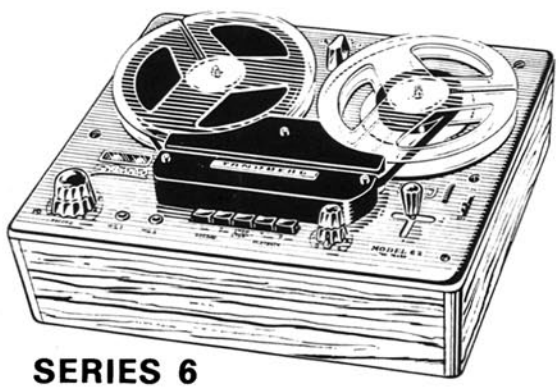
MARCH 1966 TWO SHILLINGS

tape recorder

AKAI M8 AND X4 REVIEWS — HEARD MELODIES ARE SWEET
PERSONAL BIAS — TEACHING BY TAPE — THE SECOND SPOOL

Are you at sixes and sevens with Tandberg ?



SERIES 6

SERIES 7

Q. Tandberg stereo tape recorders have been highly recommended. Which shall I buy Series 6 or Series 7?

A. For playback purposes Series 6 requires additional power amplifiers and loudspeakers. If the tape recorder is not to be used as part of a Hi-Fi installation then Series 7 is the one for you.

Q. The Tandberg Series 7 is a complete Stereo Record and Playback system, incorporating power amplifiers and loudspeakers. If I should decide to buy Hi-Fi equipment later can I use a Series 7 with it?

A. YES Series 7 has high impedance outlets designed to feed Hi-Fi pre-amplifiers.

Q. If that is so why should a Hi-Fi owner consider Series 6?

A. Because Series 6 has separate Record and Playback Heads, two recording amplifiers and two playback pre-amplifiers. These special features permit instant playback monitoring off the tape at the time of recording. "Sound-on-Sound" is also possible.

Q. Does this mean that Series 6 recordings will be superior to those of Series 7?

A. Not necessarily! The expensive "Off-the-tape monitoring", as used in professional recording studios, is well worth while, but with only a little care and experience tapes can be made on Series 7 audibly indistinguishable from those of a Series 6.

Q. "Sound-on-Sound" has been mentioned. I am very interested in photography and would like to synchronise Sound with my pictures. Is "Sound-on-Sound" similar to "Superimposition"?

A. Quite definitely No! Superimposition consists of partially erasing the first recording with consequent degrading of sound quality. With "Sound-on-Sound" a master recording, on one track, is transferred and mixed in perfect synchronisation with a second recording on the other track. Multiple recordings are possible without loss of quality.

Q. Is "Sound-on-Sound" possible with Series 7?

A. No. Not to the same extent. It is possible with Series 7 to playback track one and record track two in synchronisation with it. Afterwards both tracks can be played back, and mixed as required, either through stereo speakers or combined through the centre channel outlet.

Q. I suppose if I require the very best reproduction, and signal to noise ratio, I must buy a two track Tandberg?

A. Tandberg made the 15 i.p.s. speed, with its large reels, obsolete by low speed performances never previously thought possible. Tandberg engineers pioneered, and later perfected, four track tape recording techniques. We challenge you to detect audible difference between two and four track Tandberg recordings.

Q. Then which shall I choose four track or two track?

A. If you tend to be rather conservative. If you do not expect to purchase pre-recorded stereo tapes, which are all 4-track nowadays, and if tape economy is not a consideration then a 2-track 6 or 7 may be the one for you. Please note, however, that 4-track Tandbergs outsell 2-track by five to one.

Q. In conclusion will you please run through the complete technical specifications for me?

A. Unfortunately we have no more space, but we shall be pleased to send you illustrated literature, describing the complete Tandberg range, Mono or Stereo, upon request.

Tandberg

For further information and specifications please write to: Dept.

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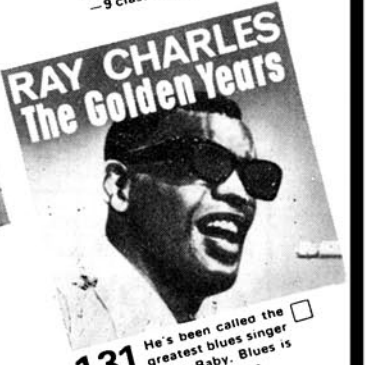

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162 Vintage collection of ballads by Big Daddy of folk-singers. Tracks include Early One Morning. The Irish Rover ☐

152 Nat King Cole opens 16 'royal' roads to dreamland. among them Dream a Little. Dream of Me. Wish I Were Somebody Else ☐

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13 William Steinberg and Pittsburgh Symphony Orchestra, with famous solo pianist Jesus Maria Sanroma.

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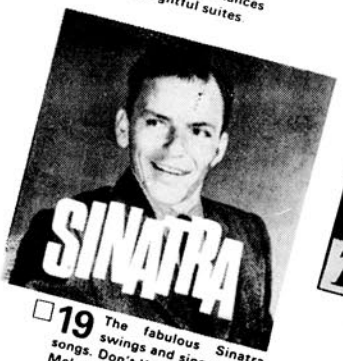

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25 The *complete* score from this great and well-loved musical. With Ian Wallace, Joyce Blair and Chorus.

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34 Lionel Hampton brings vibes magic to Stardust, Tenderness, How High The Moon, King David, plus 4.

142 The full glory and excitement of a work that sets the pace for modern music. Sir Eugene Goossens leads the L.S.O.

☐ **37** Revolutionary Study, Polonaises A and A Flat, Fantastic Impromptu—by the man who 'played' Chopin in *Song Without End*.

163 Star cast lead magnificent company in this tune-packed Gilbert and Sullivan operetta. Remember Sparkling Eyes, etc. ♪

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MODEL TC-900, a mains/battery portable with two track monaural recording and playback system at 32 gns. and

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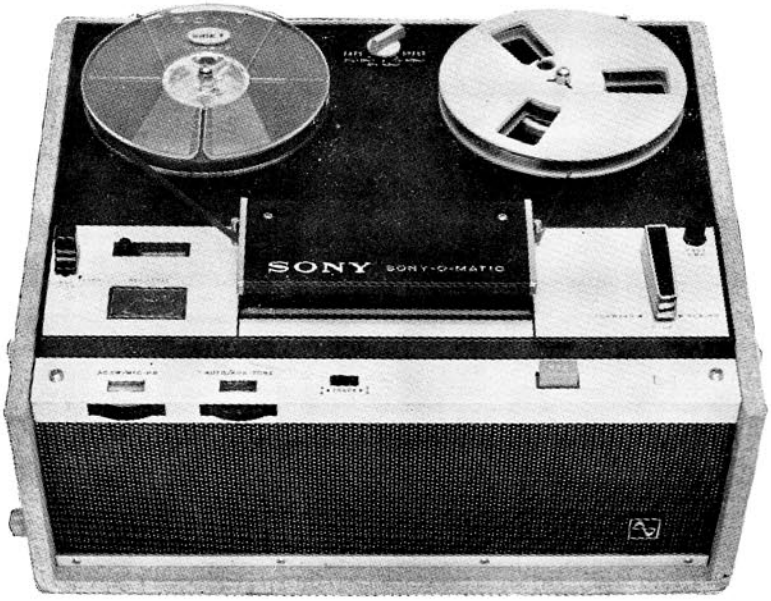
SPECIFICATION TC-357-4

Power requirement:	100, 110, 117, 125, 220 or 240 volts, 60 watts, 50/60 cps
Tape speeds:	Instantaneous selection 7½ ips, 3¾ ips or 1⅞ ips (19, 9.5 or 4.75 cm/s)
Tracks:	4 tracks, monophonic
Recording time:	45 minutes per track, 3 hours in total at 7½ ips
(With SONY Tape Super 7)	1.5 hours per track, 6 hours in total at 3¾ ips
	3 hours per track, 12 hours in total at 1⅞ ips
Reels:	7 inches or smaller
Frequency response:	40–15,000 cps at 7½ ips
	40–12,000 cps at 3¾ ips
	40– 6,000 cps at 1⅞ ips
Flutter and wow:	Less than 0.12% RMS at 7½ ips
	Less than 0.2% RMS at 3¾ ips
Record/Playback head:	In-line quarter track (2 channel)
Erase head:	In-line quarter track (2 channel)
Bias frequency:	Approx. 55 Kc
Inputs:	High impedance microphone input (1)
	High impedance auxiliary input (1)
Outputs:	High impedance line output (1)
	8 ohm external speaker output (1)
Speaker:	4 x 6" (10 x 15 cm) dynamic
Power output:	Max. 2 watts
Tube complement:	6267 (x 1), 6AN8 (x 1), 6BM8 (x 1)
Diodes:	1T22 (x 1), SE-05D (x1)
Weight:	Approx. 22 lbs. (10 kgs.) (without accessories)
Dimensions:	14.8"W x 7.9"H x 12.2"D (375 x 200 x 310 mm)

SONY®-O-MATIC

The tape recorder with completely automatic recording level control*.



MODEL TC-357-4: 62 gns.

*Can also be manually adjusted

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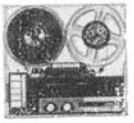
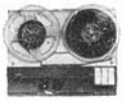

TAPE DECKS
◀ TRUVOX
STUDIOMATIC ▶

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	Kit	Assembled
MONO TAPE PRE-AMPLIFIER, TA-1M ...	£19 10 0	£28 18 0
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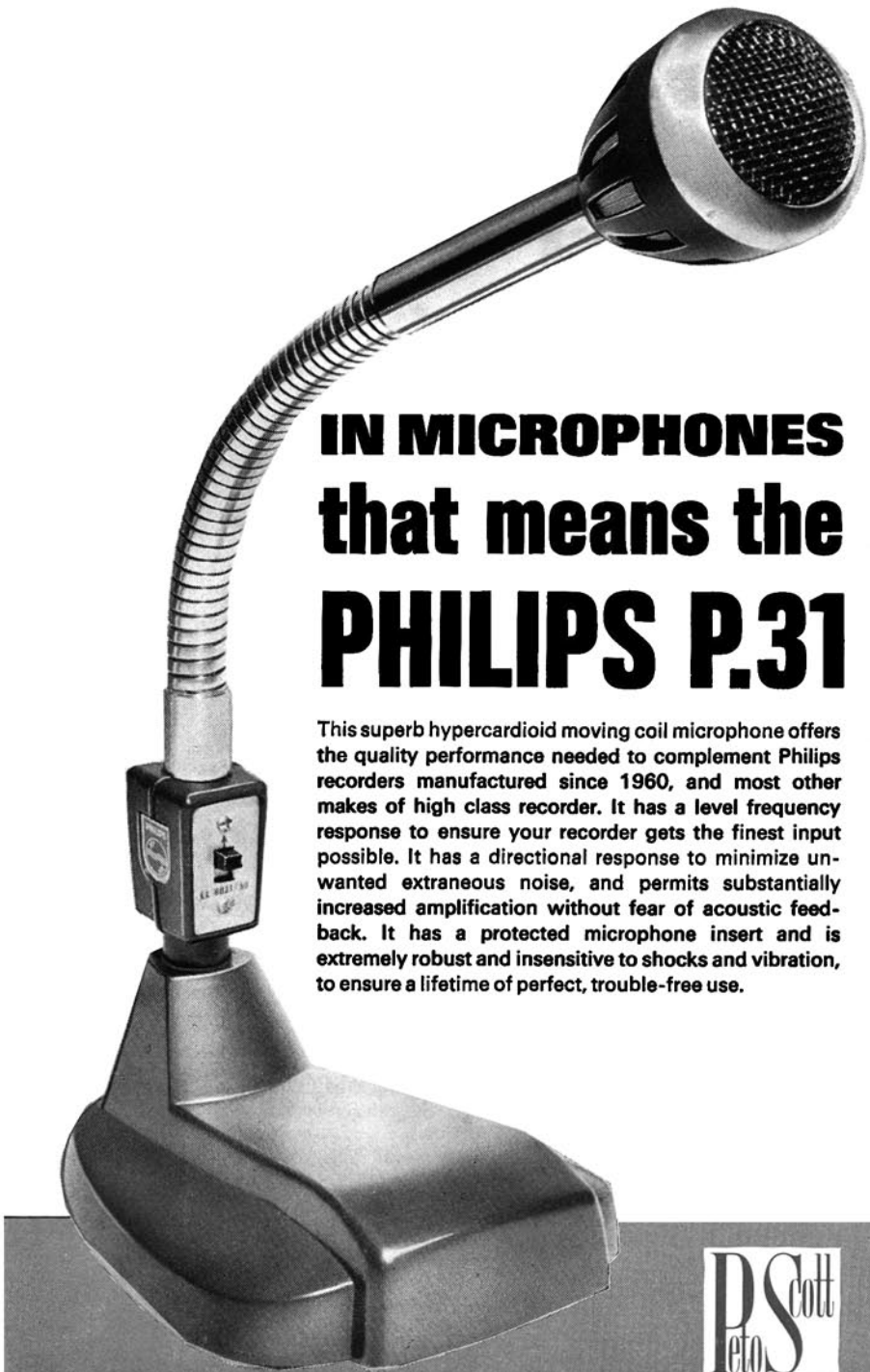

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tape recorder

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editorial

WE CAMPAIGNED for it in March 1965. We reported that the GPO were "looking into the matter" in May of that year. We can now announce that, on 1st February, the *Phonopost* service arrived.

No longer will the tape enthusiast with overseas correspondents be pauperised by letter-rate airmail tariffs of 6s. per 2oz.; nor will he be driven to dishonesty by sending personal and current recordings by (non-current-only) second-class mail. The new rates are only fractionally higher than second-class tariffs and, bearing in mind that packages may be sealed, should prove a considerable boon to international communication. Further details and a comparison of charges are given on page 51.

Our thanks for this recognition of the tape correspondent—and, we are sure, the thanks of our readers—are given to the Postmaster General, Mr. Anthony Wedgewood Benn, and also to the Speaker of the House of Commons, Dr. Horace King. Dr. King's co-operation in presenting the problem to Mr. Benn was invaluable.

From this pleasant topic we turn to one not so pleasant—the restriction of service information within the domestic electronics trade. It is normal, when one purchases a tape recorder, television or radio receiver, not to be supplied with a service manual. Only rarely does one receive even a circuit diagram. This is a reasonable situation, based on the precept that such information encourages the inexperienced owner, who would not otherwise bother, to tamper with the product. Quite intolerable, however, is the absolute refusal of many manufacturers to supply descriptive diagrams and notes when *requested* to do so by the purchaser, or even—in some cases—by the retailer. As Mr. Hellyer so aptly puts it on page 56, many manufacturers assume that the buyer has no right to know what is inside the pretty box for which he gave his birthright. We are particularly annoyed by this assumption, which puts manufacturers on the level of those who argue that "If God had meant us to fly, he would have given us wings".

The manufacturer has no divine right to withhold information regarding a product from its purchaser. In the motor-car industry, for example, a spate of magazines and manuals are available to the interested owner-driver; and this despite the fact that a wrongly-tweeked nut can double petrol consumption, ruin the pistons or de-silence the silencer.

It may be argued that competent servicing of motor vehicles is both difficult and expensive to obtain. This is true, but an identical situation exists in the audio industry. The high street washing machine retailer may be happy to repair television and radio receivers, but give him a faulty tape machine and what does he do? In six cases out of ten he apologetically refuses to undertake repairs, perhaps murmuring "Shortage of staff". In three cases he returns the machine in more-or-less working condition, but may have caused new damage in dismantling and reassembly. In the remaining case, the competent dealer returns a well-serviced recorder—but with weighty repair bill. The pressure on dealers is not helped by withholding information which might be misused by some, but which would certainly ease matters at least for those who were technical enough to think it worth applying for a circuit diagram.

There are two ways in which we, as a magazine, can alleviate this restrictive practice. The first is to remind the reader that many of the more reputable manufacturers do supply such information—in addition to having competent and willing service departments—and mechanical equipment should not be chosen on a basis of quality if no facilities exist for that quality to be maintained.

The second solution—and the one which we have adopted in consultation with Mr. Hellyer—is to publish more and more detailed service information. Commencing with this month's *Tape Recorder Service*, it is proposed to include complete circuit diagrams whenever possible and where relevant to the equipment under discussion. In the meantime, readers currently in possession of the more popular equipment—and those wishing to determine manufacturers' competence on the basis of their past designs—are referred to Mr. Hellyer's *Tape Recorder Servicing Manual*, recently published by *Newnes*.

MARCH 1966 **VOLUME 8** **NUMBER 2**

We regret that, for reasons beyond our control, publication of Anthony Wigens' *Visit to Zonal* has been delayed. It is hoped to include the promised article in the April issue.

COVER PICTURE

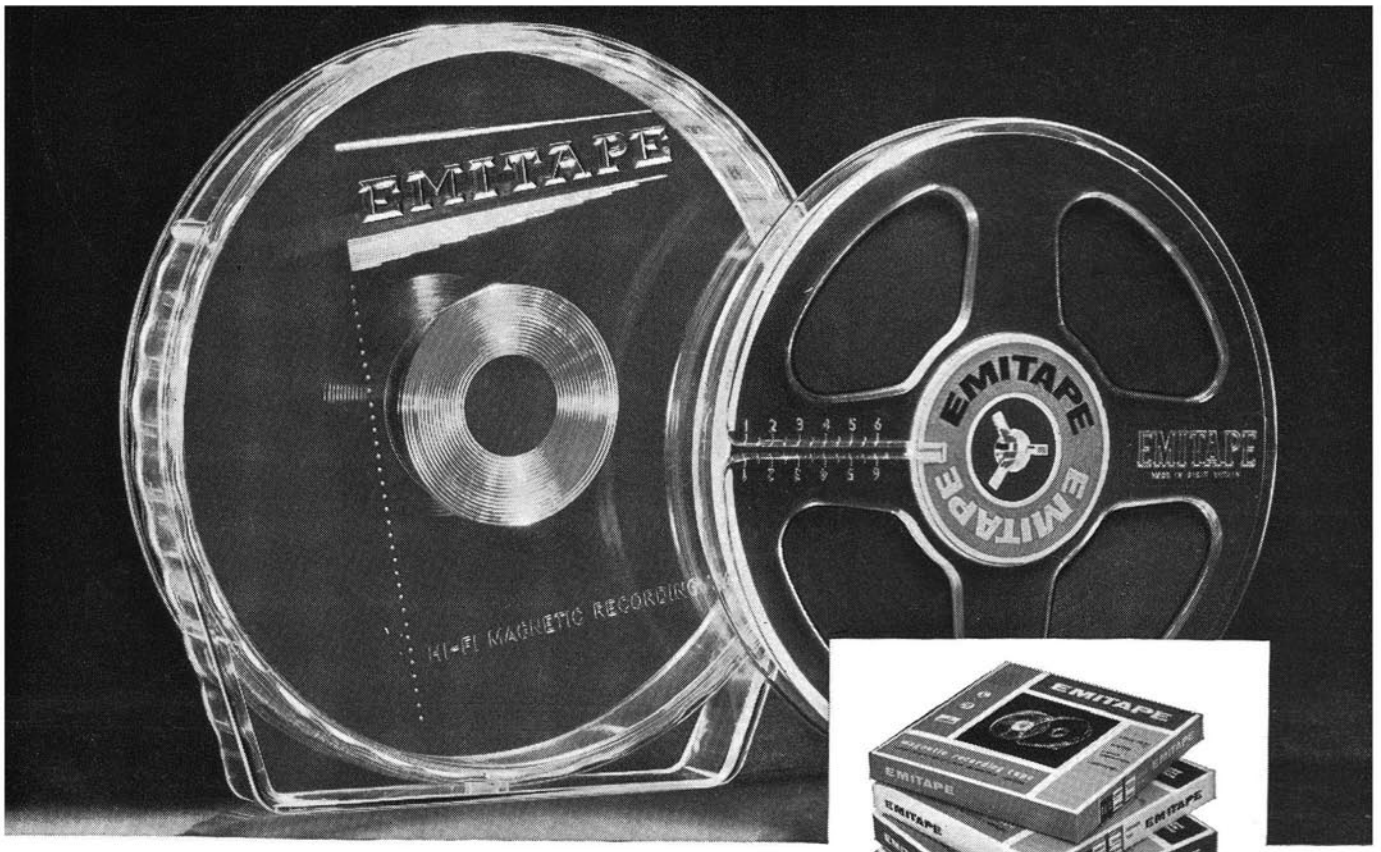
Six *Leevers-Rich Series E* recorders and three *Series ER* players are shown fading into the background of this month's cover. The machines are installed in a control centre at the London headquarters of the B.B.C. External Services. They are employed on B.B.C. relays and supply programme material to the Voice of America and Canadian Broadcasting Corporation.

SUBSCRIPTION RATES

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

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

EMITAPE
SETS A NEW SOUND STANDARD



NEW TAPE

NEW EMITAPE the most advanced magnetic recording tape in the world. Automated control and rigid inspection at all stages of manufacture, using the most specialised equipment in the latest magnetic tape factory in Europe, ensures that every reel of the new range of EMITAPE is of superlative quality for your recorder.

