

the TAPE *price 2/-* **RECORDER**

JULY 1963

Vol. 5 No. 6

INCORPORATING "SOUND AND CINE"



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REALISM



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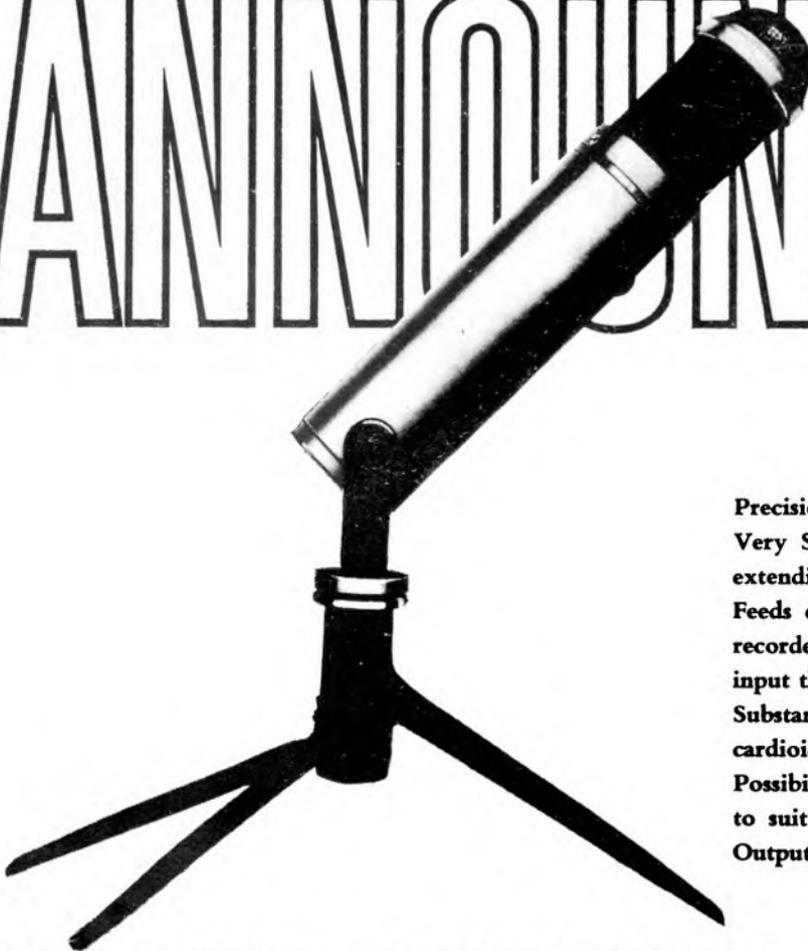
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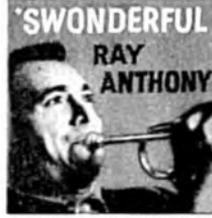
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EDITORIAL



MEMBER OF THE
 AUDIT BUREAU
 OF CIRCULATIONS
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This month, in the centre eight pages of the magazine, we plug the cause for tape editing in a pictorial-cum-directory supplement. In spite of all this—and in spite of what we have written about it in the past—we know only too well that it is going to take more than two or three dozen photos and a few paragraphs of persuasive words to put across something that all too many people at present regard as “plain unnecessary and a waste of time”. Furthermore, we are in complete sympathy with many of the readers who look at it that way. Those who have bought tape recorders for occasional domestic use, and who merely want them for an hour’s fun at a party, or when on holiday—those people and many others with the same outlook truly have no use for tape editing. For them it would indeed be a waste of time—or for most of them, we should add. But there are all too many people who have bought tape recorders (with the original idea of making useful and interesting sound records) who have long since given up using them, because they found it an irritating and frustrating effort to replay any sequence of sounds (even if they were able to locate them on the tape), once the spool was filled to the last inch with bits of everything. It is these people, in this category, who would discover, through tape editing, that their machines would give them exactly what they had originally hoped for when they bought them.

We have often wondered why it is that so many people have not made proper use of the equipment which cost them good money. In most cases, we think, it is lack of confidence: in some cases, of course, it is natural laziness. Though the analogy is not quite right, let us consider tape recording and photography (from the laziness angle!). Mrs. Brown buys a camera and a roll of film. She bangs off the eight or twelve or thirty-six exposures, takes them to the chemist when she goes shopping (or gets her husband to take them for her) and is quite often delighted with the prints that she receives in a few days’ time. She buys another film, and continues to pop off pictures for year after year. Mrs. Smith makes a tape recording (lots of them on one spool) but there is no counterpart of the chemist’s shop to which she can send her spool for editing. In the first place, only *she* can tell what bits she wants to keep, and what bits are useless. So she does not buy another spool, and the tape recorder makes a useful box to stand things on.

SUBSCRIPTION RATES

The subscription rate to *The Tape Recorder* is 27/6 per annum (U.S.A. \$4.00) from The Tape Recorder, 99 Mortimer Street, London, W.1. Subscription Index, 30 - (U.S.A. \$4.25). The same rates apply to *Hi-Fi News*.

JULY - - - - - 1963

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There are many Mrs. Smiths and Mrs. Browns who (did they but realise it) could develop their own rolls of film, and contact print them just as well as the man to whom the chemist sends them. The apparatus would cost them at most a couple of pounds. But this brings us back to the angle of lack of confidence. Tape editing, at its simplest, is a matter of slitting a length of tape (with scissors or razor blade) twice, taking out the unwanted bit, and re-jointing the two new ends with half an inch of special “sticky” tape. It requires no confidence. Anyone, other than a ham-fisted Harry, can do it perfectly.

The main secret of tape editing—particularly if the owner has only one machine—is to *make the recording on one track only*. Then the tape can be cut into a thousand slices, and reassembled, without losing anything that is wanted intact. This, to some people, sounds like gross extravagance. The idea of buying a second spool of tape, with one track of the first spool still empty. . . ! But would those same people paste up in their photo albums all the strips of print, under-exposed, overexposed, decapitated picnic groups and double-exposures? And would they consider it a similar waste of money to buy a spare roll of film?

There are, doubtless, many able dealers up and down the country who will copy the edited tape on to one track of a new tape. The user can then use the first tape again (one track only) for further recording; and when that is again edited, the same dealer will doubtless oblige by copying the second edited track on to the spare track of the new tape. The result . . . a worthwhile tape with two usefull sound tracks, and the first tape which can still be sliced about until it contains as much jointing tape as magnetic tape! That makes sense out of tape recording. It also spells economy. Please take our advice. Select a splicer from the models we have illustrated, and buy a reel of tape. Start cutting!

COVER PICTURE

Readers who have bought our booklet, “*How to Splice Tape*”, will recognise some of the photographs that we have re-assembled for this month’s cover picture. Like the subject matter, it was mainly a matter of slicing and jointing!

**Index to Volume 4 of THE TAPE RECORDER
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S-99



RSW-1



UXR-1



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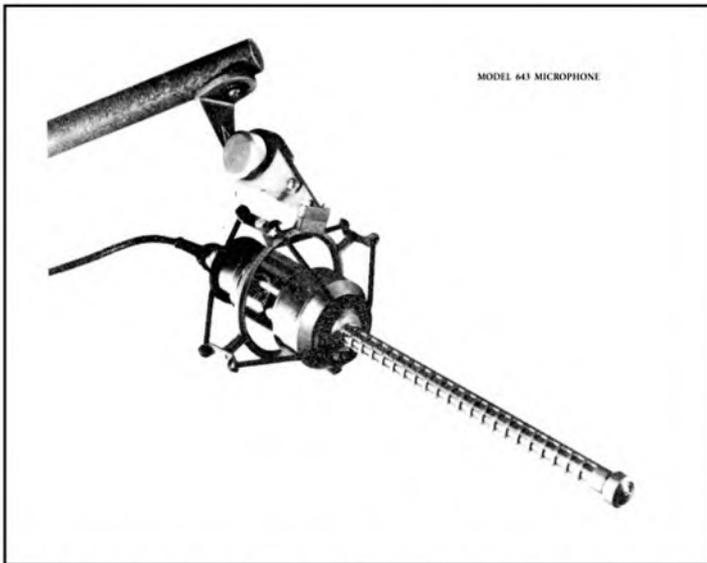
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* * *

A revolutionary new system, called *Editec*, for automatic editing and animation on television tape has been introduced by Ampex International. The *Editec* time element control system combines with the Ampex Electronic Editor to transform the VR 1000 series of *Videotape*



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recorders into a production tool capable of any editing function at a much lower cost than film. The Ampex Electronic *Editor*, solved part of the problem, making possible push button editing without cutting tapes. Combined with the *Editec*, the *Editor* now becomes the complete production accessory, permitting frame by frame editing.

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CLASSIFIED ADVERTISEMENTS 256

NEWS FROM THE WORLD OF TAPE

Music on Tape, who claim to be the first Company to make a commercial proposition of four track stereo tapes recorded at $3\frac{3}{4}$ i/s, have announced that their new "Scroll" series is now available. Titles include *Scheherazade*, *L'Arlesienne* and the overtures to *Leonora*, *Egmont* and *Prometheus*. Details of these and later releases can be obtained from Music on Tape, 188, Vauxhall Bridge Road, London, S.W.1.

* * *

Truvox Ltd. have asked us to print an apology to those people who have been unable to obtain equipment because of the long waiting list. We have been advised that the present delivery situation is as follows: R62 and R64 recorders, two weeks; R82 and R84, three weeks; PD82/5 two weeks; PD86 and PD87 ten to twelve weeks.



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* * *

The most recent of the famous members of the show business fraternity to join the exclusive *Shure* Gold Microphone Club is the ever popular Sammy Davis Jr. He received his personally inscribed gold-plated Shure Unidyne III microphone when he visited the Shure factory during his highly successful run at the Villa Venice, near Chicago, U.S.A. The award is part of the continuing Shure programme of appreciation for outstanding showmanship and recognition of the microphone's critical importance to successful entertaining.

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MAKE THIS RIBBON MICROPHONE

By M. H. O. HODDINOTT



THERE must be many owners of a tape recorder who, like myself, find that it has to fit into a tight household budget. Ribbon microphones, mixers, extra speakers, pre-amplifiers, etc., are but dreams to many of us. However the absence of a goldmine in the back garden does nothing to subdue the desire for "Hi-Fi"—or the urge to capture for future generations that earnest and private conversation over the ludo board between very young sons and daughters. Before very long the brazen head of Do-it-Yourself appears in all its over-optimistic glory and the seeds of an idea are sown.

My entry into this field of tape recording was initiated by the realisation that good quality recordings of live functions, particularly music, could only be obtained by possessing a ribbon microphone. At an average price of £10 for the cheaper types, however, these instruments are most costly items, especially when one remembers that they are essentially for studio use only, and are not suitable for outdoors. After seeing one "in the flesh", I felt that here, surely, was an item well within the scope of the home mechanic. So, after a visit to the local Public Library to obtain all the facts, I plunged into the job and eventually produced the instrument described in this article.

Structurally Simple

Although apparently a formidable thing to make, the ribbon microphone is structurally very simple; in fact probably the simplest of the three types in common use. It consists of a very light and thin aluminium ribbon held between the poles of a permanent magnet. The sound vibrations move the ribbon in sympathy and a minute electric current is generated. This current is collected at each end of the ribbon and passed on to the amplifier. The real secret of success lies in the accuracy of the construction, the care with which it is carried out, and the overall design. It is thus particularly well suited to home construction, the material cost being low and the accuracy required obtainable by time—at no cost at all!

