3 for height of playback head.

Operate 'reverse play' and check that lower edge of playback bottom gap is level with lower edge of tape ; adjust P2. Replay test-tape and adjust P1 for maximum, then check that difference in output for 'normal play' and 'reverse play' is within 1dB. As Mr. Tutchings noted, outputs are so similar that it is quite unnecessary to duplicate operations by testing response on both tracks.

In common with many other high quality tape recorders, the Akai 345 has surprisingly few preset adjustments. Those that need attention

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NEW PRODUCTS NEW PRODUCTS NEW PRODUCTS

EMITAPE TRIPLE PLAY

IMPROVEMENTS to their existing range plus the introduction of a triple play tape are announced by *EMI*. *Emitape 99* and *100* brands are now being manufactured to European characteristics to match the widely used new CCIR standard. Fresh coating materials are claimed to give a lower dropout rate, while newly incorporated lubricant reduces head wear. *Type 99* uses a pre-stretched *Melinex* polyester base film manufactured by ICI. *Type 100* has a similar composition but is a double-play tape. The triple-play *Type 300* uses an entirely new oxide formulation and was developed for slow-speed limited capacity recorders. It is available in 5in. (1,800ft.), 4in. (900ft.) and 3in. (450ft.) sizes, selling for £3 6s., £1 18s., and £1 2s. respectively. All tapes are now being supplied in colour-coded packs with plastic library containers.

Manufacturer: EMI Tape Ltd., Hayes, Middlesex.

WELLER SOLDERING KIT

CANADIAN-manufactured *Weller* soldering equipment is now available in Britain, including a range of low-price soldering guns. Of particular interest is the *8100D-PK* soldering kit, comprising *8100D* gun, resin-cored solder, spanner and two spare bits, cleaning brush and soldering tool. The kit is packed in a polypropylene carrying-case and costs £3 12s. 6d.

The *8100D* soldering gun alone costs £2 17s. 6d. and includes a pre-focused spotlight. A pistol grip eliminates all chances of accidental burning while the built-in trigger-type switch prevents wastage of heat and power. Most remarkable feature of the Weller soldering gun, however, is the very short warm-up time: a sample *8100D* submitted for test took no more than five seconds to reach a usable temperature from cold. The spotlight also proved more than a gimmick, being focused directly on the bit tip. A more powerful gun —the *X8250 AD*—is available, having a power consumption of 275W at 240V AC, compared with the 120W consumption of the *8100D*. The *X8250 AD* costs £4 9s. Spare tips are available for all models, price 7s. 6d.

Distributor: Weller Electric Corporation, Blatchford Close, Horsham, Sussex.

MINIFLUX WOW AND FLUTTER METER

MINIFLUX Electronics are now marketing a transistor wow and flutter meter, designed to assess tape recorder speed characteristics. **Model** *ME101* measures deviation from average speed of between ±0.02 and ±.5% peak-to-peak, with a separate drift indicator displaying long-term velocity changes. Frequency response is 0.5 to 500 c/s —3dB, linear or weighted. An operating frequency of 3 Kc/s or 3.15Kc/s may be selected to order. Powered direct from the mains, the unit sells for £110.

Manufacturer: Miniflux Electronics Ltd., 8 Hale Lane, London, N.W.7.

LENNARD 'DRY-SPLICE'

FOR those who find difficulty in handling conventional pressure-sensitive splicing tape, *Lennard Developments* have introduced an accessory closely resembling plastic-backed sticking plaster. A total of twenty-four 'pre-cut splices' are supplied in the 4s. 11d. *Dry-Splice*, together with a cardboard 'applicator' that may be used in place of a splicing block if the latter is not available. A splicing operation using the accessory involves cutting the two tape ends at 45° with the applicating stencil and a single-edged razor blade, butting them together—locked between stencil and table or baseboard, and locating the Dry-Splice over the two ends. When correctly positioned, the backing strips are removed and pressure applied to the joint. The Dry-Splice is produced to international tape width.

Manufacturer: Lennard Developments Ltd., 7 Slades Hill, Enfield, Middlesex.

BACKGROUND MUSIC AND SOUND EFFECTS

THEME and 'atmosphere' music, with a selection of sound-effects, are included on the gramophone record *Custom Music for 8mm* and produced by *C.D.C. Ltd.* Although intended for amateur cine use, as the title implies, the disc can be of value in sound recording and slide accompaniments. The record is divided into three opening pieces, three closing sequences and some twenty general themes with such titles as *Pomp and Pageantry*, *Circus and Masquerade*, and *Travelling and Locomotion*. The latter half of the second side features twelve sound effects including railway, traffic and sea effects, and closing with applause. No copyright fees are payable on the disc, when used within the domestic circle, beyond the initial cost of the disc. A descriptive leaflet, is supplied giving advice on using the disc and typical applications. A band selector is also included, to facilitate easy identification of each recorded track. The exact duration, in minutes and seconds, of each sequence is published on the record sleeve.