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

★ WIDER FREQUENCY RANGE ★ IMPROVED UNIFORMITY
★ GREATER STRENGTH ★ SUPER LONG-LIFE

– together with all the long established EMITAPE features acknowledged by the BBC and other leading broadcasting and recording organisations throughout the world.

NEW PACKS

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

TRY THE NEW EMITAPE NOW!

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world of tape

ONE-AND-A-HALF QUARTS IN A PINT POT

CURRENTLY undergoing development at *Bell Laboratories* is an electronic 'frequency compressor'. Using this device, recorded speech may be reproduced at high speed without the garbling introduced by overall pitch increase. The result of replaying taped speech at two or three times the recorded speed will be familiar to readers as a means of obtaining Goon effects. By employing the compressor to divide the replayed signal frequencies three-fold, the overall pitch can be returned to its normal region, while the actual word rate is trebled. In this way, spoken information may be assimilated at a rate approaching that of 'speed reading', namely up to 400 words per minute. A suggested application for the system is in the recording of books for the blind, though works of fiction—novels and poems—might well lose some of their entertainment value if reproduced in such a fashion. The use of a frequency compressor on telephone lines may also reduce the required bandwidth and hence cut the cost of communication.

LENNARD DEVELOPMENTS HANDLE FLUTTERMETER

MINIFLUX Electronics Ltd. have announced that marketing of the *ME101* Wow and Flutter Meter is now being handled by *Lennard Developments Ltd.*, 7 Slades Hill, Enfield, Middlesex. Service of the units will continue to be undertaken by Miniflux at their 8 Hale Lane, London, N.W.7 address.

TELEVISION RECORDING AT 15 I/S

QUARTER-INCH tape running at 15 i/s is the medium for a high-definition television recording system developed by the *Sonic Vee Corporation* of the U.S.A. The system was originally conceived by George Doundaloukis and Ira Kamen as a money-saving boon for the closed-circuit television and video-telephone market. "Velocity scanning" is employed to reduce the necessary operating frequency range from some 4 Mc/s to 30 Kc/s, though no information is available at the time of writing concerning frame repetition rate and definition.

GPO INTRODUCE 'PHONOPOST

AS announced in this month's Editorial, the GPO have just introduced new postal rates for tape recorded messages. Such messages were hitherto restricted to normal letter rates, under which a 3in. tape airmailed to Australia or Japan cost between 6s. and 12s. A comparison of airmail charges is given below. A complete list of Zone categories can be obtained from a post office.

	ZONE ONE (Cyprus, Egypt, Israel, Tunisia)		ZONE TWO (Argentine, Canada, Nigeria, U.S.A.)		ZONE THREE (Australia, Japan, New Zealand)	
Wt.	Letter Rate	Phonopost Rate	Letter Rate	Phonopost Rate	Letter Rate	Phonopost Rate
2oz.	3s.	2s.	5s.	2s. 4d.	6s.	2s. 8d.
4oz.	6s.	4s.	10s.	4s. 8d.	12s.	5s. 4d.
6oz.	9s.	6s.	15s.	7s.	18s.	8s.
8oz.	12s.	8s.	20s.	9s. 4d.	24s.	10s. 8d.

HEATHKIT SHOWROOM IN LONDON

THE Gloucester audio kit manufacturers *Daystrom Ltd.* have opened a showroom in London for the demonstration and service of *Heathkit* products. Ready-built equipment will be displayed and can be purchased on the spot in kit form or, in certain cases, factory assembled. The showroom is at **233 Tottenham Court Road, W.C.1.**

RECORDING IN LIVERPOOL

THREE Liverpool recording enthusiasts, including contributor John Ashcroft (who makes his debut this month on page 69) are endeavouring to contact their fellows in the area, with a view to forming an amateur tape group. "We don't want a closed-shop of boffins (the three of us who launched the idea are anything but!); we merely want get-togethers of people interested in using tape more creatively than for taping non-stop pops". Readers interested in joining the three are asked to contact *Mr. S. Williams*, 13 *Amos Avenue, Litherland* or, if inhabiting the other side of the city, *Mr. T. Elcock*, 37 *Rockbank Road, Stoneycroft, Liverpool.*

READERS' RECORDING INSTALLATIONS

THE apparent popularity of the *Readers' Hi-Fi Installations* column in our sister publication *Hi-Fi News*, together with recent prompting by *Tape Recorder* readers, suggests that a similar column might prove of interest in this magazine. *Readers' Recording Installations* would, of course, exist entirely on contributed photographs and descriptive letters, and might well prove a worthwhile exchange medium for those odd ideas we have all concocted to save a little extra floor-space or to use up that Z-shaped alcove. Some of us dangle our tapes on a knotted string suspended from a wall-bracket, while others—Harry Jay of Melbourne, Australia, being a good example—keep connecting-leads suspended from a pin board. Mr. Jay, President of the *Recording Society of Australia*, employs his *Uher/Telefunken/Sennheiser/National* equipment to produce recordings of visiting celebrities, Australian wild-life, folk-singers and musical bands, for distribution to tape correspondents throughout the world.

All photographs (moderate-sized black and white prints are preferable) will be returned after use.

MAGNETIC TAPE AT THE BKSTS

MARCH 30th will see a lecture by P. T. Hobson of 3*M* entitled The Use of Magnetic Tape. The effects on recording quality of bias frequency and amplitude, tape grade and head gaps will be among the topics covered at the Central Office of Information Theatre, Hercules Road, London S.E.1. The lecture begins at 7.30 p.m. and is open to members of the BKSTS and guests. Further details of this and future talks can be obtained from: **The Secretary, British Kinematograph, Sound and Television Society, 164 Shaftesbury Avenue, London, W.C.2.**

CASCADE OF COLOUR

ONE *Leevers-Rich* multi-channel tape recorder, three *Kodak Carousel* slide projectors, miscellaneous amplifiers, relays, loudspeakers and pumps, plus a substantial quantity of water—these are the ingredients of an ingenious audio-visual entertainment system to be shown at the March *Ideal Home Exhibition.* The *Cascade of Colour* differs from a conventional slide display in its employment of a water spray as a screen. The water is fed through a hose to a horizontally-mounted pipe. From this, it is shot into the air by regularly spaced upward-facing holes, forming a vertical curtain. A projector located behind the curtain throws an image on to the water sheet which is said to provide the picture with a shimmer and life of its own. By altering the water pressure—and hence the screen height—an intriguing vanishing effect is obtained, the image literally disappearing into thin air. *British Overhead Irrigation* constructed the 40ft. long by 8ft. high exhibition screen to Kodak specification, complete with a water catch system to prevent flooding the hall.

Heart of the display is the eight-channel Leevers-Rich, which controls three projectors, provides three water valve speeds (one, four and eight seconds) and feeds stereophonic sound to a pair of 50W *Leak* amplifiers, and thence to a pair of *KEF* loudspeakers. The programme, of five minutes duration, comprises 80 colour slides.

NEXT MONTH

A GREEN COVER will adorn the April *Tape Recorder* when it appears on Monday 14th March. In this issue, Brian Ford will describe methods of analysing the human voice with a tape recorder, while John Law gives practical advice on microphone technique, followed by notes on the construction of a simple transistor stereo mixer. Another mixer—the *Heathkit TM-1*—will be reviewed by Alec Tutchings.

WHO SAID BEAUTY AND BRAINS DON'T GO TOGETHER?

This great new tape recorder is best in its price range for performance and looks!

Philips 'High Performance' Tape Recorder with Furniture Look Model EL3556 62 gns.

Whoever said beauty and brains don't go together was wrong! For Philips brilliant new High Performance tape recorder is more than a leader in its price range for performance, reliability and technical excellence. It also has Philips breakaway Furniture Look—it's a handsome, contemporary piece of furniture that's *designed to look right in your home.* Judge for yourself. Its technical features include four tracks, four speeds, separate treble and bass controls, powerful four-watt output through the 7″ x 5″ loudspeaker, a frequency response of 60–18,000 c/s at 7½ips, a signal to noise ratio that's better than 47dB and Duoplay, Multiplay and Stereo playback facilities. In styling, too, it's way ahead. Rich teak veneer combines with dark grey polystyrene to form the sleek cabinet. All controls are sensibly grouped, clearly marked for easy operation. Supplied complete with moving coil microphone, L.P. tape, empty spool, and direct recording/playback lead.

Philips Family de luxe Model EL3558 42 gns.

Rich teak veneer cabinet. Automatic recording control regulates recording level — manual control provided. Four tracks, two speeds. Mixing, monitoring and parallel track replay. Supplied with moving coil microphone, LP tape, empty spool and direct recording/playback lead.

PHILIPS—THE FRIEND OF THE FAMILY

To: Philips Electrical Ltd. (Dept. TR2), Century House, Shaftesbury Ave., London WC2

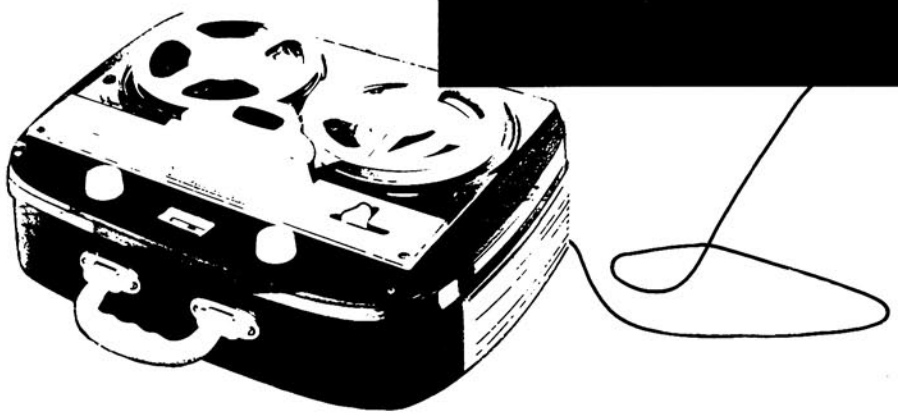
Please send details of Furniture Look recorders & free booklet 'All about Tape Recording'

Name.....

Address.....

.....

variations on an oxide theme



BY PETER TURNER

I AM reading *Wuthering Heights* for the umpteenth time. I have read it, I suppose, at least twenty times to myself ; I once read it aloud to a friend in college ; and I am now reading it aloud again—this time to a tape recorder, eventually, I hope, to be included in a library of books for blind children. As I read on into this staggering masterpiece of the human imagination, it becomes clearer to me that I am attempting something which is beyond my powers : one would need to be a genius on the level of Emily Bronte in order to read this book even passably well. But, as Chesterton once said, if a thing is worth doing, it's worth doing badly ; and if I can introduce even one child to the satisfaction and joy which this book has brought to me, well . . . And I enjoy doing it, too, partly for its own sake, and partly because it is an exercise for the recorder ; and though it is now more than ten years since I first droned into a microphone, I still welcome the moment when I switch on and connect up.

For me, recording is an abiding source of interest and enjoyment, both the equipment and the use of it. When I think back to the standards which obtained in my early days, it is remarkable how greatly things have improved : today the amateur can make recordings of which the professional would not have been ashamed then. It seems to me that tape has been greatly improved : it is more consistent, gives fewer drop-outs and a quieter background. Heads are far better, though I do not think they last as long as they used to. And amateur machines have far better speed-consistency, particularly with regard to that agonising wow which plagued my first machine but is inaudible in any I have now.

I doubt whether anyone who refuses to take any interest at all in the technical aspects of recording can enjoy it to the full : the very fact of being able to recognise a problem and rejoice in the solution of it is a source of joy. Not that I am within a thousand miles of being an engineer : I natter on glibly about things which I do not really understand, and hope that I play the right counter at the right moment. But the fact that when somebody mentions tape-weave, or even a hysteresis loop, I get some kind of mental disturbance which passes for knowledge, adds to my enjoyment. And every now and then something goes wrong and I can put it right, if only by a lucky guess. I tell myself that if I had not read that book I could not have made the guess. And then, of course, one is always meeting people who know even less than one does oneself. I take a quick glance round to ascertain that there are no experts present, probe around a little to make sure that this really is a novice ; and then enjoy myself. They will not remember much of what I say, so I shall not do harm.

Inevitably, as time goes on, one learns about the art of recording : I mean the actual fieldwork, as distinct from the engineering. This, too, is a source of interest and satisfaction. Acoustics, I expect, is a science, despite the odd sounds produced by some expertly-designed halls ; but when I arrive in a village hall to record the local handbell ringers, I become my own consultant. I have found a kind of instinct developing, which enables me to get somewhere near a microphone balance without too many trial runs. This involves the placing of the microphones, their distance from the performers, the placing of the performers and many other things, neglect of which causes the disappointments that often, I am sure, put beginners off the art. Practice helps ; but every new situation is a fresh problem, and it is tackling the new problem which is the fascination of the game.

Yes : recording is an enjoyable pastime. But actually to record, in the sense of putting a signal on to tape, is not so easily accomplished as it should be : the best microphones in the world (whoever makes them), placed perfectly, will be of no avail if, when the switch is closed, something is wrong within the recorder, and one gets either no result or a distorted one.

I think I was very lucky with my first recorder : it worked, according to the not very exacting standards proper to a machine of that date and that price. It was only as my interest grew and my standards rose that I realised that I had bought a machine which would not keep pace with me. But as I started in almost total ignorance of my subject, and bought on price without consulting anybody more competent, I was lucky to do so well.

For my next I consulted a dealer—a very nice chap, too. He recommended a machine because the makers were associated with a firm which he had found reliable in other connections. It failed on the first evening : a rubber band driving a rev-counter broke and fouled up a motor. That was the beginning : the miserable details escape me after all this time ; but I know that this machine was sent back and replaced by another which was no better. A visit was arranged by the "chief engineer" of the firm—a young man of about twenty, who arrived with little more than a screwdriver and could not put the thing right. He took it away with him, and when it came back it worked after a fashion. (*continued overleaf*)

I then got the chance to obtain a really smashing recorder, which had been lyrically reviewed in all the best journals. It was horrible : it suffered from flutter, overheating, intermodulation, mechanical noise and inoperancy of the rev-counter. By this time I was getting in to the routine, and joined battle at once. The sales-manager arranged to meet me at the dealer's, and took the thing away with him for overhaul. When it came back, it was just the same. More battles. In the end, a new service-manager was appointed to the firm, who had my recorder back at the firm's expense and put it right—so right that it went without any failures for several years, and was one of my happiest.

Meanwhile, I was feeling the need for a second machine. I chose carefully : this time I was going to get it right. I could not afford top luxury ; but I would get value and service. After a lengthy delay due to demand (I was assured), it arrived. The amplifier worked, but there was no tape transport at all. My dealer had not been appointed a service-agent for the firm, and the guarantee uttered dire warnings against unauthorised tampering. So I packed it up and sent it straight back, which made the manufacturer very cross. He said that the railway had bumped it, and disconnected the mains from the motors, and all it needed was a dab with a soldering-iron. He returned it ; and this time the tape transported indeed, but with a visible flutter which made recordings sound like sandpaper. Then there was a smell of burning, and a component inside dissolved in a series of crackles.

There followed a kind of postal course in do-it-yourself recorder repairs : new valves and other oddments would be sent to me, with sketches to show me which one to take out and replace. Pillars were to be added to the deck, motors disconnected. In the end I had four different machines, all faulty. After that, I asked for a change of model, and got it. I arranged to take a day's leave, and go up to London to collect it myself. When I tried the machine which had been specially selected for me, it wowed so as to bring a grimace of pain to the face of the secretary typing close by. An engineer dived inside it, and freed whatever it was which was causing the wow ; and I took it home.

It proved to be quite a good machine : I made one of my best organ recordings on it. Then I met a man who wanted just that machine. We agreed on a figure ; and it is now in New Zealand where, I gather, it is much admired. The makers complained to my dealer that they had had several critical letters from me, and had had to open a special file. "Don't worry," he replied, "X has had to build another wing!".

I was now armed with my friend's cheque. What should I buy now? Go for a famous name, I thought ; and did. The resulting machine was superb : its quality, even at the slower speeds, was quite equal to provincial FM. However, the speeds at which it ran when compared with other machines doing nominally the same knots, seemed odd : my correspondents began to ask if I were in the process of changing sex. Further, the tape transport, though admirably free from wow, would periodically start snatching and stopping, with horrible effects on the tape, not to speak of the programme. My dealer—a different one—was quite unable to make the provoking thing misbehave so that he could try to cure it. So—back to the old routine.

Meanwhile, why not try mating a well-known deck with a transistorised amplifier made specially to go with it? A good idea, which was placed in the hands of one holding himself out to be an audio engineer. The result was so horrible and long-drawn-out that I forbear to go into it. It ended, satisfactorily, when a friend of mine who does research into electronic brains took a look at it, tutted disapprovingly, waved a soldering iron at it, and put it right in about ten minutes. The expert had connected it the wrong way round, got his impedances badly mixed, changed the wrong components and made a wrong connection to the replay head. Otherwise, he had done a good job.

I have omitted much ; but that is roughly the story until we come to the stereo era. But it is only my own story : I have met many others almost equally harrowing. One friend had sixteen—yes : I said *sixteen*—machines of one make, at least six of another, and five of a third. He isn't really satisfied yet . . . But by the time I decided to go stereo, I had found a dealer who could help me. This man has a simple policy : he will not recommend anything which he has not knocked hell out of first, and found that it will take it. My stereo machine was not cheap, but it is very good ; it has not been free of all trouble, but what trouble I have had has been put right by somebody who knows how to do it. My wife bought a battery recorder from the same source and with similar results. We have just taken delivery of a mono machine which promises to be excellent.

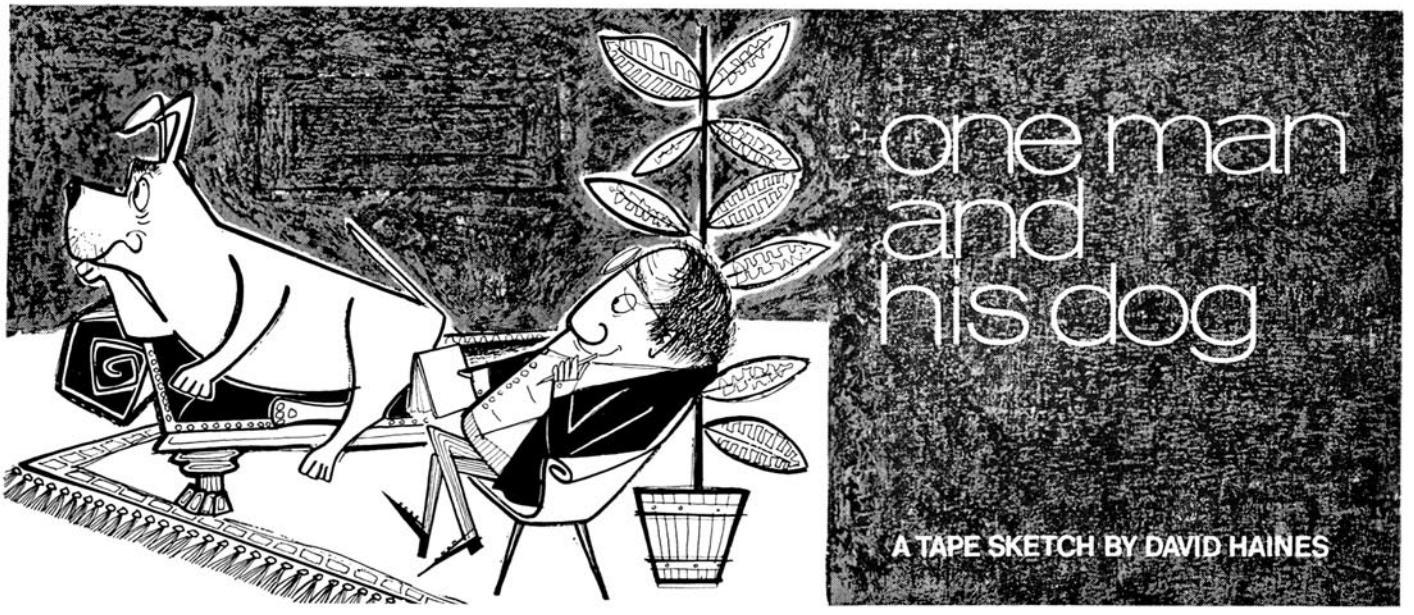
Going back to those recording locations in the light of my history, is it any wonder that I have had recorders pack up half-way through a session ; that I have had to refuse opportunities because I had not got a recorder in working order? Perhaps my luck is bad ; but the story is true, and it involves some illustrious names in audio. The more I see of it, the more I come to think that there is no jewel like a good dealer ; but whereas, if one has the money one can buy any number of jewels, one can search for years without finding a dealer worthy of the name. If a purchaser goes to a furniture-shop to buy a recorder, one can fairly say that he deserves what he gets ; but many so-called hi-fi dealers are little better, and the more dangerous from being more pretentious.