The tools required are the barest minimum found in the mechanic's workshop. A hacksaw, vice, hand-drill, files and assorted B.A. screws are the essential items. Perhaps only the 10 B.A. tap for threading may be missing but this is easily obtainable at the ironmonger.

The complete unit, without its protective gauze case, is shown in fig. 1. The shape and dimensions of this design are dependant on the only commercially made items in it—the magnets, of which full details are given at the end of the article. From this drawing the layout is clearly shown, and I would advise the constructor first to study it and get the overall idea of a ribbon microphone clearly fixed in his head before pro-

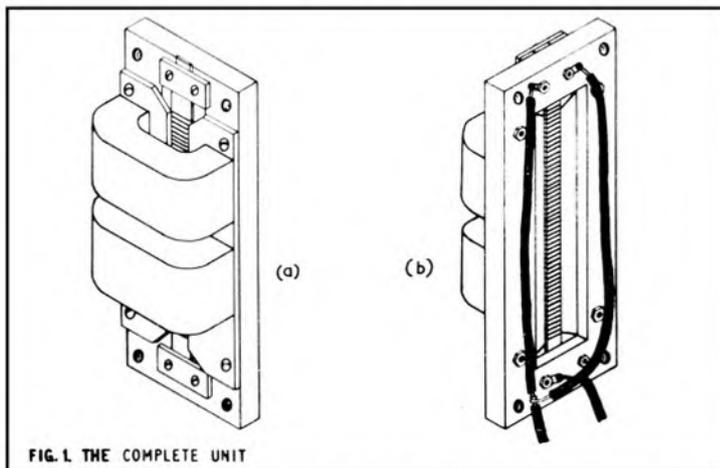


FIG. 1 THE COMPLETE UNIT

ceeding with the job. When this has been done a reference to the list of raw materials should be made to ensure that everything is available.

The frame

Commence work on the $\frac{1}{8}$ in. thick paxolin frame, cutting it to the dimensions shown in fig. 2, and marking off the central slot. Also mark out the centre line of the frame and expand it to $\frac{3}{16}$ in. wide. The use of this guide mark will be obvious later (dotted lines fig. 2). The cutting of the slot may present a little difficulty to some so I will describe a simple way (See fig. 3).

List of Materials Wanted and Possible Suppliers

Paxolin Sheet, $\frac{1}{8}$ in. thick

Price: About 6-d. per square foot. Obtainable at radio or electrical suppliers.

Mild Steel Sheet, $\frac{1}{32}$ in. thick

Price: For small amounts negligible. Obtainable at ironmongers or scrap merchants.

Brass Sheet, $\frac{1}{32}$ in. and $\frac{1}{64}$ in. thick

Price: For small amounts about 1-d. Obtainable at ironmongers or sheet metal workshops.

Perforated Sheet (Meat Safe Type)

Price and source as for the brass.

Brass Wire Gauze

20 holes per inch (wire 0.015 in.) for outer grille.

100 holes per inch (wire 0.004 in.) for inner lining.

Source: Messrs. Greening Ltd., Britannia Works, Warrington, Cheshire. Price: approx. 10/-d. per sq. ft.

Screws

10 B.A. $\frac{1}{4}$ in. round headed }
8 B.A. $\frac{1}{4}$ in. round headed } Ironmonger or model shop.
(these are to be brass)

Matching Transformer

Price: 10-d. "W.G." bell type, 200 250 V. in. 3 5 8 V. out. Ref. E 1095. Made by Ward and Goldstone, Manchester 6.

Magnets

"Eclipse" Power Magnets type No. 812B. Price: 8-d. Obtainable through ironmongers.

Brass Sheet for the Case, $\frac{1}{8}$ in. thick

Price: 30-d. per square foot. About $\frac{1}{4}$ square foot wanted for the case and is obtainable from A. J. Reeves, 416 Moseley Road, Birmingham 12.

Brass Sheet for the back and front plates of case

Price: 16-d. per square foot. About 8 square inches wanted. Also obtainable from A. J. Reeves.

Perspex as an alternative

Obtainable from handicraft shops.

MAKE THIS RIBBON MICROPHONE

THE FIRST OF TWO PARTS

DESCRIPTION AND PREPARATION

Drill out a series of small ($\frac{1}{8}$ in.) holes close to one another inside the marked out area of the slot. When a complete rectangle of holes has been made, gently chisel out the material between each hole and prise out the central portion. This will leave the slot with an irregular outline which can be filed out level until the edges correspond with the marked outline. Mark out the twelve holes in the frame as shown in fig. 2 and drill and tap them according to the diagram.

The polepieces

Obtain a piece of mild steel about $\frac{3}{16}$ in. thick, ensuring that it is reasonably flat and not badly rusted. Mark off the two pieces and cut them slightly oversize. Clamp the two together in a vice and finish off to the correct size with a fine file. A point of importance here is the actual pole edge that will eventually be parallel to the ribbon (R in fig. 4). It is essential to get this as near perfectly straight as possible and great care must be taken in the final filing. Check the edge frequently with a steel rule.

For those whose filing is not all it might be there is a way to cheat a little here. Take the original piece of mild steel, before working on it, to a local tinsmith or model engineer and ask him to trim up one edge accurately on a shearing machine. Reserve this edge then, which will require little or no filing up, for the vital pole. Whilst the two polepieces are still clamped together mark off and drill the two 8 B.A. clearance holes and, with a needle file, file them out slightly oval in the direction shown in fig. 4. This is to allow for fine adjustment over about $\frac{1}{32}$ in. when positioning the poles on the paxolin frame. Finally, rub them down on all surfaces with an abrasive paper, clean thoroughly

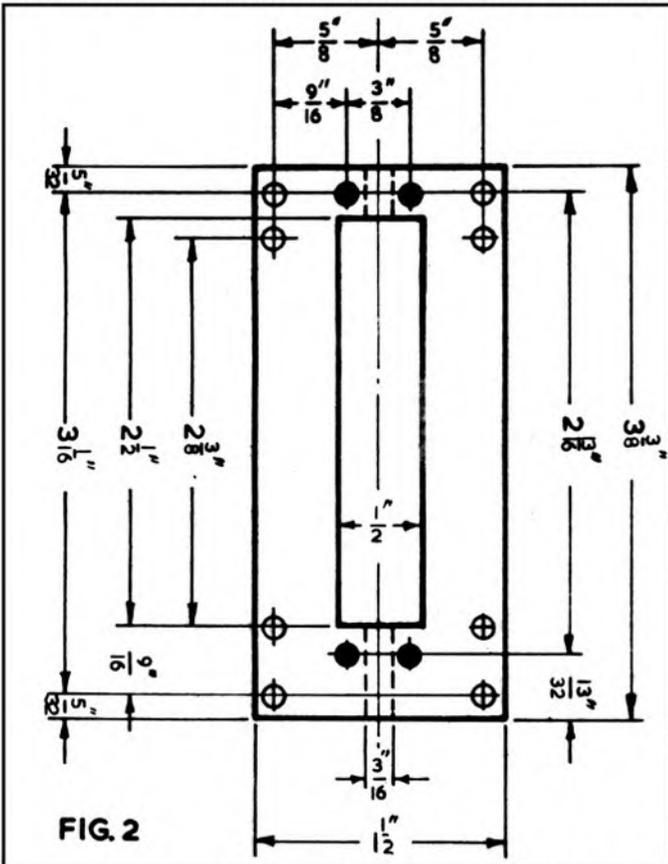


Fig. 2. The frame, $\frac{1}{8}$ Paxolin. Holes marked solid are 10 BA tapped. Holes in outline are 8 BA clearance

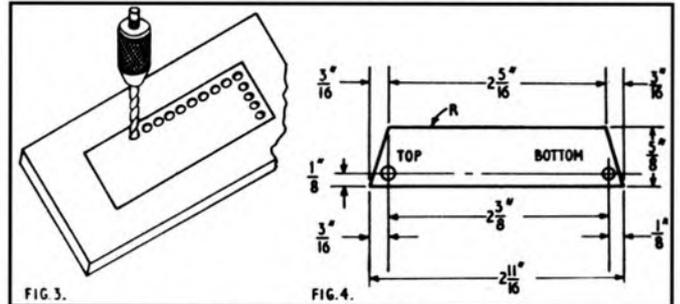
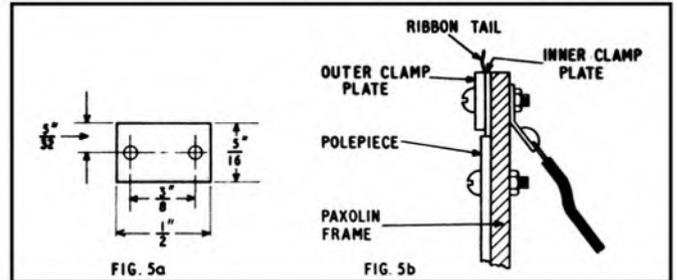


Fig. 3. A method of cutting out the central slot in the frame, using a drill
Fig. 4. Pole-piece dimensions. Note that the 8 BA clearance fixing holes are filed oval

Fig. 5a. Ribbon clamping plates. Make two at $\frac{1}{32}$ " thick and two at $\frac{1}{16}$ " thick. Holes are 10 BA clearance. Fig. 5b is an enlarged edge-on view of one end of frame showing part of poles, ribbon and ribbon clamp



and paint them with either cellulose or epoxy resin paint to prevent corrosion.

The ribbon

Making the ribbon is undoubtedly the most difficult part of the job, not only requiring great precision but a high standard of cleanliness not usual in a home workshop. It is advisable, therefore, to take certain precautions before starting. All filing and swarf from the previous work must be cleared away completely, and the bench top covered with a piece of clean card. This action is not only important at this stage but at any time later when the microphone is open and unprotected by its gauze. It should be clearly understood that, once made, the ribbon cannot be touched without damaging it, except at the extreme ends, otherwise it will be distorted and spoilt.

Ideally, the ribbon should be made of 0.0002 in. thick aluminium foil. If you remember that cigarette packet foil is roughly 0.001 in. thick the extreme fragility of the correct ribbon will be obvious. However, foil of 0.0002 in. thick is not readily available on the retail market and I had to do some searching before I found that the foil in the common waxed capacitor would do. It is rather thicker than the correct type, being about 0.0004 in. but nevertheless works quite well. The capacitors in the 0.001 microfarad range seem to be the most fruitful, though it may be necessary to open up a few before finding the right one.

Aids to Cutting

The capacitor case should be cleaned of its wax by allowing it to melt off on to a newspaper by a stove, and the cardboard stripped with a pair of pliers. Unwind the foil and paper core right out and separate the foil. Cut it into 4 in. lengths and drop them into a tin of degreaser (carbon tetrachloride is ideal). Leave them to soak for several hours to remove any oil or grease and then swill in a tin of clean degreaser. Dry immediately between blotting paper and store between the pages of a book until wanted.

The following items of equipment should now be prepared for the cutting operation. A small (6 in. square) sheet of glass, a hardwood

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block of about the same size and any handy thickness ($\frac{1}{4}$ in.), and a couple of new stainless steel razor blades.

Place one of the 4 in. lengths of foil on the glass and smooth it by gently rubbing it with the forefinger in one direction until all the creases have gone. If it curls up turn it over and repeat the smoothing. Transfer the foil to the hardwood block and lay over it a 6 in. steel rule near one edge as a guide. With the razor blade held at an angle of about 30 degrees to the horizontal, make a steady *continuous* cut from top to bottom of the foil along the rule. To ensure a perfect edge it is imperative that this cut is made in one sweep, and care should be taken to place the fingers holding down the steel rule in a position that will not interfere with the cut.

