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# tape recorder

FEBRUARY 1964

Vol. 6 No. 1

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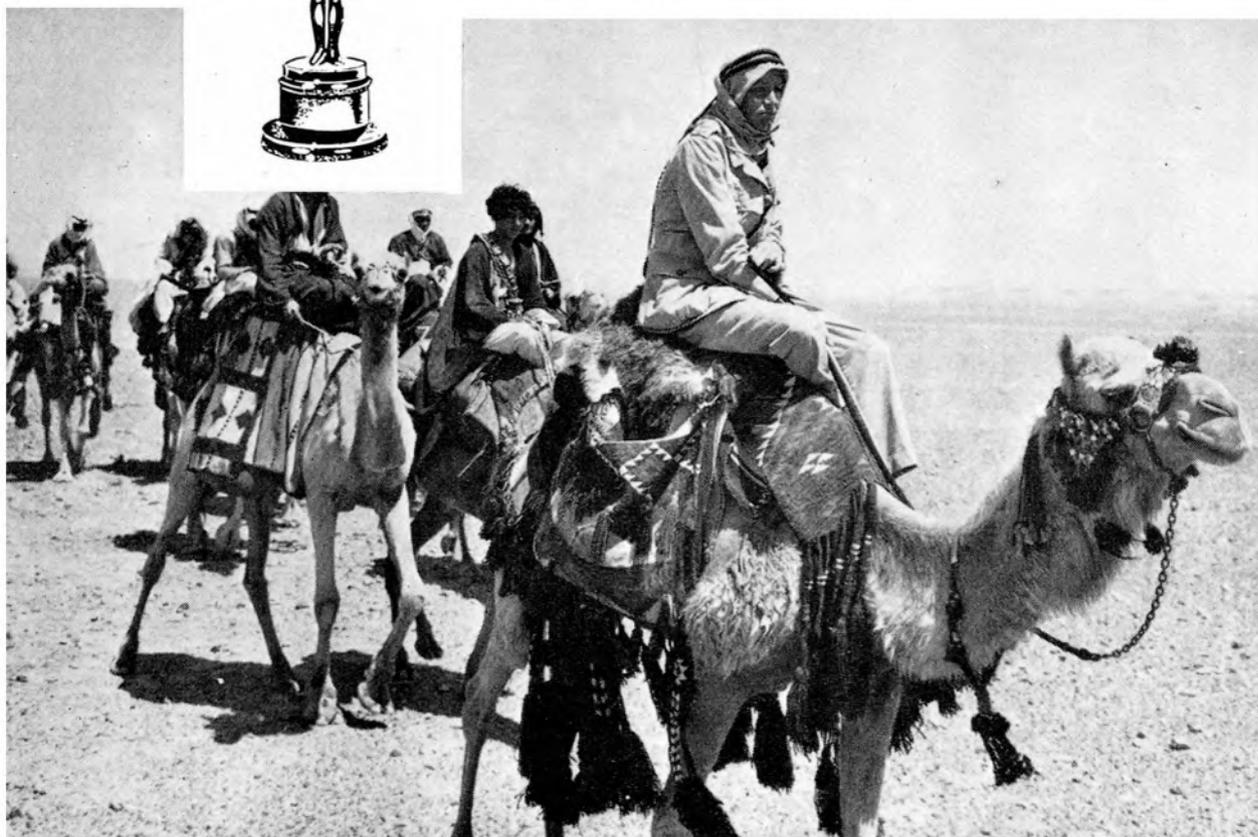
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A full range of Zonatape recording accessories includes, printed leader and timing tapes supplied in 5 colours, splicing tapes and metal stop foil.

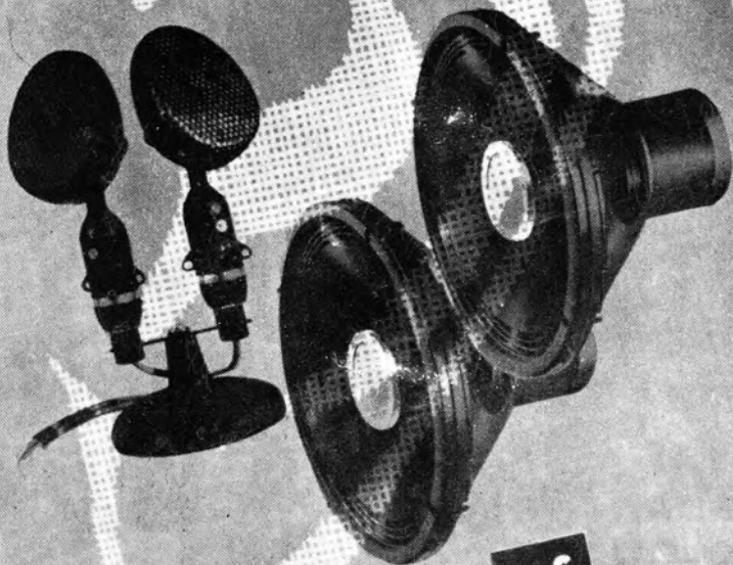
These professional quality tapes are obtainable from good class dealers but in case of difficulty send to us for name and address of nearest Zonatape stockist.



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# WORLD OF TAPE

## Ampex Mobile Video Recording Unit

A COMPLETELY self-contained mobile video recording unit, the Ampex *Minicruiser*, has been placed on the market by the Ampex Corporation. The heart of the compact vehicle is an Ampex *VR 660* weighing 97 lbs. Designed around a *Studebaker Wagonaire*, the *Minicruiser* is equipped with a sliding roof, enabling the cameraman to shoot directly from the vehicle. A swivelling operator's chair with elevation adjustment is attached to the camera mount allowing 360 degrees panning. Sufficient deck space is allowed for the cameraman to work in a standing position with the camera protruding through the roof opening. Both camera and recorder can be removed for use in other locations, up to 200 ft. from the *Minicruiser*.

A self-contained power supply gives complete freedom of movement although provision is made for operation from normal domestic supply.

The first mobile video recording unit, the *Videotape Cruiser*, was developed by Ampex in 1959. It incorporated a flexible bus chassis, an Ampex *VR 1000* video recorder, and associated camera and power equipment.

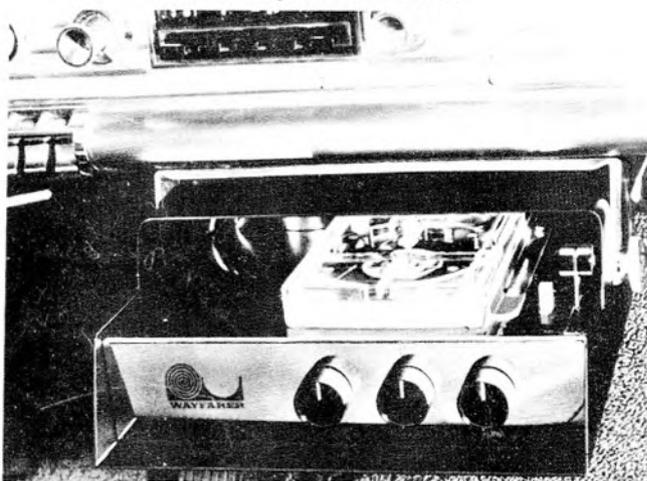
TAPE recorders turn up in many odd places and it was with no great surprise that we learnt of the use to which a Philips *EL3586* was being put by the South West Electricity Board. With 7,000 miles of high-voltage overhead cable, every inch of which has to be inspected at least once every year, the task would prove almost impossible had it not been for some original thinking on the part of certain senior engineers. The recorder is used in conjunction with a new *Augusta-Bell* helicopter, purchased by the Board last October. An observer examines and tapes a report on the condition of each section of cable, frequently fixing his position by describing landmarks and intersections.

On returning to the control centre, the information is transcribed from the recorder to a large-scale plan of the area under examination.

The only difficulty so far experienced has been the high background-noise level of the helicopter. This has been overcome to a degree by using microphones less sensitive than were supplied with the Philips. Vibration has been further reduced by mounting the microphones, which are worn by both pilot and observer, to the neck, where they pick up the throat-vibrations.



The Wayfarer Car-Stereo



TAPE takes to the road in cartridges in the U.S.A. The *Wayfarer Car-Stereo*, distributed by a division of *Telescript* in Los Angeles, uses endless-loop cartridges, similar to the original *Fidelipac* development, to provide the equivalent of up to four LP discs on one cartridge.

Two ¼-track heads are switched to select either pair of four tracks. These feed transistorised replay electronics capable of delivering 3W per channel to left and right speakers, which in turn can be installed very quickly in any convenient and suitable locations. The playback unit is fitted, with minimum connections, underneath the car dash-panel, and is completely self-contained (apart from the speakers). It is styled to match the interior of the average American car, but can be



rapidly removed for use in the home. Several accessories are now being developed that will allow the machine to be used under a wide variety of circumstances; it has already been successfully used in boats and light aircraft.

Retail prices are given as about £18 for the reproducer and £2 10s. for a cartridge. No plans have been considered for marketing this unit in Britain or elsewhere outside North America.

## COMPLETE "SLEEPOMATIC" UNIT FOR ONLY £20

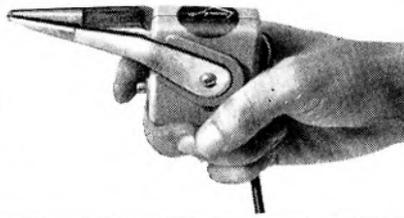
Comprising transistorised tape machine, auto time-switch, microphone, batteries, and under-pillow speaker.

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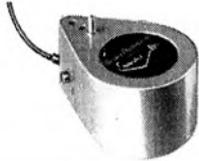
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### Head De-magnetiser

De-magnetises tape heads quickly and simply. Also for pin-point erasing on striped film and tape recordings—removes local unwanted noises

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# our readers write . . . . .

. . . about mobile hi-fi

**From: W. R. Sears, Room 44, Cambridge Hotel, Scarborough, Yorkshire.**

Dear Sir, I recently brought a new dimension into music listening by installing a  $\frac{1}{2}$ -track stereo tape playback unit in my car, a 1962 Chevrolet Corvette. It is suspended underneath the dash panel and operates on 12V. There are four speakers in the car situated in the front and rear, left and right. A double-pole switch allows the speakers to accept inputs either from the tape playback unit, or from the car radio.

The tapes are pre-recorded on cartridges which are on a single reel and enclosed in a clear plastic case. They are in the form of an endless loop, unwinding from the centre, passing the tape heads, and rewinding on the outside of the spool. All four channels are recorded with the tape moving in the same direction; the tape heads can be moved vertically to scan either pair of tracks.

To operate, the tape cartridge is inserted between guide arms on top of the playback unit. A single lever is moved which brings a rubber idler wheel up through a hole in the bottom of the cartridge where it engages the tape to press firmly against the capstan drive. This action also locks the cartridge in position and releases a spring-ratchet on the teathed outside circumference of the tape reel. It also supplies power to the amplifiers and capstan drive motor.

The unit was built by *Muntz* of California who also supply a large selection of pre-recorded cartridges, totalling some 4,000 items.

The cartridges are available in three sizes, giving a playing time of 30 minutes, one hour, and two hours duration.

The frequency response is in the order of 50 c/s to 10 Kc/s, at least twice the range of the car radio. The stereo effect is simply amazing, and the ability to select my own musical programme has rendered the car radio obsolete as I only use it to get the news.

By ordering cartridges direct from the manufacturer I can record my own tapes, a considerable saving in the cost of pre-recorded ones. This technique, of course, will only permit  $\frac{1}{2}$ -track recording, since on the mains machine the direction of the tape must be reversed to record on the remaining two tracks. Any questions?

*Yours faithfully,*

\* \* \*

. . . about tape records

**From: Michael Moore, 58 Ashton Gardens, Chadwell Heath, Romford, Essex.**

Dear Sir, Your news item describing the *Revere* tape-player ("The World of Tape", January) is significant of the slow downward evolution that may eventually turn the tape recorder into nothing more than a glorified, and simplified, competitor to the gramophone.

In all aspects of life, so we are told, history repeats itself. Edison's original phonograph provided the owner with facilities for making his own recordings. Then someone came along with the idea of selling what amounted to pre-recorded cylinders. In a short time phonographs were being manufactured without the facility to record. With the advent of discs the hobby of recording (if it ever was a hobby in those days), fell completely by the wayside.

Similarly, when the tape recorder came within financial reach of the general public the hobby of amateur recording bloomed, causing clubs to spring up all over the country. Recording enthusiasts were responsible for many original developments in the audio field, until the day, only a few years ago, when the first tape records began to appear on sale in this country. At first they seemed doomed to failure; recording enthusiasts argued then, as I am maintaining now, that this was an unforgivable trespass into the world of tape, with the result that very few people bought them. However in the last twelve months the tape record has come into its own. The majority of those who were once recording enthusiasts are now little more than music-lovers, passively spending their time listening to, rather than creatively recording on, their machines.

Slowly tape-playback machines are appearing, which, like the late phonograph, are not equipped with facilities to record. What is wrong with the tape-clubs of today? Surely they should be the centres of amateur recording activities. Quite the contrary, they are choked by

committee meetings, presidents, secretaries, seaside-outings, chairmen, everything, it seems, except tape-recordists.

Surely I am not alone in my opinions; do none of your other readers want to see the art of amateur sound-recording develop into the absorbing activity it once was?

*Yours faithfully,*

\* \* \*

. . . about ditto

**From: M. G. Duncan, 2 King Edward Avenue, Aylesbury, Bucks.**

Dear Sir, An article on stereo tape records by Rafe Seabrook, in the December issue, has finally prompted me to write to you. Let me say, initially, that I agree with everything Mr. Seabrook says, even to the extent of listening in bed via headphones, and my only comment is that any movement of the head causes the apparent movement of the orchestra. Thus, to take an extreme case, listening in bed with one's head upside-down creates the effect of an orchestra playing upside-down.

The subject of availability of tapes should also be mentioned. While I do not dispute that there are 222 stereo tapes available in this country, I have found most of them to be sub-standard (assuming the standard to be stereo disc), and come out very poorly either through speakers or headphones. The American scene is, as you say, very different, judging by the few examples available over here, all of which are excellent.

For my personal listening, I should say that the only tapes made in England which are as good as, or better than these are the EMI and WRC 7v i/s stereo tape records, and these are, without exception, the best I have heard from anywhere. All other English issues suffer from one or more of a variety of faults which make listening something of a bind for me, in view of this, I wonder when these two concerns are going to restart their issues; we have had none from EMI since 1958 (apart from *Fidelio*), and WRC have issued none for over a year. I cannot emphasise too strongly how superior these tapes are to any other form of recordings I have ever heard, and how much I, and many others, would like to see more of them.