Manufacturer: C.D.C. Co. Ltd. (Photographic Division), 460 Holloway Road, London, N.7.

LOW-PRICED STEREO HEADSET

NEW to the *S.G. Brown* range of headphone accessories is a noise-excluding stereo model retailing at £6. Frequency response is from 20 c/s to 8 Kc/s ±6dB, being effectively maintained up to 20 Kc/s. Ambient noise attenuation at 1 Kc/s is 12dB and efficiency is 1mW for 95dB sound level (normal listening level) and each headpiece. Distortion is less than 1% at this level and less than 6% at maximum input power of 0.5W, which provides 120dB sound level. Impedance is 8 ohms per transducer and the weight, including six feet of connecting lead, is 18oz. The headset is finished in smoke grey nylon and chromium.

Manufacturer: S. G. Brown Ltd., King Georges Avenue, Watford.

to suit varying conditions are bias and erase level, hum-bucking and balancing, recording level, and main amplifier distortion level. **Fig. 4** shows the rudiments of the Colpitts push-pull oscillator circuit, in which it can be seen that there is only one preset, VR. Recording bias voltage should be between 8.5 and 9V AC, measured as shown, with a valve-voltmeter, at the point of feed to the recording head. With the machine in the ¼-track stereo mode, adjust VR for this voltage.

Erasing voltage should be between 35 and 45V AC. This is measured at the point B, shown dotted. If this voltage cannot be obtained, check first the 7½pF feed capacitor, then the head. (Always assuming that the obvious substitution test of the 12BH7 valve has been tried. With painful memories of this valve used as timebase oscillator in several television receivers, this would be the first candidate for trouble-shooting in my book !)

Oscillator frequency is 60 Kc/s ± 5 Kc/s. The oscillator coil is under the mesh shield at the rear top of the pre-amplifier ; not, repeat *not*, on the bottom of the same chassis, where the two tempting coils are actually peaking inductances and should not be touched.

The hum-bucking coil will be found beneath the heads, and the hum balancer, in common with the bias adjuster previously mentioned, is at the rear of the pre-amplifier chassis. There is one of each for each channel, clearly marked. Recording level adjustment can be set by a combination of microphone gain and line level controls to suit conditions. Correct setting is for a 2V AC reading between grid of V4 (second half of 12 AU7) for 'zero VU' reading with 1 Kc/s sine- wave input.

(b) Maintain a library of special sound recordings and sound effects and make these available to members.
(c) Sponsor and assist in the production of sound recordings from members' scripts.
(d) Hold sound recording competitions for members at regular intervals.
(e) Co-operate with other organisations interested in sound, locally, nationally, and internationally.
(f) Raise funds in any way appropriate to the achievement of this programme.
(g) Actively work towards the expansion of this programme, widening the scope and facilities of the Club as circumstances permit.

This is really enough to be going on with for the present. You don't have to commit yourselves definitely to Social Services for Hospitals or the Blind as this can be covered by clause (e).

(3) MEMBERSHIP :
(a) Membership shall be open to all interested in the aims of the Club.
(b) The subscription rate shall be .... per annum, to be paid on the date of joining, and thereafter on the first day of the Club's financial year.
(c) The Committee reserves the right to refuse any application for membership without giving any reason for such refusal, and to expel any member without publishing its reasons.
(d) No member shall be paid, either directly or indirectly, for services to the Club or for anything except legitimate expenses incurred in its work.
(e) A member whose subscription has not been paid within three months of the date due shall have deemed to have allowed his membership to lapse.

Some of this may seem harsh, but the organisation must protect itself from unforeseen situations.

(4) FUNDS :
(a) The funds of the Club shall be applied solely to its stated aims.
(b) The Club's financial year shall be deemed to commence on .....
(c) The Club Committee shall have the power to authorise the expenditure of sums of money from the Club funds, not exceeding £10. Any item exceeding this must have general assent.
(d) In the event of dissolution any remaining funds shall be shared equally between all the current members or donated to a worthy cause. This shall be decided by majority vote.

(5) OFFICERS :

Officers of the Club shall comprise the following : Chairman; Secretary; Treasurer.

No member may hold more than one post. In event of a resignation, the Committee shall have power to appoint a successor for the remaining term of office.

You may wish to embody a clause to the effect that no member may hold any given post on the Committee for more than a certain period. It is, nevertheless, unwise to chop and change Secretaries. The Secretary should be the keenest and most reliable member of the club. Remember it is his address that will appear in the press. At all cost, avoid the possibility of potential members writing to outdated addresses or ex-members.

It is a sad fact that the Committee and its handful of assistants frequently cut themselves off from the club as a whole, forming a select 'club within a club'. This is the beginning of the end. New and non-technical members must not be treated merely as an audience for innumerable speeches from the Chairman or 'Technical Officer'. No detailed technical knowledge is needed by the operator of a mixing unit and frequently the least experienced club member will show great aptitude at monitoring and fading, having once grasped exactly what is going on.