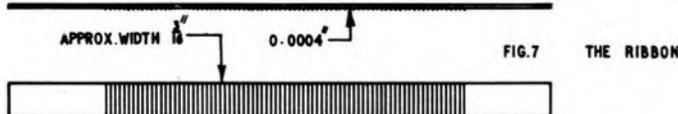
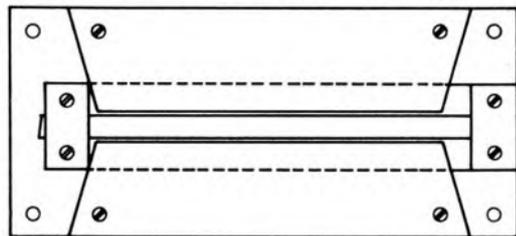
After making sure that a clean edge has been obtained, measure off $\frac{1}{16}$ in. from it and repeat the cutting operation using a *new* edge of the razor blade. If all has gone well a strip of foil 4 in. long by $\frac{1}{16}$ in. wide will result. If necessary the strip can again be smoothed on the glass at this stage, but with great care, so as not to distort or twist it.

The ribbon, which should now only be handled at its end with tweezers, must be carefully examined with an eyeglass before going any further to ensure that there are no tears, etc. I have noticed that some capacitors seem to be prone to pinholing, and this should be carefully watched out for.

The final job on the ribbon itself is to provide it with transverse ribbing to improve its stability (fig. 7). This can easily be done by very gently pressing it against a coarse comb. Ideally a grill of $\frac{1}{16}$ in. bars, spaced with about $\frac{1}{32}$ in. between them, should be used. If you have a cat which owns a steel comb, this will be found to be almost exactly to specification.

Place the ribbon on the comb at right angles to the teeth and put on top of it a piece of about $\frac{1}{8}$ in. foam plastic sheet, and a metal plate also about $\frac{1}{8}$ in. thick. None of these sizes are critical but are solely to ensure that the ribbon will be evenly ribbed along its length. The foam/plate combination should cover the ribbon for about $2\frac{1}{2}$ in. of its length and leave about $\frac{1}{2}$ in. at each end uncovered. Very gently apply a light pressure on the plate over its whole length. If this is done carefully the ribbon will take on a series of slight indentations across it and evenly impressed (See fig. 7). Here again, practice is essential, though failure far less final as the ribbon can be smoothed out on the glass plate

FIG. 6 POLES AND
RIBBON CLAMPS



The ribbon clamps

There are two of these ribbon clamps made of brass, one at each end of the frame. Each one is itself a pair, made up of an outer $\frac{1}{2}$ in. plate on top of an identical inner one of a thickness as near as possible half that of the thickness of the polepiece metal. Thus if the poles are made of $\frac{1}{2}$ in. steel, this underside piece of the clamp should be $\frac{1}{4}$ in. thick. The reason for this is that each end of the ribbon which is sandwiched between these two clamping plates must be held about the centre of the thickness of the pole pieces to ensure that they are in the area of maximum field strength. A reference to fig. 5(b) will show clearly how this idea is applied.

Mark off on one of the $\frac{1}{2}$ in. pieces of brass the clamp dimensions as shown in fig. 5(a) and the two 10 B.A. clearance holes. Hold all four roughly cut parts of the two clamps together in the vice and finish off the filing to size as shown on the marked off piece. Drill the 10 B.A. holes and clean up all edges with fine abrasive paper.

The polepieces and ribbon clamping plates can now be fitted for test to the paxolin frame as shown in fig. 6. At this stage the alignment and adjustment of the poles, using the oval 8 B.A. holes, should be checked and the ability to parallel up the two poles accurately noted. The gap between them should be $\frac{1}{4}$ in. adjustable to $\frac{1}{16}$ in. This can be checked by fitting a strip of tinfoil, $\frac{1}{16}$ in. wide in the central slot to act as a dummy ribbon.

TAPE RECORDER SERVICE

By H. W. HELLYER



Butoba MT5

One of my correspondents asked me recently why I "wasted my time" writing about the older decks, when there were such fine new machines as the later *Grundigs*, the automatic *Telefunken*, the *Sony*, the *Planet*. . . . After having used this space for eighteen months the reason for my concentration on earlier models should have been clear. If it is not, I must have failed in my object! Nothing would be simpler than to follow in the footsteps of the reviewers, describing specifications of these later decks and adding comment on construction. But what owner of, say, the latest *Clarke and Smith*, the *Revox E36*, the *Akai M6*, to name but a covetable few, is going to be tempted to delve into its innards just for the fun of checking my ham-fisted working drawings.

Surely not the new—yet!

There are two reasons for our choice of machines to discuss: **first**, any new tape recorder is presumably going to be serviced under guarantee, and manufacturers take a dim view of technical hacks who advise readers to lay about them indiscriminately with soldering iron and pliers. **Second**, the number of requests for information that come to the *Tape Recorder* office give a pretty fair indication which machines need detailed description. And, incidentally, those faults that are most prevalent.

So that's why I concentrate again this month on a machine that has been superseded by an improved design—quite radically different—and has now gone out of production. The **Butoba MT4** and **MT5** must be familiar to us all. They have been widely advertised, and are still in plentiful supply at quite reasonable prices. For the purpose of this article we shall refer to the **MT5**—differences were mainly in production modifications. So, first a few facts.

There are two motors, one for capstan drive and the other for fast

to increase), but if it is at its limit for the correct speed of tape travel, the two 100 mfd electrolytics *G* should be checked. These are tucked away under the deck-plate, between the base of the motor (by which I mean the end remote from the pulley) and the speed change lever. Since the production of the **MT5** a number of miniature electrolytics of similar capacity and rating (15 V DC) have come on the market, and replacing them is no trouble.

As a check on motor efficiency, it is convenient to measure current consumption, which should not exceed 125 mA, loaded. But even if it does, do not chase off in haste to order a new one—these motors are intended to operate on very light loading, and pinch pressure, head felt pressure and lefthand spool braking should be checked. When the motor is completely unloaded, the current should not exceed 50 mA. If it does, try tapping lightly against the motor case as it is running, with the blade of a screwdriver, to free the bearing. But go easy on the lubrication—oil

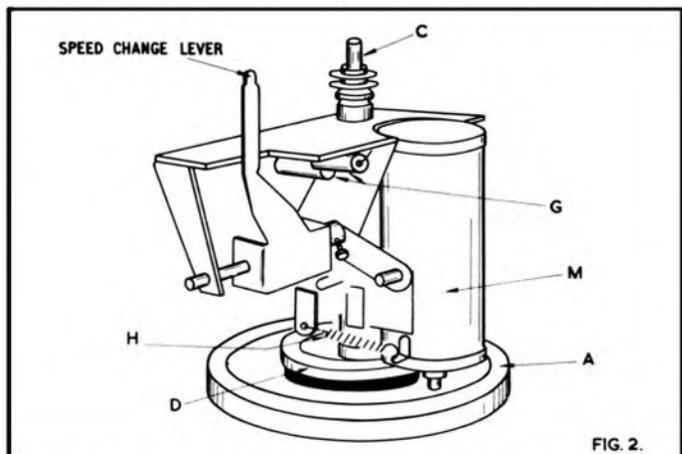


FIG. 2.

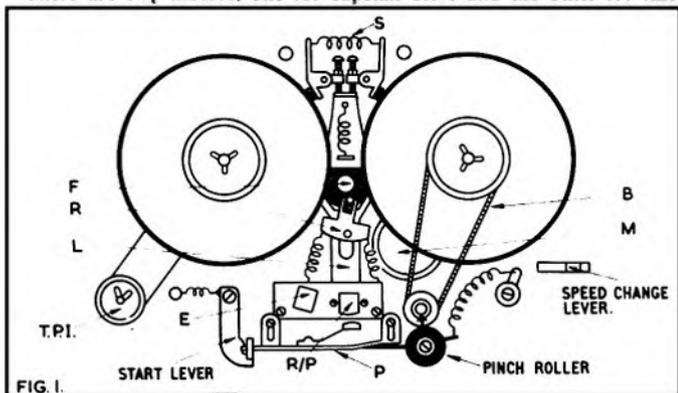
will run down to the pulley and onto the rubber of the flywheel.

Remember that the motor is sprung into position *H*, and has an "elbow" movement, so that it can become dislodged, especially if the machine has a bump! Check that the springs have not become unhooked, the lever bent and fouling the edge of its slot, or the stop-rail jammed.

The *Fast Wind* function is effected in the same way, by physical engagement of the motor *F*—also a 6 V unit, but with no regulator—with the appropriate spool carrier. Each of these has a large lower drum with a rubber rim, also used for braking. There is a rocker arm *R* with a cutaway engaging a spigot on the motor casing. This arm is directly impelled by the appropriate key, and a switch also energises the motor by the same action. There are two important springs to each arm of the rocker.

Beneath this rocker is another, larger lever *I*, which operates the brakes, sliding toward the operator when "On", allowing the swivel brackets with their common spring *S* to turn to the limit determined by the locknutted screws. Adjustment is straightforward, but do not overlook the auxiliary brake beneath the deck, consisting of an angle bracket and felt pad which supplies friction to the left-hand spool carrier during forward winding and play/record. This is adjustable by screw and small clamp, and care must be taken that too much friction is not applied—check with full and empty spool and during fast wind in both directions before locking the clamp.

The head assembly is fairly simple. Two-screw azimuth alignment is provided, and the pressure pads are mounted on the main roller bracket



winding. The take-up torque is provided by a thin spring belt *B* from the capstan to the clutch drum of the righthand spool. This spring is tensioned by its grip on a "cord reel" of aluminium which is pressed on the capstan shaft *C*. I shall probably get shot for saying so, but the remedy for reluctant take-up is either an increase in belt tension by careful shortening (not a simple job if you want to avoid annoying knocks) or a judicious attack on the aluminium with a penknife. This is, providing the flywheel itself is not slipping. The flywheel *A* has a rubber rim which is engaged by the appropriate step on the motor pulley for $3\frac{1}{2}$ or $1\frac{7}{8}$ i/s tape speeds. Note that this is not an outer rim, but a raised inner section *D*, and the motor lifts bodily to swing into place when the speed change is operated. As there is less pressure on the rubber at the lower speed, it is advisable, to prevent undue wear and resultant "wow", to leave the machine set on the $1\frac{7}{8}$ i/s speed when it is switched off.

Two motors

Both motors are 6-volt, but the drive motor *M* has a regulator consisting of a centrifugal switch and OC76 transistor, which allows constant speed over the voltage range 6.7 V to 4.9 V. There is a contact screw for this switch which provides a small range of speed adjustment (clockwise



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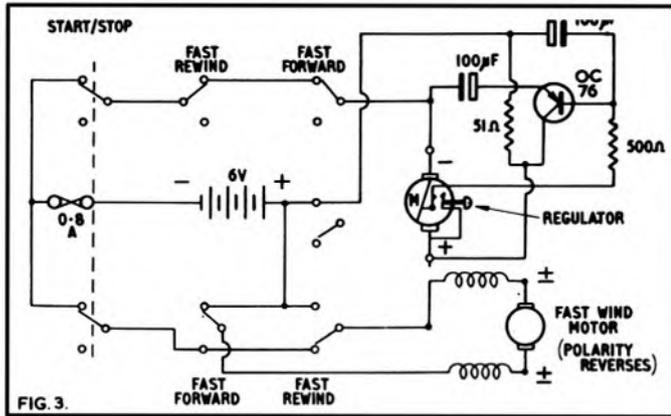


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P via a separate sprung lever. It is easiest to take this last item off to adjust head height, then set the screws of the mounting plate so that the tape is flush with the upper edge of the erase head. Allow no more than a 1 mm. overlap of head to tape. Then set the R/P head height individually, replace the pad arm and play through a test tape for maximum output, making final adjustments.