It is, in my experience, the mechanical side of recorders which gives the real trouble ; and whereas many men can trace an electronic fault and correct it, there are few who really understand the mechanics of a tape-deck, let alone possess the tools and skill to mend one. And there are many otherwise excellent recorders which are hopelessly let down by inferior decks. It is obvious that good electronics and good mechanics cannot be sold for nothing, so that I take it that a reliable recorder cannot be cheap and no longer expect it to be. Having touched wood with reverence, I will say that I have now assembled a recording kit which I think is going to last me for a few years, and which will enable me to go out on location with a reasonable assurance of being able to get a recording, and quite a good one at that. I am grateful for it.

The blind, as everyone knows, are skilful in music. A few days ago, I had the opportunity to record two friends, both blind : one singing, and the other accompanying on the piano. It was one of those occasions when everything goes right ; and by chance the microphone used just captured the special timbre of the singer's voice. Schubert, who wrote the songs, would not have been dissatisfied, I like to think. There is a radiance about the voice, a kind of overtone of reality, which places the recording beyond the run-of-the-mill stuff to which one is accustomed. This is where good equipment comes in to justify itself. Sometimes people ask : That's all very well, but can you *hear* the difference? I have to admit that I think that sometimes one cannot —as between one good pickup and another, for example, or one first-class amplifier and another. But sometimes one can : the sound has the glow of life upon it, an atmosphere rather than a tonal difference, which places it within the realm of what is called high-fidelity. Most recordings are effective reminders of what the original was like ; a few almost *are* that original. I never cease to marvel that it should be possible for the amateur occasionally to bring it off, with equipment costing little more than professionals would give for one condenser microphone. At its best, the modern recorder is very, very good.

Anything truly well made is a source of delight. Indeed, anything which functions perfectly will be *beautiful*, if only the stylists will leave it alone, and forbear to make it look like something which it isn't. So with recording equipment : the very response of good equipment to the directing hands is a pleasure to evoke. But this, after all, is a means, not an end. I sometimes think that recordists confuse ends and means—though heaven knows they are not alone in doing so : one knows so many who wallow in the technical specifications yet rarely listen to recordings for the sake of what is recorded. Yet surely one does not record the song of birds or the sounds of trains, the music of the violin or the voice of a friend, for any purpose but the sound itself? I have in my collection a piano sonata, played by a friend who, within a year of that evening, was dead. Of course it is precious, both to me and to others who knew her far better than I. But even this is accidental : I recorded the music for the sake of the music, though it is now more than music. I tried to record it well; and indeed it was reasonably successful.

This is something I have often found : one records, and in the event the recording turns out to be more than one could foresee. That is another reason for doing it : good equipment ; one's best skill ; a chosen subject—and, all being well, one will get something which can be a pleasure for ever after. And sometimes time will add to it ; or it will turn out to be just that little better than one had hoped ; or it will fill a need for someone else. These are the bonuses, added to the enjoyment of the recording itself. If equipment sometimes makes one swear, and months seem to pass without anything outstanding coming along—these are the moments which make one glad that after all one was there.



ANNOUNCER: This short play is entitled *One Man and his Dog.*

VOICE: Good morning, Roger. Did you sleep well ?

EFFECT: *Dog whimpers and sniffs.*

VOICE: I'm sorry to hear that.

EFFECT: *Dog barks three times.*

VOICE: We all feel the same on Mondays.

EFFECT: *Dog barks four times.*

VOICE: Stop complaining. (*firmly*) It's time to get up.

EFFECT: *Dog barks three times.*

VOICE: You're talking nonsense. I've seen you looking *much* worse. Get up !

EFFECT: *Dog barks four times.*

VOICE: What would happen if everybody stayed in bed on Monday mornings ? Civilization would come to a standstill !

EFFECT: *Dog barks three times.*

VOICE: So that's your attitude, is it ? This is what comes of staying up and watching television. You've lost all sense of initiative.

EFFECT: *Dog barks twice.*

VOICE: Don't answer back ! Your nose is glued to the telly night after night. But do you absorb any knowledge from it ? Not a grain ! (*sharply*) Who signed Magna Carta and on what occasion ?

EFFECT: *Dog barks seven times.*

VOICE: Your answer is unsatisfactory. You've left out the date.

EFFECT: *Dog barks twice.*

VOICE: You're thinking of the Battle of Hastings.

EFFECT: *Dog barks three times.*

VOICE: I beg your pardon ?

EFFECT: *Dog barks three times.*

VOICE: (*angrily*) That remark was quite uncalled for. If you're not in the mood for history, you only need to say so—in a suitably polite manner.

EFFECT: *Dog barks ten times.*

VOICE: (*coldly*) I didn't ask you to make a speech. A simple apology is all that's necessary. (*sharply*) What are twelve times six-and-eightpence ?

EFFECT: *Rustling of paper.*

VOICE: And you're not to use the ready-reckoner.

EFFECT: *Dog barks five times.*

VOICE: It's no good arguing—I saw you cheat. But we can easily try something else to stimulate your sluggish brain. How about a little French ?

EFFECT: *Dog barks twice. Clinking of glasses. Cork pop.*

VOICE: No, you fool—*not* with gin. Cocktails have already been your ruin. (*shouting*) Are you, or are you not, going to get up ? Or do you expect breakfast in bed ?

EFFECT: *Dog barks once.*

VOICE: Well, you're not getting it. You're not only lazy and ignorant—you're a parasite. Can you deny it?

EFFECT: *Dog barks six times.*

VOICE: That, Roger, is a claim you cannot possibly make. You're an absolutely rotten watch-dog. I had to bite the last burglar myself.

EFFECT: *Dog barks three times.*

VOICE: It's no use making excuses. I've come to a decision. (*gravely*) Roger, you're not a normal dog. We can't carry on like this—something must be done. One of us must go and be psycho-analyzed.

INTRODUCTION

This conversation with a lugubrious dog illustrates, very plainly, how a solo voice can be interchanged with a sound-effect.

The effect (a barking dog) can easily be an oral imitation—thus avoiding the necessity (in this case) of editing the tape. Alternatively a real dog can be recorded and the tape dissected into individual 'barks' (The dog's 'script' should not be taken literally). These are then spliced into the dialogue—which, of course, is recorded in anticipation.

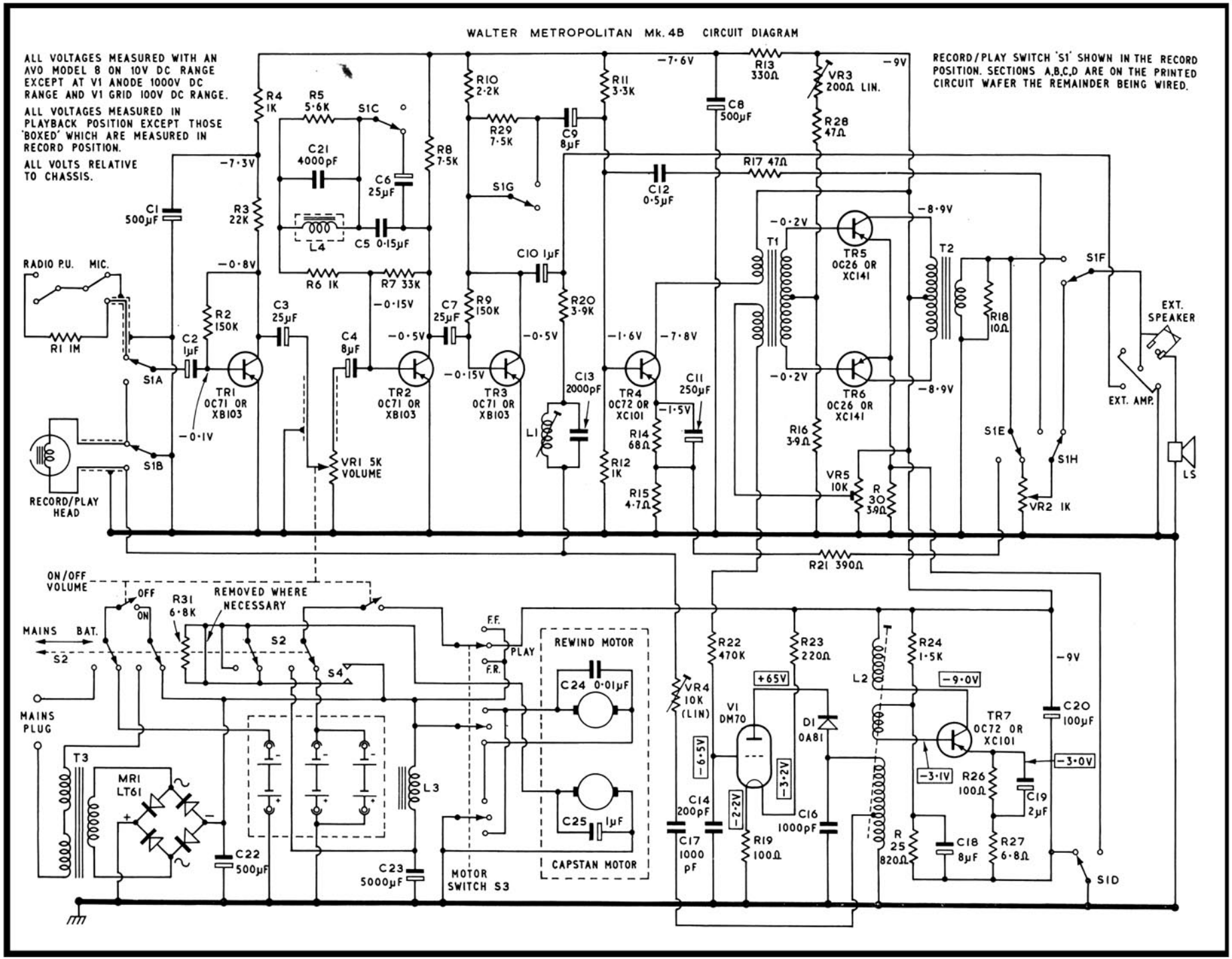
Other sound-effects can be exploited in a similar fashion—depending on the dramatic situation. A character can 'converse' with a saxophone, a ship's hooter, a blackbird or a carillon of bells.

Tape-editing is an essential principle of these applications. For example, a genuine conversation can be recorded—and a recording of the household dog substituted for the second voice. By cutting and splicing, a dog can even be made to answer the telephone.

All this can be very amusing. Success, however, depends on an acute ear—a sense for selecting the 'right' sound.

Beginners are advised to develop this sensibility by practising simple rhythmic editing. For example, a dog and a door-knocker can be recorded separately—and then spliced together to form an interchange of knocking and barking.

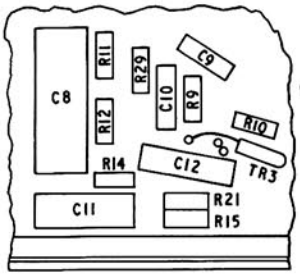
From here is but a step to the delights of producing narrative sound-effects and other 'novelty' recordings.


WALTER METROPOLITAN Mk. 4B CIRCUIT DIAGRAM
ALL VOLTAGES MEASURED WITH AN AVO MODEL 8 ON 10V DC RANGE EXCEPT AT V1 ANODE 1000V DC RANGE AND V1 GRID 100V DC RANGE.
ALL VOLTAGES MEASURED IN PLAYBACK POSITION EXCEPT THOSE 'BOXED' WHICH ARE MEASURED IN RECORD POSITION.
ALL VOLTS RELATIVE TO CHASSIS.
RECORD/PLAY SWITCH 'S1' SHOWN IN THE RECORD POSITION. SECTIONS A,B,C,D ARE ON THE PRINTED CIRCUIT WAFER THE REMAINDER BEING WIRED.
R4 1K
R5 5·6K
S1C
C21 4000pF
C6 25µF
L4
C5 0·15µF
R8 7·5K
R10 2·2K
R29 7·5K
C9 8µF
R11 3·3K
R13 330Ω
VR3 200Ω LIN.
C8 500µF
R28 47Ω
R17 47Ω
C12 0·5µF
S1G
C1 500µF
R3 22K
C10 1µF
R6 1K
R7 33K
R9 150K
R20 3·9K
C7 25µF
C3 25µF
C4 8µF
R2 150K
C2 1µF
R1 1M
RADIO P.U. MIC.
S1A
S1B
TR1 OC71 OR XB103
TR2 OC71 OR XB103
TR3 OC71 OR XB103
TR4 OC72 OR XC101
TR5 OC26 OR XC141
TR6 OC26 OR XC141
T1
T2
C13 2000pF
L1
C11 250µF
R14 68Ω
R12 1K
R15 4·7Ω
R16 3·9Ω
R18 10Ω
S1F
EXT. SPEAKER
EXT. AMP.
S1E
S1H
LS
VR1 5K VOLUME
VR2 1K
VR5 10K
R 30 3·9Ω
RECORD/PLAY HEAD
R21 390Ω
ON/OFF VOLUME
OFF
ON
R31 6·8K
REMOVED WHERE NECESSARY
MAINS BAT.
S2
S4
MAINS PLUG
T3
MR1 LT61
C22 500µF
C23 5000µF
L3
F.F.
PLAY
F.R.
MOTOR SWITCH S3
REWIND MOTOR
C24 0·01µF
C25 1µF
CAPSTAN MOTOR
R22 470K
R23 220Ω
VR4 10K (LIN)
V1 DM70
D1 0A81
L2
R24 1·5K
TR7 OC72 OR XC101
R26 100Ω
C19 2µF
C20 100µF
C14 200pF
C16 1000pF
C17 1000 pF
R19 100Ω
R 25 820Ω
C18 8µF
R27 6·8Ω
S1D
-7·3V
-0·8V
-0·15V
-0·5V
-0·1V
-1·6V
-7·8V
-7·6V
-9V
-8·9V
-0·2V
-1·5V
+65V
-9·0V
-6·5V
-3·2V
-2·2V
-3·1V
-3·0V

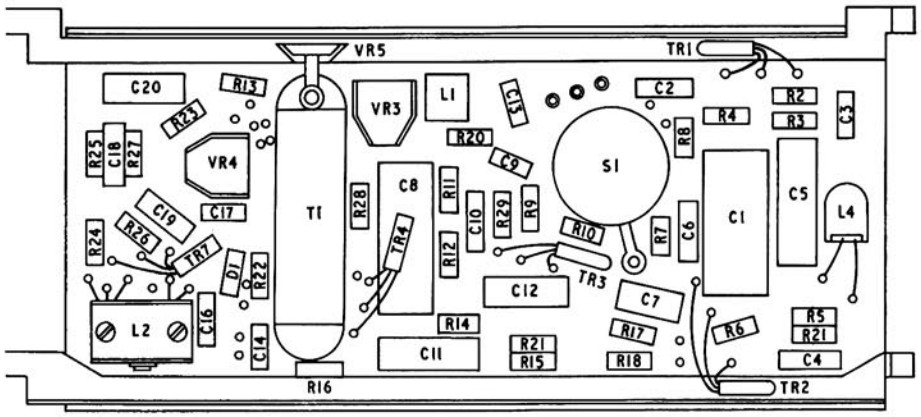
BY H. W. HELLYER

tape recorder service

WALTER METROPOLITAN COMPONENT LAYOUT



LAYOUT OF R29, C10 AND C12 ON BOARDS Z11622



NO. 51 ELECTRICAL ASPECTS OF THE WALTER METROPOLITAN

THIS MONTH, a new look. In response to repeated requests for more detailed circuit information—particularly from readers owning commercially defunct equipment—we propose to include complete circuit diagrams whenever possible.

There are limits, however, to the information that can be given. Some manufacturers are reluctant to admit that the owner has a right to know exactly what is inside the fancy box for which he has mortgaged half his birthright. Others maintain a strict dealer-agency circulation of service data—and permission to publish will only be obtained by constant pressure. (As this humble fellow has stated many times before, and as he again pledges: to press and press . . .)

In many cases, service data has never been published. A few of us, actively engaged in repair work, have laboriously scratched out circuits and constructional features for our own use. Where the Editor's tame artist can interpret these tea-stained masterpieces, it should be possible to publish.

To start the ball rolling, this month's contribution deals with the mains/battery tape recorder which was the last machine issued by the *Walter* company before the chill wind of economics blew them from the scene. Regular readers will be aware that we have already discussed the *Metropolitan* (*Tape Recorder Service* No. 30, June 1964). A skeleton amplifier circuit was given and the main features described briefly. In addition, mechanical peculiarities, typical faults, and adjustments occupied much of the available space. We are not concerned with the mechanics here, but shall concentrate on the circuit, given in full on the facing page. This has been redrawn in the manner that succeeding circuits will also follow. Component values are given on the diagram. Component numbering, where given, follows the manufacturer's original parts list, and is retained for easy reference. To avoid any confusion, the only references otherwise given are those which link with the text.

The style of the drawing is that which was long ago thrashed out carefully in the editorial office, and should enable regular readers to interpret circuits more easily than some makers' 'bramble thickets' allow.

The circuit employs an OC71 (Tr1) common preamplifier in common-emitter mode, neutralised by R2, output feeding via C3 to the slider of the common gain control and thence via C4 to the base of the first main amplifier Tr2. This stage and Tr3 are both OC71 transistors, and equalisation is effected by switched components across the first section, Tr2, and an alteration in the series feed from the

(continued overleaf)

output of Tr3, made by switch sections S1C and S1G. During recording, the signal is taken from the output of Tr3 and applied to the head via the bias trap circuit L1 and C13 and the switch section S1B.

From Tr3 the signal is tapped off via C9 and the isolating resistor R29 (open-circuit S1G during recording) to the driver transistor Tr4, an OC72. The push-pull output stage, two OC26 transistors, has base bias set by VR3 and a monitor signal is thus available at the loudspeaker. The tone control VR2 becomes a series monitor control during *Record*. Modulation level indication is obtained by application of a portion of the signal, via a separate winding on the driver transformer and the modulation level adjustment VR5, to a DM70 neon indicator. Note the unusual rectifier circuit which uses, in effect, the indicator itself as part of the rectifier load; also the coupling to the bias circuit, which tends to cancel error readings caused by standing voltage induced by the bias waveform. This method of connection and back-coupling is necessary, as the DM70 needs a fairly high positive voltage at its anode to produce a light beam, and the rectified oscillator output is employed to produce this.

The oscillator itself is a conventional collector/base feedback circuit, tuned by L2, formed around an OC72, Tr7. Bias output is adjustable by VR4. Erasure is magnetic, but a low noise level has been obtained by the spaced, reversed magnet assembly and an erase head is not needed.

During playback the main amplifier circuit is basically as before, except for equalisation switching and the application of full drive to the output stages. A high level monitor signal, or drive to an external amplifier, is available from the collector of Tr3 and the tone control is now part of a network across the base circuit of Tr4. The oscillator is rendered inactive by open-circuiting of the emitter return path by S1D.

Power supply switching is obtained by the sections of S2 operated by the swivel plate which shields the mains plug/socket input pins, thus isolating the battery circuit completely when the mains plug is inserted. A full-wave metal rectifier is employed for mains operation, with smoothing obtained by C22, L3 and C23, motor and amplifier voltages being tapped from the common source. Motor switching, however, is individual, enabling the amplifier to be used separately if needed. Two low-voltage *Staar* motors are employed, with reversal of polarity to the rewind motor for fast forward wind or fast rewind, by S3. The capstan motor is energised only on record/play by a separate switch S4 and clutch drive is entirely mechanical, by a belt from the flywheel to the clutch drum.

Noise level can be checked by short-circuiting the head input, turning controls to maximum, and measuring less than 0.1mW across secondary of output transformer, with amplifier switched to playback. (A matched output meter is necessary for accurate readings.)

Playback gain is measured with the output meter connected as before. Disconnect the head lead and apply a signal of 1 mV at 1 Kc/s to obtain a reading of 0.6W.

To ascertain microphone record gain, disable the bias by disconnecting the base lead of Tr7. Switch to record and connect a valve voltmeter across a 100-ohm non-inductive resistor inserted in the red lead of the head connection. Turn the record level control to maximum and inject 1 Kc/s at 1 mV at the microphone socket for a reading of 6 mV. (A signal of 100 mV at the Gram socket should produce similar valve-voltmeter reading.)

Record level indication: Reduce input at the Gram socket to 40 mV and note that the fluorescent column of the DM70 should just meet the spot. (It will be necessary to re-connect the oscillator before making this test.) Adjust VR5 for correct indication.

A bias reading of 170 mV should be obtained across the aforementioned 100-ohm resistor in the head return lead. Adjust VR4 for a reading of not less than 170 mV.

Switch to Playback when assessing the output stage and check voltages as indicated on the circuit diagram. Adjust VR3 for correct base bias at Tr5 and Tr6. Apply a variable signal and check for crossover distortion at all frequencies up to 9 Kc/s, keeping the input to a suitable level to produce 0.6W output. Play a test-tape and check distortion at 2W output from 100% modulated section, 1 Kc/s. Recheck by switching to record and applying a signal to the Gram socket.