Women, I find, make excellent Show Organisers (men are apt to neglect home comforts such as coffee during the interval). There is a great fund of material available for weekend 'open' meetings : tape and slide programmes, interesting sound films (ostensibly for analysis purposes but good entertainment material too) from the free loan libraries such as *Sound Services*, guest speakers, and exchange programmes with other clubs. It is useful to get in touch with other clubs anyway in order to see how they are filling their programmes. There are over five hundred Cine clubs in Britain and there is bound to be one in your area with which you may co-operate to present the Ten Best Amateur Films of the year—a sure fund raiser. (By the way, it is surprising how poorly placed some of these Cine clubs are when it comes to sound recording. Many of them can do with expert assistance from time to time, especially when engaged in producing a local sponsored documentary.)

Another warning. Do not allow your Committee to become overwhelmed with administration, and if anyone finds his work too much then find him an assistant immediately.

The keenest members are usually found on the Committee and if they are allowed no chance to function creatively then the Club will suffer as a whole.

Well there it is, prospective Secretary. Give it a try. But, if you find that after a year of writing and answering letters, dashing around to organise people into doing this or that, tangling with the Authorities, finding replacements for Committee members, and a hundred and one other things, you've forgotten just how a tape recorder works, do not blame me. You cannot say I did not warn you !

says, briefly, "the victory is decided in favour of the British Troops."

In another famous play, *The Miller and His Men* (1813), a lady blows up the villains with gunpowder—and disembodied limbs rain down amid flames and smoke. From time immemorial, the sound-effects for such typical toy-theatre scenes were produced from clappers, penny-whistles, tambourines and other impedimenta. Nowadays, tape can surely provide the more thrilling realism—even if the effects are merely dubbed from disc.

My own procedure is to record the effects in consecutive order. The child can then 'switch on' each successive effect by using the pause-control for replay. For example, he slides Cinderella's coach on stage (with his left hand) ; and (with his right) 'switches on' the hooves-and-wheels. He can then 'switch off' before speaking the dialogue—'switching on' again when the coach is drawn off. A sophisticated technique is not necessary. Generally, it is sufficient to pre-fade all effects in-and-out ; this gives the illusion of the sound 'arriving' or 'departing'.

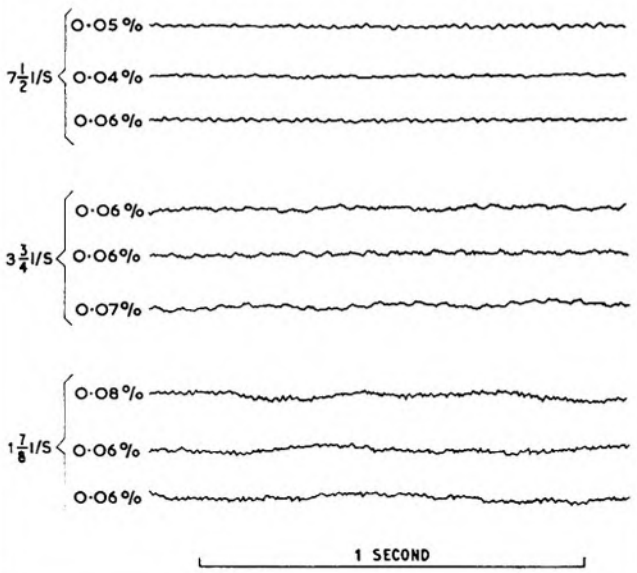
I have found the *Philips EL3300* portable ideal for the children ; it hides behind the smallest theatre and lends an impression of 'miniature sound' while being easy for them to operate without supervision.

I do not suggest that dialogue and effects are recorded together (leaving the child mute)—for this robs the performance of charm and improvisation. But there is no reason why the adults should not annexe the scripts when the children have gone to bed. The play can then be produced, with glorious gusto, as a full-scale drama tape recording. But do remember to include an imaginary audience—Sir Jasper must be hissed and the hero cheered. Properly done, this will evoke the very odours of orange peel and gaslight.

AMPEX 2073 STEREO

MANUFACTURER'S SPECIFICATION. Quarter-track stereo recorder with internal power amplifiers and speakers. **Tape Speeds:** 7½, 3¾ and 1⅞ i/s. **Frequency Response** (respective): 30 c/s-18 Kc/s, 40 c/s-12 Kc/s and 40 c/s-6 Kc/s ±3dB. **Wow and Flutter** (respective): 0.08%, 0.12% and 0.2%. **Signal-to-Noise Ratio** (respective): 52dB, 48dB and 43dB. **Output Power:** 8 W per channel. **Fast Wind:** 1 minute 55 seconds for 1,200ft. **Dimensions:** 19 × 13¼ × 7¼in. **Weight:** 39lb. **Price: £198 10s. Distributor: Ampex (G.B.) Ltd., Acre Road, Reading, Berkshire.**