Electrical tests are rather difficult without recourse to a valve voltmeter. And life is made easier with a signal tracer, which need not be a complicated instrument—Mr. Bartlett Still could probably knock us up one between meals. For the benefit of those who have suitable facilities, here are some typical figures:

Oscillator check; measure 6 v a.c. across erase head, see that magic eye lights up, if not, check filaments, (0.8 1.1 V), and DC voltage at collectors of the two OC74 transistors. These should be equal, about 6 v, and a low reading may indicate a circuit fault, provided the playback is in order. If both record and playback are faulty and the magic eye does not light up, change the OC74s. These should be matched, but a 25 K variable resistor allows balancing, for correct oscillation during record, while another 25 K preset taps off the correct voltage to the centre-tap of the driver transformer secondary. An easy check of the amplifier is its overall current. At 6 V working, without input, during playback, there should be about 50 mA drawn. If this is in order, and the voltages of the two output transistors match, it will be necessary to check the transformer windings.

If our problem is distortion, there are one or two adjustments that can be made before taking an axe to the printed panel—"doing a Lizzie", in the trade parlance. Check the biasing voltage, which should be between 12 and 15 volts a.c. (incidentally, the bias and erase frequency is as low as 30 Kc/s). There is a 10 K preset to regulate this bias level, taken from a tap on the oscillator transformer via a 0.022 mfd capacitor. If the erase circuit is in order but recording is distorted, and this voltage low, replace the last item. These parts are situated on the small printed panel. The large panel contains the 4-stage amplifier.

If signal tracing is to be carried out, it is most likely necessary on Record. For Playback tracing, simple noise reproduction—the old screwdriver approach—is sufficient until the source of loss is established—from then on it is a matter of distortion tracing. The head should deliver between 150 and 250 microvolts at 1 Kc/s from a test tape (fully modulated). To revert to Record, take the amplifier on the larger panel as a complete unit and apply 150 250 microvolts at 1 Kc/s to the OC603 base. Disconnect the erase oscillator to avoid spurious responses, and to enable tracing all the way through to the head: unsolder the two blue terminals on the erase coil. It should then be possible to read a full 3 V at the OC76 output.

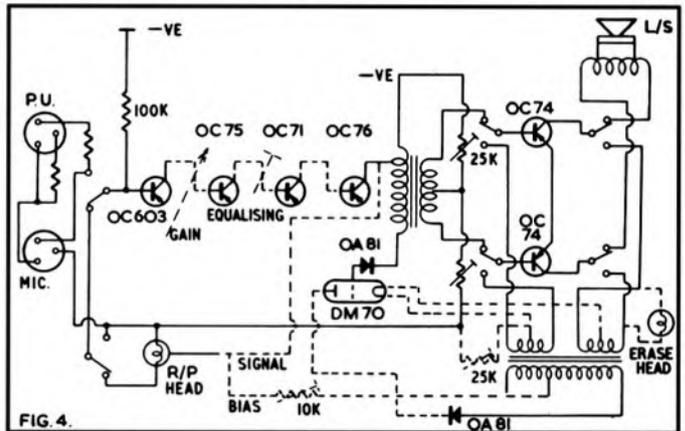
Noisy reproduction is another bugbear especially if a machine has been standing for a long while. I would emphasise that this is very rarely caused by transistors themselves. More often, it is a change in operating conditions beyond the limits stipulated by the manufacturers, or quite different component failure. If I seem vehement, it is because of the strong rubbish talked by many people about transistorised radios—when, quite often, the circuits which the transistor manufacturers designed so carefully have been pared by the receiver manufacturers to save costs or to speed production.

At the risk of a hollow laugh from some unfortunate owners, I would aver that this rarely happens with tape recorder design, so if there is

noise, there must be a reason, and *ipso facto*, the transistors are the last parts we need to check.

On this machine, there is the possibility of a dried-out coupling capacitor—these components are happier with regular use. Hum or motor-boating may be the result of one or more of the 100 mfd electrolytics failing—but this is an obvious fault, common to all stages, more noticeable as one traces along the chain. The sort of noise that sounds like atmospheric hash is more likely to be caused by a current carrying resistor. As might be expected, this kind of fault is more noticeable in early stages, for the thermal noise produced is amplified along the chain. The higher the ohmic value, the more pronounced the effect. In the machine we are discussing, there is one resistor, a 100,000 ohm from the decoupled negative line to the base of the OC603, which is prime suspect, and should be replaced with a high stability component. It is usually situated at the left upper side of the board, right beneath the OC603.

Before closing—a word of warning about component replacement. There is a temptation to be niggardly, to bend connecting wires and keep components for further use. Do not succumb: better to clip off the



component and let the tail end of the connecting wire drop off with the minimum of applied heat, then to bend the wires of the new component exactly to length, avoiding too sharp an angle where a wire enters the body, clean the wires and the print, leaving insertion holes clear, fit the component to its flush position, solder with as brief an application of heat as is compatible with a good joint, finally cutting the excess tails from the print side.

Wasted words? I do not think so, for, like the advice to use a heat shunt, gripping the wire between iron and component with a pair of pliers, or even a crocodile clip, it is too often honoured in the breach. And if you change the resistor we have been talking about *without* providing a heat shunt for the transistor that shares its anchoring, you may well cure your noise trouble by getting no signal at all!

Index to Volume 4 of THE TAPE RECORDER
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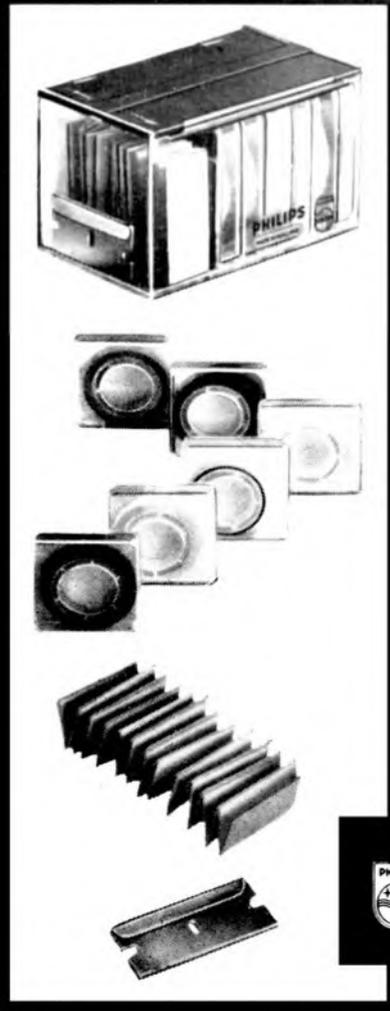
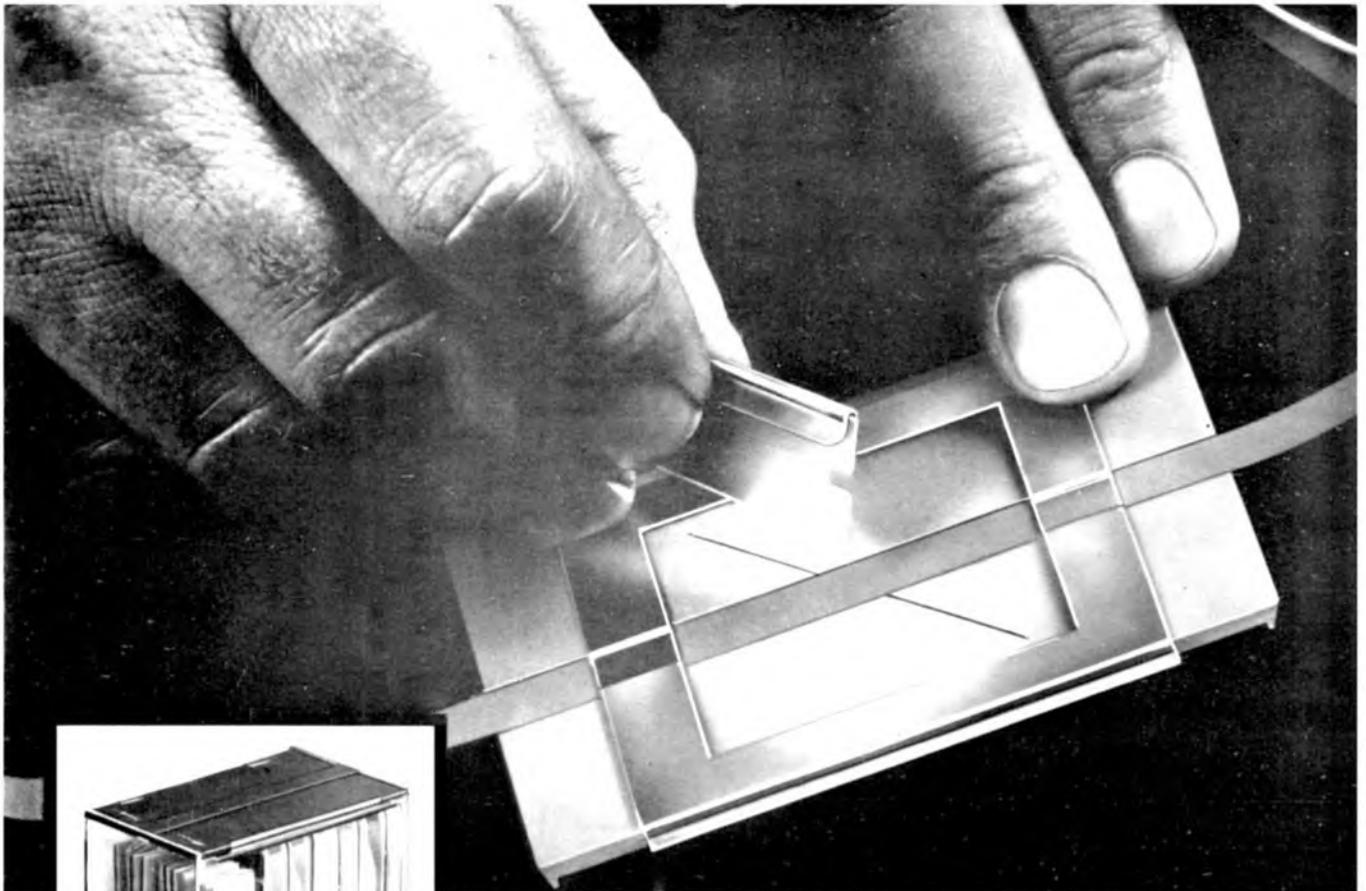
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TAPE EDITING EQUIPMENT

★Elementary tape editing is a job that anyone can do with a little patience and inexpensive equipment. It consists of cutting out unwanted lengths of tape – from maybe $\frac{1}{4}$ inch to several feet – and joining the ends together. The professional uses the very simple items shown below: the amateur can buy splicers that do most of the tricky work for him. In the following four pages we give pictures and details of a wide range of available equipment. Tape editing opens up a new field for every tape recorder user. For those who want to know more about it, we recommend the booklet "How to Splice Tape", published by this house. For details see page 252.