*Yours faithfully,*

\* \* \*

. . . about a solo quartet

**From: R. S. Finlayson, 64 Downlands Road, Purley, Surrey.**

Dear Sir, It is comparatively easy to sing a duet with oneself, given moderate vocal ability and a tape recorder. Given two tape recorders this achievement can be taken one stage further to record a single voice in three parts. My fourteen year old daughter has done this. She first sang and recorded the soprano, or melody, with piano accompaniment (*tape 1*). This recording was played back and re-recorded through the high-level input of a second recorder while, at the same time, recording through the low-level input, she sang the second or alto part. *Tape 2* thus carried two parts. This tape was similarly re-recorded on *tape 3* while the tenor part was added through the low-level input. *Tape 3* thus carried three parts.

Unfortunately the pass part was beyond her range.

It should be possible to add the fourth part, on the principle that doubling the speed of the tape halves the frequencies and so lowers the pitch of the recording by one octave. Unfortunately I only have single-speed machines, and I would be interested to know if any readers have tried this.

If *tape 3* is played back at double the recorded speed and re-recorded at the same double speed on to *tape 4*, the bass part could be sung one octave higher than the proper pitch. The pitch and tempo would revert to normal when reproduced at the original speed.

*Yours faithfully,*

● We invite readers to write in and comment on any subject raised in these letters but point out that the views expressed do not necessarily reflect editorial opinion.



## How to get great sound effects with Emitape

If you finger-walk a couple of thimbles over a pad of cotton wool, your recorder will pick it up as footsteps in the snow. If you play quite ordinary sounds backwards you can emulate the eerie twitterings of creatures from outer space.

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**FREE EMITAPE LEAFLETS** Emitape have written a new leaflet called 'Emitape

for Sound Effects'. It is packed with practical examples of how to produce the right sound at the right moment. It is free, and you can get it by simply filling in the coupon on the right.

While you are at it, ask for another new Emitape leaflet 'Emitape Jointing'. This tells you not only how to splice without tears but shows how intelligent jointing can actually improve a tape programme.

**E.M.I. TAPE LIMITED, HAYES, MIDDLESEX**

**PLEASE SEND ME FREE LEAFLETS**

'Emitape for Sound Effects'.

'Emitape Jointing'.

NAME \_\_\_\_\_  
(Block letters please)

ADDRESS \_\_\_\_\_

ET-109

# REVERE TAPE PLAYER

REPORT ON A NEW TAPE CARTRIDGE RECORDER

By J. W. Berridge

READERS of American audio and technical periodicals will no doubt know that the *Revere Camera Company*, a subsidiary of the giant *3M Corporation* of St. Paul, Minnesota, introduced a radically different tape cartridge recorder in April of last year. They did so quietly and with very little fanfare. Many writers and engineers were quick to point out that an apparently similar machine was shown as a prototype by CBS Laboratories back in the early months of 1960. Now that some months have passed however, it has become obvious that there are some very essential differences between that early prototype and the present *Revere/3M* machine.

The possibility that tape in cartridges could offer all the advantages of long-play discs on record-changers, plus better quality and the ability to record, has intrigued many for some time, but up to now no one has introduced either cartridge or machinery which would compete with such record-changers, not even RCA or Garrard.

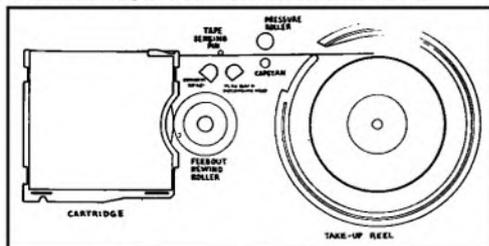


Fig. 1. This shows the Revere mechanism just before it snaps into action. A stiff tape leader moves across and is gripped by the flanges of the take-up reel, then things proceed as in fig. 2.

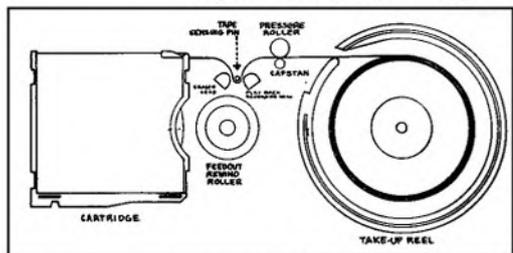


Fig. 2. When the stiff leader has passed by, the tape sensing pin drops down to engage the tape between the heads; the feedout drive roller is disengaged and the pressure roller and capstan come together.

After a relatively short while, the *Revere/3M* equipment began to be reviewed with great enthusiasm by most technical magazines associated in any way with tape recording. Without exception, every test report showed that the machine, running at  $1\frac{3}{8}$  i/s produced the equivalent of semi-professional results from a repeatable cartridge—a feat which may perhaps prove to equal the advent of the micro-groove long-play disc. The initial library of some 20 or so cartridge records was mostly from the Columbia files (interestingly enough, many were brand-new releases). Since then the library has been increased, the advertising and sales campaign has been stepped up to the point of full-page spreads in such magazines as *Life*, and enough machinery is being produced to ensure that there is no particular problem about getting a demonstration.

As for the restrained and startlingly un-American approach to the machine's introduction, this reporter can make two conjectures. Either the company acknowledged possible failure of the basic idea, and wanted to be able to back out without too much loss if necessary, or they were sensibly biding their time until a good selection of cartridge records was built up so that the market would expand on its own merits without too heavy promotion. Whichever it was, it is beginning to seem likely that a thoroughly practical tape cartridge may be stealing on to the scene with none of the fanfare that was expected. In correspondence, a spokesman for the *3M Corporation* was emphatic that no plans are being made to market either cartridges or recorder in Britain or Europe, and that if and when machinery of this type does appear there, it will have undergone a long period of refinement.



As shown in figs. 1 and 2, actual transport of the tape during operation is almost conventional reel-to-reel, with capstan and take-up reel (hub) as normal. Under these conditions both *play* and *fast forward* modes are possible. The major difference lies in threading the tape past the appropriate heads and the capstan on to the take-up hub. This is accomplished by rim-driving the spool of tape through a slot in the side of the cartridge. A stiff springy leader attached to the free end of the tape is pushed out through a small slot in the corner of the cartridge (which is moulded inside to guide the leader to this opening), and is then pushed further until it is gripped at its edges by spring-loaded flanges on the take-up hub. Its own stiffness (and suitable guides of course) keep it in the required path. Once enough leader has been pushed out (the same amount every time is a good enough indication), the machine converts to normal tape operation, as in fig. 2. Pushing the appropriate control button will also run it in *fast forward* mode when required.

Rewind is accomplished automatically, in that the tape is permanently attached to the spindle of the cartridge. At the end of a "play", this causes back tension which pulls the tape taut, tending to straighten out its path past the heads and throwing back the tape sensing pin. This same pin, incidentally, also serves to wrap the tape around the face of the two heads (in the *record/playback* mode) for optimum tape/head contact.

From then on, the sequence is as follows: The pressure roller drops back from the capstan and the feedout-rewind roller again rim-drives the tape, this time in the opposite direction, to rewind the tape. Because of the stiff-leader threading system, no accurate stop is required for the rewind operation.

Once the tape is fully rewound, four pins are pushed out from the sides of the cartridge well, between the cartridge in the "play" position and the one immediately above it. A tray on which the played cartridge has been resting then tilts, causing the cartridge to slide to the other end of the tray. The tray then returns to the horizontal. The four pins supporting the stack of cartridges to be played are retracted. This causes the stack to drop and brings the bottom one into position for playing. At this juncture, the feed-play-rewind cycle starts again with the new cartridge.

Meanwhile, as the tray comes back up, it pushes the reject cartridge past four spring-loaded pawls set in the sides of the reject half of the cartridge well. When the tray tilts again, the already-rejected cartridge stays up on these one-way pawls while a newly rejected cartridge slides underneath. The tray just keeps building up a stack of rejects from underneath with the bottom one always resting on the pawls.

## Ingeniously Designed Cartridge

The whole simplicity of the idea lies in designing a cartridge such that rim-driving the tape will push out a stiff leader, and also moulding the outside of the cartridges so that the four supporting pins can be slipped between two cartridges to support all but the bottom one of a stack. Added convenience features are also included as part of the cartridge design. Other advances include a radically improved tape only  $\frac{1}{4}$  in. wide, a vastly improved *record/playback* head and some unconventional thinking. The tape and head combination produces optimum quality at a speed of  $1\frac{3}{8}$  i/s while the narrow tape width and slow speed combine to produce a small cartridge with a fast rewind time. The one serious problem not yet solved by *Revere/3M* is how to get enough information about the contents of the tape records on to the outside of the cartridge. It's too small!!

As yet, no details have been made available concerning the radical nature of either the tape itself or of the record-playback head.

By J. A. Hamilton

# THE WHY AND HOW OF

A MUSICAL friend asked for a copy of one of my recordings. Having bought a second tape recorder for this very purpose, I was delighted to be asked, and soon despatched what I regarded as a fairy copy. It was disconcerting to receive it back by return of post with the message: "Please re-copy in proper key. This is *sharp* by a minor third."

My machines are both two-track *Reflectographs*, Models A and RR101 respectively; my friend's is a four-track *Stella*. Obviously I had to rebut the criticism, but I felt that the fellow had a nerve to make it. A minor third is the interval between *me* and *soh* and the frequency ratio is 6:5. It was therefore alleged that my copy was 20% (or three semitones) different in speed from the original. My friend's musical sensibilities and my pride in my recorders were equally affronted.

## Both were Sharp

I put the offending copy on one machine and the original tape on the other, and could hear no difference. To clinch the matter I tried the keynote on the piano and was put out to find that both recordings were *sharp* by a vague amount exceeding a whole tone. Apostrophising piano tuners, I sat down to think it out and to re-listen to the copy. Apart from this keynote query it still seemed good to me. At the end, half an hour later, I idly rechecked the keynote. To my horror the whole orchestra had drifted *down* more than a semitone and slipped into one of the cracks. Keeping in tune seems to me to be the most elementary musical requirement; and I was faced with the unpalatable conclusion that my friend's instrument was by this definition more musical than either of mine. Credulity was overstrained. Complacency was shattered. Something was wrong!

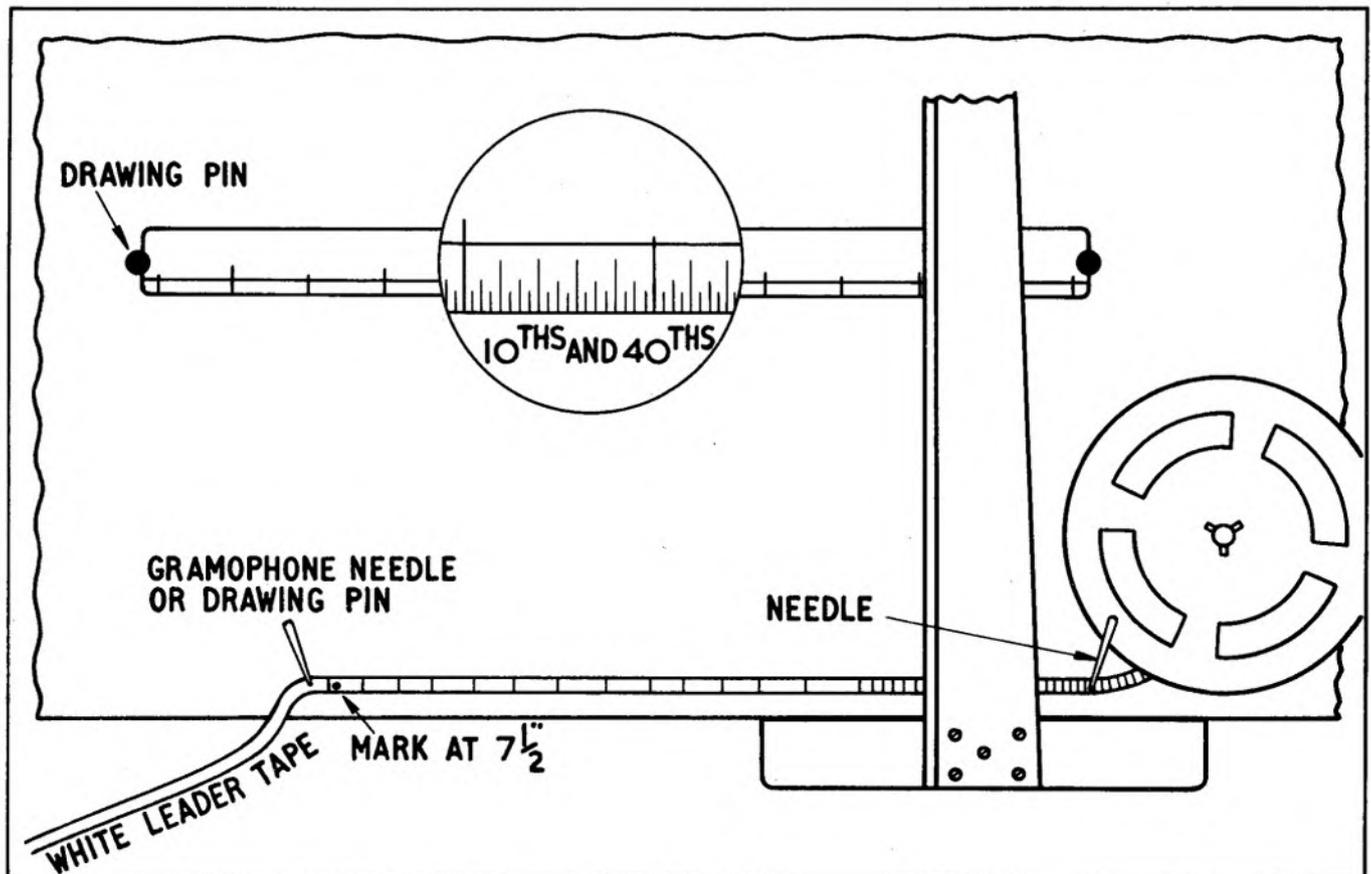
It was clear that my machines were out of step. I soon found that the approximate tuning of original and copy on replay had been luck,

and was due to cancellation of errors. Transposing the spools gave an appalling disparity of keynote. I tried measuring the amount of tape passing in a few seconds, and was immediately impressed by its vast amount. The transport mechanisms of my two machines are very different, so that starting and stopping could not be included in the observations. A patch of Jointing Tape was attached where it could be seen after the motors had gained speed, and I attempted to measure the tape spooled from that mark in a few seconds. The difficulties were: 1. Co-ordination of observations on two unlike mechanisms; 2. Watching simultaneously the second-hand on my watch and the moving tape; 3. Measuring the tape.