FIG. 1 AMPEX 2073 WOW AND FLUTTER

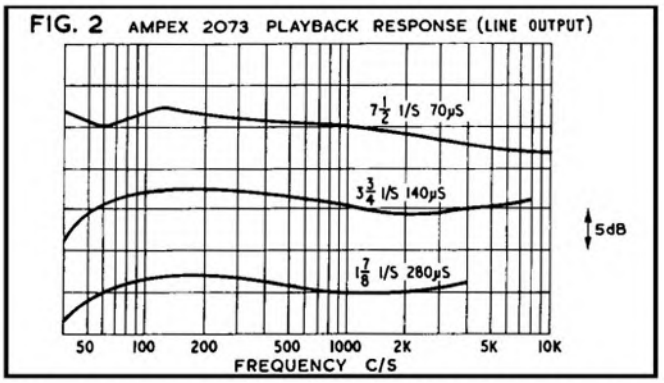


ONE original feature of the *2073* is the automatic threading facility. The tape is led round the curved face of the head block and dropped into a straight slot which runs from top to bottom of a box-like casing that replaces the normal take-up reel. Inside this box is a single flanged spool with a castellated hub which grabs the tape and starts winding without any further bother. After fiddling with American style reels with no slotted flanges and a tape anchoring slot which could only be reached by the fingers of a child of five, I can well appreciate the reason for this gimmick.

It will be seen that the reels cannot be turned over and interchanged in the normal way, so that the direction of tape movement has to be reversed to play the second pair of tracks. On this machine the tape direction can be reversed at any point by recording a subsonic (20 c/s) tone on the tape. So, with a tone at each end of the tape, or desired section, the recorder will go on repeating it robot fashion for ever more, or until somebody presses the stop key !

The tape reversing facility is easily provided because two capstans are fitted, one at each end of the head block. Both capstans are driven, and the tape held against them by pressure rollers so that the tape motion across the heads is effectively insulated from any external effect. This 'closed loop' system is a heritage from *Ampex* instrumentation FM recorders, where wow and flutter had to be held to very low levels indeed.

FIG. 2 AMPEX 2073 PLAYBACK RESPONSE (LINE OUTPUT)



A contributing factor to smooth tape motion is the elimination of pressure pads on any of the heads. A single sensing rod measures the tape tension and maintains it constant by a servo braking action on the trailing flywheel. It also keeps the tape against the heads even when reversing. The excellent wow and flutter performance of this system is demonstrated by the fluttergrams of **fig. 1.** On this particular machine total cumulative wow and flutter did not exceed 0.1%RMS at any of the three speeds. On each speed I deliberately stopped and started the machine several times, altering the tape position slightly on each test to try and phase the recorded and play speed imperfections so that they added. The highest reading on each set of traces was produced in this way, and only at the lowest speed on 1⅞ i/s could the very low capstan wow be heard as a very slight waver on a constant oscillator tone. At the higher speeds the tone was dead steady and sounded particularly pure due to lack of high frequency flutter.

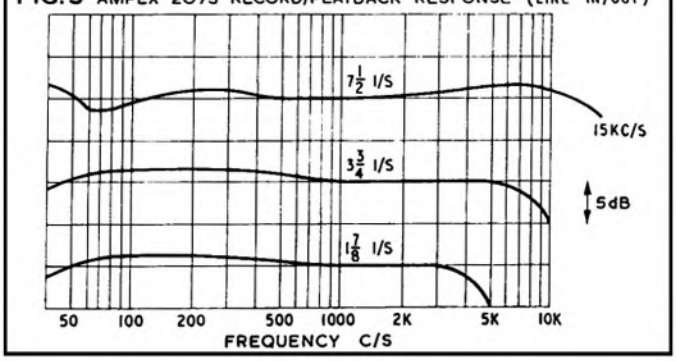
Playback equalisation (**fig. 2**) was checked by playing test-tapes recorded to 70, 140 and 280μS characteristics. The slight 3dB fall on the 7½ i/s response shows that the equalisation is to the NAB standard of 50μS. System noise, with no tape passing the heads, was 40dB below test-tape level.

Record/play tests were made from line-input to line-output at all speeds at a level 6dB below test-tape level to allow for the severe high frequency pre-emphasis which is used in recording the NAB characteristic. **Fig. 3** shows some fall in high frequency response against the specification, but it should be mentioned that, as no Ampex tape was provided with the recorder, the tests were made on a good quality British tape which may, however, need a slightly different bias. Nevertheless, the responses are in line with fully professional machines, which seldom promise more than 15 Kc/s at 7½ i/s, 7½ Kc/s at 3¾ i/s and 3¾ Kc/s at 1⅞ i/s, i.e. 2 Kc/s per inch, with the bias set for minimum distortion and noise.