When replacing output transistors, a matched pair should be used and the setting of VR3 rechecked for optimum conditions.

take a bed recess

THE STORY OF A BLIND MAN'S NEWSPAPERS BY IAN ROSE

IN the top flat of a Scottish tenement on Clydeside, an old fashioned set-in bed recess has been transformed into the tape recording 'plant' of the sound journal *Scottish Magazine*, the brain-child of 39-year-old Derek Stuart. Nothing remarkable in that perhaps. Except that Mr. Stuart is partially blind and crippled by polio.

Yet every eight weeks he publishes from his Greenock home a magazine which, as he says, "mirrors what has been going on in Scotland".

Much of the material he gleans from the Scottish region of the BBC's radio programmes, with the occasional item from Scottish Television's nightly current news programme *Here and Now*. The rest he produces himself, including excerpts from his vast collection of gramophone records, and the whole thing is linked by himself. The magazine runs to an average of thirty minutes, though sometimes he brings out a king-sized edition lasting up to an hour.

Considering the difficulties under which he operates, Derek Stuart has won tremendous appreciation from those friends who receive *Scottish Mirror*.

Nor is this a mere exercise in creating a digest of recorded words and music, or a pleasurable means of passing time. It is a determined effort to communicate and to contribute to the pattern of life around him. And it succeeds.

Nevertheless, tape recording did not come into Mr. Stuart's life as the saving grace to a man bordering ultimate frustration and despair. For years sound radio and recorded music had been twin companions with whom he shared many happy and exciting hours.

"I saw this new device as a way to collect more material for permanent use," he says. That was 17 years ago. Now he has tape correspondents all over the country and one in South Africa.

In his tape library are miles of music—classical, light and 'pop'. As chairman of the local gramophone society, he has used his tape recorders to rehearse illustrated talks and programmes for the society. He has word pictures and commentaries, too, including one of a presentation to the manager of the factory where he is employed as a telephonist. He has taped the annual Orange Walk in Glasgow, with its patriotic cries and bands of all description, 'noises-off' and snatches of overheard conversation. There are memories, also, of New Year parties at the Stuarts', with a hidden mike!

Within his wide circle of friends, Derek is something of an expert to those who know next to nothing of tape recording. Consequently he finds himself being commissioned to record radio programmes, music and to provide taped dance music at parties. Once, a friend asked him to copy the style of disc jockey Jack Jackson and compile a record programme with interrupted comments by her favourite comedians.

Mr. Stuart is proud of being a self-taught tape recordist. But then that is typical of the man. Born in London of Scots parents, he came to live in Scotland during the war when his father, a doctor, returned to his native land. Before that, Derek had matriculated at Worcester College for the Blind, studying entirely in Braille. He later added mechanical shorthand and Braille typing to his collection of certificates.

At Edinburgh University he succeeded in obtaining a certificate in social studies, with hopes of becoming a home teacher for the blind, but because of his disablement (his legs were affected by polio) he had to give up this ambition.

"I've never held a perpetual grudge against life, despite its afflictions on me," he will tell you. "Occasionally, however, I feel bitter."

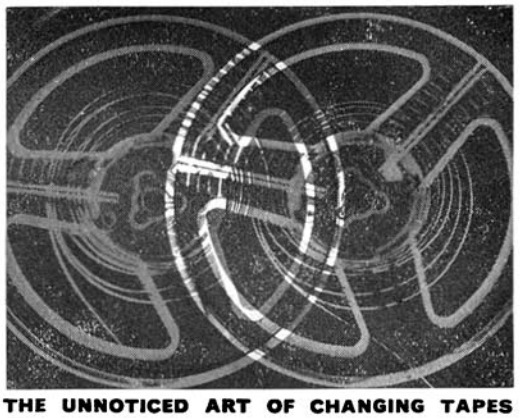
Naturally he does quite a lot of tapesponding with blind friends and reckons that this is *the* way for blind people to keep in touch with one another—far better than using Braille. "You feel the person is in the room with you, when you switch on. It's much more personal," he believes.

Difficult as it is for him to travel, which he does with the help of his wife Ria, Derek is buying a portable battery recorder to extend his rather limited field. More 'live' interviews and commentaries will add greater variety, he feels, to *Scottish Mirror*, and probably result in more issues. They would also enable him to undertake several documentaries he has in mind, particularly one about his cousin's farm on the island of Arran.

All this is much in the nature of a challenge. But life itself has been a challenge to Derek Stuart and he has never failed to pick up the gauntlet yet.

Many a person with perfect eyesight and mobility would be proud of what he has accomplished in 17 years. His story with tape is an inspiration to those who have met him and to those others in similar plight who are wondering what to do with their lives.

THE SECOND SPOOL



THE UNNOTICED ART OF CHANGING TAPES BY GORDON GOMPERS

IN spite of the great advances in technical performance of domestic tape recorders during recent years, their versatility does not seem to have increased greatly. Although the ¼-track head has given us the opportunity to squeeze large quantities of recorded material on to a fairly small tape, the recording of very long musical works on small-capacity decks still presents a problem. Unless one can be sure that an interval in the performance will coincide with the last few seconds of a track, there is no alternative but to lose fifteen to thirty seconds of programme in transposing and re-threading the spools.

After some experimentation, I eventually discovered a system that permits a continuous recording to be made on two separate tapes without any break in sound whatsoever. I do not claim to have invented it—the solution seemed so obvious.

A little preparation is needed and involves, firstly, removing the rear leader of the first tape to be used (which I shall call *Tape 1*). Similarly, any leader on the front end of *Tape 2* must be cut off. A small strip of jointing tape is now placed on the uncoated side of the front end of *Tape 2*, one half projecting beyond the edge. We are now ready to begin.

Well in to our music programme, we notice that *Tape 1* is coming very near its end. *Tape 2* is thus brought to hand, the front end, with its incomplete splice, dangling from the front of the bench. As the closing turns of *Tape 1* begin to run from the feed spool, this spool is hastened round manually, the last few feet of tape spilling on to the deck and cabinet. Taking every care not to twist the tape, the adhesive tape of *Tape 2* is brought down hard on the end of *Tape 1*, rubbed with a fingernail, and allowed to pass before the heads. The major task is now over and we now endeavour to place the full reel—*Tape 2*—on the newly vacated feed turntable.

Our attention is now turned to the take-up spool, which by this time is probably almost full. Taking the tape between finger and thumb, a quick cut is made in the tape path from head to take-up spool. Care must be taken to ensure that the tape does not curl round the capstan,

(*continued overleaf*)

or feed into the mechanism, as it snakes out from the head slot. If it can be arranged to fall of its own accord on to the floor (mind your feet !), so much the better. While one hand controls the spilling tape, the other should be brought in to remove the full take-up reel and replace it with an empty spool. The oozing tape is now grasped at the outlet from the head slot. Isolating the other hand from the tape drive in this way (to avoid wow) the tape is now slipped between two fingers until the front end of the tape is retrieved. Taking care, once again, to prevent twisting the tape, this front end should be threaded on to the empty take-up spool and allowed to wind fairly quickly until most of the slack tape has returned under control. A little care at this point will ensure that the take-up spool does not jerk the tape as it commences its action.

One assumes that the second tape will prove more than adequate for the complete programme but, if high speeds or small reels are being used, there is no reason why the recording should not be continued further on to a third or fourth spool, or even on to other tracks of *Tape 1* and *2*.

When the recording has been completed, one can return to the tapes and re-locate the break, or breaks, at a convenient quiet or unwanted point in the programme. This becomes rather a problem if more than one track of each tape is employed, but is by no means insoluble to those with patience.

In closing, it is worth describing a slightly simpler variant of this system, which involves less scissor-work, but needs a little more skill. The splice between the end of *Tape 1* and beginning of *Tape 2* can be grasped and broken as it leaves the head slot. We are then left with the two tapes intact ; not that this solves anything, since the splice will, in any case, probably need to be re-positioned.

The system is crude, in inexperienced hands, and may cause disastrous wow and drop-out (if a bad splice passes the record head). With practice, however, the operator can change tapes without any noticeable interference. This, surely, is better than the alternative solution—$\frac{15}{16}$ i/s !

book reviews

TAPE RECORDER SERVICING MANUAL By H. W. Hellyer. 340 pages. 357 line and three tone illustrations. Price 63s. Published by *George Newnes Ltd.*, Tower House, Southampton Street, London, W.C.2.

MY first reaction on reading this book was a feeling of disappointment that so many of the recorders described were so very old—the *Baird Soundmaster* for example must be all of twelve years old—but a little consideration showed that even recorders such as this have a place in a Service Manual when all other technical and electrical information has long since disappeared.

Out-of-dateness is a criticism which must inevitably be levelled at any collection of servicing information. The recorders must have been in use long enough to develop characteristic faults before such information becomes available, and there is a further time interval before it can be written and published. The alternative is to publish manufacturers' service notes, which can only be based on factory test procedure.

Mr. Hellyer's book steers a middle course by presenting all available manufacturers' data and circuits, but he supplements this with bench notes collected over a number of years of practical servicing. A cursory examination of the book might well miss these little gems of service information—I recognise a few on machines I have tussled with over the years—but this is the real value of the book: the little practical hints and tips which come in so useful when you are confronted with the 'stinker' which will just not come out of its cabinet, or when the only possible way to change a belt seems to be to dismantle the mechanical side of the recorder completely. Any one of these tips or short cuts could be worth the price of the book to both part-time and professional engineers.

I found a very big spread on the bias voltages suggested for recorders using the same deck or heads; for example, on page 15 two *Alba* recorders using *BSR TD2* decks show a bias variation of six to one—70V RMS for model *R14* and 12.5V AC for the *R59*. The *R15* is intermediate at 36V RMS. On page 118 the *Argyll Minor* demands 80V bias. Certainly some are measured on the 100V range of an *Avometer Model 8* and others on a valve voltmeter, and there were small changes in the bias requirements of the early *Marriott* and *Bradmatic* heads fitted to BSR decks, but an actual recording test to set the bias for maximum output at 1K/cs should be done on all doubtful recorders.

The 14-page Introduction dealing with basic principles is generally well written, but there is one lapse on page 4 in the section dealing with Bias: the simple little statement that fig. 6a shows the BH curve associated with a typical recording head. This and the transfer characteristic in fig. 6b, refer of course, to the *tape oxide* and *not* the head! I am sure this is a slip of the pen (or typewriter), but it must be mentioned unless it misleads the reader.

The CCIR and NAB standards on the same page are now obsolete, and show once again how quickly information can be made out of date between the time of writing and publication.

Despite my minor criticisms, I am sure this book will find wide acceptance, not only by the full time service engineer but by recording enthusiasts who are keen enough to know a little more about circuit trends over the past decade. Most of the circuits use valves, but there are a number of transistor circuits of early portable recorders such as the *Stuzzi Magnette*, *Grundig Cub* and *TK1*, leading to the *Butoba* and newer *Fi-Cord*, which illustrate advances in circuit sophistication and point the way to modern transistorised mains and portable recorders which are covered by the *Philips* and *Cossor* sections of the manual. **A.T.**

RADIO AND AUDIO SERVICING HANDBOOK by Gordon J. King. 256 pages, 140 illustrations. Price 25s. Published by *Odhams Books Ltd.*, Long Acre, London, W.C.2.

THE work of this author will need no detailed recommendation to readers of *Tape Recorder*. Recent articles, "Towards Better Taping" and sundry other contributions to this and our sister magazine, *Hi-Fi News* have shown that Mr. King has an easy and informative style. This handbook is no exception to the quality of his work.

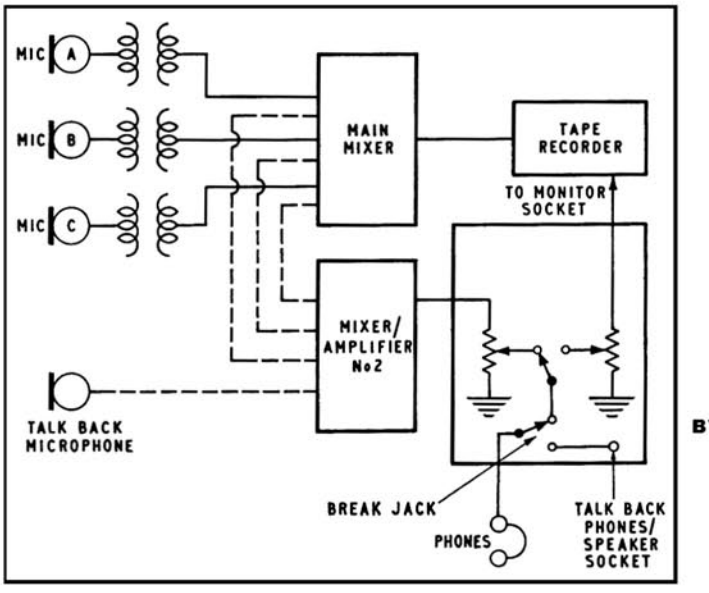
His terms of reference cover the servicing of all types of domestic radio including FM tuners, record reproducers and turntables and tape recorders.

Unfortunately for our specialised readership, such wide terms of reference mean that only one chapter of thirty-nine pages at the end of the book deals with our subject. In this short space, a brave attempt to explain the principles, give examples of circuits and mechanisms and a few pointers toward correct maintenance comes off very well. The illustrations chosen are very general: the Mullard amplifier (without the various modified pre-amplifiers), the *Bush TP50*, the *Philips EL3585* transistor circuit, examples of *Truvox* and *Brenell* motor switching circuits and the old, familiar, out-of-date *Monardeck* as a basis for mechanical explanation. Nothing is said about the vital clutch and braking devices that cause so much trouble; nothing about preamplifiers, mixers or microphones, and, surprisingly, loudspeakers receive no separate treatment at all.

However, it would be churlish to continue a negative review: our purpose here is to argue that this book is worth the cost of a 5in. DP tape. Its positive virtues are a very readable coverage of the whole domestic radio field, including two valuable chapters on the transistor, transistor circuits and their servicing. FM tuners are dealt with sufficiently, without too much theoretical discourse but a great deal of practical horse-sense. Indeed, it becomes obvious with each successive handbook produced by this author that he has 'kept his hand in' by working with the equipment. We can benefit from his experience—presuming that readers of *Tape Recorder* are not so restricted in their interests as to concentrate entirely on their spinning spools. **H.W.H.**

HEARD MELODIES ARE SWEET

some notes on mixing and monitoring



BY C. H. SIMMONS

THERE is no evidence that Keats knew anything about the art of tape recording, but one cannot doubt that he might have been thinking of monitoring when he concluded by saying that "those unheard are sweeter". The seven-part article, *A Studio Quality Mixer*, by Mr. D. P. Robinson, which I read with considerable interest, prompts me to describe a less sophisticated 'lash-up' which I built some time ago.

The church to which I belong is, like most churches, desperately short of money for repairs and it occurred to me that I might help to earn a little by taping wedding ceremonies. I accordingly obtained permission to install a number of microphone cables, starting in various parts of the building and terminating in the gallery which the builders had thoughtfully provided at the back of the centre aisle. This worked out very well—I was able to plug in my microphones when required and to operate my recorder quite unobtrusively, so that usually nobody, unless previously in the know, was aware that a recording was being made.

After a while I began to feel that the system needed a few modifications. My chief criticism was that while I could hear what was going on to the tape from *Microphone A*, if that was the particular one which was faded up, I couldn't tell what the effect might be from *Microphone B* or *C*, if they were faded down. My mixer (a *Grundig*) copes with three microphones and each input is made to a GPO jack socket with a DIN socket in parallel. It occurred to me that I might try the effect of using the second socket of each input as a tapping point from which I could feed a second mixer/amplifier, and that is exactly what I did.

Now the expert will say that such an arrangement will upset all the impedances; but nevertheless it works and does not apparently mess things up. One important point is that made by Mr. Robinson in the second paragraph of Part Four of his article—the inputs to the second mixer must be isolated, in order that any clicks or noise which might originate from the second mixer's gain controls shall not feed back to the main mixer and thus to the recorder. In my case this isolation is provided by feeding each input into one half of an ECC83 valve and placing the various gain controls after these first stages. I do not propose to describe the circuit of the second mixer beyond this point—it was strictly a lash-up from the junk box, based on the valve manufacturer's published information, with no attempt to provide 'hi-fi' quality, since the output was for my ears alone and not for recording.

Previously, when recording, I had plugged an external volume control, followed by a pair of headphones, into the 15-ohm output of the recorder. Now, having two points at which to listen—the recorder output and that of the second mixer—I put two volume controls into one box, with a change-over switch to connect the phones to one or the other as required. The usual drill is to monitor the recorder, only switching over to the non-recording microphones to listen to something which I think might sound better if recorded from a different position. Like so many other things, this is far easier to do than to describe and in fact the operation of up to six gain controls is not nearly so complicated as it might appear.

One more point which has proved useful: the second mixer has a fourth microphone input, while the dual volume control box has two output sockets in series. The second socket is normally isolated by plugging the phones into the first, but this second socket provides a point into which one can plug a line to a second pair of phones or a loudspeaker. Thus by unplugging the phones from the monitor socket one has a circuit which can be used for talk-back when rehearsing an event, or for giving a cue to the organist when the bride arrives. Here again, description is tedious, but the block diagram perhaps makes the circuit more clear.

As I said earlier, when on the subject of impedance matching, I have broken or seriously bent quite a number of the rules and no doubt the experts will raise their hands in horror; but nevertheless, the system works and there is no apparent loss of quality in the recording. Of course, the people who have the greatest interest in hearing the recording of a wedding—the bride and groom—are usually the most uncritical listeners that one could meet. I recorded a wedding not so long ago when the organ motor was playing-up at the start of the ceremony and two small choirboys were put on the hand pump for the opening voluntaries. You never heard anything like it! I played this back, unedited, to the happy couple after they had returned from the honeymoon and explained that I would cut out these ghastly noises. But not a bit of it—it was their wedding and they wanted it all—every last wavering note!

But that is a digression, and to get back to the point I was making, the mismatch does not upset the applecart.

Perhaps all this sounds too complicated for the average recording enthusiast, but while I am happy to be called an enthusiast, I would stress that I am not an expert, either at recording or electronics. My dearly beloved and sore tried wife describes me as a 'fiddler', happiest when messing around with some bits of wire and a soldering iron, and that is more or less correct. So, if Mr. Average Enthusiast finds the second mixer something more than he can stomach, I hope that he will think about the idea of permanent lines in a situation where he records regularly. They save an enormous amount of time and effort when setting-up, and when using low impedance microphones, almost any cable will do.

One more point here which is worth thinking about: I fitted multipole plugs and sockets on the microphone lines, just in case I should decide to run further cables in parallel to those already installed, in which circumstances I could connect up the various cables simultaneously and without any possibility of crossing the connections. You may not find it so, but when I am handling more than one cable at a time, somehow the wrong plug always seems to get connected to the wrong socket, where it remains unnoticed until the recording has started, resulting in the opening sequences being unrecorded.

And finally—have a check list. I have, ever since the day when I remembered everything except the tape!

TEACHING BY *tape*

A budget approach to automated education

BY DAVID KIRK

THE educational-aids industry can justly claim to be among the oldest on earth. Far from appearing alongside the development of electronics and magnetic recording, this industry catered, in a very small way, for the requirements of pupils long since covered by the Sahara dust.

Overlooking the multitudinous contrivances for corporal punishment, the industry was limited to the output of slates and abaci until, with the advent of radio, followed by educational broadcasts, the market began to expand. Today it would be difficult indeed to find a school not in possession of radio receiving equipment, most being fitted with comprehensive sound relay networks. Many authorities take advantage of the BBC educational programmes—which normally run to some two hours daily and are backed by illustrated pamphlets and books—basing an entire syllabus in geography, history or music on the broadcast schedules.

Television at present plays a somewhat smaller part in teaching, due to the high cost of good-quality large-screen receivers and television relay systems. A collapsing Tower of Babel is much easier to simulate acoustically than visually, and it cannot be said that the BBC educational television broadcasts approach the standard of school radio. Despite these disadvantages, new schools are in many cases being wired for closed-circuit television between classrooms, for possible use in the future.

The success of 16mm cine in the teaching field suggests that economic video tape recording will be essential if television is to make much headway in education. Throughout his not-so-long-departed school-days, the writer observed various applications of the cine projector. These ranged from the unimaginative passing of time allocated for cancelled physical instruction classes with filmed entertainment, to the clarification of more complex aspects of biology and blast furnaces. Thirty-five millimetre transparencies are also popular, on both sides of the tutor's desk, as a means of supporting and enlivening a classroom lecture. Projected slides retain the personal element of conventional teaching and when arranged to provide a well-illuminated picture in a darkened room, aid concentration.