THE owner of a tape recorder who does not edit his own tapes is not taking advantage of a most fascinating hobby which can be enjoyed at little cost and which can be the means of effecting economies in expenditure on tape. A tape splicer is an invaluable tool for anyone who undertakes recording.

It is hardly necessary to mention that one advantage of recording tape over cinematograph film is that the unwanted portions of tape can be jointed together and used again. The other equipment therefore required is either a clean basket or box in which the excised pieces of tape can be dropped and then jointed together later. As the signal to noise ratio varies with different brands of tape, it is as well to keep the different types in separate boxes.

Those unwanted words

There are numerous broadcast programmes which the tape recording enthusiast will wish to record, many of them will be musical programmes incorporating spoken commentaries or introductory remarks about the items being played. Whilst one may wish to hear the music many times the spoken words become monotonous, and use of a tape splicer could remove them without difficulty. The recording enthusiast who undertakes the job conscientiously will gain a sense of achievement when he has completed his work. An excellent example of the kind of programme I have in mind is the many broadcasts of musical shows either covering a certain period or associated with a specific theatre.

Other owners of tape recorders whose musical tastes are for popular records may wish to build up a tape of popular songs and dance music, and by cutting out the introductory announcements tapes can be made which are eminently suitable for dancing or listening. In fact until one possesses a tape splicer one cannot appreciate how useful this device can be in producing tapes to form a permanent or semi-

permanent library. Recording tapes that have been properly jointed will last indefinitely and give as good service as tapes that have not been jointed. At the many national radio shows loops of tapes in which 20 joints have been made have run continuously through a recorder for the duration of the exhibition, which has been equivalent to more than 100 hours' playing time. This far exceeds the time any owner of a tape is likely to play one section of it.

Use one track only

It is, of course, impossible to edit tapes which contain more than one track of recording, the economical user will therefore, edit one track and then use the other track or tracks on the tape for recording continuous programmes of music which he knows will not require editing.

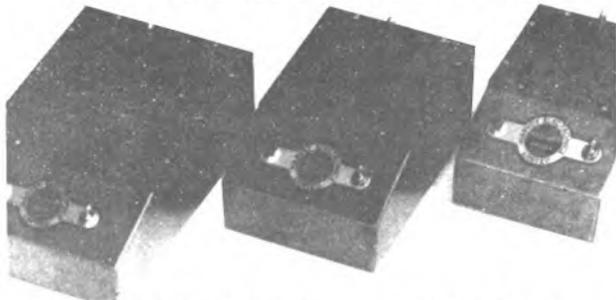
It is of course, possible to make "trick" tapes with the assistance of a tape splicer. Recordings from the radio, those made on location and in the home from a microphone can be edited and jointed to produce most amusing finished recordings. If the tape recording enthusiast is using his machine for recording performances of local operatic societies judicious editing of tapes can remove extraneous sounds and even replace faulty notes by ones played or sung on a different part of the recording or at another performance. It may not be generally realised that the high standard achieved by commercial gramophone records would be very difficult to obtain without being able to splice tapes. Some of the master tapes from which the disc records are made contain hundreds of splices.

Real tape splicing enthusiasts who wish to prove how accurately and efficiently they can undertake their art can amuse themselves by recording a friend giving a speech and then cutting the length of the speech by at least 20 per cent, whilst still retaining all the words.



● These five items are the basis for professional editing. Jointing tape, cutter, block, "Chinagraph" and chalk

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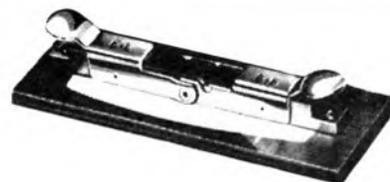
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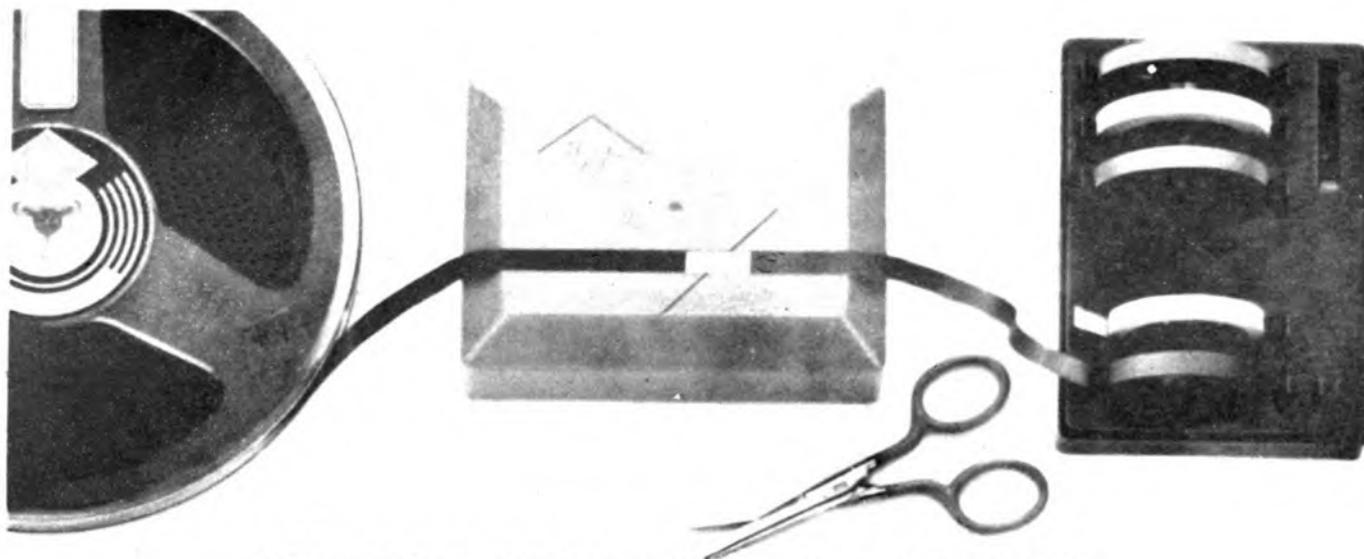
The Bib tape splicer saves tape and makes editing a fascinating hobby.

More Bib splicers have been sold in recent years than any other make. It is incorporated in the "Scotch" Tape Accessory Kit and is used by recording studios and broadcasting organisations.

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CHMS 13



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CUTTING & SPLICING TOOLS



On this and the following three pages we illustrate and give brief details of some twenty useful products for tape editing. On this page are four currently popular models of tape splicers. Top left is the "Bond", a self-contained automatic tool, with tape retaining clamps and cutting blades for a 45-degree cut, and for trimming the edges after the jointing tape has been applied. Price 29 6. **Cine Accessories (Brighton) Ltd., 15 Bond Street, Brighton, Sussex, England.** Top right, the "Sound" splicer, CM6, with replaceable blade and tape guide. Price 32 6.

Tape Recorders (Electronic) Ltd., 784 788 High Road, Tottenham, London N.17. Bottom left, the "Metro" splicer for tape or 8-mm film has spring-loaded clamps and a non-magnetic cutter adjustable for any angle. Price 15/-. **Metro-Sound Manufacturing Co. Ltd., 19a Buckingham Road, London N.1.** Bottom right, the "Irish" splicer SP3, with spring-loaded tape clamps, stainless steel blade for a 45-degree cut and further blades which trim the tape after splicing. Replaceable pads and blades. Price 67 3. **A. C. Farnell, Ltd., Vicar Lane, Leeds 2, England.**

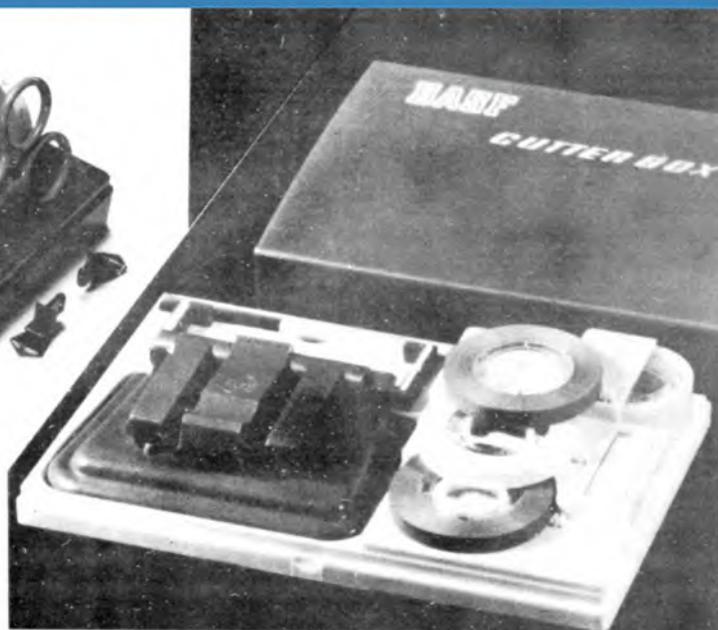
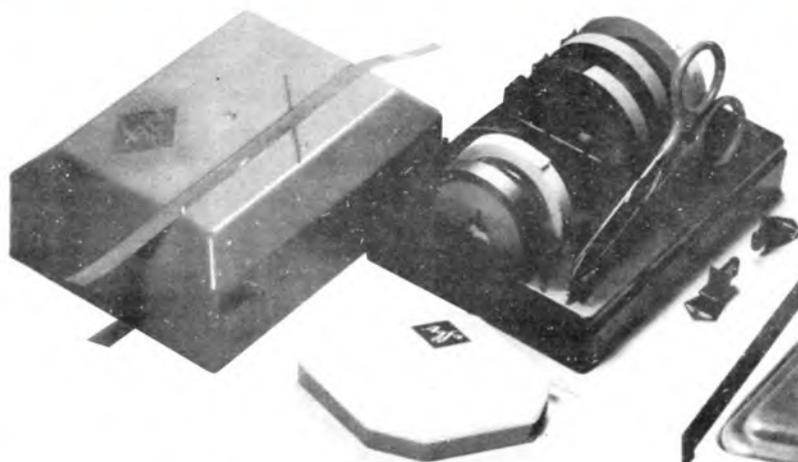
TAPE EDITING EQUIPMENT



There are six tape editing kits on the English market. Above, top left is the "Scotch" Accessory Kit which incorporates the famous "Bib" patent splicer, a reel of $\frac{1}{2}$ -inch splicing tape, reels of marked timing tape and white leader, 10 fastening clips and a cutting blade. Price 29/6. Minnesota Mining and Manufacturing Co., 3M House, Wigmore Street, London W.1. Right, the Emitape Accessory Kit, comprising reels of stop foil, splicing tape and green, red and white leader tapes, two cutting blades and Emitape jointing block with two cutting slots for 90- or 45-degree cuts. The whole

is contained in a plastic rack with spaces for two extra spool holders. Price 37/6. E.M.I. Tape Ltd., Blyth Road, Hayes, Middlesex, England. Bottom left, Emitape non-magnetic scissors, Price 16/-. Bottom right, the Philips E.L. 1901/50 Splicing Kit, in its transparent plastic container. The lid embodies a splicing jig with clamp and channel for 45-degree cuts. Four reels of leader, one of stop foil, one of splicing tape, a cutting blade and indexing labels are included. Price 23/-. Philips Electrical Ltd., Century House, Shaftesbury Avenue, London W.C.2.