Overload tests at 500 c/s showed that a level 15dB above test-tape level could be recorded with no visible distortion of the recorded waveform, and that even at 17dB above test-tape the distortion was

(*continued on page 549*)

FIG. 3 AMPEX 2073 RECORD/PLAYBACK RESPONSE (LINE IN/OUT)



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Tandberg 823 ...	8 10 3	4 0 4	54
Reps R10 Mk. II	9 6 0	4 7 9	59
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Ferguson 3214 ...	6 19 0	3 5 5	44
Grundig TK400 ...	7 9 0	3 9 10	47
Grundig TK23L...	7 14 6	3 12 11	49
Tandberg 843 ...	9 6 0	4 7 9	59
Philips EL3556 Teak	9 15 6	4 12 3	62
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not that of violent overload, but just a slight rounding of the sine-wave peaks.

The record level indicator was unusual in using a flashing neon with two electrodes, one above the other ; the lower one had to be kept flashing most of the time, but flashing of the top one indicated incipient overload and corresponded to a recording level about 15dB above test-tape level. The indicators proved very easy to use, and were well suited to the gentle overload characteristic of this recorder.

Peak recording level was erased and the wide-band signal-to-noise ratio found to be 53dB. Weighted to the ear's response at low levels, the ratio was better than 60dB.

The single knob tone control, which acts on the output stages only and does not affect the line output, proved to be rather awkward in that it was impossible to set it to give a level response at the external speaker jacks. With the pointer in the central position, the response was up 8dB at 100 c/s and 3dB at 10 Kc/s with reference to the 1 Kc/s output. With the control fully anticlockwise, the high note response was sensibly level with a bass rise of 12dB at 100 c/s. With the control fully clockwise, the bass response was level, but the high note response was up 10dB at 10 Kc/s. On the internal speakers, a few dB here or there did not matter ; in fact, **fig. 4** shows that the tone control can be set to give a reasonably level response over the range 200 c/s to 7 Kc/s in any listening position.

With wide-range external speakers, however, the 'built in' bass rise at the most level setting of the tone control was unpleasantly obvious.

The response of the microphone supplied with this recorder was calibrated against a standard in a white-noise sound field and gave the very level response shown in **fig. 5.**

COMMENT

The technical performance of this recorder up to the line output is beyond reproach and reaches professional standards of frequency response, signal-to-noise ratio and tape transport. The microphone also is capable of feeding a wide-range signal to the recorder under proper acoustic conditions.

It seems a pity that the output stages and speaker system do not do full justice to the available signal. There is no lack of power and the signal is clean ; it is simply a matter of poor tonal balance which the tone control does nothing to rectify.

Another point which I did not realise until late in the review was that the machine only *records* from left to right, so that the self-threading reel and covers have to be removed and replaced with a normal reel so that the reels may be interchanged for recording in the other direction. In other words, the self-threading auto-reversing facility can only be used on recorded tapes.

However, we mere males probably do not fully appreciate the virtues of auto-threading and endless background music without changing tapes, and such facilities may well appeal to the distaff side of the family to an extent which would justify the purchase of the 2073 to feed the master's high fidelity installation. **A. Tutchings.**

FIG. 4 AMPEX 2073 ACOUSTIC RESPONSE

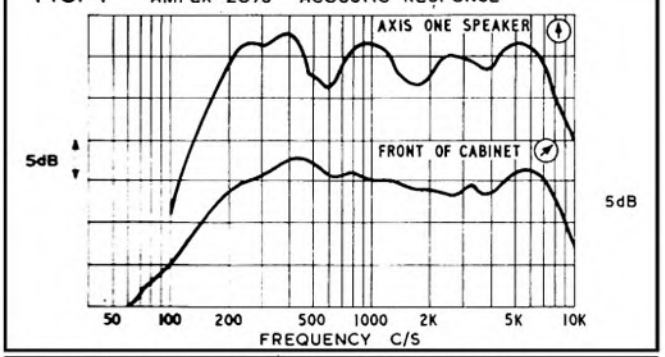
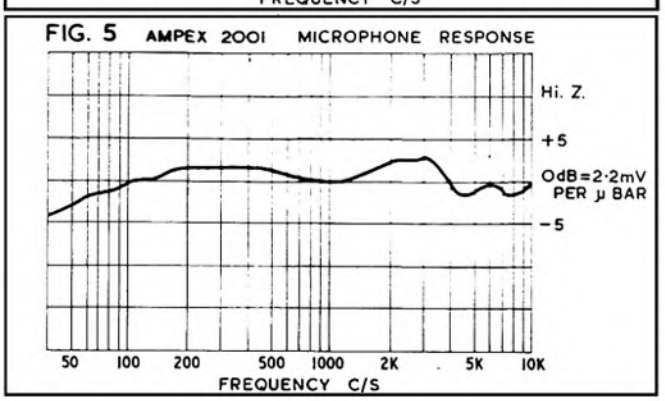