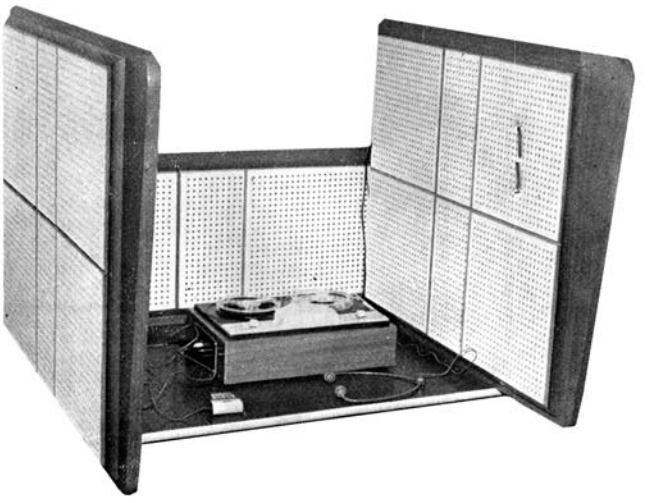
The tape recorder has always been a victim of apathy—in the school no less than in the home. But despite the acknowledged versatility of radio, television and film, magnetic sound recording is responsible for the boom being enjoyed by the educational aids industry. Although by no means new to school surroundings (phonetics and music teachers have kept a *Clarke & Smith* in their cupboards for years) the recorder is today finding universal acceptance in various specialised forms.

Best known of these forms is the language laboratory—a system that could do to education what mass-production techniques did to industry. An aura of mystery surrounds the 'laboratory', however, the latter badly chosen word conveying an impression of battery hen farming or mind feeding in the tradition of *Brave New World*.

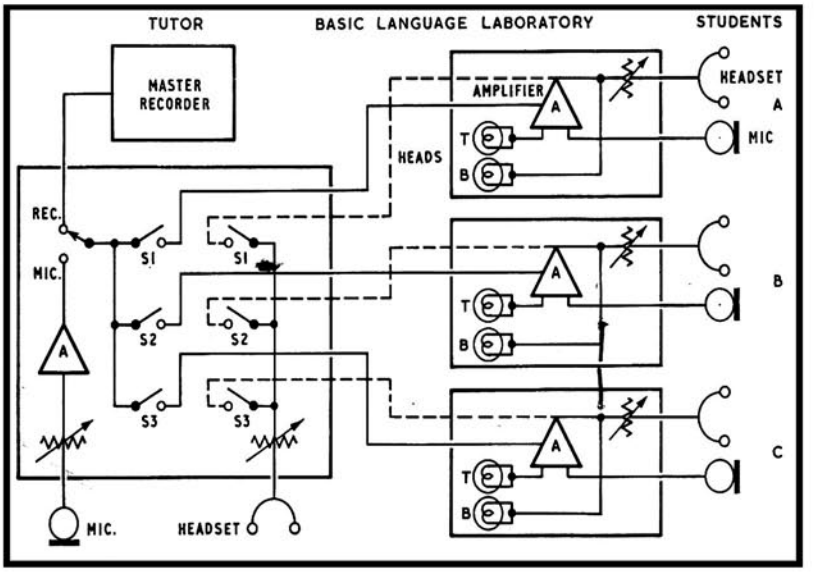
To demonstrate that teaching by tape is neither mysterious nor expensive—provided an installation is designed thoughtfully—we turn our attention to the products of one company catering for educational needs. *Tutchings Electronics* will be known to many readers as the company established by reviewer, Alec Tutchings. From small beginnings, the firm grew to compete with *Tandberg*, *Rank-Truvox*, *Bang & Olufsen*, *Grundig*, the *British Radio Corporation*, *Wright and Weaire*, *Pamphonic* and *Telefunken* (to name but a few) in the manufacture and sale of teaching machines.

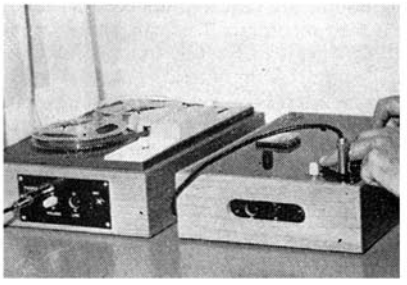
The products of Tutchings Electronics range from complete language laboratory installations to simple audio-dictation instruction systems. In a field where a 24-pupil installation can cost upwards of £3,500, the Tutchings systems are designed with the limitations of school budgets very much in mind. Standardisation of components and connections permits a school to develop its laboratory in easy stages.

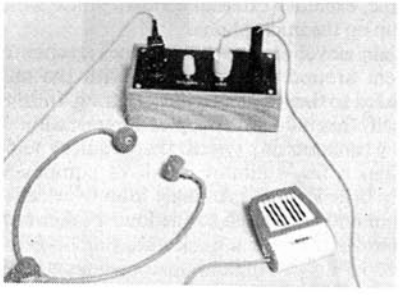
Before analysing these components, it is necessary to explain the limitations of conventional classroom language teaching. Unlike mathematics and spelling, foreign languages derive little benefit from written exercises. Initially, language study requires the mentality of a parrot—listening to and repeating the equivalent of English words until a substantial vocabulary has been committed to memory. Memorising a vocabulary from textbooks (a lengthy and most frustrating evening's homework), besides being more difficult than oral memorisation, places a stumbling block before the novice linguist that the writer, at least, with his God-forsaken German tuition, found impossible to overcome. Learning orally, the student tends to *think* in the language being taught. Text-book-taught souls, however, generally find themselves thinking mainly in English and only sporadically in the new language.



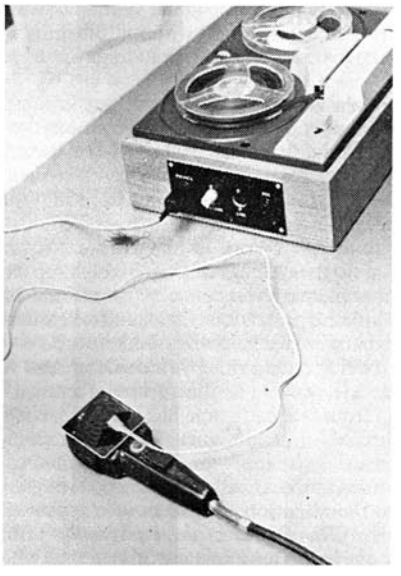
Above: Complete language booth comprising Student Recorder, microphone and headset.







Top: Master Recorder and Control Unit.
Middle: An audio dictation lesson in progre
Above: Student amplifier employed in the Tutchings 'B' system.
Below: The 'artificial-voice'.



"Where is the cat?" the textbook might ask in the barely decipherable vocabulary. The logical procedure in answering this question is to commence by translating it into English. A sensible reply can then be formulated, again in English, for conversion in to the unknown tongue . . . which is precisely the wrong way to go about it.

The occasion when a classroom-taught pupil can practise aurally is rare (to the exceeding pleasure of many classroom-taught pupils). Assuming that a lesson spans some thirty minutes, no pupil may expect more than one minute of speaking; the emphasis of instruction remains squarely upon the tip of the pen. Small wonder that awards (*General Certificate of Education* being a good example) come much less frequently to conventionally taught language students than to those studying more fundamental subjects.

A laboratory-taught pupil spends some 80% of the tuition period listening, repeating and answering the phrases of a pre-recorded tape. A lesson commences with the donning of headphones (very light, comfortable and clear stethophones in the case of the Tutchings system). The simple controls of a *BSR Monardeck* are manipulated, setting a twin-channel Student Recorder in motion. The pre-recorded phrases are relayed in to the headphones from the upper segment of a ¼-track head. Simultaneously, recording is in progress on the lower track as the pupil tapes his reply in the interval left between each phrase. At any time fast rewind can be selected and the recording sampled. This brings home to each pupil the mistakes made in grammar and pronunciation. By operating a control unit on his desk the tutor may monitor the efforts of any pupil and discuss mistakes individually. The tutor is equipped with a twin-track Master Recorder from which future lessons are dubbed.

Schools may purchase or hire tapes specifically for laboratory language teaching, or can record their own. An arrangement between *Sir Isaac Pitman & Sons* and Tutchings Electronics provides a selection of Pattern Drills in French, German, Russian, Spanish and Italian.

Assuming a lesson to be under way, all pupils will be in the process of monitoring the pre-recorded phrases on headphones and answering or repeating them through their microphones. A preamplifier between the microphone and headphones allows each student to monitor his own speech as he records it. This amplification takes place within the student recorder and is suitably mixed with the output of the top track. The tutor may wish to monitor the progress of Pupil A and he may overhear this student's efforts by depressing switch S1; if he desires to speak back to the pupil, the tutor operates switch T1, connecting his own microphone to the amplifier of Pupil A (see diagram). It will be noted that the conversation now in progress is limited entirely to the tutor and pupil. Crosstalk between channels is kept at a negligible level to ensure complete privacy. When the conversation ends, the tutor may disconnect Pupil A and pass on to another. Pupil C, for example, would be reached through switch S3. With the basic system shown, it would seem that, to speak to the entire class, the tutor would need to operate all the T switches. In practice, a single control is incorporated to permit class announcements.

The full-scale language laboratory so far described is the most elaborate, and the most expensive, of the Tutchings products. Nevertheless, the 24-booth laboratory previously quoted as costing anything up to £3,500, depending on the manufacturer, can cost less than £1,400 from this company. This price includes 24 student recorders, one master recorder, booths and control equipment.

Most of the cost of any language teaching system is incurred in the purchase of student recorders. To overcome this price barrier, Tutchings have evolved a simple system using a single Master Recorder to feed student headphones. The pupils are also equipped with microphones through which they may converse with the tutor (the tutor retains his control switching unit). The precise arrangement of lessons with this system is identical to that in a conventional laboratory, except that all students must work in step from the master tape and cannot go at their own speed. Mr. Tutchings was confident that few tutors, after the first two or three lessons had acquainted pupils with the language, would employ the combined replay facilities in the later half of each instructional period. He also believes that few students employ the check replay facilities of system 'C' after the first few lessons have acquainted them with the language, and the novelty of hearing their own voice has worn off.

Replacement of student recorders with transistor amplifiers provides the acoustic isolation of a conventional laboratory, thereby aiding concentration and eliminating shyness, and retains the facility for each pupil to imitate or answer recorded phrases on the Master tape. A

(*continued overleaf*)

further advantage of this system is that permanent installation and screening booths are rendered unnecessary and pupils do not have to operate a tape recorder. This can be important when teaching very young students (between seven and nine is considered the ideal age to learn a language). A complete 24-pupil 'B' system—as just described—would cost precisely £420, including £10 installation fee. The laboratory schematic is also applicable to this system if the record heads are disregarded.

At the opposite end of the price scale to system 'C' is system 'A'. An installation based on this may be employed for training audio-typing and shorthand students. A 24-pupil system costs £114, including £5 for fitting. Essentially, the equipment comprises a Master Recorder which relays taped dictation exercises to 24 headsets. (Audio copy-typing and shorthand instruction tapes have also been prepared by Sir Isaac Pitman & Sons.)

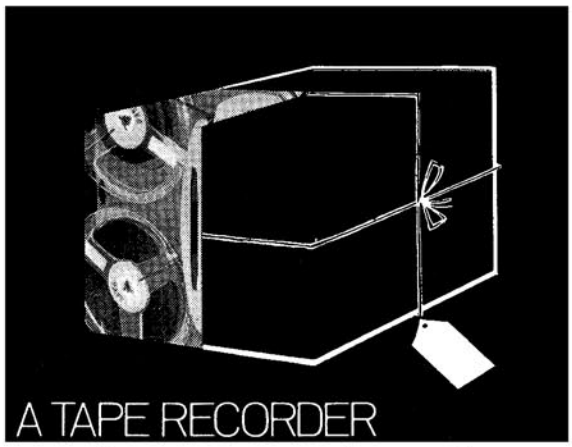
An interesting accessory developed for this system is the 'artificial voice' through which recordings may be dubbed from the Master Recorder to any type of dictaphone. Life in the world of commercial dictaphones is considerably more hectic than in that of the domestic tape recorder, since no attempt has ever been made to adopt standard fittings between equipment. Few dictaphones incorporate direct recording facilities and many have peculiarly-shaped microphones, the design of which is made all the more abnormal by the frequent inclusion of remote control facilities. The problem of dubbing tapes on to dictaphones without incurring background noise or excessive distortion has been solved by an acoustic coupler, which connects a standard stethophone earpiece to any dictaphone microphone by a rubber-faced baffle which is held in place with an elastic strap and which, at the same time, excludes external acoustic noise which might otherwise be picked up on the microphone.

Another novel device allows the teacher complete freedom of movement around the classroom, with the ability to hear the programme fed to the students without a long, trailing, headphone lead.

In itself, this induction-loop communication is far from new. For a 'wireless' broadcasting system that requires neither GPO approval nor more than a few shillings worth of equipment, however, it is surprisingly little known. A single loop of wire is positioned round the classroom and connected to the loudspeaker output of an amplifier or tape recorder to create a weak pulsating magnetic field. The wire may be placed in any convenient position—on a picture-rail or beneath the floor. A ferrite-cored coil connected to headphones via a small transistor amplifier is all the tutor requires to pick up the signal within the loop. He may thus move round the class, unrestricted by cables, monitoring the output of the master recorder. A further application of the induction loop that has already been employed in Tutchings laboratories is a wiring arrangement that allows the tutor—by locating his pick-up coil in the immediate vicinity of a study booth—to monitor the efforts of a single pupil without 'plugging in'. This is achieved by mounting a small transmission loop in a convenient part of the furniture.

In schools where permanent wiring is impractical and temporary wiring unsightly, students may be connected to the main programme source by induction loop. One of the beauties of induction transmission is that none of the components are critical. The transmission loop may be almost any size and have any number of turns (with a reasonably powerful amplifier, a single loop could feed an entire school building). Work is now in hand to develop a multi-channel induction loop system, through which up to four programmes at different academic levels could be transmitted simultaneously.

It is interesting to note that audio dictation may well kill the art of shorthand writing in the years to come—and here are the two methods being taught side by side. Of greater weight than the future of shorthand, however, is the future of education itself. Unconscious learning from magnetic tape has yet to be established as a reliable—or even unreliable!—technique. The author cannot claim to have risked death in a fiery inferno—or even a flattened capstan idler—by leaving his recorder automatically controlled throughout the night. He would bring to the attention of readers who repeatedly play certain tapes to themselves (*The Hound of the Baskervilles* at bath-time, perhaps) how quickly one learns long passages of dialogue without having the slightest conscious desire to do so. The promoters of 'sleep-learning' perhaps attach too great an importance to the blissful state. In and out of education, the tape recorder has a most promising future.



A TAPE RECORDER *for my birthday*

BY KATHLEEN McBREARTY

THERE is only one thing I really want for my birthday. An automatic potato peeler.

But I am the mother of a largish family, all intent on giving me presents that—to their minds—I should prefer. Yet, if only they realised it, a potato peeler would be worth more to me than a golden disc to a pop-singer !

However, the family pooh-poohs that idea completely. "What would you want an automatic one for," they puzzle, "when you have able-bodied males ready and willing to do the spuds for you, rather than let *your* hands get stained ? Tell you what, we will take it in turns and get the job done overnight."

They do, too, whenever I remember to remind them ; but suddenly it is hard to get a word in edgeways . . . all the talk having become hinged on tape-recorders. The whole family starts trying to sell me the idea, watching my face intently as we window-shop, forcibly stopping me beside every tape-recorder, openly discussing the merits and demerits of the various models, calling for my opinion as if it mattered.

Now, what I know about tape-recorders could be written on a speck of household dust. To me they are rather scaring new fangled machines and I would feel as nervous handling one as when I first answered our newly installed telephone . . . not that I went quite as far as my mother, who powdered her nose and tidied her hair before picking up the receiver !

Nevertheless, as my birthday approaches, it becomes more and more apparent that the family wants me to want a tape-recorder. I decide to help build up the suspense.

"I would much rather have a potato peeler," I insist.

"Oh no ! " protests my husband, "you can get one of those things anytime, but a tape-recorder, well ! Just think how you would love to be able to play back the late-night classical music, at a time when you were awake enough to appreciate it," he enthuses. "Why, you could record all your favourite pieces, and get perfect reproduction whenever you wanted it !"

"*And* catch all the pop-shows," our teenager adds hopefully.

"He would use up all the tapes on 'pop' " complains our youngest boy.

"We could always wipe the tape clean again," my husband interrupts, "there is a special gadget for that, called an *eraser*."

"But don't forget there is also an *erase cut-out*, to *stop* the track being cleared !" our teenager grins.

"You could record all our piano practices and songs," our little daughter suggests optimistically.

We all groan teasingly.

"What many people do not realise about tape-recorders," my husband reflects, "is that a slow speed is adequate for recording speech, but if one wants to record music, then the faster the tape is run the more perfect the reproduction of sound. One cannot afford to put quantity before quality if perfect orchestral results are desired, so it is no use trying to skimp on tapes," he hesitates, looking thoughtful, "There is a lot to learn," he says.

The next day he walks in late for lunch. There is a book under his arm. "I've been to the library," he explains, "and I don't want you to think that I am considering buying a tape-recorder ; I just wanted to read up about them. I was surprised to find so many books on the subject. This one makes them sound particularly interesting, would you like to look through it ?" He hands it to me, his blue eyes boyishly wistful.

Nevertheless, hardening my heart, I decide to be awkward.

"What's the use," I say, "we are never likely to have a tape-recorder; well, not for many years, anyway. There are other things we need first, like a potato peeler . . . "

"Oh that," again my husband dismisses it with a casual wave, "why, do you know, you can edit tapes by cutting and splicing them. Imagine the family comedies and dramas we could produce in that way, for our general amusement. Or we could combine tapes to make one single record, adding introductory music, and commentaries ; why—the possibilities are endless !" He pauses, then adds dramatically, "do you know, tapes are so fine that it takes the thickness of three of them, put one on top of another, to equal the width of a human hair !"

We all gasp encouragingly. "Fancy that !" I say, "And could we record music on tapes so fine, and sing to that music, recording the combined result together ?"

"Yes," my husband replies, understanding my Irish, and thumbing through the book I left unopened, "provided you have a superimposition switch on deck, or a mixer, and most machines do have these things, evidently. They also have pause controls, which enable the tapes to be stopped and held temporarily, to let one find the right word when dictating, for instance." He looks at me, struck with a sudden thought, and triumphantly produces a trump card . . . "Just think," he says, "what it would mean to you to be able to dictate an article while busy doing the washing or ironing !"

And that settles things as far as I'm concerned. Now, quite definitely, I want a tape-recorder more than anything else. For it can be very frustrating to lose one's brightest ideas simply because there is no time or opportunity available to write them down. I can see that it would be a simple matter just to speak them instead and copy them down later at one's leisure.

"Not only that," continues my husband, "but while our older boys are away we can send them pieces of recorded home life, instead of letters, and, in return, play back their own tapes. It would be like having them in the room with us again, listening to them talk . . . and it would help all of us to correct any speech faults, by hearing ourselves as others hear us . . . "

"We could act plays ; make candid records, concealing the microphone and hiding the recorder in a cupboard of another room . . . " the teenager suggests, "Record the 'top-ten', make scrap-books of odd things—and by 'odd things' I don't necessarily mean you, Curly !" he pulls his younger brother's short-back-and-sides none too gently.

Ignoring the ensuing scuffle, my husband speaks reflectively, "Yes, and we could send the boys the noisy chirps of our guinea-pigs and other familiar sounds of home. There are all sorts of quiz games that can be devised too, mystery voices and noises to be identified, or snatches of music to be recognised by contestants . . . "

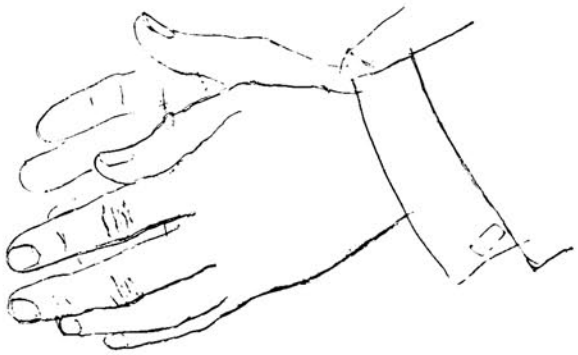
"Especially pop-numbers," our teenager grins, sitting triumphantly astride his brother, "and there are other games to play, such as recording questions before a party, asking the guests to record their answers, but first make sure the questions you ask them are *not* the ones prerecorded. You can get some jolly funny answers that way, when you play the tape back !"

"There can be educational uses too," my husband reminds him, "one can tape facts, talks, lessons—why they say one can learn a language in half the usual time with the help of a tape-recorder ; for, after all, the lessons can be played back over and over again until one is word perfect."

"And the days you can't take your favourite walk, down to the sea," our teenager turns to me thoughtfully, "you can play recordings

(*continued on page* 81)

you've got to hand it to them



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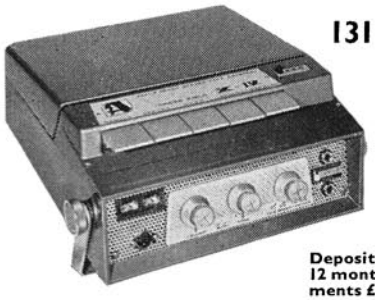

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tape reviews

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SPOKEN WORD **MAURICE PODBREY**

TCHAIKOVSKY/FRANCK Piano Concerto No. 1 (Tchaikovsky). Symphonic Variations (Franck). John Ogdon (Piano) and Philharmonia Orchestra conducted by Sir John Barbirolli. **HMV TA-ALP1991.** 3¾ i/s twin-track mono. 40s.