CUTTING & SPLICING TOOLS



Above, top right, the *Agfa tape Accessory Kit* in plastic case containing red, green and white leader, splicing tape, stop foil, non-magnetic scissors and tape clips. Moulded into the case top is a splicing template with 45-degree slot. Price 34/6. **Agfa Ltd., 27 Regent Street, London S.W.1.** Top right, the *BASF "Cutter Box"*, incorporating a splicer, spare cutting knife, four tape clips, three spools of leader tapes, stop foils and tape indexing labels. Price 52/6. **BASF Chemicals Ltd., 5a Gillespie Road, London N.5.** Bottom centre, the "daddy" of all splicers, the "*Bib*" with 90- and 45-degree

slots (Price 18/6) and, to its left, the "*Bib*" *Accessory Kit*, which includes a "*Bib*" splicer, tape reel labels, splicing tape, four blades, and a data card of playing time for all speeds. Price 28/6. **Multicore Solders Ltd., Hemel Hempstead, Hertfordshire, England.** Bottom right, two types of *Emitape* Jointing Compound, AP35 for acetate base and AP77 for PVC base tapes. These are for making permanent moulded joints without the use of splicing tape. Price 7/6 per bottle. Address ----- **E.M.I. Tape Ltd., Blyth Road, Hayes, Middlesex, England.**



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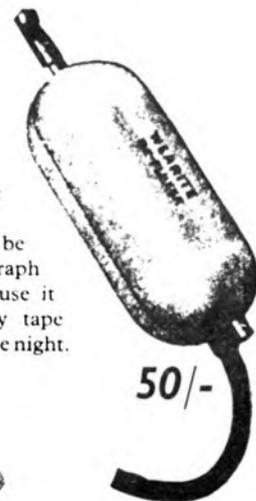
'IRISH', 'FERROSHEEN' and 'Signature Binding' are registered trade marks of Orradio Industries Inc., Opelika, Alabama.

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The recording head of any Tape Recorder tends to become magnetised in use. Small at first but gradually building up, this residual magnetism can seriously affect the quality of your recordings by progressively increasing the hiss level. It can also impart a noisy background—which can never be removed—to any pre-recorded Tape at the first time of playing.

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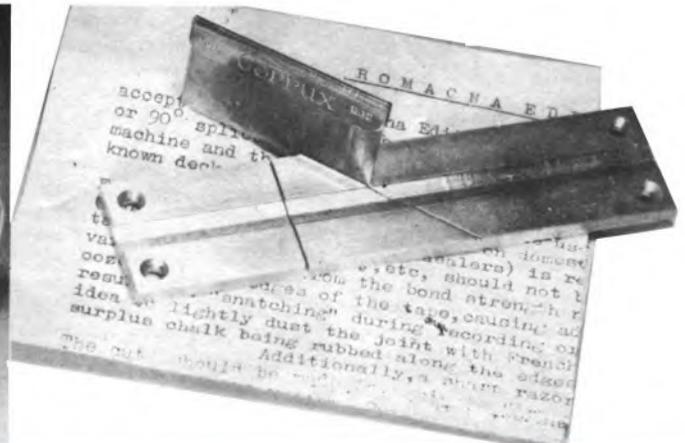
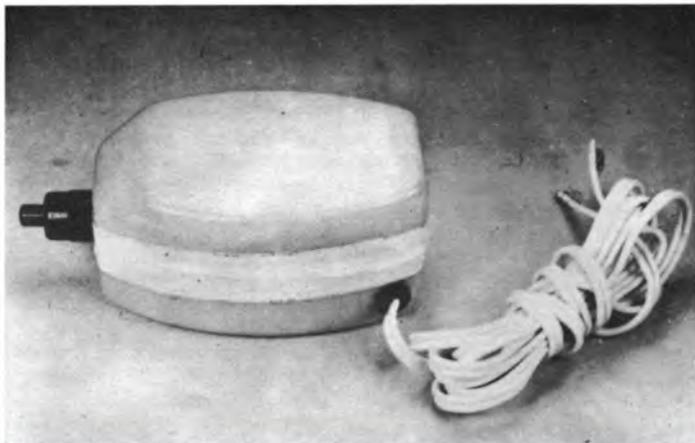
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TAPE EDITING EQUIPMENT



Bulk erasure and "spot" erasing of tapes are part of editing. Top left, the *Harvey bulk eraser*. Different models handle spools from 3½ to 12 inches. Prices from £6 5s. to £15 10s. **Harvey Electronics Ltd., 273 Farnborough Road, Farnborough, Hampshire, England.** Top right, a small splicer in two simple parts, the "*Gibson Girl*". Price 18s. 3d. **A. C. Farnell Ltd.** (address on page 239). Centre left, the *Wearite Defluxer*, primarily for demagnetising tape heads, also useful for "spot" erasing. Price 50s. **Wright and Weaire Ltd., 84 Blackfriars Road, London S.E.1.** Centre, *Indicord*,

a fluid which makes recordings visible for editing. Supplier not known. Send postcard for details. A similar tool (not shown) is the *Cinesmith Depolariser*. Price 45s. **Cinesmith Products Ltd., Britannic Works, Regent Street, Barnsley, Yorkshire, England.** Bottom right, a small bulk eraser, the "*Instant*", handles spools from 3½ to 7-inch diameter. Price 35s. **Osmabet Ltd., 46 Kenilworth Road, Edgware, Middlesex, England.** Bottom right, the *Romagna* editing block, with 45- and 90-degree cutting slots. Price 7s. 6d. **Romagna Reproducers Ltd., Bycullah Avenue, Enfield, Middlesex,**

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The London sequence begins with him leaving Calais by boat and shows his journey, condensed of course, and his arrival in town. He goes to his hotel and then leaves to ride on a London bus to see some well-known spots. He stops off to see the changing of the Guard at Buckingham Palace. From there he sets off to Putney to visit a school where a choir is performing. The rest of the day includes visits to the Tommy Steele show for a performance, the Lyceum Ballroom to see some dancing championships and to the *Pigalle* and *Gargoyle* clubs in Piccadilly and Soho for some light, late evening entertainment.

The Changing of the Guard

Although the film lasts for only one hour on the television screen the crew were hard pressed to get everything in during the three weeks of their stay here and the changing of the Guard had to be fitted in on a Saturday morning. Fine weather brought people early and in large numbers. The three 35 mm Arriflex cameras and their crews had to be in position for more than an hour before the start of the ceremony and, as the crowd density and heavy traffic prevented the use of long leads, the Nagra recording equipment had to be set up close to the main camera position. The first Arriflex was mounted high on the steps of the Queen Victoria Memorial facing the main gate of the Palace to deal with the approach of the soldiers, panning with them as they marched round to the right-hand gate and to film them again as they marched away through the main gate at the end of the changing over.

The second Arriflex was set up on the pavement, left of the main gate and the third, occupying the main camera position together with the Nagra in synchronisation, was between the main and right-hand gates. As both these cameras had to shoot through the railings into the Palace forecourt and also to be able to pan away to provide cutaways for camera number one their positions had to be carefully chosen. No fewer than two were in use at any one time and the material covered gave plenty of scope to the Editor back in Munich.

Radio links for camera operators

The German Director was with the third camera but he was able to communicate with the other crews by use of a *Sony Transceiver*. There were six of these instruments in use. The German continuity girl was stationed on the steps but she was quite able to follow all camera directions over her Sony and to note down exactly which camera covered which shots. The Sony, by the way, is just a little larger than a pocket transistor radio, it is extremely economical on batteries and it has a range of about two miles.

Location Film Services

The Sonys, and indeed all equipment and production facilities for the German Television teams on the film series, are supplied by Location Film Services Limited of Goldhawk Studios, London, W.12 who are, themselves a very well known film production company in their own

right. The list of feature films for which they have full credit is impressive and includes such spectaculars as *Solomon and Sheba*, *Exodus* and *The King of Kings* and top box office home products such as *Taste of Honey* and *The Loneliness of a Long Distance Runner*.

The range of equipment carried by the company is most extensive. The Sound Department, headed by John Hales, can supply no fewer than eleven different types of recording unit, seven different types of microphone and four completely different types of radio transmitter-receiver. The afternoon that I was at the studios I was told that seven complete recording units were out on location at that very moment, working for Television and Documentary companies, and that this was in addition to equipment in use for their own films in Ireland (*Once Upon A Summer*), Malaya (*The Third Road*, starring William Holden) and Africa (*The Zulu*).

The Nagra.

The newest additions to the Sound side are three Nagra HiP recorders and John Hales is so pleased with their performance that he is inclined to use them in front of the *Perfectone*. Like the *Perfectone*, the Nagra HiP is a Swiss machine designed for recording in synchronisation with a film camera. It is transistorised and completely portable, weighing only 15 lb. It has a frequency response of 15,000 c/s ± 1 dB at 15 i/s; 30-12,000 c/s ± 1.5 dB at 7½ i/s; and 50-7,000 c/s ± 3 dB at 3¼ i/s. It runs on 12 x 1.5 volt torch batteries for a life of about 20 hours. On alkaline accumulators it has a life of about 70 hours.

It differs from the normal Nagra recorder (a high quality professional portable) by virtue of its *Neopilot* head and some additional electronic circuits. The *Neopilot* head is in addition to the audio heads on the tape recorder but it is positioned to face the tape in such a way that the recording of a pilot signal from the power frequency that it makes will not interfere with the programme material. When the camera is driven by a synchronous motor supplied by the mains, or by a very stable converter, the pilot signal (1 volt at low impedance, less than 10 ohms) is taken



Westrex 1135 recorders on location for the film Exodus

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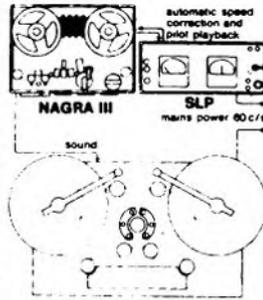
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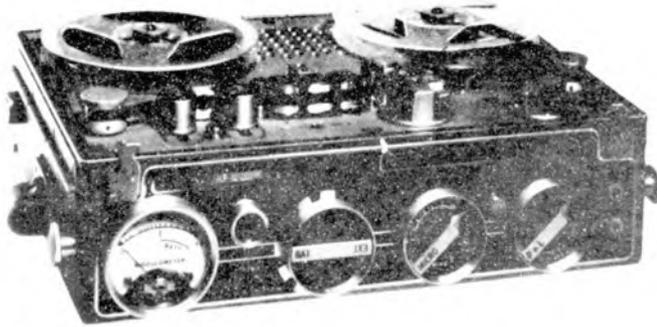


Layout showing the SLP connected to the Nagra III P

SOUND AND CINE — continued

I watched the Location Sound engineers transfer the German recordings from the Nagra via a *Westrex* dubber to 17.5 mm fully coated sprocketed filmstock and not once did they have to go over to manual control. I was told that they have never had to on any of their previous recordings either. This 17.5 mm copy, plus another copy on $\frac{1}{4}$ inch tape, were to be sent to Munich with all picture takes and complete continuity notes for a German commentary to be added to the edited film.

As I left the Location Sound Services studios plans were being made to ship off the three *Arris*, the *Nagra* recording equipment and all the German technicians plus one British Maintenance engineer, to Athens for the next stage in the tour of European Capitals. After this they will have a three weeks break back in Munich and then they will be off again.



The Nagra III P recorder

directly from the Nagra's regular power (it is desirable, here, that the converter will produce the 50 cycles at a $\pm 1\%$ tolerance).