Operation 1 introduced as many errors as there were trials. 2 convinced me that I would soon have a divergent squint. As for 3, my particular inch-tape never agreed on re-check with its previous findings. Even pursuing great lengths of slippery tape across the hard floor soon made me wonder if I was catching housemaids' knee. After an exhausting afternoon I decided that only a statistician could compute a result from my figures. At this juncture Mr. G. A. Cloud very kindly wrote his article "Construct a Stroboscope Disc" (*The Tape Recorder*, May 1963).

## Where to put it

The practical location for a Stroboscopic Disc was the top of the pinch wheel, and the question was, how many divisions had to be marked on the circumference. Its length was  $\pi d$ . I was immediately in trouble. I could not make up my mind what effect compression of the rubber by my unusually narrow capstan had on the effective circumference. Did compression really reduce the diameter or did the capstan, while visibly sinking in the wheel, ride on rubber of length equivalent to the undistorted circumference? I inclined to the latter view, but shelved the problem because the pinch wheel of one of my



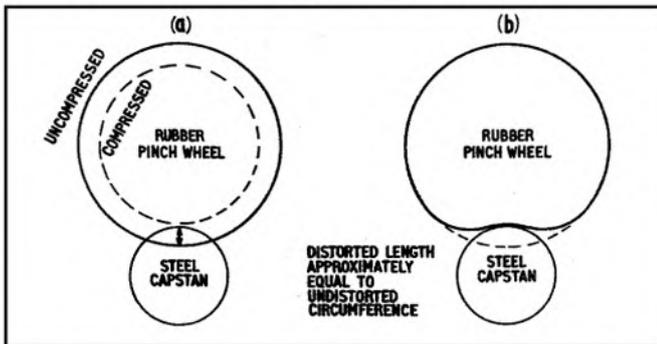
# A STROBOSCOPIC TAPE

machines was so inaccessible and small that I judged my draughtsmanship unequal to the task. Consequently I gave up pretending to do things mathematically and decided that since in this case ignorance was not bliss, arithmetic (which I have always disliked) would have to serve. I wanted a length of tape with stroboscopic markings which I could apply to either machine at any time. A loop would not suit because I wanted to test not only the capstan motors, but also any drag or acceleration of the spooling motors. The solution seemed to be to mark the centre of a considerable length of white leader tape, thus allowing concentration of attention on a minimum length, without the need to worry about starting and stopping.

## Strobe Requirements

One flash per half cycle of 50-cycle Mains, means 100 flashes per second. For a steady image, each flash must show both black and white in the same relative positions. My speeds were  $7\frac{1}{2}$  and  $3\frac{3}{4}$  inches per second. Taking the latter or more exacting requirement gives 100 flashes on  $3\frac{3}{4}$  inches and the width of either black or white markings is therefore  $3\frac{3}{4}$  ins.  $\div$  200, or 3 ins.  $\div$  160. A glance at a ruler shows this to be a highly inconvenient fraction to mark, far less to shade. Ordinary ink blots on lead tape, so a ball-point pen was preferred. This involves an uncertain distance between the ruler-edge and the mark made by the pen.

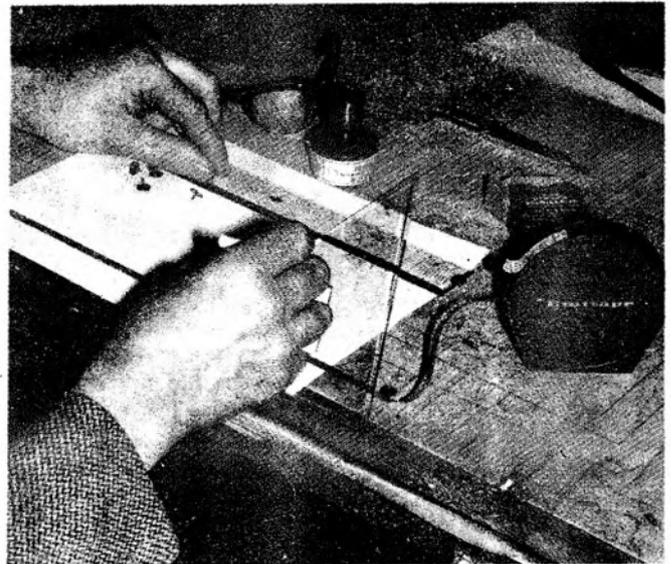
By this time I was sure that if I thought the matter out carefully I would again find excellent reasons for its impracticability: so I hastily persuaded myself that if I could make narrow lines in some of the right places and no lines in the wrong places, persistence of vision would have a double effect. *First*, it would broaden my lines to a uniform degree, eliminating the need for shading; and, *second*, it would fill in anything I was unable to draw, provided that the background was white. Experiment justified this view. I therefore decided that it would not be hard to mark intervals at three-fortieths of an inch.



A ruler marked in fortieths of an inch was fastened to a drawing-board, parallel with the edge and a few inches from it. White leader tape, to take the strobe marking, was pinned nearer the edge. A T-square over all completed the preparations. It happened that my T-square was opaque and the markings on the ruler were so monotonous that I began to forget what the next position should look like. To avoid tiresome counting, a self-checking routine was devised as follows: 1. Mark off  $7\frac{1}{2}$  ins.; 2. Divide into intervals of  $\frac{3}{16}$  in. each mark being three wide divisions on the ruler; 3. Subdivide each  $\frac{3}{16}$  into four, each mark being three narrow divisions on the ruler.

In practice I marked the narrow divisions consecutively, and every fourth mark was of course found to be already there because of operation 2. This prevented error and eyestrain. The result was 100 marks per  $7\frac{1}{2}$  ins. When this was finished I shifted the leader tape so that the last mark became the first of a new series—making due allowance for parallax between rule and mark. A marginal reference mark was also made, to indicate one second, and to facilitate any count-back to the beginning of the section. 4. Repeat for as many sections as are required.

The procedure is easily mastered in the first section and subsequent lengths are soon added. Minor errors do not matter—the grand impar-



ality of the 50-cycle Mains obliterates them. A clear, well-spaced scale at either speed is given by the light of an *Osglim* Neon Night Light.

My early adventures were now explicable with the utmost ease. The stroboscopic markings ran steadily from right to left on the **RR101**. This is a variable-speed machine and a small adjustment on the control stabilised the image. It was only necessary to mark the new positions for each speed on the dial. This is controlled by a sort of windlass and I suspect that the fastening of the line must have slipped.

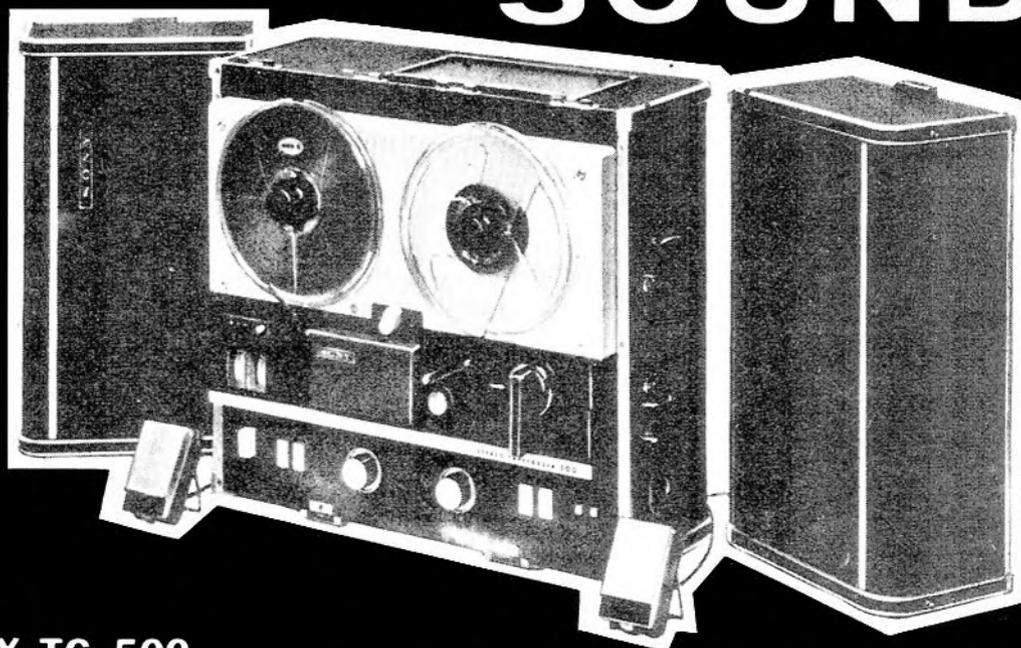
Accepting that this error made a difference of over a tone, the sequence of events must have been: 1. An original recording was made on the machine which I have possessed for some years and which, unsuspected by me, was running slow. 2. In making a copy, no harm would have resulted if the same recorder had been used for replay. By chance the newer machine, running at normal speed, was used for replay, and a copy was made on the slow-running recorder; thus doubling the error and increasing it by more than another whole tone. 3. Replaying the copy on a normal machine therefore sounded sharp by three semitones. 4. The puzzling drop of a tone or more on playing the whole recording, was due to not following the instructions of the maker, who explains that before serious recording the motors must be warmed up for some minutes. On my original machine the three *Garrard* Motors are of similar design and seem to settle down almost at once. The tape however showed that on the Model A the heavy *Papst* capstan motor tends to run fast until it and the spooling *Garrards* settle down. About ten minutes is needed, in my case, after which synchronism is perfect.

## A check with the BBC

As a cross-check I recorded the BBC Tuning Note, 440 c/s. The tape was cut in two, and each half was simultaneously played on the two recorders, which were deliberately thrown out of step. Recording had been at full strength. The result was massive beats which could be instantly tuned to the null point. This gave a most convincing verification of the stroboscopic synchronism.

**Note:** In comparing recorder speeds there is no fear of confusing beats with the ordinary standing waves set up by the tuning note. The latter, while impressive, are the merest ripples compared with the beats produced by the above experiment. If the machines under test have no speed control, beats can immediately be heard should a finger be delicately placed on the tensioning spool. Alternatively, the stroboscopic tape can be made to show the gamut of variations down to the half speed. This manipulation must be done with the sensitive deliberation of a dishonest trader assisting a scale pan. The trick is rewarding.

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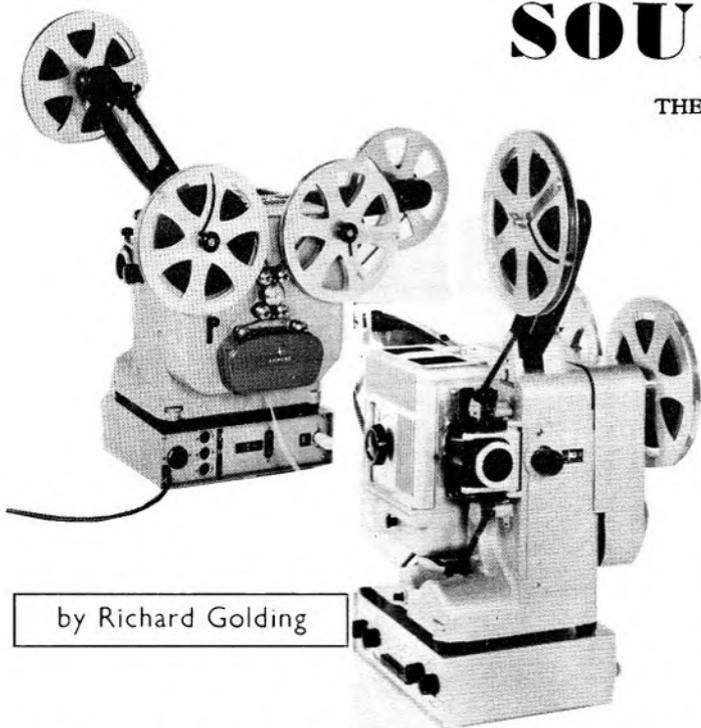
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# SOUND AND CINE

THE DOUBLE-BAND PROJECTION SYSTEM . . . . .



by Richard Golding

The Siemens 800 projector showing the double-band attachment side with sprocket and four film guides. The magnetic heads are contained in the lower housing which is hinged, allowing free access to the heads for marking up. Both picture and sound spools are fitted with easy-loading device.

**T**HE petty complexities sometimes encountered by separate-tape enthusiasts in setting up projector, tape recorder and synchronising agent, be it strobe, disc, coupler or what-have-you, brought about what is perhaps the ultimate in separate-tape projection—"the double-band system"

This system, which is more popular in France and Germany than it is over here, consists of using the same motor to drive both film and tape (or fully coated magnetic filmstock) on the same machine. It is compact, extremely portable and synchronisation is assured at all times. For a number of years, however, the choice has been fairly small, being divided between the British *Dominus* and the French *Sonoclub*. The two machines are completely different in styling and application.

## The Dominus

The *Dominus*, with which many readers will be fairly familiar, has the traditional tape recorder design with the projector added to the other side. It can of course be used as a tape recorder in its own right separately from the projector. It has the following main features: tape speeds of  $3\frac{1}{2}$  and  $7\frac{1}{2}$  i/s, projection speed 16 fps, superimpose control, forward and reverse running, fast rewind. Weight 33 lbs. Sprocketed capstans can be fitted for perforated tape. Through the past few years the *Dominus* has gained a good reputation as a mobile 8 mm. cinema and recording studio in backward countries, working with the *Bayflex* back-projection unit, but it doesn't seem to have caught on so much over here as a double-band projector. This is probably because many people thought it over-priced at £120, but even so it is still cheaper than most 8 mm. mag/stripe machines and the least expensive in the double-band range.

The *Sonoclub* (available in G.B.) is of conventional projector design and the tape spools are carried at the rear of the machine. As with the *Dominus*, the tape recording mechanics can be used separately but with only the one speed of  $7\frac{1}{2}$  i/s. In spite of the single speed, the tape recording side is very versatile, including 3 heads for top and bottom track recording for music and effects and for mixing with a commentary on the centre track. Erasing of a previous recording is possible from 0-100%, permitting perfect superimposing. Facilities are provided for using perf. tape or fully coated 16 mm. filmstock. The price of the *Sonoclub* is £290 (with Xenon arc £380).

These two models are now augmented by the very fine *Siemens* projector. This machine had been available for a number of years in a

silent version and indeed, similar to the *Siemens* 16 mm. system, the same silent version now provides the basic model for building up to the sound version. The stages of building up and the prices involved are as follows.

The basic silent 800 model costs £81 10s. For this you get a custom-built projector really made to stand up to rough usage—it looks heavy, and it is just that for the Germans have made it to last a lifetime of use. It has two speeds—18 and 24 fps—with interchangeable two- and three-blade shutters, single knob control with programme switch for forward and reverse running with the lamp on, powered rewind and two-stage lamp switching.