JOHN Ogdon is one of our younger 'home grown' concert pianists and recitalists who seems to have established a secure reputation for himself very quickly. On listening to this tape record, some of the reasons for this are immediately apparent. He has elected to play two well-known and popular works but treats neither of them lightly merely because they are familiar. His performances are very straightforward, giving us exactly what is on the written score, with rhythmic forthrightness. In fact, if anything his rhythm is in the main too exact, and one could wish for more flexibility, particularly in the second movement of the Tchaikovsky concerto.

The balance of the recording favours the bass end of the spectrum. The double basses sometimes sound too close for comfort, and tend to mask some of the low piano notes. The dynamic range is satisfactory, but in the louder *tutti* the sound lacks definition, presumably because of a restricted frequency range. It is not a very bad recording, mark you. it just could be better. **G.G.**

PEER GYNT (Grieg) Beecham Choral Society and Royal Philharmonic Orchestra conducted by Sir Thomas Beecham. Chorus Master Denis Vaughan. **HMV TA-ALP 1530.** 3¾ i/s twin-track mono. 29s. 6d.

GRIEG was not the most prolific of composers. The two suites arranged from his incidental music to Ibsen's play *Peer Gynt* are among his few orchestral compositions. The music ranges from lively marches and dance movements to melancholy songs and descriptive pieces, and in places the orchestration is very colourful. Unfortunately a good deal of this last quality is lost in the recording issued here. A restricted frequency range makes string tone, and particularly the voices, lack lustre. The chorus, especially in the *Arabian Dance* on Track Two, tends to be lost in the general orchestral sound. True, users of smaller machines may not find these shortcomings so serious, but they will certainly notice the unsatisfactory balance between chorus and orchestra. A pity, because the performance has wit and charm. **G.G.**

MOZART/HAYDN Sinfonia Concertante (Mozart). Concerto in C (Haydn). **HMV TA-ALP2017.** 3¾ i/s twin-track mono. 40s.

IF beauty were something absolute, and if it were possible to set up a standard of beauty in the world of music and compare other works with it, then I am sure many people would agree that Mozart's *Sinfonia Concertante* for violin and viola could well be that standard. Mozart is often considered to have given his more profound ideas their full expression in the piano concerti, but this Sinfonia Concertante seems, to me at any rate, to stand apart from his other concerti.

The Haydn concerto on Track 2 is a typical eighteenth century concerto. Menuhin here plays his own cadenzi, giving an extra touch of authenticity. Needless to say, the performance throughout both works is of the consistent standard we expect from Bath Festival ensemble with Menuhin giving the lead.

The recording quality, whilst not being brilliant, is a very satisfactory one, free from serious blemish. The Mozart work is the significant part of the tape, so buy it to hear Menuhin and Barshai working their way through those magnificent two part cadenzi. **G.G.**

THE BIG NEW BAND OF THE SIXTIES Twelve Items by Ernie Wilkins and his Orchestra. **World Record Club TT 435.** 3¾ i/s twin-track mono. 29s. 6d.

WILL the big band ever return again to dominate the field of Pop and Jazz as it did from the thirties right through to the fifties? Those who await this unlikely turn of the wheel will be thankful for the appearance of this tape, which resulted from 13 top jazzmen spending a few hours in the recording studio to run through a dozen Ernie Wilkins' arrangements.

Wilkins developed as an arranger while a saxophone player with Basie in the early fifties, and eventually he was contributing the major part of the Basie library. After leaving Basie, he also wrote scores for the late Tommy Dorsey and the Harry James bands.

The music on this recording is fresh, swinging, tasteful and enjoyable without being of any special merit. The best items are the three Wilkins' originals: *Ernie's Blues Fresh Flute* and *A Swinging Serenade*.

The sax section produces a lot of good sounds as might be expected when it includes tenor men Zoot Sims, Yusef Lateef and Seldon Powell. Lateef is featured soloist on *Ernie's Blues*, Sims is heard on *Fascinating Rhythm* and *I'll Get By*, while Powell plays very effectively on *A Swinging Serenade*. Clark Terry blows some very nice flugelhorn on *Lover Man* and *Very Much in Love*.

Satin Doll, *Canadian Sunset*, *Undecided*, *Everything's Coming up Roses*, and *Speak Low* make up the rest of the twelve numbers.

If you like the robust sound of a big band, this tape should please you. **T.F.**

BEETHOVEN Sonata No. 2 in G Minor, Sonata No. 3 in A Major. Janos Starker (cello), György Sebök (piano). **World Record Club TCM 60.** 3¾ i/s twin-track mono. 29s. 6d.

WHEN Beethoven composed these cello sonatas, he was better known as a pianist than as a composer. He never was a cellist, but of course his teacher, Haydn, was an expert and it may well have been through him that Beethoven first became aware of the instrument's attractions. I say 'attractions' and not 'possibilities' because in the sonatas recorded here it is the more obvious qualities of the instrument that are exploited. They make no great technical demands on the cellist, though the piano parts are formidable. Indeed, at this time bowing and fingering techniques for the cello were barely perfected, and later virtuosi were still to add new tricks to the trade. Almost seventy years earlier, Bach had written the finest of works for the cello in the unaccompanied suites for the instrument and it may well have been that Bach was seeking to show that the cello could rival the viola da gamba as a virtuoso's instrument and in producing polyphonic textures using multiple stopping techniques. In these two Opus 5 sonatas Beethoven sticks to established procedure and gives to the cello deep and broad melodies, and to the piano the more brilliant passage work. This is essentially for two instruments.

Starker's playing on this record is warm and enthusiastic. He and Sebok polish off the two sonatas with a combined competence and relish which is completely convincing. The quality of the recording is very good too, and the balance of sound between the two instruments is well maintained, no mean feat with these particular works. **G.G.**

(continued on page 81)

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IN every magic-eye versus VU-meter debate, technicalities hold the stage; snobs ridicule the magic-eye until you throw a *Tandberg* at them; or they chant a Black Mass of peak-values, under-modulations and even darker mysteries shunned by clean-living yokels such as yours truly. And nobody seems to stress the most glorious advantage of the magic-eye . . . its luminosity.

"Who cares ?" demand the mains machine men. But try using a portable in poor light, bad light, or the dark! Despite half-a-gale that tested the *Grampian* wind-shield to its utmost, my Bonfire Night recordings came out quite well . . . but how I wished for a luminous indicator. Near the fire, I tilted the *Fi-Cord's* control panel to catch the flame-light; further away, I had to use a torch. And, stumbling over hummocks with microphone in one hand, torch in the other, and 202 slung around your neck, while dear kind friends aim the biggest, costliest and most destructive missiles at you because they know you want spectacular close-ups, you look and feel a bit of a twit.

Ornithologists seeking nocturnal twitters (rather than nocturnal twits) can build a 'hide' equipped with flashlamp and all mod cons, and use headphones for monitoring. But, on November 5th, among friends who resemble frustrated Cape Kennedy boffins plotting trajectories without a computer, the less luggage the better—mobility is not merely desirable but often essential. You needn't be a criminal to go recording in the dark; I've hit this problem many times. So, please, can't we have either a magic-eye or an illuminated meter on every 'serious' battery portable ?

Tape is a superb documentary medium, and many people are keenly capturing for posterity the audible but dwindling aspects of life. Steam-railways form an obvious example, and much work is being done on such lines (sorry). Readers will readily instance umpteen other sources of otherwise imminently irrecoverable sounds ; amid the millions of feet of tape, in homes around the world, lie some real treasures for the folk of *our* future. Speaking of whom . . .

darkest dooms of prophetic pessimists with its contributions to traffic chaos, loss of life, and atmospheric pollution!

The future is largely unguessable . . . and which of our "recordings for posterity" will be *wanted* by posterity ? Amateurs can seldom compete with such organisations as the BBC in the recording of national or international events; but even your treasured 'scoop' of Lord Bigwig opening the new Town Hall may in the year 2050 be scorned by collectors who will cherish your informal family recordings which offer such candid and fascinating Pepys into the past. The graveyard at midnight ("Just listen to that silence") may prove a treasured item. Meanwhile, watch it—your birthday-party tapes might become the subject of some solemn thesis on the folkways of the pre-something-unimaginable-to-us era and its hairy inhabitants!

Which reminds me . . . this column comes from Lancashire where (judging by some Londoners' comments) half the natives cough out their grimy lives in dark Satanic mills while the remainder are aborigines clad in hyena-skins who converse in simple grunts while scrabbling wrist-deep in the soil for edible roots—spuds, to you lot down in London. "*Down* in London ?" you squawk with horror. Yes indeed; north is surely 'up,' so being in my moments a vaguely logical geezer I insist that London lies in the other direction. Anyway, to show that I'm open-minded, let me tell 'ee a tale.

Daubed in finest woad (10s. 7d. a stone jar from any northern branch of *Clogs*, the Chemists) I ventured with Grampian and Fi-Cord into a great gleaming glass wonderland of discs, tapes, speakers, recorders, gramophones, mixers, microphones and—well, you name it and it seemed to be there somewhere.

I browsed amid the LPs—but assistants sprang at me whenever I paused to study a sleevenote. In the equipment showroom, others breathed down my neck, asked pointed questions, and conveyed the cold impression that looking around from technical interest without an imminently exploding cheque-book was a crime against the Almighty.

The shop was not busy; but never, anywhere, have staff convinced me so rapidly that any customer is a nuisance to be dismissed with haste and hostility. So I went to the battery department, and, when one admittedly pretty wench condescended to divert her attention from her fingernails to me, I asked quite politely if any *Mallory* mercury batteries were available.

PERSONAL BIAS

a sort of column by john ashcroft

NUMBER ONE DOWN FROM THE HILLS

She . . . merely touched one or two screws, and at once the room was filled with the music of a grand organ anthem; filled, not flooded, for by some means the volume of melody had been perfectly graduated to the size of the apartment.

"Grand!" I cried. "... but where is the organ ?"

"There are a number of music rooms in the city, perfectly adapted acoustically to the different sorts of music . . . connected by land-line with all the houses . . . whose people care to pay the small fee. The programmes . . . offer a choice . . . so that all tastes and moods may be suited."

From Edward Bellamy's classic *Looking Backward*, published in 1888 when 'telephone broadcasting' seemed the only feasible system, this passage neatly exemplifies the appalling difficulty faced by the most far-sighted social prophet or science-fiction writer. H. G. Wells's aviation ideas (c. 1900) seem quaintly primitive now, although he did forecast 'dogfights' and transatlantic airliners. But what about that amusing contraption, the horseless carriage ? It stared him in the face, but he apparently missed its potential.

Yet Churchill's "infernal combustion engine" has outclassed the "Who ?".

I explained that they were for the Fi-Cord, showing her its control panel.

"Never heard of them," she said. "Or of *this*. It's rather nice—but isn't it just a little big and heavy for a radio ?".

Dumbfoundedly I displayed the tape spools. "Oh," she said, the light dawning. "*That's* why you're having a job finding the proper batteries. But that's the risk, isn't it, when you buy one of these Japanese things."

Outside again, the sun went 'bong' like a hammer on my reeling skull...

It's a great life in Lancashire. But this happened during my holidays, in one of London's biggest and most renowned audio palaces. Your Editor would collapse quaking if I named it. On two visits in other summers the same place had given me the idiot treatment; and experiences in one or two other large metropolitan hi-fi shops confirm my suspicion that we barbarians miss very little. It can't *all* be blamed on the linguistic barrier. As I said, I told this tale to show that I'm open-minded; but you're welcome to doubt my motives.

PART 4

BATTERY POWERED TAPE RECORDERS

VOLTAGE CONTROL

BY MICHAEL GORDON

TO date in this series we have investigated batteries, DC electric motors and motor-speed governing systems. We shall now go on to explore methods of *voltage control*, a feature that can assume some importance under certain conditions associated with the battery powering of tape recorders.

Not so very long ago there were two main voltage control systems, one employing a gaseous tube and the other composed of thermionic valve circuits. Of recent years, however, semiconductors have exhibited distinct advantages over these two systems; but before going on to look at these, a brief résumé of the earlier systems would be instructive.

The gaseous tube voltage control system, or regulator, is shown in elementary form in **fig. 1.** Here a gas-filled two-electrode tube is the control element. Such a tube has a characteristic that relatively large variations of current through it fail greatly to affect the voltage dropped across it. Thus, in spite of the equipment which the control system is powering taking a fairly widely varying current, the actual voltage applied to the equipment remains substantially constant. This can be explained by the gas-filled tube itself acting in a way to 'buffer' the changing current requirements. For instance, if the current required by the equipment rises, then the current through the tube falls and, conversely, if the equipment current falls, the tube current rises. This function is really the basis of all voltage control systems.

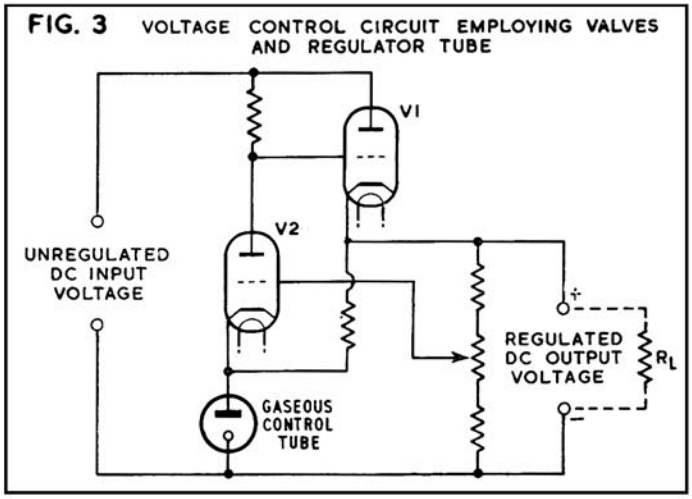
Look at **fig. 1** again. RL represents the power load of the equipment (part of a tape recorder circuit, for example), and as the value of this increases, which is what happens when the equipment takes *less* current, the voltage *across* the series resistance Rs decreases. Now, without the tube, the voltage across RL would rise, but the tube neutralises the effect by passing more current, thereby increasing the voltage drop across Rs and holding the voltage across RL almost at its original value.

It will be appreciated that Rs is an important element of the circuit, and its valve must also limit the tube current to safe values. The tube works by the gas in it ionizing at a critical voltage, called the 'striking voltage', and the input voltage must be sufficiently high to achieve this condition otherwise voltage control will not take place. Once the tube 'fires', however, it will hold its ionized condition when the voltage falls below the striking voltage; the 'operating voltage' is generally below the striking voltage. Voltage control tubes of this kind are made over a range of starting voltages to suit a diversity of requirements.

Neon is the gas often used in control tubes, and some idea of the characteristic of this kind of tube is given in **fig. 2.**

A typical valved voltage control circuit is given in **fig. 3.** Here V1 acts rather like a variable resistance, the value of which is adjusted by changes in grid bias. Now, when the output voltage tends to fall—as the result of the effective equipment power load value decreasing—the grid voltage of V2 goes less positive. The cathode of this valve is

FIG. 3 VOLTAGE CONTROL CIRCUIT EMPLOYING VALVES AND REGULATOR TUBE



voltage stabilised by the gaseous control tube with respect to the negative line, the cathode being held at a constant positive voltage with respect to the grid. This means that the fall in output voltage—making the grid go less positive—will increase the negative bias on the valve, thereby decreasing the anode current of V2 and causing a rise in anode voltage.

Since the anode of V2 is connected direct to the grid of V1, the effective negative voltage here will fall and the anode current will rise, tending to maintain the original V1 cathode potential and to restore the original voltage across the load RL.

Having gleaned some idea (we hope) of the important basic principles of voltage control, we should now appreciate the finer points of the second-generation voltage control systems using semiconductors. The solid-state equivalent of the gaseous control tube is the 'zener diode', and this is a very important component indeed in the control circuits of semiconductor amplifiers, tape recorders and so forth.

The circuit of the zener diode control system is given in **fig. 4.** This is identical to that in **fig. 1** except that a zener diode is used in place of the gaseous tube.

Before we can properly understand how this control system works, however, we must learn one or two things about semiconductor junctions. A semiconductor junction is a rectifier. That is, it has the ability to pass electric current easily in one direction—the forward direction—while greatly suppressing the flow in the opposite, reverse direction.

To be 100% efficient, the junction should offer no resistance at all in the forward direction and act as a complete open-circuit in the reverse direction. Like all things, 100% efficiency is never attained. From the forward direction aspect, however, junctions now approach more of a short-circuit than ever before and under normal conditions only a very small current (in the order of microamperes) flows in the reverse direction. These excellent characteristics have evolved from

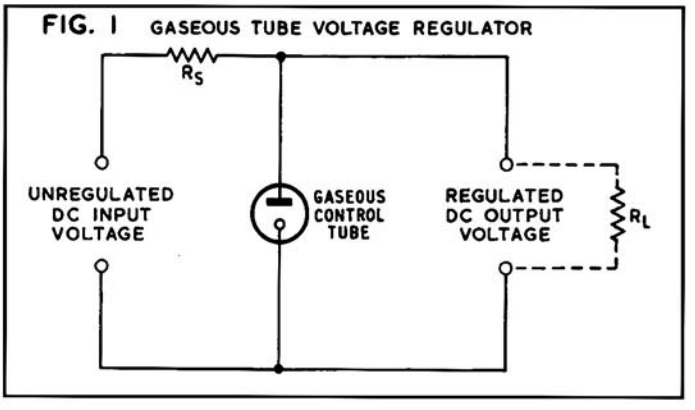
A zener has several advantages over the gaseous tube, however, including a relatively low zener voltage feature (for instance, the gaseous tube requires quite a high supply voltage to 'fire' it, while a zener diode can be designed with a zener voltage as low as 2V or so) and the fact that the *operating* voltage of a zener is (or can be) the *same* as the zener voltage (remember here that the gaseous tube has to have a higher than operating voltage across it to 'fire' it).

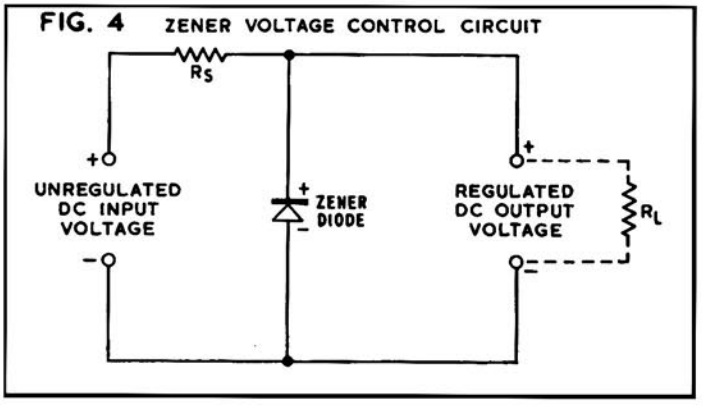
A zener is much smaller than a comparable gaseous tube and it can pass far greater currents than even the biggest control tube. Moreover, its forward resistance or impedance is much lower than that of the control tube.

There are two important and basic aspects of the zener diode to consider; these are (1) all semiconductor diodes exhibit the 'zener effect', but not all diodes may be used in a zener control circuit (though, within reason most zener diodes may be employed as ordinary semiconductor rectifiers or diodes, according to their ratings, etc.) and (2) the zener effect occurs only when the junction is biased in the *reverse* direction. If it is inadvertently biased in the forward current direction, there will be no voltage control and the diode would probably exceed its power rating.

There are two primary ratings, *power dissipation* and *zener voltage*. If it is required to stabilise the DC voltage applied to the drive motor of a battery tape recorder, for example, the zener voltage of the diode selected should be as near as possible to the input voltage required by the motor under ordinary conditions of running.

The dissipation is given in watts (or milliwatts) and this rating depends on the product of the zener current (maximum) the device will be expected to pass under its conditions of working, and the zener voltage. As an example, a 1W zener diode working at 10V zener could pass up to a maximum of 100 mA within its power rating. If the zener voltage is taken down to 1V, then the zener current could be pushed up to 1A.





the use of silicon crystals.

Just why current flows freely in one direction and barely at all in the other need not bother us unduly at this time. If we are really interested in knowing, a good book on semiconductor theory will solve the mystery.

If we plot the forward and reverse currents against forward and reverse voltages of a semiconductor junction, we should obtain characteristics something like those drawn in **fig. 5.** This depicts graphically what has already been said, except for one thing, and that is the sudden *increase* in reverse current when the reverse voltage exceeds a critical value. This is the 'reverse breakdown' characteristic, when the diode goes crazy and no longer follows the expected law. It is also called the 'zener voltage', in honour of Dr. Carl Zener who, some time ago, explored the breakdown mechanism of diodes and was responsible for the initial work leading up to the breakdown theory.