FIG. 5 AMPEX 2001 MICROPHONE RESPONSE



FILMAGIC CLEANING ACCESSORIES

MANUFACTURER'S SPECIFICATION. Tape Cleaning Accessory Kits. *Pylon Kit* comprising guide, tape conditioning fluid and spare sleeves. **Price:** £1 15s. *FM200 Kit* comprising two 2oz. bottles of fluid (a cleaner for heads and guides and a lubricant) with brushes. **Price:** 17s. 6d. **Postage:** 1s. 6d. per kit. **Distributor: Concordia, 42 Museum Street, London, W.C.1.**

THE tape recorder enthusiast is well catered for nowadays. If he takes the trouble to shop around, he will find a dozen splicing kits, two or three cleaning devices and an abundance of lubricating media.

Nevertheless, an inspection of a few of the machines that arrive in a service department would convince the visitor that the only accessories available were a blunt pen-knife and an oily rag. The usual excuse for neglect is the inconvenience of cleaning regularly. *Concordia* offer a method of easing that burden—a method which, surprisingly, works as well as its pre-marketing publicity promised.

The *Pylon* kit contains the basic pylon, which is an acetate guide with removable outer sleeving, and a padded centre. A few drops of *Long-Life* fluid applied to the centre padding before a recording session allow gradual infiltration and thus a lubrication and cleansing action. If the pylon is mounted after the feed spool and before the transport section, the tape carries the fluid across guide and head faces on its oxide surface. The effect is difficult to judge, but the reviewer used an old tape, discarded because of faulty bonding, which had a habit of cluttering up the tape path of most machines with a residue of debris. Running this through completely, against a pylon, reduced the clutter to negligible proportions. (A second pylon, prior to the take-up spool, would have been a good idea in this instance.)

The pylons come in three types: suction cup mounting, that can be stuck on the deck-plate anywhere, and is handy if the tape recorder lid does not allow permanent mounting in a convenient place ; screw fixing, which needs a permanent mounting position; and spade or slide mounting, which can be slid under a convenient screw head. The spare sleeves are simply fitted, and can be squeezed out in warm water, so long as detergents which may loosen the nylon bond are avoided. The tape conditioner is claimed to prevent curling, warping and embrittlement of the tape, a claim hard to check. Certainly it lubricated and cleaned and for that purpose alone is worth employing.

MINIATURE SIGN

The second kit consists of two small bottles, like a miniature apothecary's sign. The red fluid is a powerful cleaner, much better than methylated spirit or any alcohol preparation. A single application with the small brush fitted to the bottle cap leaves head faces bright and shining—even those which arrived in the workshop looking as if they had been kept in the coalhouse. The only restriction is that this fluid attacks painted surfaces and some plastics, and must thus be kept away from covers and decorative plates.

The blue fluid is a tape lubricant which should be the answer to some of those readers who complain that DP tape on their older machines leads to squeaking noises and occasionally flutter. It is useful in the workshop, where a number of machines have to be handled, or at home when a pylon is not available. Applied to friction points, it considerably assists tape transport and gives that extra touch of efficiency that the enthusiast always seeks. The liquid makes an excellent alternative to the *Polytetrafluorethylene* lubricant, described in the August 1965 issue.

Both these fluids are also available in 16 ounce bottles for professional purposes. But the kit size should last for months at the rate it will be used by the average chap. The sample kit issued to the reviewer has been in use by two apprentices engaged in tape recorder service and after three weeks is still only about two-thirds denuded. More than this—the boys say they like it, and have forsworn meths. What greater accolade is needed ? **H. W. Hellyer**

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READERS' PROBLEMS

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

MATCHING THE FOORD MIXER

Dear Sir, I shall shortly be constructing the mixer described by A. Foord in the January and February 1965 issues. Before commencing the task, however, I should like to clarify one or two points.

Firstly, is the ceramic pickup preamplifier suitable for GC8 crystal cartridges and would equalisation be necessary? Secondly, would the tape-head preamplifier match the 'external amplifier' output of an *Elizabethan LZ30* recorder, or is a new circuit called for?

Yours faithfully, **P.K.S., London, S.W.2.**

The ceramic pickup input is quite suitable for the GC8 crystal cartridge. In fact, the slightly lower impedance of the latter, and the higher output than the type to which Mr. Foord designed his module, will assist you in the equalising problem, giving greater effective input impedance. No, there is no need for further equalising.

Regarding the second query, the tape input is designed to match a playback head and needs only 4mV for correct output of 500mV, with 100K matching. The 'external amplifier' socket on the LZ30 gives about 250 times as much at the same impedance. The output from this socket should be fed direct to the main amplifier, not via the preamplifier, unless you want to tidy things up by providing a 'straight-through' socket—which seems a little superfluous.

We would close in commending to you some additional preamplifier circuits based on the new BC107 transistor and published in June 1965. They appeared in 'Mullard Outlook', available from Mullard House, Torrington Place, London, W.C.1.