To this is added the 8 mm. double-band attachment, £86 10s. This is not an attachment in the strictest sense of the word for it is fitted as a component part of the projector and so does not have to be set up for each new show. Once the silent basic machine has been converted it can stay that way for ever if need be. Now both film and sound are controlled by sprockets driven by the same spindle and perfect synchronisation must result.

As to the recording medium, *Siemens* scorn the use of tape, preferring to use fully coated 8 mm. magnetic filmstock. This has two advantages over perforated  $\frac{1}{4}$  inch tape; it is more durable and, more important, it gives an exact frame-for-frame registration to the 8 mm. picture film carried on the other side of the projector. Sound editing away from the machine is no longer just an attractive possibility but a definite fact. This, in itself, may have a great deal of importance if 8 mm. optical transfer from original 8 mm. magnetic film becomes desirable.

With this stage, a tape recorder can now be connected to the attachment and used, quite normally, to dub sound on to the magnetic filmstock. The track-width of the perforated filmstock is 3 mm., the same as half-track on tape, but almost four times the width of the sound-track on 8 mm. mag/stripe.

At 18 fps the track will travel at 2.7 i/s; at 24 fps it will travel at 3.6 i/s. So the recording and reproduction potential at 24 fps is almost that of tape running at  $3\frac{1}{2}$  i/s. This, as you know, can be exceedingly good nowadays and it is quite certain that when using a tape recorder of *Ferrograph* quality coupled to the *Siemens* 800 that this combination will result in results finer than are possible on the best 16 mm. optical machine.

## The Siemens Amplifier

Although the system is complete with this addition of a tape recorder, *Siemens* have introduced their own amplifier. This normally fits under the projector, making one compact unit of the three parts; but it can be used apart from the other two stages if desired. It costs £71 10s. and contains the following main features:

Superimposing of additional effects, commentary or music at correct volume to a recording already made on the magnetic filmstock.

Mixer inputs for microphone and record player.

Built-in recording interlock to prevent accidental erasure.

Neon volume indicator.

Headset jack for monitoring recording level.

Jack for radio or additional amplifier.

Frequency response at 18 fps: 70-7,000 c/s. 24 fps: 70-9,000 c/s.

Flutter less than 0.5%.

The three units in what *Siemens* fondly describe as their "building block principle" cost together £239 10s. which is about £25 more than the dearest 8 mm. stripe projector. A carrying case, however, costs an extra £30, but I should imagine this to be an essential if any sort of mobile projection is planned, for the three units together weigh, I should think, about 40 lbs.

## Using the Siemens

Now, just what is possible with this system? In the first place, it is obvious that recording to picture is a simple matter for as the picture comes up and the cue mark flashes on the screen so can the related effect be laid in sync. As with magnetic stripe, if the picture is hit late with the commentary then it either has to be just left that way or re-recorded. With the *Siemens*, adjustment of track to picture can be effected from one frame to as many as you like by simply re-lacing the

(Continued on page 18)



for the professional

# IRISH

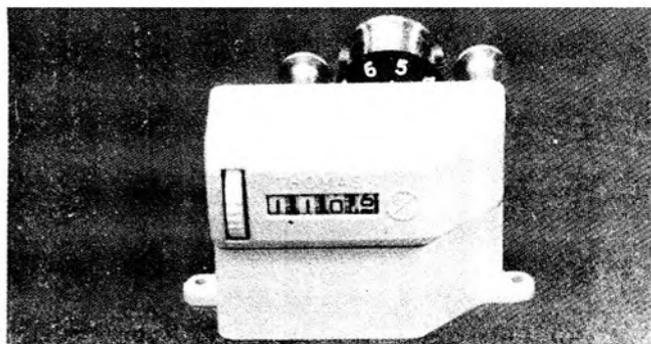
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## SOUND AND CINE—continued

magnetic film in its sprockets. This is an important facility for it means that you can go on from there to the re-adjusting of separate sections along the track. You can fit the first section to match its visuals, mark up sound and picture and then go on to re-adjust the following section and so on. When all the sections are correctly marked to sync., the superfluous frames can be spliced out between the cue marks, resulting in a perfectly synchronised soundtrack to one frame. This means that pace in sound cutting is possible within certain limitations. The limitations, surely, being that the whole track is assembled on the projector and that the series of sounds which are laid first must serve as a pilot track for all subsequent superimpositions.

With extra apparatus there is no need to accept these limitations, for sound editing is possible and track reading or frame counting can be carried out on the bench. One of the many interesting things that can be done away from the projector is, for example, the breaking down of the track into beats so that the visuals can be matched to it for the purpose of "Micky Mousing".



As far as I know, there is no 8 mm. sound editing apparatus available on the market but there are many useful accessories that can be adapted with a minimum of effort.

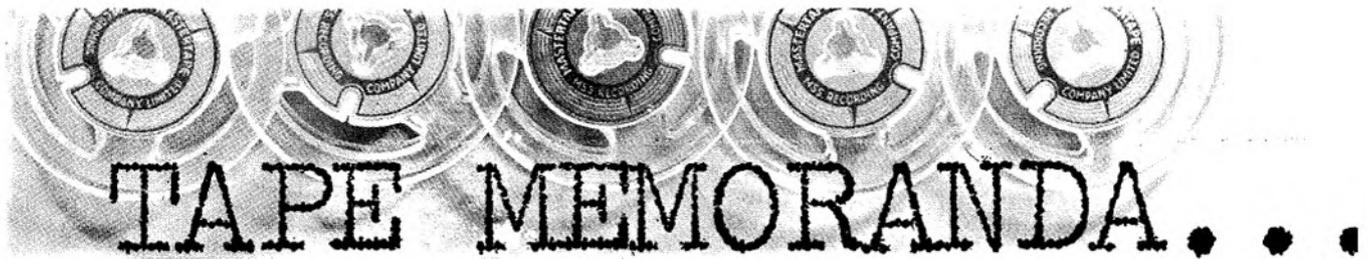
I have lately been experimenting with a *Thomas* 16 mm. Frame Counter linked to a professional two-way synchroniser in breaking down soundtracks for cartoons. The *Thomas* Frame Counter costs £5 retail and is supplied by Eight-Sixteen Products Ltd., 115 Baltimore Road, Birmingham 22B, and is a useful little unit.

The Counters (Eight-Sixteen also do a *Seconus* Counter and can supply a sprocket for Cinetape A) are primarily intended to be used with a viewer/editor, and are fitted with a 10-tooth sprocket and a pair of film guide rollers and are supplied for 8 or 16 mm., but not dual-gauge. The film can be laced either over or under the sprocket, depending on the direction of film travel. The 4-figure-in-line counter reads every ten frames, the individual frame being indicated on the dial round the sprocket. If the sprocket on the counter is removed, you are left with a  $\frac{1}{16}$  in. diameter shaft which may be coupled to a synchroniser by intermediate gearing. As a matter of interest, the small plastic gears available at model shops are useful for experiments in this line.

The sprocket on the Frame Counter permits the addition of an extra magnetic head, either plugged into a tape recorder or functioning through something like the *Wal* transistorised *Hi-Gain* pre-amplifier, for there is enough room for it to be fitted without it interfering with the normal run of the Counter. When the first magnetic trackreaders appeared they had sprung heads so that the reading heads would always maintain very close contact with the film. Now, it is recognised that it is not necessary to apply tension and most modern trackreaders have heads which just lie on the soundtrack and for the purpose of reading beats this system is quite adequate.

The home-made 8 mm. trackreader can therefore be constructed with little trouble or expense (it is a general rule in Cine that the more ambitious you are, the more it will cost you) and will give good results for sprocketed tape or 8 mm. magnetic film. For 8 mm. mag stripe, however, it would require a little precision engineering but it could be done without heartbreak or great expense.

The Frame Counter has at least one more application for double-band. It can be used as a read-out counter for placing commentary while the projector is running. It could be mounted on some sort of platform so that the film could pass over it from the bottom projector sprocket to the take-up. Conversely, intermediate gearing could be fitted to get a drive from the projector itself and the Counter turned so that the digits would be visible from the commentary box or position.



# TAPE MEMORANDA

THERE is a new disease at large today. It has not a pet name, and I will not attempt to give it one, but it is very closely associated with other, horrible, recently coined names which cover the activities of tape letter senders. It is the practice of recording and posting spools of useless nonsense, under the heading of "Tape Letters". Now, having got so far, I am aware that I have already invited the wrath of many people who post these "tape letters"; so may I close this introductory paragraph with the reminder that I have specifically referred to "*spools of useless nonsense*". If the cap does not fit, do not wear it!

I often receive spools of recorded tape from friends abroad, and I enjoy listening to them. I return the compliment, and I sincerely hope that what I send is as interesting as what I receive. But I have often suffered the impact of tapes which deserve the description in the previous paragraph; and this is what I want to write about first, for I am certain that I am not alone in the matter. Let me give just one example.

Some three months ago a box arrived from Tasmania. It contained a seven-inch tape spool and a short note from an acquaintance I had last seen in London some two years back. The note said: "*I hope you will like this recording. Please record something else on it and let me have it back.*" I found time to play it recently, when I was away from work and in bed. It was full to overcrowding on both tracks with music dubbed from gramophone discs, with occasional remarks about the very ordinary domestic type equipment that was being used to make the recording. Now, why on earth was it necessary for this person to inflict that lot on me—or on anyone else for that matter? What a waste of time. What a waste of energy. What a waste of postage.

I think it is time for a lot of people to get this whole business of tape-sending into proper perspective, so let us examine it from what seems to be a sensible beginning—the art of letter writing.

The post, today, is a very different kettle of fish from the post of about a century ago. Commerce has seen to that. So has the telephone, and the aeroplane, and everything else that has contrived to kill distance between remote points and close friends. A century ago, when a person sat down to write a letter to a friend it was an event that held real significance. It was usually preceded by a planning of the sequence in which the items of news should be told. It was also an effort, for the labour of writing many pages in a good, legible handwriting, and with not always friendly nibs and ink, took care and patience. The news value of such letters, then judged by today's standards, may appear trivial; but in those days, remember, with the distance between, say, London and Bath a considerable barrier, it really meant something to Cousin Anne to learn that Tibby had a litter of six tortoise-shell kittens, and that the postman's wife had won the first prize for her marrow at the local fête. Much more important, however, was the art of telling the story—of stringing together a chain of events.

Going a stage further, let us consider the masterpieces of letter-writing which have been preserved and published in recent years. Many of these collections have given us a valuable insight to the characters of well-known people who wrote to each other in order to describe the nature and details of their work, and to ask for advice on this and that. And now, with those very vital thoughts in mind, let us have a look at the possibilities of the new medium—tape. How is it abused? How can it be properly used?

Just imagine, for a minute or two, the tremendous appreciation of a Victorian who had on the writing desk a tape recorder and a microphone; and then think of the unbelievable excitement that would have greeted the arrival of a recorded voice by post. *Think of those things against a background in which there were no telephones or motor-cars.*

Now think again of the average "tape message spool", and think of it against the modern background which *does* contain every modern distraction and time and detail killer. Depending upon the amount of thought expended to fill the demands of the last two paragraphs, the reactions should be interesting. And, for final emphasis, throw in the

tape that reached me from Tasmania. I think the last syllables of that country's name just about sum it up.

Surely the first thought, before getting down to the job of tape posting, should be: "I must tell so-and-so about such and such"—not, "I want to send a tape: who can I send it to?" For there is no doubt at all that the recording of a tape letter is a real art—almost more so than the writing of a letter was in the bygone days. Good dictation is an art, and that is a sensible prelude to the more difficult business of tape letter writing. In other words, the mere possession of a tape recorder and some spools of tape and some spare time does *not* ensure a good product. On the contrary, it is this very combination, coupled with an over-abundance of enthusiasm, which is responsible for most of the bad products. If half the available enthusiasm can be diverted into effort to acquire the art, then a very marked and rapid improvement will result.

For the would-be tape poster I can suggest nothing more useful than a quiet hour, alone with a microphone. And of that hour I suggest that at least the first fifteen minutes can be profitably used in silent thought. The very first exercise should be to tell oneself a story—not a "joke", but an account of something that has happened—just as one would tell it to a friend in the room. Next, play it back and ask (and answer honestly) would that be interesting if my friend had recorded it for me? There should be no *ers* and *ums* in it. No pauses, because the fifteen minutes of thought should have been followed by a rehearsal telling of the story *without the recorder*. The subject matter is of no initial importance. This is practice. And after several such sessions, armed with pencilled notes to help continuity, the time will come when there is really an urge to pick up the microphone and, without hesitation, to say . . . "George, I have just realised why you couldn't get your car to start the other night . . ."

There are many people who look down the proverbial nose at the tape letter. But there are very many of these people who would adopt the medium gladly if they were to spend time on acquiring the art. I was visiting a friend some while back when he said suddenly, "just a moment. I think you would like to hear this," and he switched on his recorder. A voice said: "John, I wonder if you would like to give this problem a bit of thought for me." And it continued by outlining an experiment which had ended up with a frustrating obstacle. "It could be caused by so-and-so, but I've tried that without success, etc., etc."

"I've found the answer, I think," said my friend," and I'm just about to pull his leg and tell him what a nitwit he is!" I listened to the reply that was recorded, and admired it. Apparently this form of tape memorandum passed quite regularly between the two friends, both of them electronic research workers. It is in its way a very true modern counterpart of the intelligent, well-written letters which passed between people in the old, pre-electronic days, exchanging views, asking for advice, and including really worthwhile items of news.

Let it should be thought, from all that I have written, that I am directing a sneer at the growing movement of tape exchanges—the equally modern counterpart of the not yet out-moded "pen friends" clubs—let me say emphatically that I am not. Indeed, I can well understand the sense of adventure that prompts this, and I can equally well imagine the pleasure that it brings to many people. My point is, or should be, a perfectly clear one. It is that far too many people are destroying something potentially bright and useful by thinking—as with all too many things these days—that everything happens by pressing a button. It does not.

Relatively few people write letters because they want to put an envelope in the post box. Fewer still write long letters about nothing. An effort is required, and there is nearly always an urge to tell something, or to ask something, before the effort is made. So should it be with the tape memorandum or letter. But the tape recorder can make things too easy, so the potential tape poster should think first, and then think again—and then, if there is nothing to talk about, put the lid back and wait till there is.