The high reverse current that flows at and beyond the zener voltage is called the 'zener current'. Now, a zener diode exploits the reverse characteristic at the zener point, and a study of this area of the characteristics shows that the voltage across the diode remains substantially constant for quite wide changes in zener current. Indeed, it has much in common with the characteristic of the gaseous control tube **(fig. 2).**

Small zener diodes operate quite well in free air, but larger devices rated in terms of watts need to be mounted on a 'heat-sink' of minimum specific size, related to the power rating of the device. Sometimes two power ratings are given, one for free-air placement and the other for heat sink mounting. The latter, of course, is always considerably above the former.

How the zener diode itself works can also be discovered from a good book on semiconductor theory. It falls outside the scope of this article to become deeply involved in these theories; but it can be said briefly that the reverse current through a semiconductor junction results from the movement of 'minority carriers' into the junction. At the reverse breakdown or zener point, the minority carriers are accelerated across the junction by the reverse bias voltage. These current carriers thus progressively attain more and more energy as the reverse bias is made even greater, until they eventually displace valence-bound electrons from the atoms. At each such displacement a pair of current carriers (i.e., free electron and a hole) is created, thereby adding up to the high value zener current.

Our interest at this stage lies mainly in seeing how the zener diode controls or regulates the equipment or motor voltage. The basic action

(continued overleaf)

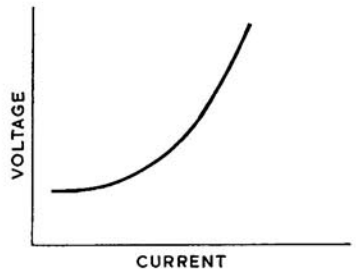
is very similar to that already described for the gaseous control tube.

Let us look at **fig. 4** again. Now, the circuit is adjusted so that with the load (RL) of the equipment, the correct voltage appears across it. This implies that the series resistor Rs is adjusted in relation to the supply voltage so that the volts drop across it due to the equipment current *plus* the zener diode current gives the correct equipment voltage, or voltage across RL.

Should the equipment demand a greater current (perhaps a motor is switched on, for instance), the tendency normally would be for a greater current to pass through Rs, meaning that the equipment voltage would fall. However, with the zener diode in circuit, while the equipment current requirements rise, the current in the zener diode falls by an almost equal amount. Thus, the total current in Rs remains substantially the same and the volts drop across it is practically unaltered, meaning that the equipment voltage is stabilised in spite of its changing current requirements.

This is a very happy state of affairs in many instances as will be appreciated, and it is so easy to achieve. The only basic requirements is a zener diode and a series resistor, Rs.

FIG. 2 GASEOUS TUBE VOLTAGE REGULATOR CHARACTERISTIC



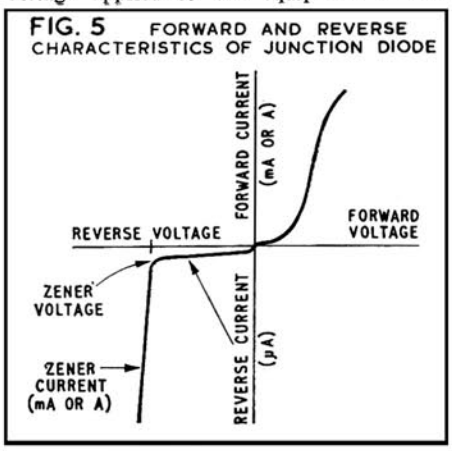
Let us now run through an example. This time let us consider that the supply voltage itself also has a tendency to vary. Let us suppose that the input is proved to vary from, say, 12 to 12.8V and that the equipment calls for a constant 6.8V over a current range of 40 to 60 mA. We would choose a zener diode rated at 6.8V or thereabouts, and a power rating in the order of 1W. At 6.8V, therefore, the maximum zener current would be about 140 mA.

The next thing is to work out the value for Rs. This is done first by looking at the circuit under the worst conditions: that is, with minimum equipment current (40 mA) and maximum input voltage (12.8V). This gives a difference of 6V between the supply input voltage and the equipment voltage (i.e., 12.8 to 6.8). The current in the series resistor, Rs, would thus be 140 mA zener current *plus* 40 mA equipment current, adding up to 180 mA.

The resistor value is then found by Ohm's law, where R equals the voltage (6V) divided by the current in amperes (0.18A). This works out to 34, that is 34-ohms. The power dissipated by Rs is equal to the voltage across it (6V) times the current in amperes (0.18A) in it, which equals a little over 1W. A safety margin would be allowed here, and the resistor would probably be rated at 2 or 3 W.

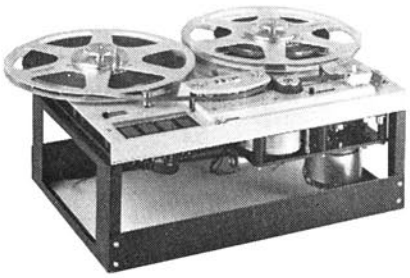
This is all there is to it. Now, should the equipment current rise from 40 mA, say, to its maximum of 60 mA, the zener current would fall by 20 mA and the current in Rs would be unchanged, meaning that the voltage applied to the equipment would hold constant. Similarly, if the input voltage dropped to 12V, the zener current would fall proportionally, reducing the volts drop across Rs and again holding the equipment voltage constant.

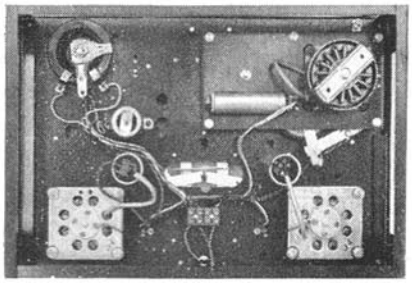
FIG. 5 FORWARD AND REVERSE CHARACTERISTICS OF JUNCTION DIODE



The zener diode is, indeed, a very useful device and more practical information about its use in battery tape recorders will be given next month.

NEW PRODUCTS NEW PRODUCTS NEW PRODUCTS





NEW RANGE OF DECKS

FOUR tape speeds, facilities for accommodating 10in. spools, three *Papst* motors and a choice of solenoid control or variable spooling speed are offered by *Tape Recorder Development*. The company has just announced a series of four tape decks based on a single design and retailing, in standard form, at £80 17s.

Model *TRD1/S* is solenoid-controlled and operates at 7½, 3¾, 1⅞ and 15/16 i/s. Fast winding speed is fixed at two minutes for 3,600ft. and spool tension, in record and replay modes, is switchable to suit large and small reel diameters. Latching solenoids are powered only when a mode is changed and require no further holding current, being held in position mechanically. In the event of a power failure when the deck is operating, a button located between the spools permits the mechanism to be neutralised. Automatic stop neutralises the mechanism when the tape ends or breaks. The entire solenoid sub-chassis may be removed, together with associated wiring. Full remote-control facilities, a four-digit push-button reset footage counter and vertically adjustable tape guides are incorporated.

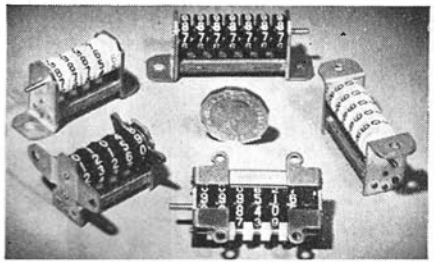
Model *TRD1/S/15* boasts an identical specification, save for the omission of the 15/16 i/s tape speed and the inclusion of 15 i/s.

Model *TRD1/VR* and *TRD1/VR/15* operate at 15/16 and 15 i/s respectively, in addition to 7½, 3¾ and 1⅞ i/s. Basic facilities are similar to the solenoid decks, but mode selectors are mechanical. A rheostat is located on both models to the left of the deck, permitting variable spooling in both directions.

None of the decks employ pressure-pads or pins, heads being mounted on the radius system. Up to four heads can be accommodated. Claimed wow and flutter at 15 i/s is 0.05% RMS, 0.08% at 7½ i/s 0.13% at 3¾, 0.2% at 1⅞ i/s and 0.35% RMS at 15/16 i/s. Top plate dimensions of all models are 17 x 11¼in., while vertical dimensions are 5½in. below and 1½in. above the plate. Operation is from 200/240V 50 c/s supply.

Manufacturer: Tape Recorder Development Ltd., 7 King George Avenue, Bushey Heath, Hertfordshire.

VEEDER-ROOT MINICOUNTERS



SIXTY-SEVEN open-frame miniature counters make up the extensive range of *Minicounters* lately announced by *Veeder-Root Ltd.* The counters are suitable for numerous applications and are available in many permutations of figure wheels, drive ratios, mounting plates and colours. The maximum continuous counting speed is claimed to be exceptionally high for the price at 20,000 units per minute. A count life of at least 500 million is guaranteed.

Manufacturer: Veeder-Root Ltd., New Addington, Surrey.

LEM MICROPHONES

MICROPHONES from the French *LEM* range are now being distributed in this country. Among the designs are models intended for public address, domestic and professional recording. The *DO-24* illustrated is a moving-coil unit designed for indoor and outdoor use, having shock-resistant resilient suspension of the element and low sensitivity to wind gusts. Frequency response is 40 c/s—15 Kc/s ±4dB at 30 to 50 ohms impedance, with sensitivity quoted as -82dB. The microphone is non-directional below 8 Kc/s and is 6dB down to 15 Kc/s at 180°. Nominal price of the *DO-24* is £10 15s. Other microphones in the range include the *DO-35* lavalier, price £19 19s. and *DO-21B* 200-ohm broadcast model, listed as £21 10s.

Distributor: Douglas A. Lyons and Associates Ltd., 32 Grenville Court, Dulwich, London, S.E.19.

TUTCHINGS TAPE CORRESPONDING KIT

ALIGNMENT of playback and erase heads becomes particularly critical when recordings are exchanged between two or more machines. A head alignment kit, price 5s., is now available for use with half and ¼-track equipment. The kit comprises 40ft. full-track white noise tape and 2in. length of Magnetic Rubber. Full instructions are supplied.

Manufacturer: Tutchings Electronics Ltd., 14 Rook Hill Road, Friars Cliff, Christchurch, Hampshire.

NEW AKAI MODELS

TWO newcomers to the *Akai* range have just been announced by *Pullin Photographic*. First of these is the Model *X-355* stereo which features a similar specification to the *345*. Cross-field bias is used to give claimed responses of 35 c/s-24 Kc/s at 7½ i/s and 40 c/s-18 Kc/s at 3¾ i/s, ±3dB. A total of four heads are incorporated, including separate record and play heads and a cross-field head facing the record head. This permits off-tape monitoring and echo effects. Three motors are fitted, a tape guide flywheel being used in conjunction with the capstan flywheel for speed stabilisation. Wow and flutter figures at 7½ and 3¾ i/s are 0.1% and 0.15% respectively. The *X-355* is corrected to NARTB playback equalisation and has -53dB noise level. Twin transistor playback amplifiers give a total of 50W music power. An automatic reverse/repeat mechanism is featured and tapes may be played in two directions.

Model 910 is based on the conventional Akai deck and has two speeds, 7½ and 3¾ i/s, obtained by means of a capstan sleeve. Frequency response at the highest speed is 40 c/s-12 Kc/s ±3dB. Conventional AC bias and a combined ¼-track mono record/playback head are employed. A single four-pole induction motor is used for tape drive and fast wind. An illuminated VU-meter provides modulation level indication. The 910 is supplied complete with a 50K dynamic microphone and has maximum output power of 3.2W into a 4 x 6in. internal drive unit. Dimensions are 15½ x 13⅛ x 7½in.

Distributor: Pullin Photographic Ltd., 11 Aintree Road, Perivale, Greenford, Middlesex.

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equipment reviews

LOOKING back, I find that I reviewed the *M-6* in November 1962, and the *M-7* in June 1964. They have all used valve amplifiers and the same basic layout and styling, but the *M-7* and the present *M-8* use the exclusive 'cross-field' biasing system. All these recorders have a continuously variable playback equalisation which can be used as a form of tone control.

Only the record/play heads are switched, the bias and erase heads are moved up and down to provide the various recording facilities. In the stereo model they are aligned with the record heads, and on mono the heads are moved so that the top head or the bottom head are off the tape. This novel system avoids any problems of oscillator load variations which would need to be compensated if the heads were switched.

The twin monitor speakers are mounted on the top of the cabinet and stereo monitoring is only available to the operator near the recorder. At greater listening distances the stereo effect from these speakers is negligible and widely spaced wide-range external speakers must be used for normal stereo listening.

A 'sound-on-sound' button has been added so that one amplifier is set to play and the other to record with appropriate cross connections for track-to-track transfer with added recording. The long term speed stability was checked by strobe and standard frequency test tapes and found to be within limits of ± 2% at all speeds at the beginning and end of 7 in. reels.

The short term speed stability was tested in the usual way by recording a 3 Kc/s test tone at each speed and then playing it back via a sensitive frequency discriminator circuit to a wide range pen recorder. The fluttergrams of **fig. 1** show that wow and flutter are satisfactorily low at tape speeds of 3¾ i/s and 1⅞ i/s with no sleeve fitted to the caps tan (traces **C** and **D**), but that capstan wow at 7-8 c/s and 3-3½ c/s were unpleasantly obvious when the capstan sleeve was fitted and the recorded and play speed deviations happened to be in step (lower traces of **A** and **B**). For short periods the capstan wows cancelled to give the smoother traces (top **A** and **B**). It should be mentioned that the capstan sleeve on this particular machine was a very loose drop-on fit and that the effect would not be so bad on a correctly fitting sleeve.

Next, test tapes recorded to known levels, corresponding to surface induction characteristics of 70, 140 and 280μS time-constant, were played and the tone controls set for the best line output response. The arrows on **fig. 2** show the position of the tone control knobs at each speed. Noise and hum were 33dB below test tape level with no tape running through the machine at 7½ i/s, and 28dB below test tape level at 3¾ and 1⅞ i/s.

The tape supplied was then loaded on the machine and test recordings were made to find which VU reading corresponded to test tape level. This was found to be −6dB. Thus true peak recording level (12dB above test tape level) would be above the full scale reading of the VU-meters, and 0dB corresponds to a level 6dB below true peak recording level. This is standard practice on professional VU-meters to allow for the inertia of the meter movements on normal programme material.

Test tones were now recorded at −6dB level and the playback responses measured at line output to give the curves of **fig. 3**. It will be seen that the tone control positions are similar to those shown in **fig. 2** indicating that the recorded time-constants are close to those shown against these responses.

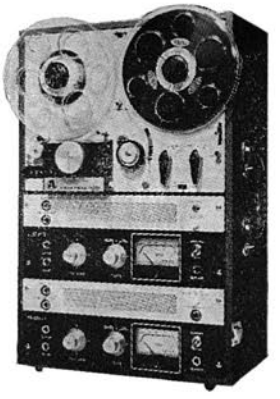
Overload tests at 500 c/s showed that waveform distortion was low up to recorded levels 4 to 5dB above full scale deflection of the VU-meters. This corresponds to levels 13 to 14dB above test tape level and proves that bias is optimum for minimum distortion. Further CRO tests showed that amplifier overload was some 6 to 8dB above that of the tape. This ensures that the tape is the first part of the system to overload, even with other lower sensitivity tapes.

Peak recording level was erased on the machine and the wide band signal-to-noise ratios were 45dB at 7½ i/s and 41dB at 3¾ i/s.

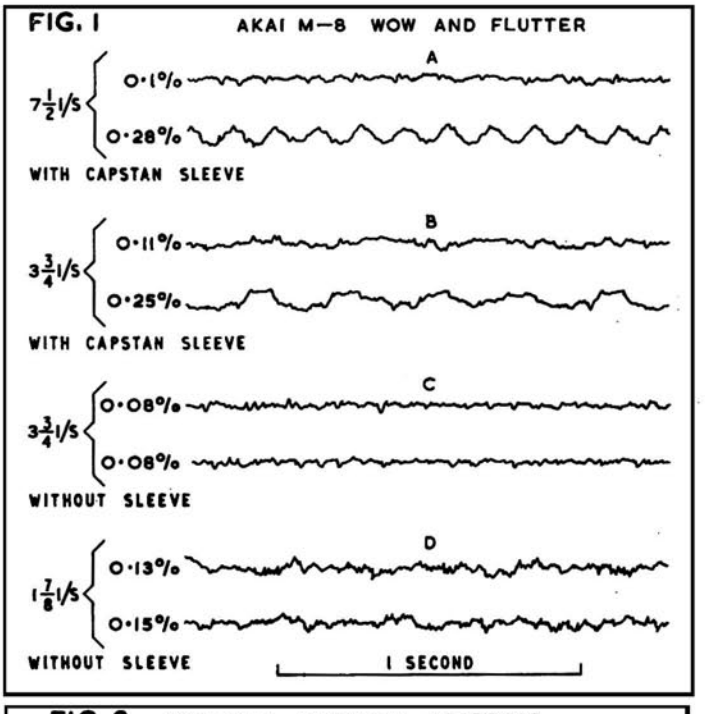
Finally, 25 one-third-octave bands of white noise were recorded at 7½ i/s and the sound output of the loudspeakers measured with a calibrated microphone on playback. The acoustic responses of **fig. 4** show the expected fall in low note response below 200 c/s due

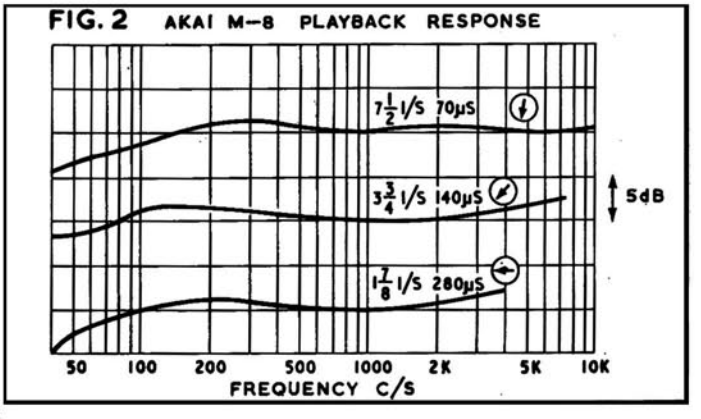
(continued overleaf)

AKAI M8 STEREO



MANUFACTURER'S SPECIFICATION: Quarter-track stereo recorder with internal power amplifiers and monitor speakers. **Spool capacity:** 7in. **Tape Speeds:** 7½, 3¾ and 1⅞ i/s. **Frequency Response:** 40 c/s—21 Kc/s at 7½ i/s, 40 c/s—18 Kc/s at 3¾ i/s and 40 c/s—10 Kc/s at 1⅞ i/s, ±3dB. **Wow and flutter:** 0.15%, 0.25% and 0.35% respectively. **Fast wind:** 1½ minutes for 1,200ft. **Signal-to-noise ratio:** 40dB. **Crosstalk:** 53dB. **Weight:** 45lb. **Dimensions:** 20 x 13 x 9in. **Price:** £153 6s. **Distributor: Pullin Photographic Ltd., 11 Aintree Road, Perivale, Greenford, Middlesex.**





to the small cabinet volume and indicate that the response is reasonably level in front of the machine (lower dotted curve).

The free air response of one of the microphones supplied with the recorder was measured in a white noise sound field to give the response of **fig. 5.** The impedance is high at 50K ohms to suit the valve input stage. Polar response is omni-directional so the spaced microphone technique must be used for stereo recording. Listening tests confirm that this response is indeed smooth and wide range and that the microphone is a worthy partner to the M-8 recorder.

The promised very wide frequency response at low tape speeds with the cross-field method of recording has still not materialised, but there is some evidence that higher recording levels are possible with low distortion and with adequate frequency responses for the three speeds. It was thought that the slight roll off at very short wavelengths might be due to high frequency overload, but tests at very low recording levels did not show any startling extension of frequency response.

Personally I would choose low distortion and a good signal-to-noise ratio any day, and this is not because my own hearing may be deteriorating above 10 Kc/s, but because I am somewhat cynical about unlimited extension of frequency response until all other distortions and inter-modulation products have been reduced to a very low level indeed.

Cross-field bias is only one step in this direction.

