

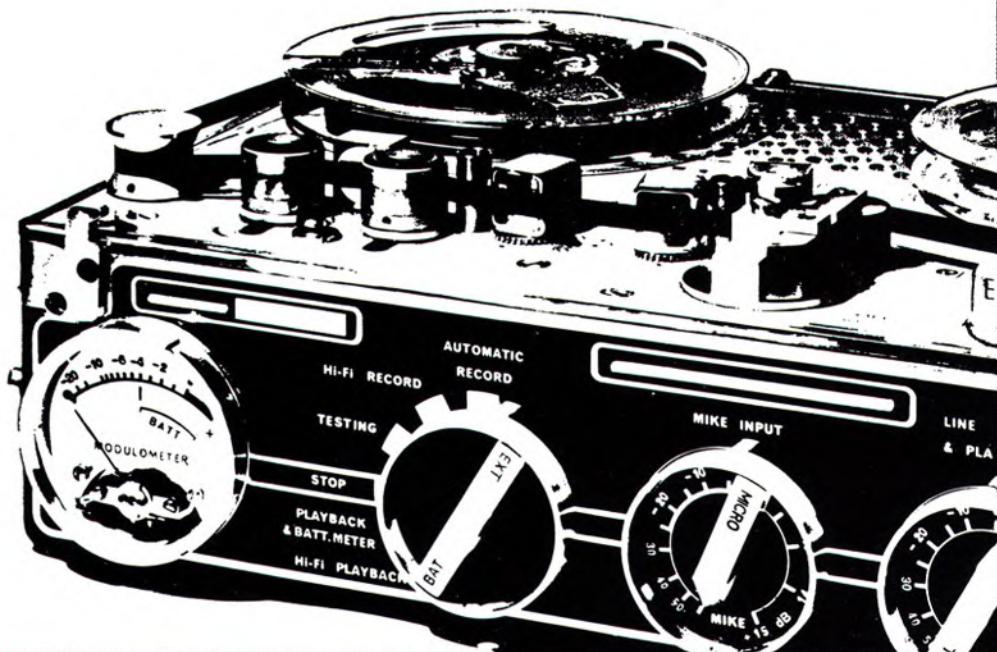
AUGUST 1965 TWO SHILLINGS

tape recorder



TAPE IN DENMARK — A HOSPITAL MIXER — UNDER THE STAIRS
COSSOR CR1605 REVIEW — CONSTRUCT A TAPE FOOTAGE COUNTER

I SAID YEAH YEAH YEAH ! YEAH YEAH YEAH WAOOOOH ! UM UM HE SAID
YEAH YEAH YEAH ! YEAH YEAH YEAH WAOOOOH ! UM UM UM WE SAID YEAH
YEAH YEAH WAOWE SAID UM UM UM ! AN'A YEAH YEAH YEAH I SAID UME
YEAH YEAH YEAH ! YEAH YEAH YEAH WAOOOOH ! UM UM UM WE SAID YEAH
YEAH YEAH WAOWE SAID UM UM ! AN'A YEAH YEAH YEAH UM I SAID UME
I SAID YEAH YEAH YEAH ! YEAH YEAH YEAH QAOOOOII ! UM UM HE SAID
YEAH YEAH YEAH ! YEAH YEAH YEAH WAOOOOH !UM UM UM! WE SAID YEAH
YEAH YEAH WAOWE SAID UM UM UM ! AN'A YEAH YEAH YEAH I SAID UME
YEAH YEAH YEAH WAOWE SAID UM UM UM YEAH YEAH YEAH I SAID UM UM
UM! YEAH YEAH WAOWE UM UM UM ! YEAH YEAH I SAID UM UM UM YEAH
AN'A YEAH YEAH YEAH ! YEAH YEAH yea gh ! wao.