**by: rate seabrook**



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# TAPE RECORDS



## REVIEWED

**A**N opera, a musical, jazz dance-music, cha-cha dance-music, a folk-pop singer, pure jazz and a piano recital—these make up our selection this month, comprising five 3 $\frac{3}{4}$  i/s mono tapes and one 7 $\frac{1}{2}$  i/s stereo.

The first mono is *World Record Club TT253*, carrying songs from *The Threepenny Opera* and *Irma La Douce*. Performers are Stella Moray, Mike Sammes and his singers, Mary Preston, John Huw Davies, Grahame Laver, Ruth Little and the New World Show Orchestra under Alan Braden.

*The Threepenny Opera* is one of the results of the collaboration between musician Kurt Weill and dramatist Berthold Brecht (in English translation here); from the same source came the *City of Mahogany* and *Seven Deadly Sins*. The *Threepenny Opera* is a barely disguised satirical protest set in the dismal semi-slum society of Germany in the 1920s; it is between an opera and play in character and the influence of jazz, Stravinsky and others is apparent. The Overture and nine songs are recorded here, including *Mack the Knife*; the items are well-sung and convey something of the hard down-to-earth flavour of the work—the recording is clear and clean.

*Irma La Douce*, on the other track, is a bitter-sweet French show with music by Marguerite Monnot and lyrics by Alexandre Breffort (also in translation). This, for English listeners, is very French, with its nostalgic accordian music. The Overture and five set-pieces are included, and apart from Grahame Laver, whose style is rather too ponderously English, the songs are well put over.

Less engaging, but quite suitable for party background music, etc., is *In a Sentimental Mood* on *WRC TT189*. This features Jimmy Hamilton (clarinet), Paul Gonsalves (tenor sax), John Anderson (trumpet), Mitchell ("Bootie") Wood, Britt Woodman and Dave Wells (baritone horns), Jimmy Rowles (piano), Sam Woodyard (drums) and Aaron Bell (bass). Ten pieces, mostly played in modern jazz style and suitable for dancing, are competently played and clearly recorded.

Also for dancing, but recorded vividly with a wide frequency range and great "punch" in stereo at 7 $\frac{1}{2}$  i/s (1 $\frac{1}{4}$ -track), is *Dance Tempo Cha Cha Cha* on *Crown ST 123* (available from *Teletape*). This features Manuel Rivera and his Orchestra playing ten pieces in cha-cha rhythm; this is good solid "slick beat" music performed with great precision and aplomb in the best American tradition. The stereo is also very American, however, having been produced with widely spaced microphones and no cross-mixing—consequently there is rather a gaping

hole-in-the-middle. But for people who play their tape recorders via a stereogram or who are compelled to place the loudspeakers rather close together, this tape will show its channel separation to advantage.

Returning to mono, we have *Gather Round* on *WRC TT316*, featuring Tennessee Ernie Ford singing 18 songs accompanied by a small band. This American singer covers a remarkably wide range of songs very effectively, going from folk/traditional (*Barbara Allen*, *Grandfather's Clock*), through farming songs and ordinary anecdotal and love songs, to almost (but not quite) modern "pop". It is all beautifully done, with tasteful and well played instrumental accompaniment. For unabashed sentiment without slush we particularly liked *Black is the Colour of my True Love's Hair* and *First Born*—this is a delightful tape.

From sentiment to uninhibited noise and energy in the form of two famous jazz drummers "battling it out". *Gene Krupa meets Buddy Rich* on *WRC TT248*, and they are supported by Flip Phillips and Illinois Jacquet (tenor sax's), Dizzy Gillespie and Roy Eldridge (trumpets), Ray Brown (bass), Herb Ellis (guitar) and Oscar Peterson (piano). These two drummers are almost classic exponents of the art—Krupa, particularly, is a real old-timer, having been with Benny Goodman in the pre-war swing days. Five extended pieces show that some jazz men can keep going long after anyone else would collapse with exhaustion. These are really showpieces for the two drummers, and they certainly show terrific fire and energy, but they receive virtuoso support from the other players, any listener who likes the tension of sustained high pressure rhythm will enjoy this tape.

Our last tape takes us to quite the opposite musical extreme in the form of gentle and expressive piano playing by Shura Cherkassky on *WRC TT247*. The programme consists of *Sonata in B flat* by Clementi, Schumann's *Der Contrabandiste* (arranged for piano by Tausig), *Consolation No. 3 in D flat major* and *Grande Etudes de Paganini, No. 3 in G sharp minor* by Liszt, and *Scherzo No. 3 in C sharp minor, Barcarolle in F sharp major, Nocturne in F minor, and Waltz in E minor* by Chopin.

All the many moods and styles are well expressed; the Clementi is very attractive and most people will recognise the Liszt Paganini Etude as *La Campanella*. The recording is satisfactory for playing on a small tape recorder, but wide-range equipment shows up a slight "fizziness". Otherwise the piano tone is very natural.

# HUM AND NOISE IN TAPE RECORDERS

NO. 3 —THE RECORDING CHANNEL

By GRAHAM BALMAIN

THE removal of unwanted hum and noise from the playback chain sometimes reveals that some from the recording amplifier is being recorded on the tape. Recorded hum is most likely to arise either in the microphone amplifier or, oddly enough, in the output stage or the HF ease/bias oscillator. Localise the source first. If the hum (or noise) is controlled by the recording gain setting, then it obviously comes from the input stage(s), and these can easily be dealt with according to the suggestions in the first two parts of this series. Since there is no bass boost in microphone amplifiers, signal-to-hum-and-noise ratios of 70-100 dB can readily be achieved if necessary.

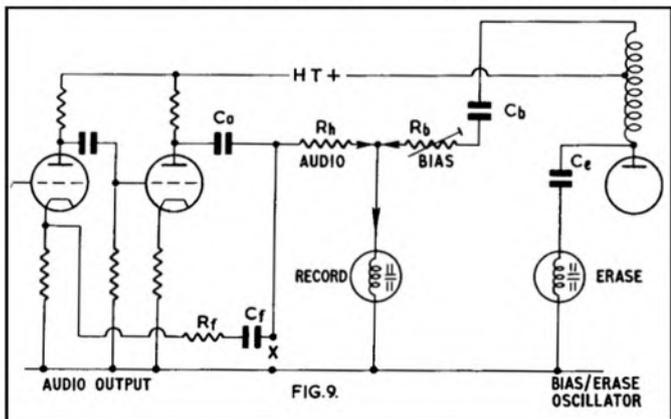
Should the recording gain control have little or no effect then some or all of the *hum* must arise elsewhere (apart from gross faults, wideband noise is hardly likely to be troublesome outside the microphone amplifier). Shorting the signal output between the feed capacitor C and the head series resistor R (see X in **fig. 9**) will remove hum due to the output stages—for temporary test purposes only, of course—and anything remaining must be due to the HF oscillator. In either case there is likely to be too much ripple on the HT supply line; this is usually curable by increasing smoothing capacitances.

However, it may be difficult to increase smoothing of the oscillator supply without upsetting the "anti-click" switching arrangements, especially if that switching is in the HT line. In this case look first for *faults* if the hum is really bad: the oscillator valve, for instance, or insufficient main HT smoothing. Otherwise, establish whether the hum is recorded via the erase head or the record head, by lifting the tape off the former for a moment (use pre-erased tape, of course). About the last expedient available now is to tune either or both heads as necessary; but more of that later.

## Recorded Noise

A common trouble is excessive noise on the tape which has apparently no cause in the recording channel—no audible cause, anyway. Such noise is distinctively rougher than simple recorded amplifier noise, sometimes quite bubbly. There are several possibilities, falling into two main groups: AC—excited noise, and that caused by direct magnetisation of the tape.

AC noise is, in fact, always present on tape under the name of "modulation noise" or the "noise behind the signal", whether or not the signal is of an audible frequency. Normally it is obscured by the



**Fig. 9.** Possible DC leakage paths, causing high background noise on tape, through  $C_o$ ,  $C_f$ ,  $C_b$ , and  $C_e$ .

programme which produces it, but infra- or ultrasonic signals obviously cannot do so: hence the "noise-without-a-cause".

Infrasonic signals are most likely to be low frequency self-oscillations of the amplifier—"motor-boating"—which are sometimes audible and sound like amplified heartbeats or like the thudding science-fiction background noises heard on radio or TV. If otherwise inaudible, they produce a corresponding "whoosh, whoosh, whoosh" background

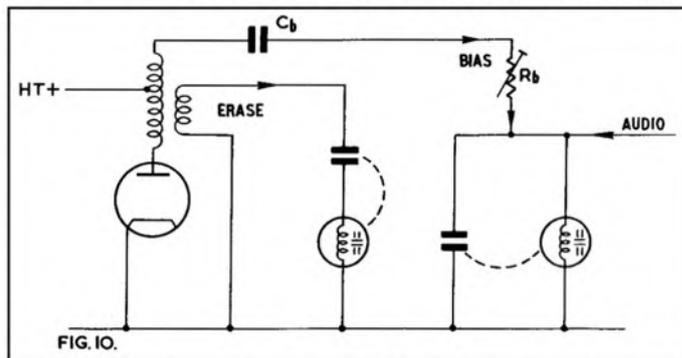
noise on the tape. The effect may be visible on the recording level meter. The cause is generally insufficient or unintelligent HT decoupling between stages, or too good an amplifier response at low frequencies. Beyond saying that increasing smoothing capacitors and/or decreasing coupling capacitors may work a cure, this subject can hardly be pursued here.

Ultrasonic signals can arise either from self-oscillation of the recording amplifier at a high frequency or from interaction between some external interfering source and the bias/erase oscillator. The former is usually accompanied by severe signal distortion and its cure is a matter of finding the fault. Again, the condition may be detected by a reading on the recording level meter, this time a steady one.

Preventing interference between external sources and the bias/erase oscillator usually involves examining the screening and earthing of the recorder and its input leads, and also, wherever possible, of the source of interference. Again, the possible conditions and cures are too many to be examined here.

Some conditions akin to these may actually produce interference *within* the audio range, either in the form of a steady tone or as vague but irritating twitterings at the treble end of the range.

The latter is a sure sign either of excessive high frequency content in the audio input or of an insufficiently high bias frequency. Under these conditions, ultrasonic harmonics of the high audio frequency signals react with the bias frequency to produce various beat tones,



**Fig. 10.** Typical resonant feed circuits for low-impedance erase head and high-impedance record head. Resonant combinations shown by dotted lines; erase in series, record in parallel.

some of them audible. There are only two cures. One is to ensure that the bias frequency is at least four or five times that of the highest useful audio input frequency, either by restricting the input bandwidth or by raising the bias frequency. The other is to reduce the recording level, since the effect is associated with the onset of tape overloading.

## DC Noise

Probably the most common cause of excessive tape noise is DC magnetisation, and it can often be eliminated simply by demagnetising the deck and heads regularly as described in Part 1. Heads do become magnetised accidentally for various reasons: switching surges, sudden transient signal peaks, removing the signal input abruptly instead of fading down, uncontrolled oscillator switching, and so on. But if DC magnetisation persists in spite of everything then there is probably a direct current through the erase or record head or a DC component in the erase/bias supply.

An explicit direct current through a head must obviously be due to a direct leakage path. **Fig. 9** shows some of the possibilities with faulty or unsuitable capacitors, which are the most likely causes. Capacitors used in these positions *must* be good paper types (for audio stages) or mica (for bias/erase feeds) of at least sufficient voltage rating, and the higher the better, according to the space available. Remember that a leakage DC of only one-thousandth of the normal audio current

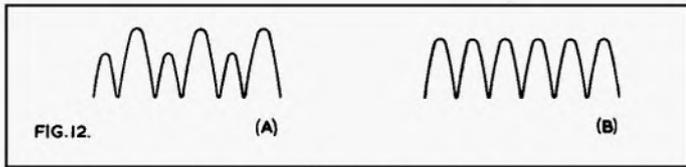


FIG. 12.

(A)

(B)

**Fig. 11.** Push-Pull Oscillator for erase/bias supplies. Frequency about 80 Kc/s when loaded. Half-primary inductances 5-10 mH, equal within 1%.  
**Fig. 12.** Waveforms across 470 ohm cathode resistor of oscillator (fig. 11): (a) incorrect, (b) correct, obtained by adjusting 250 K balancing pot

will cause an appreciable rise in tape noise. With modern high-impedance recording heads this means that leakages of hundredths of microamperes may cause trouble.

Erase heads are not nearly so susceptible—hundredths of milliampères and above will be needed to raise the tape noise—and ferrite types do not become permanently magnetised at all, of course. Although permanent head-magnetisation is not a requirement for causing noise, these heads do remove the necessity for demagnetising the erase head on most modern machines.

Heads which receive bias and erase supplies via HF transformers cannot experience direct leakage from those suppliers unless the transformer has a leakage path. It could happen, but I have never met one yet.

The tape may still experience an effective direct magnetisation, even though no direct leakage path exists, by virtue of asymmetry in the bias/erase supply waveform. Most single-ended valve oscillators produce some even-harmonic waveform distortion (which causes the asymmetry), but how much actually appears in the bias and erase current waveforms—current being the important quantity here—depends critically on the overall design of the oscillator and feed circuits.

Tuning the heads at the bias/erase frequency is often very helpful, although arriving at suitable capacitor values and deciding whether to use series or parallel resonance may be difficult and cannot be done safely without the help of a cathode ray oscillograph to check current waveforms. Tuning the heads, particularly the erase, will usually lower the oscillator frequency, and this may involve raising the unloaded oscillator frequency to arrive at the correct value with the tuned load connected. Too much or too little tuning capacitance may cause peculiar unwanted modes of oscillation. Series resonance is best used where the head impedance is high compared to the oscillator output source impedance; parallel resonance where it is comparable or lower. The current magnification in resonated ferrite erase heads is generally about ten times, and in radio-metal erase heads two or three times, so some extra control may be needed to restore suitable current values. Fig. 10 shows a typical resonant feed circuit for a low-impedance erase head and a high-impedance record head; the actual circuit

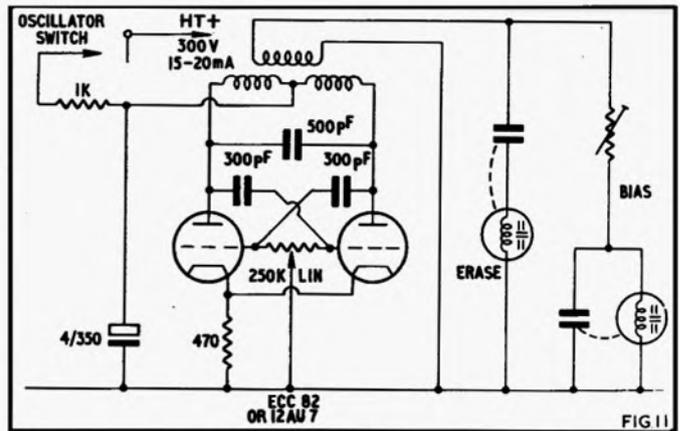


FIG. 11

arrangement and values will obvious depend on the particular oscillator and heads used.