The synchronous motor, however, has the disadvantage that it is heavy and the necessary accumulators and rotary converter are also heavy and awkward to carry. It is more convenient to use a motor which works directly from batteries, in which case it is possible to incorporate in the camera a *Piloton* generator which will produce the necessary signal. When the camera turns at exactly 24 frames per second (25 for TV) the generator will produce exactly a 50 cycles signal. This pilot signal is then tied to the speed of the camera and everything works as though the camera were driven by a synchronous motor powered by a rotary converter. It has been possible for some time to secure delivery of *Arriflex* cameras equipped with a *Piloton* generator and it is now also possible to obtain such generators for many other camera makes. The important point is that the motor should turn at a constant speed. There are many motors with centrifugal speed stabilisation which are nearly satisfactory but an electronic stabilisation system is preferable.

The Transfer

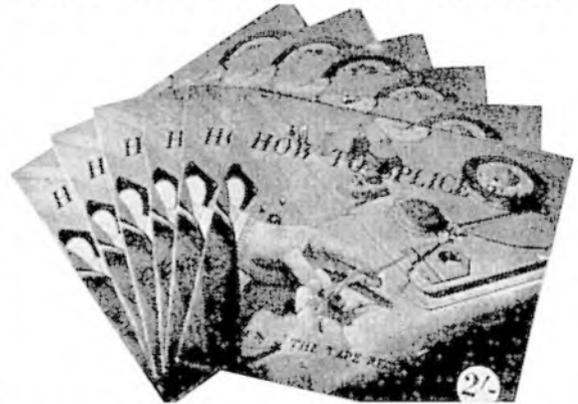
When the recording has been made the transfer to perforated film or tape should be effected with the Nagra SLP synchroniser. This is a smaller instrument which is connected to the pilot signal input of the Nagra III P after the SLP has been set to the mains tension. Its function is to modify the playback speed according to the phase difference.

Constant Speed device

Once the playback is begun the SLP will react. A click is heard and the left-hand meter on the SLP will show the tension of the pilot signal which should normally read between 20 and 100 micro-volts. The right-hand meter will oscillate faster or slower according to the phase difference between the mains and the pilot signal. One oscillation back and forth per second will correspond to a phase difference of 2% but this is an extreme example. By setting the SLP selector to Automatic Speed Control, the SLP will start to modify the speed of the Nagra recorder. If the needle does not move this means that there is no error and therefore no speed correction is taking place. Movement of the needle to the right means that the Nagra III P is being slowed down, movement to the left, accelerated. If the needle moves to the right or left and then jumps back to the centre in a sudden jerk, it means that the phase difference is larger than 1.5% tolerance and that the Nagra should be controlled manually.



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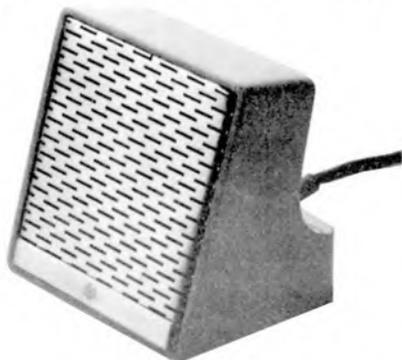


TAPE, RECORDERS & ACCESSORIES

FIRST DETAILS OF NEW PRODUCTS

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

Standard Telephones and Cables Ltd. announced two new microphones in the medium price range at the 1963 Audio Festival. They are the Type 4113, a ribbon cardioid, and the Type 4114 moving coil microphones. The first of these is a uni-directional microphone with an impedance of 30 ohms. The directional discrimination is 50-20 dB. It weighs only 10½ oz. and measures 2½ × 1½ × 2 in. The price is £11. 11s.



The 4114 is an omni-directional microphone which has been designed for sound reinforcement and announcing systems, tape recorders and transistor amplifiers. The nominal impedance is 200 ohms which is suitable for feeding transistor input stages without the use of an input transformer. The response is claimed to be 100-8,000 c/s. A threaded insert in the base of the microphones enables it to be fitted to a standard camera tripod stand. The price is £3. 13s. 6d. **Manufacturers Standard Telephones and Cables Ltd., Connaught House, 63, Aldwych, London, W.C.2.**

A new four-track, two speed tape recorder has been introduced by **Stella Radio and Television Co. Ltd.** The Model ST.458 has a sloping fascia panel at the front of the machine which houses the speaker and all but two of the controls. The exceptions are the speed selector switch, which is placed at the top of the deck layout between the reels and the track selector switch. On the control panel are push button controls for record, play, pause, fast wind, stop and fast rewind, together with controls for microphone, tone, pickup/radio and playback volume. Fitted at the top of the panel is a four position digital programme indicator, with a press button zero reset. Recording levels can be checked with a magic ribbon type indicator.



★
A STELLA
4-TRACK
MONO
RECORDER

★
The machine is supplied with a five inch spool of long play tape, but the deck has been designed to take seven inch reels. By using an additional pre-amplifier, together with an amplifier and loudspeaker pre-recorded

stereo tapes (3½ i/s) can be played. A parallel playback facility enables simultaneous replay of tracks one and three or two and four.

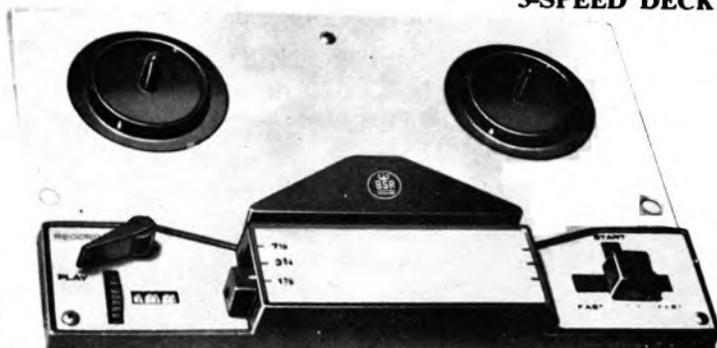
Quoting from the specification received, the frequency response figures claimed are 60-13,000 c/s at 3½ i/s and 60-10,000 c/s at 1½ i/s. Both ±3 dB. Wow and Flutter is less than 0.6% peak to peak, and the signal to noise ratio; better than 40 dB. A 6½ in. diameter speaker is fitted to take the 2½ watts output. The weight of the ST.458 is 18 lb., dimensions 14½ × 14½ × 7½ in. The price is £40. 19s. **Manufacturers Stella Radio and Television Ltd., Astra House, 121/3 Shaftesbury Avenue, London, W.C.2.**

* * * * *
The Uher Royal Stereo is a four track, four speed, fully transistorised recorder that takes 7 inch spools and weighs only 20 lb. Simple adjustments make eleven different operations possible without the use of extra accessories. These include stereo recording and playback, transfer of recordings from one track to another, automatic slide projector synchronisation, and echo.



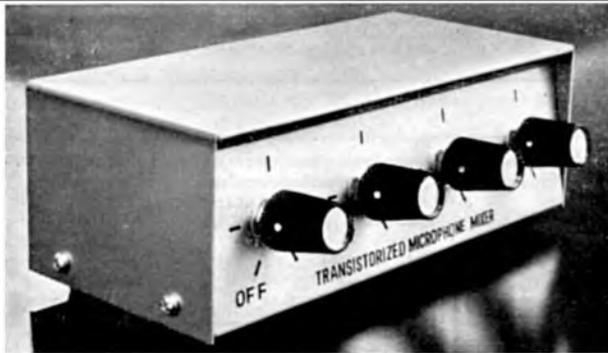
The specification supplied gives the following frequency response figures 50:20,000 c/s, 7½ i/s: 50-16,000 c/s, 3½ i/s: 50-8,000 c/s, 1½ i/s: 50-4,000 c/s, ½ i/s. Wow and flutter figures are claimed to be 0.15% at 7½ i/s. The power output is 2 watts per channel. Dimensions of the Royal Stereo are 15 × 14 × 7 in. Price £141. 15s. **Distributors are Bosch Ltd., 205 Great Portland Street, London, W.1.**

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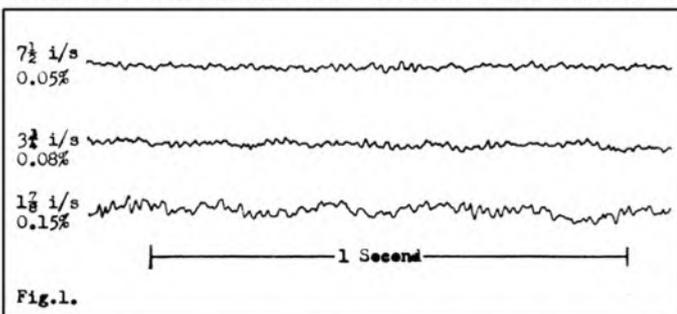
EQUIPMENT REVIEWED

TRUVOX MODEL R82 RECORDER



Manufacturer's Specification. Reel size: maximum diameter usable 7". **Tape speeds:** 1 $\frac{1}{2}$, 3 $\frac{3}{4}$ and 7 $\frac{1}{2}$ i/s. **Motors:** 1 capstan drive, 2 wind motors. **Speed variation:** less than 1% at either tape speed. **Wow and flutter:** maximum total content: 0.15% at 7 $\frac{1}{2}$ i/s, 0.2% at 3 $\frac{3}{4}$ i/s and 0.3% at 1 $\frac{1}{2}$ i/s. **Brakes:** mechanical. **Counter:** digital. **Recording sense:** British and American two track. **Record heads:** high impedance, gap length 0.00014". **Erase heads:** low impedance. **Valve line up:** EF86, ECC81, ECC82, ECL86, EM87, OA81, B250-C75. **Output power:** 4 watts. **Frequency response:** 7 $\frac{1}{2}$ i/s, 30-20,000 c/s, 3 $\frac{3}{4}$ i/s, 30-12,000 c/s, 1 $\frac{1}{2}$ i/s, 30-8,000 c/s all plus or minus 3 dB. **Inputs:** Microphone, 1 millivolt at 2 meg. Radio gram, 150 millivolts at 500 K. **Outputs:** high impedance line 1.0 v at 47 K, low impedance 3 and 15 ohms at 4 watts. **Power consumption:** 80 watts. **Weight:** 35 lbs including tape and microphone. **Size:** 16 $\frac{1}{2}$ " by 15 $\frac{1}{2}$ " by 10" including lid. **Price:** £57 15s. Manufactured by Truvox Ltd., Neasden Lane, London, N.W.10.

THIS recorder uses the new Type 80 deck which is built on a heavy die cast plate, with a *Papst* external rotor hysteresis capstan drive motor, and separate spooling motors for each reel. It features such refinements as micro-switches for all mains and motor switching to prevent the common trouble of arcing at the switch contacts, and a spring loaded *Record-Play* switch which returns to the *Play* position whenever the *Stop* key is pressed. Mechanical design is slightly on



the heavy side and this is reflected in the feel of the control keys which are wide enough to take three fingers or a thumb, either of which must be used for positive operation of the controls. Despite this, I would rate this amongst the top three British decks available at the present time.

Wow and Flutter

The fluttergrams of fig. 1 show that the short term speed fluctuations are extremely low with R.M.S. readings of 0.05%, 0.08% and 0.15% at the three tape speeds of 7 $\frac{1}{2}$, 3 $\frac{3}{4}$ and 1 $\frac{1}{2}$ i/s. There was little evidence of cumulative build-up between record and playback wow or flutter, and this indicates that all rotating parts are running true to very fine limits.