FIG. 3 AKAI M–8 RECORD/PLAYBACK RESPONSE

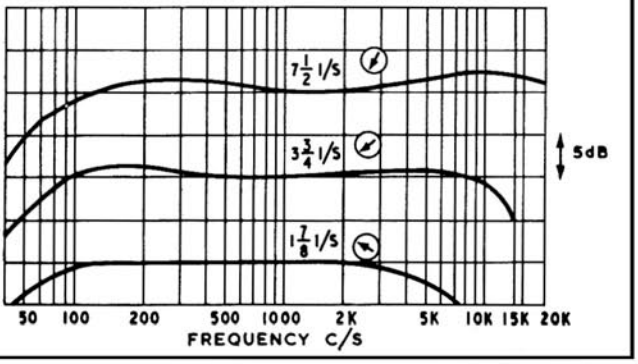


FIG. 4 AKAI M–8 ACOUSTIC RESPONSE

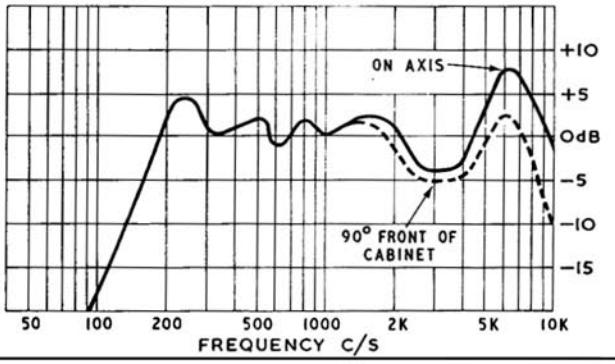
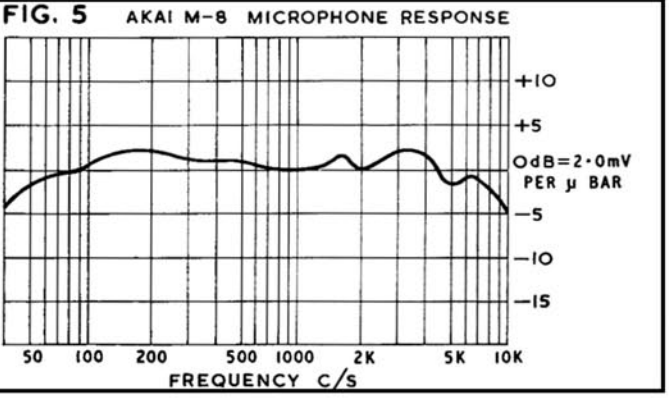


FIG. 5 AKAI M–8 MICROPHONE RESPONSE



AKAI X4 STEREO BATTERY PORTABLE

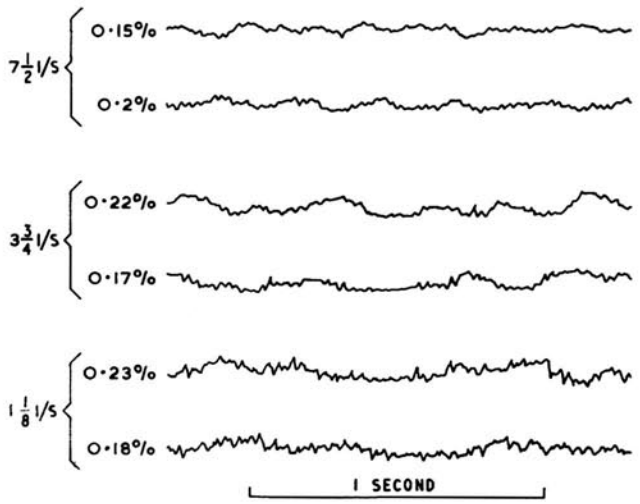
MANUFACTURER'S SPECIFICATION. Battery portable ¼-track stereo recorder with cross-field heads **Tape Speeds:** 7½, 3¾, 1⅞ and 15/16 i/s. **Wow and flutter** (respective): 0.16%, 0.17%, 0.28% and 0.35%. **Frequency Responses** (respective): 40 c/s—25 Kc/s, 40 c/s—17 Kc/s, 30 c/s—11 Kc/s and 30 c/s—5.5 Kc/s, ±3dB. **Spool Capacity:** 5in. **Fast Wind:** 1 minute 15 seconds for 600ft. **Output Power:** 2W per channel. **Inputs:** Microphone: 0.1mV at 600-ohms. **Line:** 60mV at 250K. **Dimensions:** 10 x 9½ x 4in. **Weight** 12½lb. **Price:** £137 11s. with two microphones, table stands, connecting leads, tape and integrated power-unit/charger/single channel power amplifier. **Distributor: Pullin Photographic Ltd., 11 Aintree Road, Perivale, Greenford, Middlesex.**

THIS recorder was used as (a) a true portable recorder, (b) a home unit with external speakers and mains power unit and (c) feed unit for wide-range amplifier and speaker units, for many weeks before starting the review measurements.

As was to be expected, its use as a deck to feed hi-fi equipment at line output gave the most impressive results, with its own amplifiers feeding good speakers coming a good second, although there was some evidence of lack of extreme bass response under these conditions.

Playback on the internal speaker was sufficient for checking the content of a tape, but it was far from hi-fi and in fact rather tinny.

FIG. 1 AKAI X—4 WOW AND FLUTTER



Recorded quality at all speeds had a slightly 'tizzy' quality which asked for the tone control to be turned down at the higher speeds, and demanded a top lift at the lower speeds which in fact could not be used as it exposed too much high frequency 'dirt'. This all pointed to low bias, and so a number of tapes were tried, including several which were known to require a lower bias: results were marginally improved, but all tapes were sensitive to drop-outs, particularly on the top track, which served to confirm my suspicion of low bias before making any objective tests.

Wow and flutter measurements gave readings well within the manufacturer's specification, but which nevertheless were poor by modern standards. Capstan wow was visible at all speeds (and audible on a sustained tone) being 6 c/s at 7½ i/s, 3 c/s at 3¾ i/s and 1½ c/s at 1⅞ i/s. See **Fig. 1.** Measurements were not attempted at the very lowest

(*continued on page 79*)

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4"	300'	4/-	3/9
5"	600'	9/-	7/6
5¾"	900'	11/6	9/-
7"	1200'	16/-	12/-
Long Play			
3"	220'	3/-	2/9
4"	450'	6/-	5/-
5"	900'	11/6	10/-
5¾"	1200'	16/-	11/6
7"	1800'	23/-	15/6
Double Play			
3"	400'	6/-	5/-
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5"	1200'	21/-	14/-
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7"	2400'	39/-	23/-

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FIG. 2 AKAI X-4 PLAYBACK RESPONSE

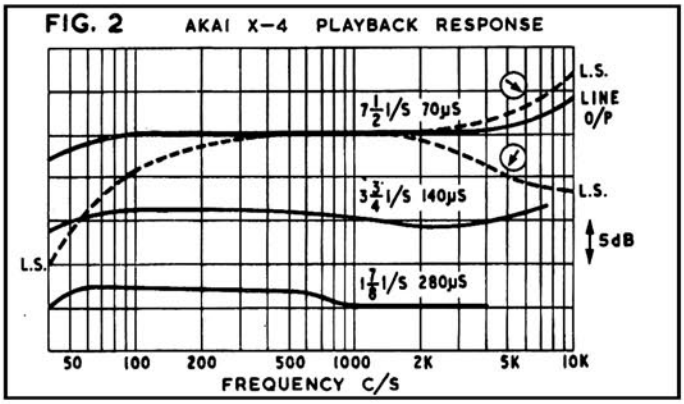
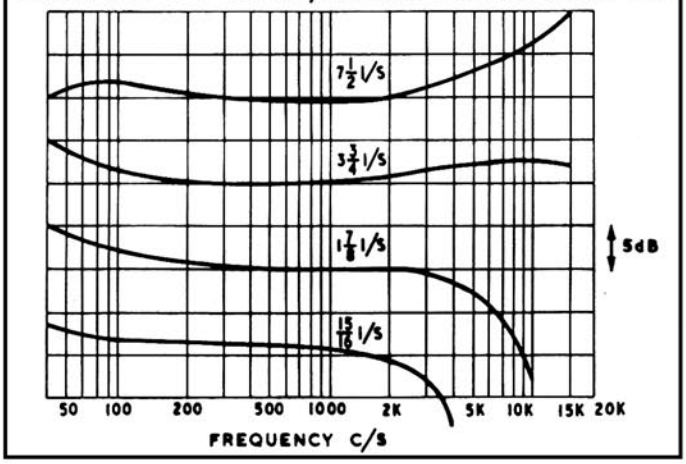


FIG. 3 AKAI X-4 RECORD/PLAYBACK RESPONSE (LINE IN OUT)



speed of 15/16 i/s, as there was under-signal noise mixed up with the 3Kc/s test-tone which made measurement difficult.

High frequency flutter only seemed to be serious at the two lowest speeds and would not account for the roughness on the higher speeds mentioned earlier.

Replay of test-tapes recorded to known characteristics gave the solid curves of **fig. 2** at line output. As the tone control did not affect the line output, measurements were made at the loudspeaker jack at extreme positions of the tone control to give the dotted curves on the top response of **fig. 2.** These curves were taken with the test-jack inserted in such a way as to leave the internal loudspeaker connected. The bass fall still persisted with the test-jack fully inserted, with a resistive termination of 8-ohms, and is probably due to inadequate inductance in the output transformer.

System noise with no tape was 38dB below test-tape level at line output on the top track, and -35dB on the bottom track, which picked up more motor noise.

Record play responses are shown in **fig. 3.** These are average responses for a variety of tapes. The low frequency responses on all tapes were almost identical, but the extreme high note responses varied about ±3dB at 10Kc/s, as would be expected from my review tests of a wide range of tapes.

The tapes with the best top response overloaded to show appreciable waveform distortion at 9-10dB above test-tape level. The 'softer' lower coercivity tapes accepted a higher level without distortion, but even these were slightly underbiased, as evidenced by the high incidence of drop-outs on both tracks.

I spent some little time on these tests to give the new 'cross field' biasing system every chance to justify itself, but my conclusions are that under-biasing produces exactly the same kind of troubles as orthodox bias, and, even when under-biased, the very wide frequency response claims cannot be substantiated—responses at the two lower speeds fell far short of the specification. This is not to say that cross-field biasing is a dead loss; properly biased for minimum distortion and

(continued overleaf)

noise, it does give an appreciable extension of frequency response for a given tape and bias condition; but it seems even more sensitive to low bias than the normal method.

A 7½ i/s white-noise test-tape containing 25 one-third-octave bands of filtered white noise was played and the sound output level measured on the speaker axis to give the overall acoustic response of **fig. 4.** This accounts for the rather poor sound quality on the internal speaker.

The dip at 3Kc/s was explored by moving the test microphone over a wide arc vertically and horizontally from the speaker axis, but the dip remained. It is probably due to the placement of the control panel in front of the speaker. Several of the controls are actually placed within the speaker cone.

The microphone tests were much more satisfactory, both microphones were tested in a constant white-noise sound field to give the almost identical responses of **fig. 5.**

The circuit diagram provided shows that the record/play circuit, to line output of each channel consists of two pairs of transistors; the first pair have two switched time-constant networks in the feedback loop, and the second pair have a most elaborate four-way switched feedback loop containing sharply tuned circuits for high note pre-emphasis in the recording mode. This heavy pre-emphasis may also account for some of the high note distortion and intermodulation encountered in my tests. The two power amplifiers, one in the recorder and the other in the power unit, are identical, with the ganged tone controls in the feed circuits in the recorder. Buffer transistors are fitted to feed the VU meters, and erase and bias current is supplied by a single power transistor Hartley oscillator. The motor control circuit also uses only a single transistor, with the governer contacts switching the base potential through a time-constant circuit.

COMMENT

I think most of my comment is contained in the body of this review. It is a disappointing machine in many ways. The two lower speeds are virtually useless for any really important recordings, and I feel that the very low bias is a direct result of the incorporation of these low speeds.

Anyone buying a machine in this price range would not need to economise in tape, and two speeds, properly biased and with optimum flywheel speeds for improved wow and flutter, would have been a much better proposition.

A. Tutchings

FIG. 4 AKAI X-4 ACOUSTIC RESPONSE

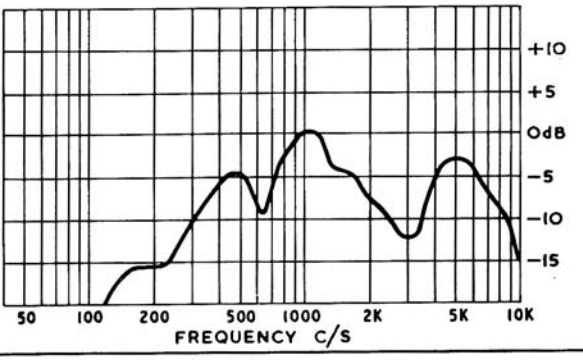
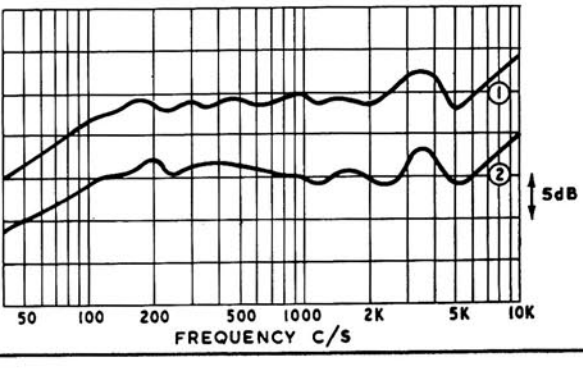
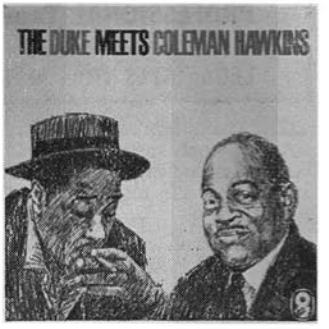


FIG. 5 AKAI X-4 MICROPHONE RESPONSE





THE DUKE MEETS COLEMAN HAWKINS Eight items including Limbo Jazz, Wanderlust and the Ricitic. Duke Ellington (piano), Coleman Hawkins (tenor sax) and others. **World Record Club TT489,** 3¾i/s twin-track mono. 29s.

TWENTY years elapsed between the formation of the idea of a session involving the Duke and the Hawk and the actual meeting in the recording studio in 1962. Was it worth waiting for?

This recording shows that much more is needed to ensure the worthwhileness of such get togethers, than just bringing the musicians to the studio. This is without doubt good jazz, but the pity is that Hawkins is completely overshadowed and out of place among the Ellingtonians on this occasion. Not only is Hawkins' angular phrasing out of place against the smooth playing of Hodges and Carney, the material is all of Ellington origin.

Hawkins plays well, but it is only on *Wanderlust*, *Ray Charles Place* and with the fine singing melody of *Self Portrait* (of the Bean), that he sounds really at home. For the rest, it's all Ellingtonia with some originals and some older items.

The calypso-like *Limbo Jazz*, with its gay informal atmosphere, greatly helped by drummer San Woodyard's unselfconscious singing and *Ricitic*, are both excellent originals. *You Dirty Dog* and two old favourites *Mood Indigo* and *The Jeep is Jumping* complete the programme.

If you want another Ellington small group recording in your collection, this is worth having; but unfortunately it cannot be recommended as at all representative of the best of Hawkins.

Players comprise Ray Nance (Cornet and Violin), Lawrence Brown (Trombone), Johnny Hodges (alto sax), Harry Carney (baritone, sax and bass clarinet), Coleman Hawkins (tenor sax), Duke Ellington (piano), Aaron Bell (bass) and Sam Woodyard (drums). **T.F.**

of seagulls' cries and waves thundering on the shore—then you won't miss it all so much."

"No, not without a mile-long lead," my husband answers, "for where could we plug in the recorder and microphone? But one can buy commercially recorded tapes of out-of-door noises; unless, of course, you would prefer a battery tape-recorder? We could record it with one of those."

Which sets us off debating again, this time arguing the pros and cons of battery versus mains models.

"Not that there is any chance of us having either for years yet", one or other of the family remarks frequently. "Just in case I should start suspecting something", I tell myself, intrigued.

And so it goes on, until my birthday is almost upon us. Then, suddenly, no one mentions tape-recorders any more.

I begin to wonder where they have hidden it and try my hardest not to probe into any likely-looking parcels. For now I am as keen on having a tape-recorder as I can be, and am afraid only of being disappointed.

The great day dawns. With solemn ceremony I am presented with the one large box I have always conscientiously ignored. I see that it is labelled 'Electric Blanket'. My heart sinks. Or have they stuck that label on just to fool me? Amid hushed excitement and tension I open the box . . .

Please can anyone tell me how to convert an automatic potato peeler into a tape-recorder?

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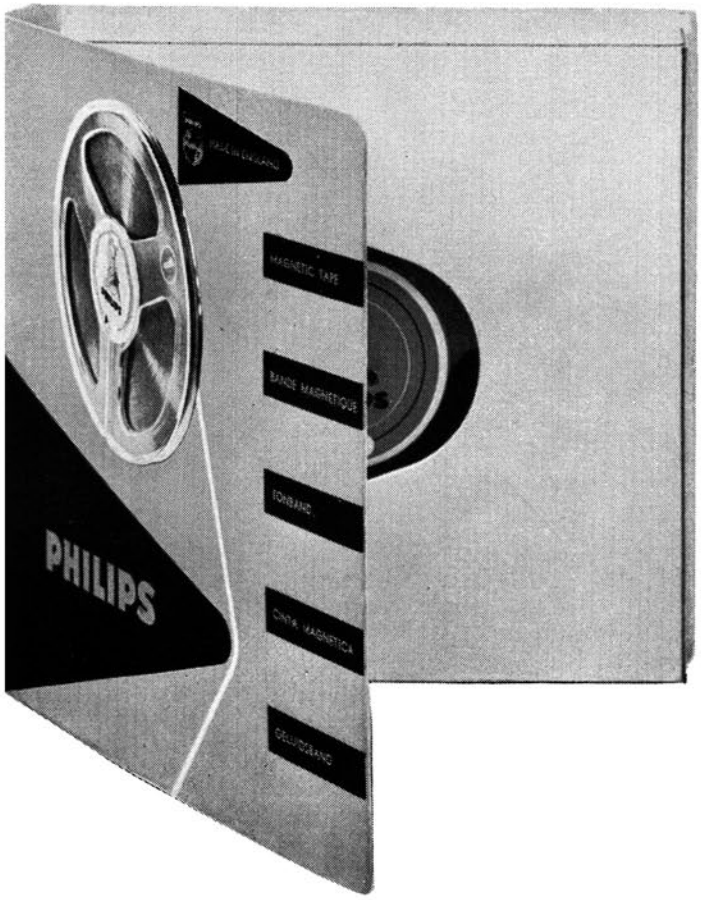

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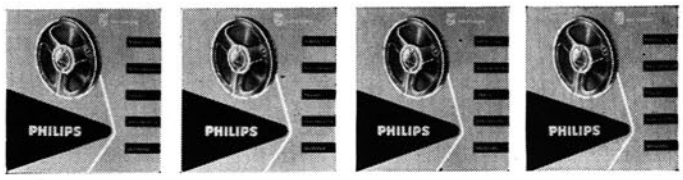

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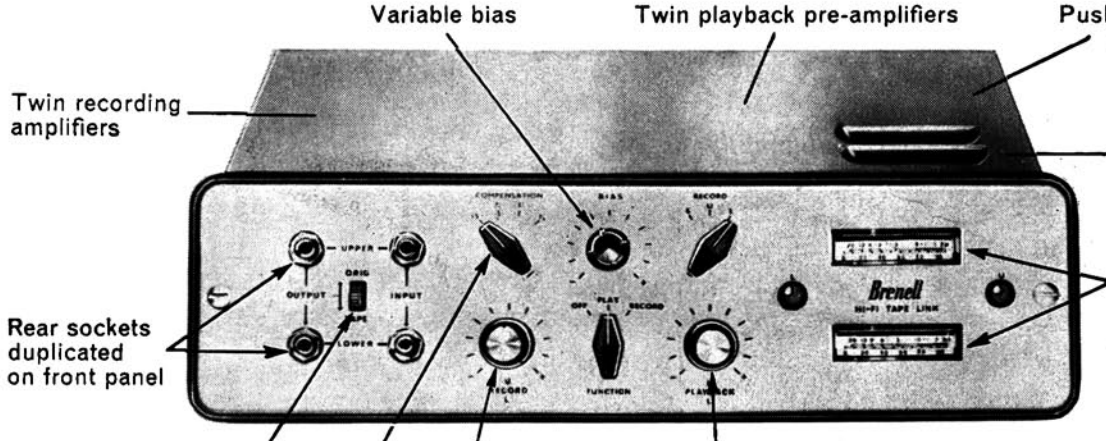

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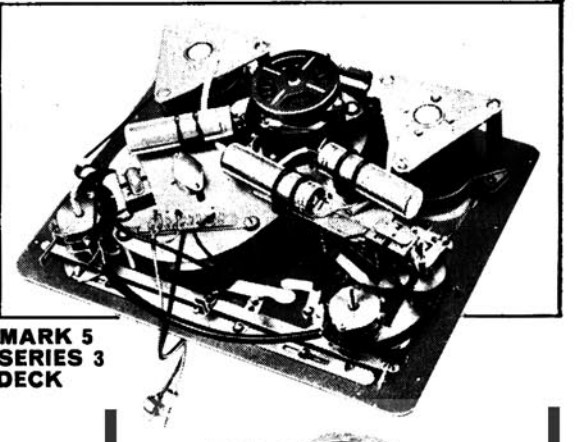

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