Inexperienced readers are strongly advised to consult the makers of the heads before embarking on this sort of exercise. And please note, if you are trying to reduce recorded hum by resonating heads, that only series resonance is effective for the purpose.

A very powerful method of reducing bias/erase waveform asymmetry (and also recorded hum due to HT ripple) is by using a push-pull oscillator, in which even-harmonic products tend to cancel out. A simple and economical circuit is shown in fig. 11 and recommended to home constructors. The coil should have two equal half-primary windings with the secondary between. If a ferrite core is fitted it should be locked firmly in the position which gives equal half-primary inductances, or removed entirely. Any attempt to tune the oscillator by moving the core will unbalance the half-primaries and cause waveform asymmetry.

The primary/secondary ratio will depend on the heads used (consult the makers!) and should be such as to reflect a load of some 50-100 K across the valve anodes from all secondary loads, with tuning. Unless the secondary is suitably tapped, the heads must be chosen so that the tuned erase head requires a voltage drive about twice that needed across the record head, or no control of the bias current will be possible.

The 250 K potentiometer is adjusted to balance the outputs from the two valves for the best waveform symmetry, either by listening for minimum tape background noise or, with a CRO across the 470 ohm cathode resistor, making alternate cathode current peaks equal (see fig. 12). This adjustment may need trimming if any circuit changes are made subsequently.



Continued on page 42

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# TAPE RECORDER SERVICE

No. 26—Telefunken 75-15, 76 by H. W. Hellyer

A GROWING number of readers request information on the Telefunken machines. From their remarks, it would seem that there is a prejudice against Continental design, and a fear that in the event of failure, spares would be hard to get, and expensive. They are suspicious of these models, which may be offered at what seem reasonable prices on the second-hand market, and want more information before risking those hard-earned savings.

## Prejudice Against Continental Design

Let us squash one prejudice immediately: Messrs. Welmecc Corporation Ltd., (Lonsdale Chambers, 27 Chancery Lane, London, W.C.2) have been distributing the Telefunken range in this country for a number of years. They are the sole distributors, and their outlets are well established. From personal experience, I can say that their technical advisors are always most helpful, and the spares situation is no more difficult than with home-produced equipment.

As to value for money: this is not the place for a review, or a comparison of designs. If Continental design appears over-fussy to some correspondents, it may be only the result of judging the ambitious construction of the machines marketed in this country, and forgetting that a whole world of different models never crosses the Channel. When buying any second-hand machine, one can only consider first, the points mentioned above, and next the condition of the actual piece of equipment. Articles have appeared before in these pages on choosing and buying second-hand tape recorders, and although there is much I would like to argue on the subject, this is not the place to say more than: never buy without trying. Test the "bargain" thoroughly; the tiny knock or the hint of harshness may well betoken a deep-seated, quite incurable fault. The best bargain is the machine put aside by the owner who is graduating to something better.

## The Basic Machine

Which brings us, by devious routes perhaps, to our brief. The Telefunken 75-15 is one of the "basic" machines in the Welmecc range. Many enthusiasts cut their teeth on the 75 and have now gone on to the 77, 85, 89, etc., leaving behind them a machine that is perhaps four or five years old and still capable of results comparable to new machines at twice the price.

To sum up the specifications: this is a two-speed machine,  $3\frac{3}{4}$  and  $1\frac{1}{2}$  i/s, with  $5\frac{1}{2}$  in. spools. (The earlier model, the 75, had smaller spools, but was similar in most other respects. The later model, the 76, is a  $\frac{1}{2}$ -track machine. Other differences between these and the earlier models are the replacement of the EM71, an exclamation mark type of magic eye, with a conventional EM84, and the separation of the input selector from the volume control and on-off switch. A transistorised pre-



amplifier stage is added, and parallel playback facility is incorporated on the 76.)

The model 75-15 has an EF86 first stage, a dual-triode ECC83 and EL95 output-cum-oscillator. HT is supplied by a B250, contact-cooled rectifier, and the single motor is fed from the 165 volt tapping on the mains transformer for 50 c/s operation. The rewind time for a full,  $5\frac{1}{2}$  in. spool, is approximately 4 minutes. Wow and flutter at the higher speed is given as less than  $0.4\%$ , and signal-to-noise ratio better than 40 dB. The frequency response is sensibly level between 60 c/s and 16 Kc/s at the higher speed on the 75-15 and extends to 30 c/s on the model 76. Inputs are 2 mV into 2 Megohms-microphone, and 2 mV into 50,000 ohms-Rad/PU. Output at the Audio socket is 1.5V into an 18 K load, or 0.5V into a low impedance earphone, and 2.5W to a 3.5 ohm loudspeaker.

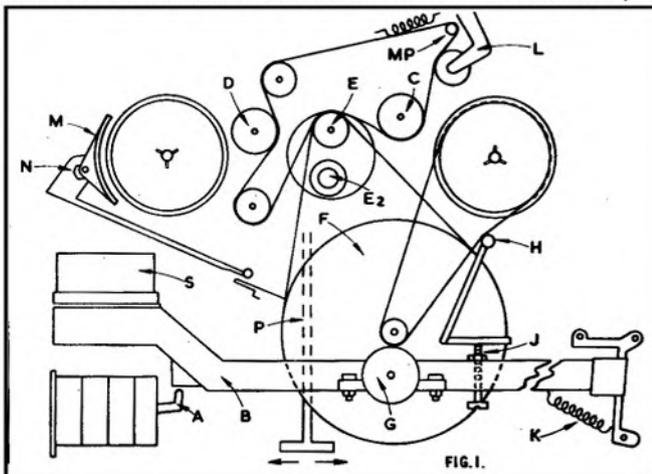
## Tape Transport System

The mechanical drive system is shown in fig. 1. This is drawn in the Playback position, selected by the appropriate key, which pushes the small lever *A* forward and impels the long arm *B* toward the solenoid *S*, which is energised by a separate 25V supply from the mains transformer. Normal current is 300 mA. The motor is a two-pole, synchronous type. A flat rubber belt is linked over the pulley *MP*, two idlers *C* and *D*, over tensioning guide pulleys, and around the speed selector idler *E*. The latter is mounted on a disc plate which can be swivelled through 180 degrees to engage *E2*, of a lesser diameter for the correct speed drive. From these idlers, another belt drives the flywheel *F* and its capstan, with which the capstan idler *G* engages. Another flat belt is coupled to the capstan pulley and drives the clutch of the right-hand turntable. Allowance for the difference in speed as the spool fills is made by letting the belt slip on the capstan spindle, and tension is adjusted by the running idler *H* on its angled arm. Note the adjustment screw *J* in the pressure lever arm, which sets the position of the angle, and should be turned for correct take-up torque (actually 70 to 100 gms. pull), but not to the extent of its travel. If it is necessary to compensate, bend the lower part of the tensioning lever a little. Before doing this, check the inward pressure of the main arm. The pivot is between the chassis and a bearing support, and is held by three screws. By slackening these screws, the bearing support can be moved slightly. If a spacer of 0.3 mm. is available, clamp this between the capstan idler holder and the lever, compressing the right-hand pressure spring. Then hold the armature to the solenoid and move the support bracket until the capstan idler engages correctly. Tighten the screws and note that the return action of spring *K* is adequate. When the Quick-Stop button is operated, the clearance between the solenoid and armature should be 3.5 to 4 mm. This can be adjusted by bending the small operating lever on the push button assembly. Note that for fine capstan idler pressure adjustment, two screws are provided on its mounting bracket. Do not forget to tighten the locknuts on these after adjustment, or you may end up with wow.

Another tensioning device will be seen in fig. 1. This is an idler on a sprung arm *L*, which keeps the main drive belt at correct tension. It is important to check both the speed selector swivel disc for correct positioning and the tension of the spring that is hooked to this arm.

## Ingenious Brakes

The braking system of these machines is quite ingenious, depending on the tape tension for adjustment of pressure to enable even winding. Part of the assembly is shown in fig. 1. The hub-brake *M* is pivoted on a



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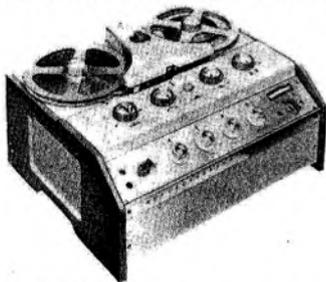
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## Tape Recorder Service—Contd.

lever which has a pin at its forward end, over which the tape runs. As the angle of the tape increases with the growing amount spooled on, so the pressure on the pin increases. Conversely, the pressure on the feed spool decreases. Difference in diameter ratio of a full and empty spool is about 1:3, and this system allows an even pressure over this quite wide difference, without the need for complicated clutch devices. It will be noted that the actual shape of the brakes follows the wedge design, familiar to users of Philips machines, for example; this enables the spools to receive proportionate braking force dependent on the direction of rotation. From this it follows that brake shape is important and evidence of wear should be checked if spillage is reported. Note also that the pivot has an eccentric bush *N*, which allows a fine adjustment. For a spot check, load a full spool and hold the tape firmly so that from the outer turn of the spool it just sits against the nearest tape guide. The control pin of the brake lever should then just touch the tape.

Fast-wind and rewind are effected by swivelling of the reversing assembly so that the appropriate idler engages the rubber ring of its turntable. In the neutral position, the clearances should be equal, and an adjustment is provided on the arm of selector *P*. The method of adjustment is to adjust the spring along the length of this lever, after slackening the lock screw, then rewinding from empty to full in each direction, re-adjusting as necessary. Some patience is needed when making this adjustment, and it should always be done when the machine is thoroughly warmed up—never on a "cold" machine.

### The Recording Heads

The head assembly is completely screened by a flap during Record and Play. The setting of this flap is important. There are slotted holes in the plate spring, and two screws securing it. After making any azimuth changes, remember to check the correct seating of this flap, and note that on neutralising the mechanism, it springs back clear of the tape loading aperture.

The azimuth alignment screw is the one to the left of the head, but the complete head assembly can be adjusted by first removing the screening shield. Note that the level run of the tape may be altered slightly by adjustment of the left-hand tape-guide near the capstan. This is a screwdriver adjustment, but should be made with circumspection.

Note that the speed selector disc is adjustable within small limits to keep the belt in the middle position of the upper diameter step at the higher speed. Elongated holes, with screws accessible from beneath allow adjustment of the bearing bracket. A locking ring on the axle of the disc limits end play. Remember that the belt alignment also depends on motor positioning, and it may be necessary to adjust the three nuts holding the motor, through rubber buffers, to the chassis. These are accessible after removing the take-up spool carrier. To do this, first withdraw the two securing screws and take off the upper portion, then take off the grip ring. This allows the lower portion of the turntable to be lifted from its shaft. Care must be taken with the washer at the top of the spindle, and it should be noted on reassembly that a clearance of about a millimetre is necessary between this washer and the grip ring. Less than this will result in erratic take-up.

Another cause of this fault, not always obvious, is a loosened nylon sleeve on the capstan itself. The only effective cure is to use a good—but thinly coated—adhesive. If it is necessary to remove the flywheel assembly, the head component mounting plate, the right-hand turntable, brake and slipping belt should all be removed and then the capstan idler lever, by taking off its three screws at the right-hand support. The capstan shaft bearing has three screws, accessible through holes in the flywheel. Remove these, and the belt, and the complete assembly can be withdrawn. On reassembly, the adjustment of the capstan idler lever should be checked, as outlined previously. Note that this adjustment is extremely important on this range of machines. Curious faults can occur through, for example, incorrect solenoid setting. A hum may be noted, and much fruitless testing can be avoided if the solenoid and idler lever are first checked.

Electrical adjustments are few and simple. Normal test bench procedure requires the use of a screening plate with holes for access to adjusting points, but the best method of *in situ* checking is to replay a good test tape or wide range recording, first set the azimuth alignment with the left-hand screw, and then check the bias.

The bias trimmer on the 75-15 is a single unit, but the 76 has, of course a separate trimmer for each track. Turning these clockwise

(Continued on page 33)

# TAPE, RECORDERS & ACCESSORIES

## FIRST DETAILS OF NEW PRODUCTS



AMPEX SERIES F-44

DYNATRON SPECIALIST 1200



FERGUSON 3024



Q-Cord 203

**A** SISTER machine to the *R119K*, reviewed in our November 1963 issue, is the *Q-Cord 203*. Priced at £34 14s., it is a battery portable recorder, with a tape speed of  $3\frac{3}{4}$  i/s. Frequency response is given as 60 c/s to 10 Kc/s, with 0.5% wow and flutter. Several accessories are available, including a mains adapter, price £5 5s., a microphone transformer, permitting low-impedance microphones and consequential long leads to be used with the recorder. **Distributor: C. Braddock Limited, 266 Waterloo Road, Blackpool, Lancs.**

\* \* \*

Unicorder SR-F6IRT

**A** NEW mains/battery portable tape recorder has been announced by *Denham & Morley*. Made by *Standard* of Japan the *SR-F6IRT* measures 8 x 6½ x 3 in. and weighs 6 lbs. The machine has two speeds,  $1\frac{1}{2}$  and  $3\frac{3}{4}$  i/s, and two tracks. Maximum spool size is 3½ in. Output power, into a 2½ in. internal speaker, is 300 mW. The microphone supplied is a 400 ohm moving-coil unit. A separate high-level input is incorporated, requiring an impedance of 100 K.

The *Unicorder* can be operated while inside its leather carrying-case; it incorporates fast forward and rewind facilities, and has sockets for remote control, for which foot switch and microphone with built-in switch are available. The machine cost £37 16s. complete with remote-control microphone, leather case, recording and mains leads, earphone, shoulder strap and microphone case. **Distributor: Denham & Morley Limited, Denmore House, 173/175 Cleveland Street, London, W.1.**

\* \* \*

Dynatron Specialist 1200

**A**N interesting new recorder, using the well-known *Pamphonic* Tape Deck, is the *Specialist 1200*. The machine is extremely versatile, offering such facilities as echo, variable bias, three-channel internal mixing, and speeds of  $3\frac{3}{4}$  and  $7\frac{1}{2}$  i/s. Frequency response at the faster speed is 50 c/s to 10 Kc/s ( $\pm 2$  dB), 50 c/s to 13 Kc/s ( $\pm 3$  dB). Response at  $3\frac{3}{4}$  i/s is 45 c/s to 7.5 Kc/s ( $\pm 2$  dB). Signal-to-noise ratio is given as 50 dB (unweighted including hum). Wow and flutter is 0.2% RMS at  $7\frac{1}{2}$  i/s. A ½-track recorder, the *1200* takes spools of up to 8½ in. diameter. It is equipped with an automatic stop and has outputs from head pre-amp and main 3W amplifier. A 10 x 7 in. *Goodmans* speaker permits internal monitoring. Separate inputs are available for three microphones, two high and one low impedance; modulation level is indicated on a meter. Retail price is £145 19s. **Manufacturer: Dynatron Radio Ltd., St. Peters Road, Furze Platt, Maidenhead, Berks.**

UNICORDER SR-F6IRT

Ampex Series F-44

**A** COMPLETE new line of stereo tape recorders, comprising four different models for domestic and educational use, has been announced by Ampex.