CLUTCH BINDING ON THE STELLA ST454

Dear Sir, My problem is wow. Using a 5in. spool of *BASF* LP tape I made a recording with my *Stella ST454* covering the entire length of one track. On playback I found that the first half of the recording was satisfactory. The next ten minutes showed a slight wow, which gradually increased until the last ten minutes or so became intolerable. This fault has been present for the past three months, despite being 'repaired' by a local dealer claiming to specialise in tape recorder maintenance. The main drive belt and pinch wheel have been replaced. Fast wind in both directions appears to be in order.

Yours faithfully, **J.M.T., Bury St. Edmunds**

The problem, as you describe it, appears to originate from a fierce clutch action as the weight of tape on the right-hand spool exceeds a certain point. This is understandable if you study the type of clutch used, comprising a felt ring inset in the turntable underside, which slips on a plastic plate fixed to the spindle. The level of the plate is determined by the setting of a lever beneath the mechanism, which allows the plate to drop during fast wind to engage the upper section of the turntable solidly with the Vulcanan plugs in the clutch drum. The latter is driven by the single belt.

Beneath the square section of the spindle, which has a plastic disc affixed, there are two or three PVC washers that act as a bearing 'float' above the main mounting boss. These tend to become dry and brittle and may need a little lubrication with light grease or even to be replaced if broken or worn. While the assembly is dismantled, clean the felt disc

(continued overleaf)

and soften it with methylated spirit, and ensure that the plastic disc is absolutely clean and free from grease—this is important. Make sure also that there are no particles of worn washer or foreign matter on the mounting beneath the disc, on the spindle, or in the brass bush. Re-assemble with the flat portion of the spindle to the right as it is re-inserted.

OILS AND LUBRICATION

Dear Sir, Can you please give me a name and source of supply for a lubricating oil and grease suitable for use with tape recorders? The oil would be for motor bearings, spindles, etc., and the grease for sliding parts. *Yours faithfully*, **J.N., Belfast, 4.**

There are a number of alternative types of oil and grease recommended by various manufacturers. The choice is wide but the difference between brands and grades is small.

Motors need very little oiling nowadays. Sintered bearings are oil retaining and, indeed, the very act of putting a thin oil on a sintered bearing is detrimental, causing some of the goodness of the original impregnation to be lost, usually due to heat and evaporation. Of course, grit and dirt in the bearing has an even worse effect, so the true answer is scrupulous cleanliness. Some makers recommend one or two drops per hundred playing hours at bearing points (revolving parts), for which Shell Vitrea No. 3 is most suitable, though Singer Sewing Machine oil is adequate. A graphite based oil is preferable.

Graphite is the secret, too, of lubrication for sliding members and pivots, there being hardly anything better than molybdenum disulphide —sold at garages under the Molyslip trade-mark. Despite its distasteful appearance, this is an excellent lubricant, being quite unaffected by the temperature changes likely to occur in a tape recorder.

RELAY CHATTER ON THE COUNTESS

Dear Sir, I have a *Countess* tape recorder which uses spools stacked vertically rather than in the more usual mode.

It has given no trouble until recently when, on pressing the START button, the solenoid-operated pinch wheel assembly sometimes 'chatters' backwards and forwards for a few seconds before taking up its normal position against the heads. This has happened during long recording sessions when the machine was left to operate by itself. I would be grateful for advice on a possible remedy.

Yours faithfully, **J.P., London, E.3.**

Relay chatter has two possible causes. Most likely is a voltage drop, which may be due to rectifier deterioration or regulating resistors developing a high resistance. In this case, the latter reason is unlikely, as the wirewound types employed seem quite adequate for the current rating and you should check the voltage supplies to the armature winding.

Second possibility is mechanical defect due to oxidised contacts; these should be cleaned with a proprietary solvent such as Electrolube. It is not advisable, however, to adjust the solenoid clearance points unless you have the correct tools, including feeler gauges. A return spring at the end of the pinch arm may be binding and should be checked before any alteration to the solenoid is made. Inspection of the guide rods in the channels is also needed, to ensure that there is no binding. Check for dust deposits on the armature slide and ensure the physical action is easy.

FAULTY ERASURE

Dear Sir, I have an *Elizabethan Princess* tape recorder which uses the *Motek* tape deck. Although the valves have been changed and the heads cleaned, I cannot get the machine to erase completely. When attempting to erase the level is merely reduced by half the original volume. I can detect no sign of residual magnetism in the erase head and the machine records and replays perfectly. Could you suggest the possible fault? *Yours faithfully*, **D.M.P., Newcastle.**

Most likely trouble is that the erase head is out of alignment, or is itself faulty. But you should check the cathode of the 6BW6, which is biased by a 220K resistor during playback, this component being shunted to deck via pin-6 of the connector plug and the record switch during recording. If this is in order, check the 0.003μF capacitor across one section of the oscillator coil.