"Play only" Responses

The playback equalisation was checked by playing *C.C.I.R.* test tapes, recorded to surface induction characteristics of 100, 200 and 400 microseconds time constant at 7 $\frac{1}{2}$, 3 $\frac{3}{4}$ and 1 $\frac{1}{2}$ i/s, to give the curves

of fig. 2. The signal was measured at the high impedance line output with a low capacity valve voltmeter. The slight dip in response, which moves down in frequency as the tape speed is reduced, is characteristic of the *Miniflux* short pole face heads used in this machine (see previous reviews and my article in the April, 62 issue).

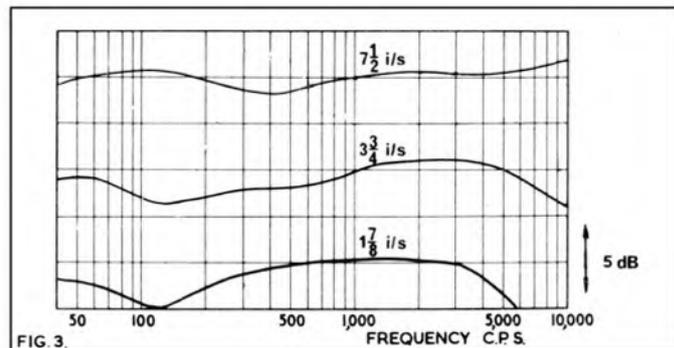
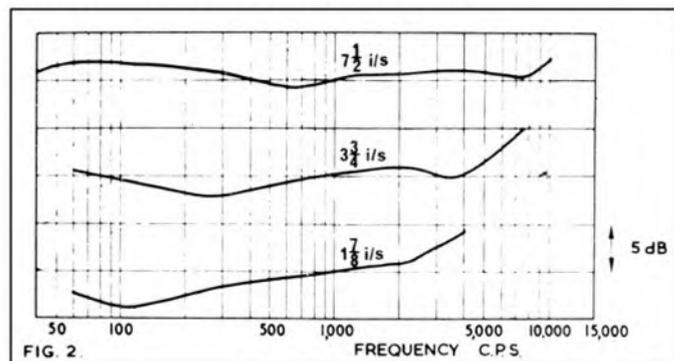
Noise and hum with no tape passing over the heads was 36 dB below test tape level or 48 dB below peak recording level with optimum recording conditions.

Record-play Responses

Recording tests at 500 c/s showed that waveform distortion was negligible at a level 12 dB above that of the test tape and that the level could be raised to 13 dB, where the indicator beams just met, before tape overload became evident. This shows that the bias is optimum for maximum output and lowest distortion.

Frequency runs were made at the three tape speeds to give the responses shown in fig. 3. These are sensibly the same as the test tape responses, except for a high frequency roll off at the two lower speeds. This indicates that the recording characteristic is close to the *C.C.I.R.* standards of 100, 200 and 400 microseconds, and that the bias has been properly set for the highest tape speed of 7 $\frac{1}{2}$ i/s. The response is still satisfactory at 3 $\frac{3}{4}$ i/s, but the bias would have to be reduced at the lowest speed to meet the specified 8 kc/s high frequency limit of

3 dB/s. Such a change in bias would increase the distortion at the higher speeds. (Why has no designer switched the bias to suit the tape speed and so get the best of both worlds?)



Signal Noise Ratio

Bulk erased tape noise was 1 dB above the system noise of 48 dB below peak recording level measured in the playback tests, but tape erased and recorded on the machine with all gain controls at zero showed a level 12 dB above virgin tape noise. *C.R.O.* examination of this signal showed that it was mainly pure 50 c/s hum, which was not audible on the internal speaker of the recorder. Subjective listening tests proved that the hiss level was also up by an estimated 4 to 6 dB but, without delving into the internal circuitry, it was difficult to know whether this was a bias effect or the under signal noise carried by the 50 cycle hum. A wide range external speaker showed up the hum

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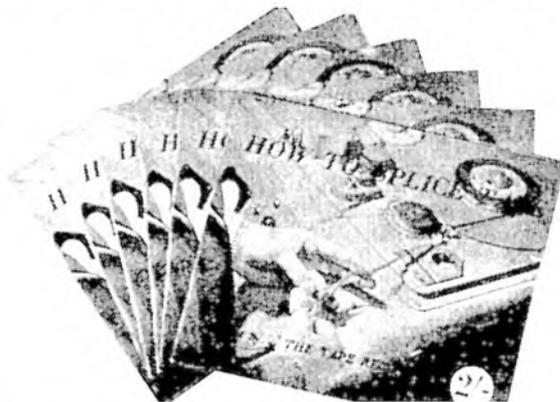
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Philips EL3549	6 12 0	4 17 6	62
Truvox R84	6 4 0	4 12 11	59
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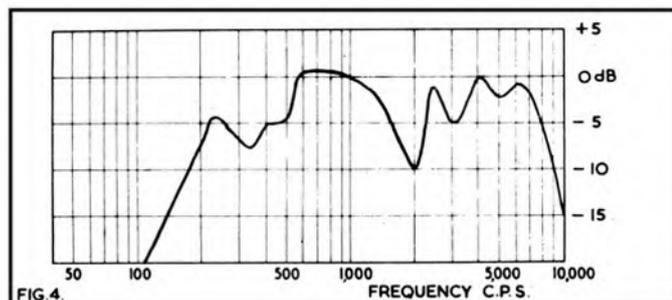
EQUIPMENT REVIEWED—continued

"loud and clear", and touching the reels caused a change in pitch, proving that it was indeed recorded on the tape.

No circuit diagram was provided with this recorder so that I can only guess at the cause of the trouble. No hum was evident on playback so that I do not think it was an H.T. smoothing fault. My guess would be that the constant current head feed resistor is too low so that the "normal" low level hum on the plate of the recording stage is recorded on the tape at 25 dB below test tape level, or 37 dB below peak recording level.

Acoustic Response

The overall response from tape to sound output from the internal speaker was measured by playing a 7½" White Noise test tape, and measuring the sound level on the speaker axis with a calibrated microphone. The resultant response is shown by fig. 4. This shows



clearly why the 50 c/s mains hum is not audible. The rather ragged response in the mid upper register, together with the sharp cut at 250 c/s, gave a thin edgy quality to the sound and I would guess that there is considerable intermodulation and frequency doubling near the low frequency cut off frequency of this speaker.

Comment

An excellent deck and tape transport mechanism, let down by its amplifier and speaker. I have said nothing yet about the cabinet because this can only be a personal opinion. I do not like the eastern pagoda-like styling, and if anybody mentions the lid catch I am liable to go hot under the collar: twice it jammed shut so that, try as I would, I could not gain access to the interior. On both occasions I had to remove the rear hinges to get inside. Perversely, when the closed cabinet was placed on the ground the lid tended to fly open, due to some "give" at the hinges, so that if the reels of tape had not been firmly secured by the excellent "hubloc" system, they would have rolled off across the room.

I am quite prepared to be told that I was unlucky, and that other people have had no trouble with the lid or catch—but seriously, I do think the excellent deck deserves a better housing and associated equipment than it has been given in this review sample.

A. Tutchings

Manufacturer's Comment

An encouraging review, but we do not quite understand the remarks concerning the amplifier in view of the comment under the heading: "Play and Record Responses". We suspect that the mains transformer has moved causing hum induction and in this respect a new transformer mounting was introduced recently, as it was found under certain conditions that it would shift. We also suspect that the characteristic of the oscillator valve has changed causing an increase of tape noise after erasure.

The type of heads used have an impedance of 100K ohms at 20Kc/s and ideally the feed resistor should be higher than this. It is in fact, 220K ohms.

The cabinet lid catch has been modified to overcome the problem experienced by the reviewer.

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★ one of the great encouragements to me personally, over the years that I have been writing these articles, has been the number of letters that I receive from readers. To those who have been able to find something complimentary to say, I would record my particular thanks, but I am grateful for all letters because they help me to maintain my perspective. They tell me, also, that I am not only writing for a variety of tastes, but for all strata of technical ability. I try to maintain a balance, but I would ask you all to be kind enough to remember that, while some are absolute novices, there are others who, though amateur in status, are professionals in terms of knowledge and ability.

I am not often presumptuous enough to aim my article at those whose experience may well be greater than mine, but I make no excuses that my words this month are for the inexperienced, those just starting with a tape recorder and who may have little practical knowledge. For all that, I suspect that there are those, whom I would not dare to call novices, who are not quite certain why there should be several types of tape available to them, and what are the relative merits, or otherwise, of each.

The Different Base Materials

First of all, let us determine just how to decide what *base* materials should be used, and how to recognise the different types. There are three sorts of base material, acetate P.V.C., and Polyester. "Mylar" is a trade name for American polyester base material, the English material is known as "Melinex." (The latter is made by I.C.I. and I have been told that Mylar is made by Du Pont under licence from I.C.I.)

Acetate tape is cheap, but suffers the disadvantage that it is brittle, and will become more wo with time, making it a poor medium for recordings that are to be kept. P.V.C. is more durable and quite suitable for general purposes, but if important recordings are to be made, particularly those that you may wish to keep indefinitely, I would consider that polyester has better lasting properties and would make a technically superior recording. When the thinner tapes are being considered (long or double-play) polyester tape again is better because of its increased strength and longitudinal stability.

Now, how to identify the type of base material on a reel when it is held in the hand. Of the three types let me first take P.V.C. The reverse side of this tape is not so shiny as the other two, it normally has a slight curl across its width, with the oxide on the inside, and if the spool is held up to a bright light the wound tape is completely opaque.

With Polyester tape (Mylar or Melinex) there is no curl, the backing is glossy and if held up to the light it is not completely opaque. Acetate tape is also glossy with no curl but if held up to the light is considerably more transparent. If a small sample can be destroyed, when pulled, acetate tape is brittle and will snap cleanly. P.V.C. will "wire-draw" to about 3 or 4 times its original length and then snap. Polyester tape acts similarly to P.V.C. but is stronger, and will extend much further before breaking.

Should the tapes be of different thickness, naturally the foregoing will have to be modified accordingly. Bearing in mind that the oxide coating will be substantially the same, the thinner tapes, with a thinner base material, will tend to be less transparent.



workbench

No. 48 by A. Bartlett Still

The oxide coating itself can vary, but this will occur from one brand to another; normally a given make of tape uses a similar oxide coating whatever the base material or thickness. By and large one must not be too dogmatic about this question of oxide but, in theory, each variation demands a different bias setting on the recorder, and may require a different level of record treble pre-emphasis. With the cheaper domestic machines, whose performance may often leave something to be desired, the change from one brand to another may not be noticeable. Where closer limits are considered, and this particularly applies in professional circles, the machine and the tape have to be adjusted in combination to produce the desired result. It is then that one is able to obtain a relative assessment of tape performance—output for a given distortion level—sensitivity—frequency response, etc.

The use, the choice, the price

To sum up, it will be apparent that the type of base material used will be something about which an intelligent choice can be exercised, bearing in mind the purpose for which the tape is required. As far as the brand of tape is concerned, you are always at liberty to experiment but, because of possible variations in oxide, the results may be inferior. They may, equally, be better, but this will not necessarily mean one brand of tape is better than another. Lacking any other guide, it is always safest to use the brand recommended by the recorder manufacturer, since it should be for this particular oxide that the machine has been adjusted.

So far I have not mentioned price. For a long time all tape, whether imported or home produced, seemed to cost exactly the same to place on the shop counter. Now tapes are available at prices that considerably undercut the so-called standard and a lot of them seem to be of excellent quality, and certainly worth a try in view of the possible savings. Who knows, perhaps one day tape will be available at a realistic price, allowing us to get away from rout-track working at impossibly slow speeds?



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