Several advances have been made over the *Series 1200* which the *F-44* replaces, these include, on the service side, an individual performance record showing the specification of each machine. A new hysteresis-synchronous motor has been designed, providing smooth, quiet operation through a dynamically balanced rotor and fan. The improved amplifiers now incorporate separate bass and treble controls, and a horn-type tweeter with crossover network has been added to the speaker system.

The *F-44* line includes the following models:

*F-4450*: Unmounted for use in custom installations, or in optional wooden cabinet. Includes playback volume control and microphone inputs.

*F-4452*: Unmounted, for use in components systems with central volume control. There is no playback volume control.

*F-4460*: Portable for on-the-spot stereo recordings. Mounted in carrying case.

*F-4470*: Portable for on-the-spot recording, monitoring, and playback. Has built-in stereo amplifiers and speakers.

*Model 2044*: Portable, self-contained amplifier and speaker system. For use with *F-44* recorders, AM/FM tuners, or as a portable PA system.

\* \* \*

Ferguson 3024

**L**AATEST addition to the Ferguson range is the *3024* tape recorder. Incorporating an entirely new tape-deck, the *FTD 4*, the recorder has several interesting facilities. The most unusual, on a domestic machine of this type, is a pause control built into the microphone. Also, an automatic stop and superimposition facilities give an added touch of luxury.

Using various special accessories it is possible to play back stereo tapes, and to synchronise the recorder with a slide projector. The *3024* operates at  $1\frac{1}{2}$ ,  $3\frac{3}{4}$  and  $7\frac{1}{2}$  i/s, ½-track, and has storage space for the microphone and connecting leads in its two-tone blue cabinet. The list price is £34 13s. **Manufacturer: Ferguson Radio Corporation, Upper Saint Martins Lane, London, W.C.2.**



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# EQUIPMENT REVIEWED

## TRUVOX PD99 STEREO TAPE UNIT



**Manufacturer's Specification:** Reel size: Up to 7 in. diameter. **Tape speeds:**  $7\frac{1}{2}$ ,  $3\frac{3}{4}$ ,  $1\frac{7}{8}$  i/s. **Tracking sense:** International top track left-to-right. **Drive:** Three motors, including external-rotor capstan motor driving a heavy balanced flywheel. Drive completely disengaged in "off" position. **Brakes:** Mechanical, compensated. **Fast wind and rewind:** 1,200 ft. in 60 seconds. **Wow and flutter:**  $7\frac{1}{2}$  i/s—better than 0.1%;  $3\frac{3}{4}$  i/s—better than 0.15%;  $1\frac{7}{8}$  i/s—better than 0.25%. **Record-Play heads:** High impedance. **Erase heads:** Low impedance. **Counter:** 4 digit. **Frequency response:**  $7\frac{1}{2}$  i/s, 40-17,000 c/s.  $\pm 2$  dB, 30-20,000 c/s  $\pm 4$  dB.  $3\frac{3}{4}$  i/s, 40-10,000 c/s  $\pm 2$  dB. 40-12,000 c/s  $\pm 4$  dB.  $1\frac{7}{8}$  i/s 60-8,000 c/s  $\pm 3$  dB. **Hum:** Less than 45 dB. **Signal noise ratio:** Better than 50 dB. **Input 1:** Microphone, 1.4 mV at 2.2 M. **Input 2:** Radio/PU, 150 mV at 500 K. **Output:** Across 100 ohms. **Oscillator frequency:** 62 Kc/s. **Recording level indicators:** Meters. **Price:** £82 19s. **Manufactured by Truvox Ltd., Neasden Lane, London, N.W.10.**

THIS stereo tape unit is designed to be incorporated in a Hi-Fi system, as it contains no loudspeakers or power amplifiers of its own. The deck and pre-amplifiers are mounted on a dark wooden plinth which blends unobtrusively with other equipment. The deck is the new *Model 90*, which replaces the *Model 80* reviewed in the July issue of this magazine. The action of the keys is much lighter due to a change of shape and the provision of a finger plate which allows the keys to be operated by a squeezing action rather than a push.

### A Novel Feature

A novel feature is a splicing block mounted on the underside of a flap which opens to give access to the heads. When the flap is folded back the block is in precisely the right place for quick and easy splicing, and is hidden when the lid is closed.

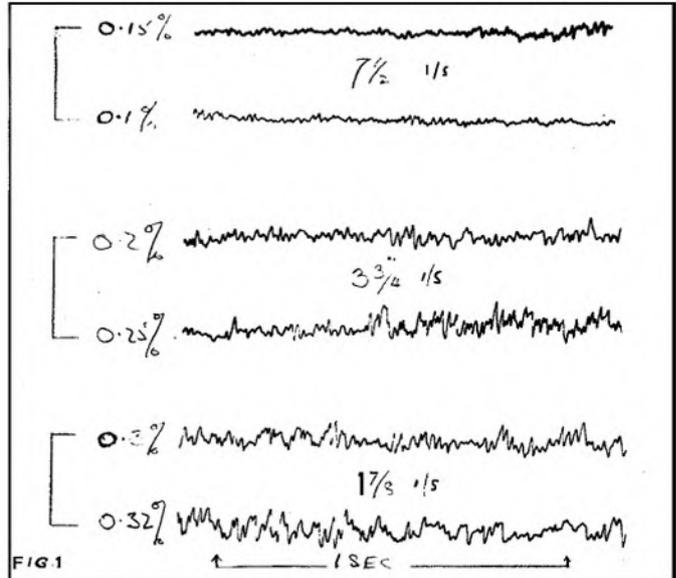
The control panel is separate from the deck, with clearly numbered edge-type mixing controls for the two channels grouped in the centre, flanked by Record-Play push keys with neat little red and green indicator lamps to indicate the state of the circuits. The two microphone input jacks are on the extreme left, and the two edge-type record level meters and line output switches are to the right. Phono type sockets for line outputs and RPU inputs are sited in a cut-out on the right side of the cabinet.

### Subjective Tests

The machine was loaded with mono and stereo tapes of known performance and careful listening tests carried out through wide-range speakers and power amplifiers. The first impression was of slightly too

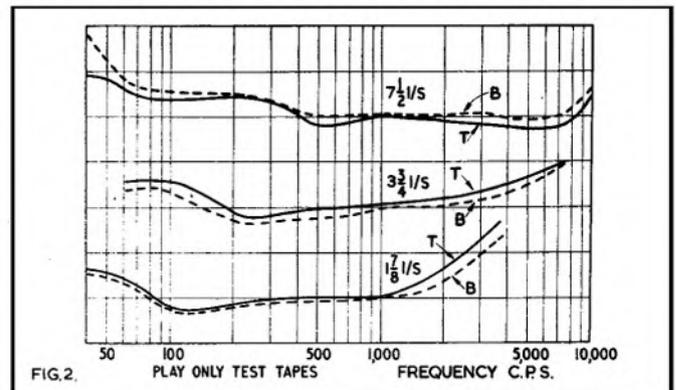
much extreme top and bass at all speeds—a slight "hole-in-the-middle" effect in terms of frequency response, not stereo placement. At the two lower speeds quality sounded super wide-range, but not quite clean.

Record-Play tests were excellent at  $7\frac{1}{2}$  i/s with a better frequency balance and less of the bass and top emphasis, but with a little low frequency tape noise and extreme high frequency tape hiss which showed that the playback response was still affecting things a bit. At the two lower speeds, record-play quality was even more obviously unclear, with intermodulation products of some kind "clogging up" the high frequency response. Also "drop outs" were very obvious on the top track, and these certainly had not been noticed on the play only tests.



At no time was there any suspicion of speed unsteadiness. A sustained musical note sounded dead on pitch although there was this constant feeling of slight roughness. I can usually recognise the effects of under-biasing, overmodulation or various types of tape flutter, but this was different, and I proceeded with my measurements with some interest to try and uncover the exact cause of the trouble.

Fig. 1 shows the fluttergrams or pen recordings of short-term speed variations at the three tape speeds. It will be seen immediately that the flutter is well above the specification at all speeds and at the two lower speeds in particular it has an almost completely random quality which prevents it being recognised as "gargle" or "warble", symptomatic of cyclic speed variations due to rotating parts of the tape drive mechanism. It is this random frequency modulation of the high frequencies which is responsible for the roughness noticed at the two lower speeds. The July review of a recorder using the type 80 deck had



(Continued on page 31)



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## Equipment Reviewed—(continued)

shown excellent wow and flutter figures, and I therefore looked to see what differences there were between the type 80 and type 90 decks.

Removing the head cover revealed one very obvious difference: the individual head pads had been replaced by a long block of foam rubber, faced with a fabric ribbon, and I would guess that there is some "stick and release" effect, or resonance between the tape tension and the rather "live" foam, which is particularly affecting the central record head (separate record and play heads are fitted to ease switching problems and to allow cross-recording from track to track without trouble from bias break through).

Test tapes recorded to the CCIR 100, 200 and 400 microsecond time constants were used to plot the responses shown in fig. 2. The solid curves are for the top track, and the dotted curves for the bottom track. Agreement between top and bottom track responses was very close, but both showed the bass and top rise noticed in the listening tests. Readings were fairly steady on the top track, but there was a very slow wander in level of about plus or minus 1 dB which seemed to be due to up and down movement of the tape caused by the pressure pad system.

System-noise and hum was only 28 dB below test-tape level on the bottom track and 30 dB below test-tape level on the top track at  $7\frac{1}{2}$  i/s. The difference is due to the extreme low-note equalisation in the two channels, and both hiss and hum are exaggerated by the boost at the extremes of the response range.

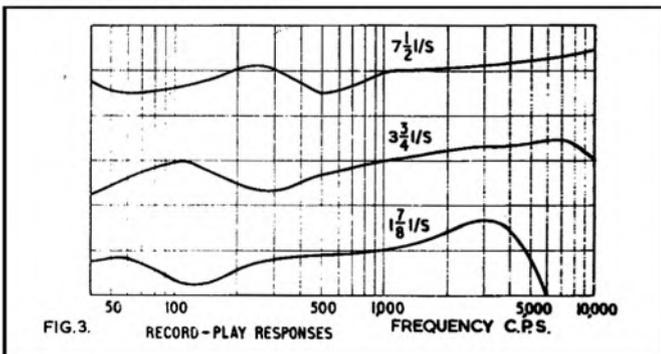


FIG. 3.

The record play response of fig. 3 show peaks and dips which shift down the spectrum as the tape speed is reduced; these are caused by the short pole-face heads used in this recorder (see July review and my article in April '62 issue). The high frequency roll-off (compared to the play-only responses of fig. 2) indicates that bias is near optimum at the highest speed, and this was confirmed by peak-level recording tests which showed that a level 14 dB above test-tape level could be recorded with only just perceptible waveform distortion. At this level the record level meter pointers were just entering the red overload sector of the scale.

Measurement of the bias voltage across the record heads indicated that the bias was slightly above the recommended 40V. Thus under-biasing is not the prime cause of the roughness noted in my listening tests. Further recording tests, however, continued to show slight distortion and intermodulation, even at  $7\frac{1}{2}$  i/s, where tape flutter effects were quite low. CRO tests at a fixed playback level, compared with known properly recorded tapes, indicated that tapes recorded on this machine were considerably over-modulated even when the record level meters were not allowed to kick above mid-scale.

It was eventually found that correct level recordings were made with the meter needle hardly leaving the stops, and with absolute peaks barely reaching the -12 dB mark. Steady tone tests had shown that the calibration of the meter was correct, so that these tests prove that it is the dynamics of the meter or the time-constant of the associated circuits

(Continued on page 33)

### SUBSCRIPTION RATES

The Subscription rate to *The Tape Recorder* is 30s. per annum (within the British Isles) and 32s. 6d. per annum overseas (U.S.A. \$4.50). This includes a free copy of the annual index. The same rates apply to *Hi-Fi News*.

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## Tape Recorder Service—Contd.

increases the treble response. Quite a small difference in bias setting can make a great improvement in overall response.

Hum is a problem that needs some care in solution. It is first necessary to check the heater balance control. This is a pre-set resistor situated (on the 75-15) roughly at the centre of the machine, viewed from below. It is against the vertical screening plate, easily accessible. The procedure is to run the machine at the higher speed on playback, with no tape loaded, adjusting for minimum hum, as measured with a valve-voltmeter at the output. To reduce hum still further, it may be necessary to reverse the wires to the solenoid, and to adjust the head screening flap.

The 76 requires no heater balance control, as the heater supply is DC. The use of the transistorised input stage also makes for a better noise factor. However, the minor points mentioned above still apply, and should be checked.

Much of the foregoing also applies to the Stereo 77 model, which, apart from its push-button assembly, is similar to the 75-15 and 76. There are, however, a number of small but important changes in the later model, the 85, and for details of both these machines, we shall have to spend a little more time and space than is available here. Till next month, then . . .

## Equipment Reviewed—(continued)

which are at fault. I would hazard a guess that the circuits are OK, and were designed for the light-movement meters used on the mono machines, but that the heavier edge-type meter pointers are not correctly indicating true peak levels. (See articles by Grahame Balmain in August, September and October '62 issues).

**Comment:** Last month we had a recorder which had been designed "by ear" and which sounded all right despite some rather poor frequency responses. This month we have one where all the facilities of a well equipped laboratory have been used during the design stages, but nobody has had time to take it into a quiet corner and live with it, to sort out the little snags which are not revealed by steady-state meter readings, but which the ear can pick out straight away as "something wrong".

I think a little attention to the pressure pad system, a check on the meter dynamics and a slight re-distribution of the frequency correction between the record and play circuits will make this recorder live up to its very professional finish and styling.

A. Tutchings.

## Readers' Problems

### Poor Erasure on the Viscount

Dear Sir, I was interested in your reply to E. H. of Swansea, in the November issue of *Tape Recorder*, regarding faulty erase on his Elizabethan tape recorder. I have experienced the same trouble with my Wyndor "Viscount", which defies all remedy.