CLASSIFIED ADVERTISEMENTS

Advertisements for this section must be pre-paid. The rate is 6d. per word (private), minimum 7s. 6d. Box Nos. 1s. 6d. extra; trade rates 9d. per word, minimum 12s. Box Nos. 2s. extra. Copy and remittance for advertisements in **FEBRUARY 1966** issue must reach these offices by **20th DECEMBER** addressed to: The Advertisement Manager, Tape Recorder, Link House, Dingwall Avenue, Croydon, Surrey.

Replies to Box Nos. should be addressed to the Advertisement Manager, Tape Recorder, Link House, Dingwall Avenue, Croydon, Surrey, and the box no. quoted on the outside of the envelope. The district after box no. indicates its locality.

FOR SALE

Grundig TK 830/3D tape recorder 3¾/7½ ips, six watt, plays both ways, excellent performance, cost £110, price £52, Leak Varislope £6 TL12 plus, 100v line £12, point one preamp £8.10.0. Box No. 389 (Bucks.)

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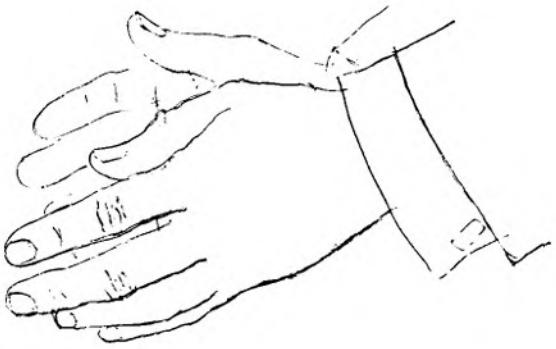

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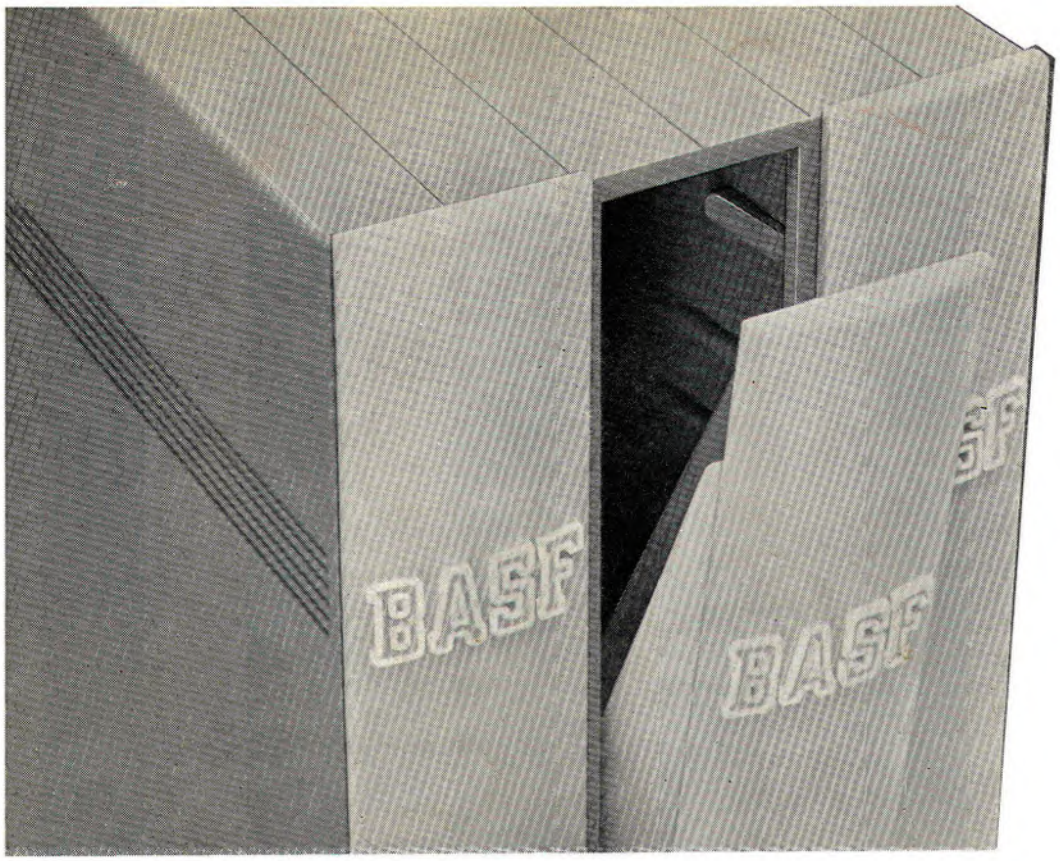

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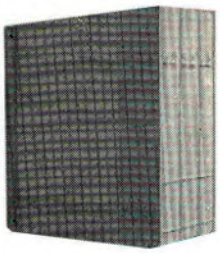

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