Both right- and left-hand erase heads of its Collaro Mk IV deck have been thoroughly cleaned, and the HF, bias and erase oscillator valve (6BW6) changed. Is it possible that the information you gave, concerning the erase feed capacitor, can apply in this case?

Yours faithfully, A. C. M., South Benfleet.

The poor erasure on your Wyndor "Viscount" has a different origin than in the case of E.H., Swansea, with his Elizabethan. In your case there are four separate capacitors which could be faulty—and if your recordings on clean tape are also below standard, the likelihood is that you will have to replace at least three of these. Luckily, they are quite inexpensive. The reason for the poor recording is incorrect bias, which can be caused by the two 0.002 mfd capacitors associated with the primary of the oscillator transformer, or the anode feed capacitor, which is 197 pF, and fairly critical. (But unless the last mentioned is leaky, which can be proved by disconnecting, erase should not be impaired.) Best cure is to replace the two 0.002 mfd caps and the 0.007 mfd across the secondary. Use good quality, 500V WKG capacitors in these positions, and if necessary to replace the anode feed capacitor, use disc ceramics, a 250 pF and a 47 pF in parallel, because 197 is not a preferred value.

(Continued on page 35)

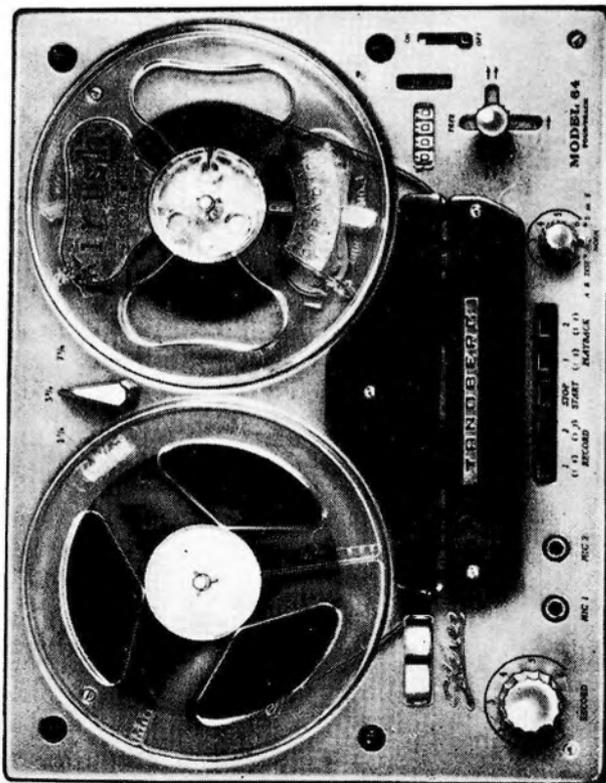
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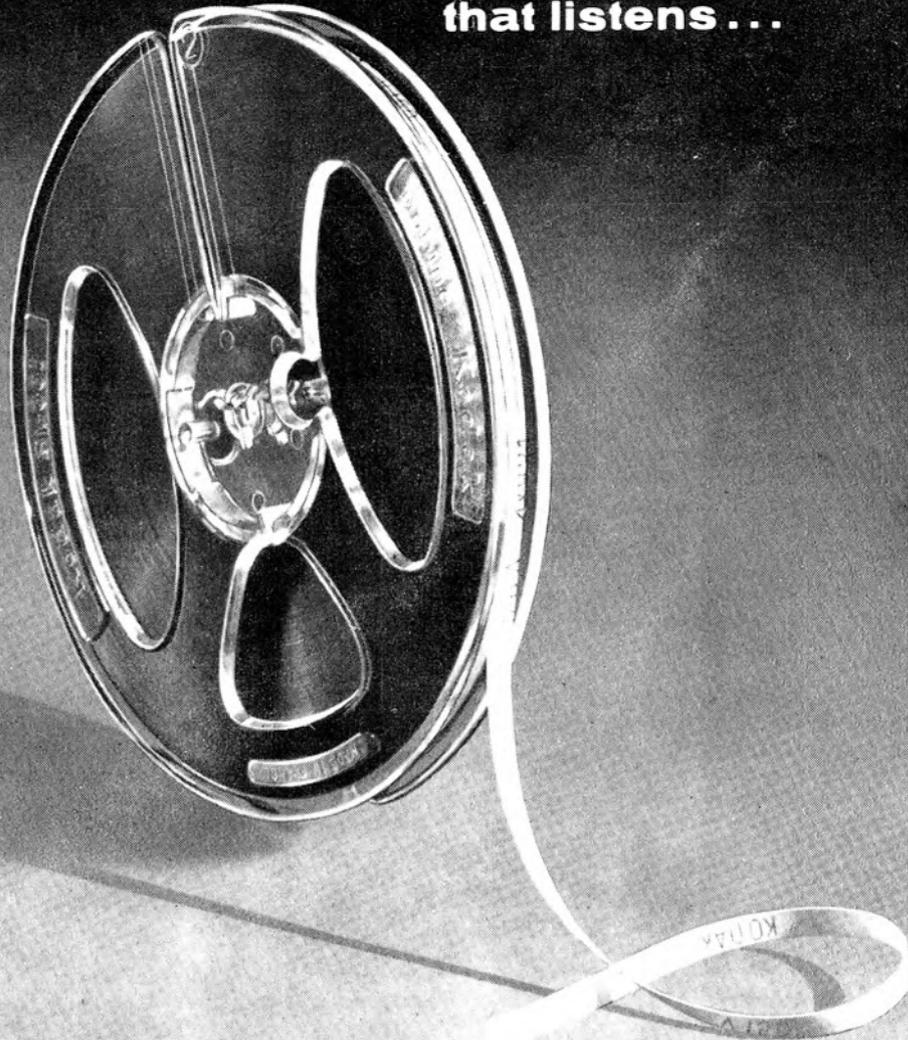
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# Readers' Problems

## Microphone Mismatching

Dear Sir, I am experiencing some difficulty with hum in tape recordings made on my Hi-Fi system. I use a Collaro Studio Tape-Deck with the Mullard Type "C" Tape Preamplifier. The hum is present on replay when the recording is made with the BM-3 (Japanese) Crystal Microphone connected to the appropriate input jack of the Tape Preamplifier. However, when the signal from the Tape Recorder Output of a Heathkit AA-60 (American) control unit is fed into the high level (Radio) input jack of the Tape Preamplifier, the recordings when replayed are quite satisfactory. Also when the microphone, control unit and power amplifier are used as a PA system, the results again are satisfactory. I wonder if you can help me eliminate this hum from my recordings.

Yours faithfully, A. J. V., Poona.

*The hum you are experiencing when recording through BM-3 (Japanese) crystal microphone, Mullard Type "C" preamp to Collaro Studio Deck is almost certainly due to severe mismatch of microphone to input circuit.*

*As the input impedance of the Mullard Type "C" is nominally 2·2 megohms, I would suggest that there is a high resistance connection in series with the microphone at some point. The actual connections to jacks, microphone connector, etc., are easily checked. But the BM-3, in one version, has a "stud" fixing, with screw clamp, relying upon the pressure of the fitting to maintain electrical contact. This is hardly the most satisfactory way of connecting a crystal microphone, and I would advise you to first make a temporary direct connection of the cable from the microphone capsule to the connecting lead inner, and to connect the outer screen to the other capsule lead, isolated from the casing. Also, if this is the switched version, bypass the switch.*

*If the hum now disappears, resume the original state by connecting each joint individually, until the hum returns, to show which connection is at fault.*

*If, when bypassing these possible sources, the hum is still present, check the actual capsule connections, with especial regard to the rivets. Great care must be taken not to break these—they cannot be re-soldered by normal methods, and an attempt to use the greater heat necessary for aluminium solder would ruin the crystal.*

*Finally, ensure that the microphone lead is not too long, and, if the reduction in gain can be tolerated, shunt the input, near the grid connection of the 1st stage, with a 2·2M resistor.*

\* \* \*

## A Squeaking Effect

Dear Sir, I have an Ekco RT 366 tape recorder which has been giving considerable trouble due to a squeaking effect that occurs about once a second. It does not seem to be a mechanical fault as it is affected by the volume control. I have replaced several capacitors and inserted a new valve at the first stage, but the noise continues. Please could you advise me as to what may be wrong.

Yours faithfully, D. D., Tottenham.

*The intermittent "squeaking effect" on your Ekco RT366 is probably due to high grid loading of the first stage. If the fault is apparent with the machine switched to Playback and the screened lead from the switch to the 0·04 mfd coupling capacitor disconnected, replace the 10 Megohm resistor which is the grid load. You can quickly check the cathode conditions by short-circuiting the corrector coil, but even a high-resistance joint at the coil ends would hardly give these particular symptoms.*

*As you say you have replaced relevant capacitors, I am presuming the fault is not the coupling capacitor from the anode of the EF86 to the next stage. This is a prevalent cause of the fault, but this usually progresses rapidly to distortion, hum and weak signals. Reason it vanishes when the EF86 is removed is the change in conditions, not the lack of voltage.*

\* \* \*

## Superimposition on the EL3527

Dear Sir, I recently decided to add superimposition facilities to my Philips EL3527 by switching the erase head out of circuit and substituting a shunt resistor of equivalent value. Not having a reliable meter, I wrote to Philips' Birmingham branch to discover the impedance of the head. I was informed that this was 500 ohms. I experimented with shunts of this, and similar values, but for some reason the set-up

(Continued on page 37)

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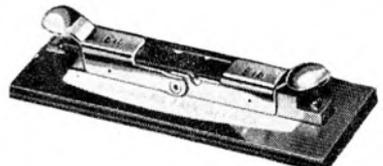
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## Readers' Problems

did not work. I then wrote to their London branch and was told that I could not cut the erase head from the circuit. I would be grateful if you could tell me why this is.

Yours faithfully, J. E., Birmingham.

It is not possible to substitute the erase head of the EL3527 for a shunt resistor as the coil-windings in the head play an important role in the oscillator circuit. It would, however, be satisfactory to insert a non-magnetic shim between the head-facing and the tape. However, we do not favour this method and think it better to re-design the oscillator circuit to operate in a shunt-fed mode, so that it can be substituted by a resistor for superimposition. A more recent method is to employ 1-track operation and parallel-play, but this would entail much more ambitious changes.

\* \* \*

### Intermittent Wow

Dear Sir, I am the owner of a Ferrograph tape recorder, which has not been extensively used, and is nearly three years old. Recently wow occurs when the instrument is first switched on, disappearing after five or ten minutes. If the machine is left for some time without use the trouble is not evident. I have scrupulously followed all the cleaning operations described in the instruction book and am unable to discover the cause of the trouble.

Yours faithfully, W. F., Edmonton.

You do not state which model this is, but we presume, from its length of service, it is one of the later series 4 decks. The probable cause is a need for lubrication, and as you say you have the Ferrograph handbook, there is no need for us to go into detail in this respect.

Although you say that you carry out the cleaning most scrupulously, we presume this to mean the top deck parts only, and suspect that you have not attempted to clean or oil the lower motor bearing. The problem arises when a bearing runs at a certain heat. If the machine is standing for some time, it is not always apparent until after two or three recording sessions, then shows up on initial play, as you describe, disappearing as the machine warms up.

Check, particularly, the flywheel bearings and the lower bearing of the capstan motor.

It is worthwhile inspecting also the engagement lever of the idler wheel assembly and the two small return springs, to make sure of positive engagement. A smear of grease at the selector rod can help here.

\* \* \*

### Magnetised Heads

Dear Sir, I have a Philips EL3536 stereo tape recorder which has given very good service until recently. Now, when recording from my radio tuner, the recording level has to be advanced almost half-way to obtain reasonable modulation, instead of a quarter, as has been usual. Also, the recordings have begun to suffer from loss of high and low frequencies. I have inserted a new EF86 valve, and cleaned the heads, but this has had no effect. I should be obliged if you could tell me where I might look for the fault.

Yours faithfully, S. P., Walsall.

Either reduction of HF bias, or a severely magnetised head, appear to be the most suspect causes of the trouble on your EL3536. There are a number of tests that can be made to determine the fault. First, if a pre-recorded tape of known high quality plays back well, and at full modulation level, the head is not likely to be magnetised. If the replay is poor, the head should be de-gaussed. This should, in any case, be regular procedure for the enthusiast, even on a machine such as yours, which has a preventative decay circuit.

Next, check the erasure by playing through a fully modulated tape, while switched to Record, and note if complete erasure is obtained on the first run-through. If the erasure is poor, swoop over the oscillator with the other EL84 and check again. From this point it gets rather complicated so we can only hope that the fault is no more serious than suggested above.

\* \* \*

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### LCC Contract for Rank Language Laboratory

**W**ORK commences this spring to install a Rank Language Laboratory at the City of Westminster College. Comprising 16 booths and a control console the complete laboratory will cost £2,450. Described in our issue of December 1963, the units are claimed to be the first specifically designed for education, and are the result of four-way collaboration between Rank Audio Visual, Raymond Hart Associates Limited, Intra Design Limited, and Truvox.

### Library Cassettes

**F**OLLOWING the news of reduced tape prices *Agfa* have just introduced a plastic library cassette. Attractively designed, it provides a neat and sturdy way of storing recordings. The cassettes are available to all purchasers of *Agfa* tape at an extra cost of 2s. 6d. **Manufacturers: Agfa Limited, Deer Park Road, Wimbledon Factory Estate, London, S.W.19.**

### Grundig Open New Showrooms

**N**EW and larger showrooms were opened, early last month, by Grundig. Situated at 15 Orchard Street, London, W.1, they will take the place of the firm's new Oxford Street premises which closed just after Christmas. The new showrooms provide space to house a wide range of tape recorders, radios, radiograms, and dictating equipment.

### B.S.R. Acquire Scottish Factory

**B**S.R. Limited recently announced the acquisition of a factory at East Kilbride, Scotland. With a total area of 180,000 sq. ft. the factory is expected to give employment to at least 500 personnel by December 1964, and has potential capacity for a staff of over 5,000. The company hope to gain a substantial share of the contracts for equipment in a £900,000,000 scheme to modernise and expand British telephone services.

### Cosmocord Export Microphones

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### HUM ON TAPE—POSTSCRIPT

Graham Balmain was ill in bed when he wrote this, part three of his series. The diagram numbers skipped fig. 8 so we thought he, and our readers, might be amused at this possible cause of hum which he overlooked. Ed.

**Errata**, line 15 should read:

C<sub>0</sub> and the head series resistor R<sub>n</sub> (see X in fig. 9) will remove hum

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