BATTERY TAPE RECORDERS? *For at least 4 times longer life—*

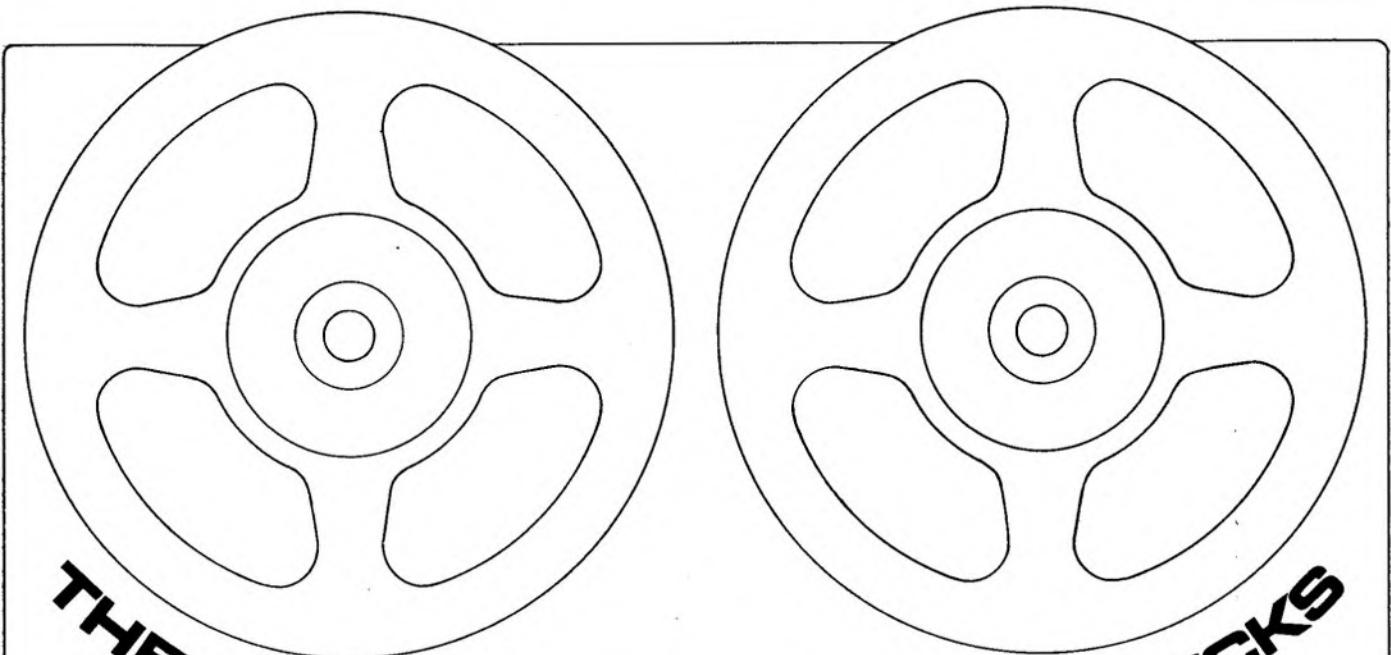
EVER READY HIGH POWER BATTERIES!



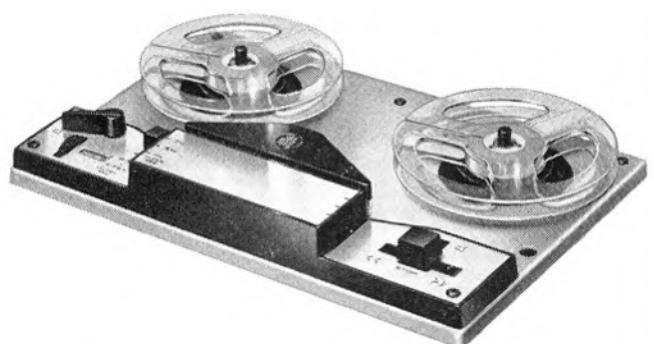
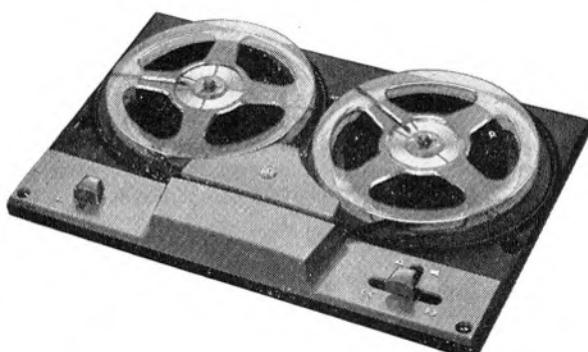
In portable tape-recorders* with power requirements around 300mA a standard battery will drop below the necessary voltage to power the motor and amplifier in a matter of hours. An Ever Ready High Power Battery in the same recorder will keep up its voltage for a working life at least 4 times longer.

**Record players too.*

THE EVER READY CO (GB) LTD,
Hercules Place, Holloway N7 Tel: ARCHway 3030



THE WORLDS FINEST TAPE DECKS



Take a look at the precision built and quality tested T.D.2. Listen to its superb performance — only BSR can combine this proven reliability with such truly magnificent performance. Takes 5 $\frac{3}{4}$ " reels playing at 3 $\frac{3}{4}$ " per second.

BSR

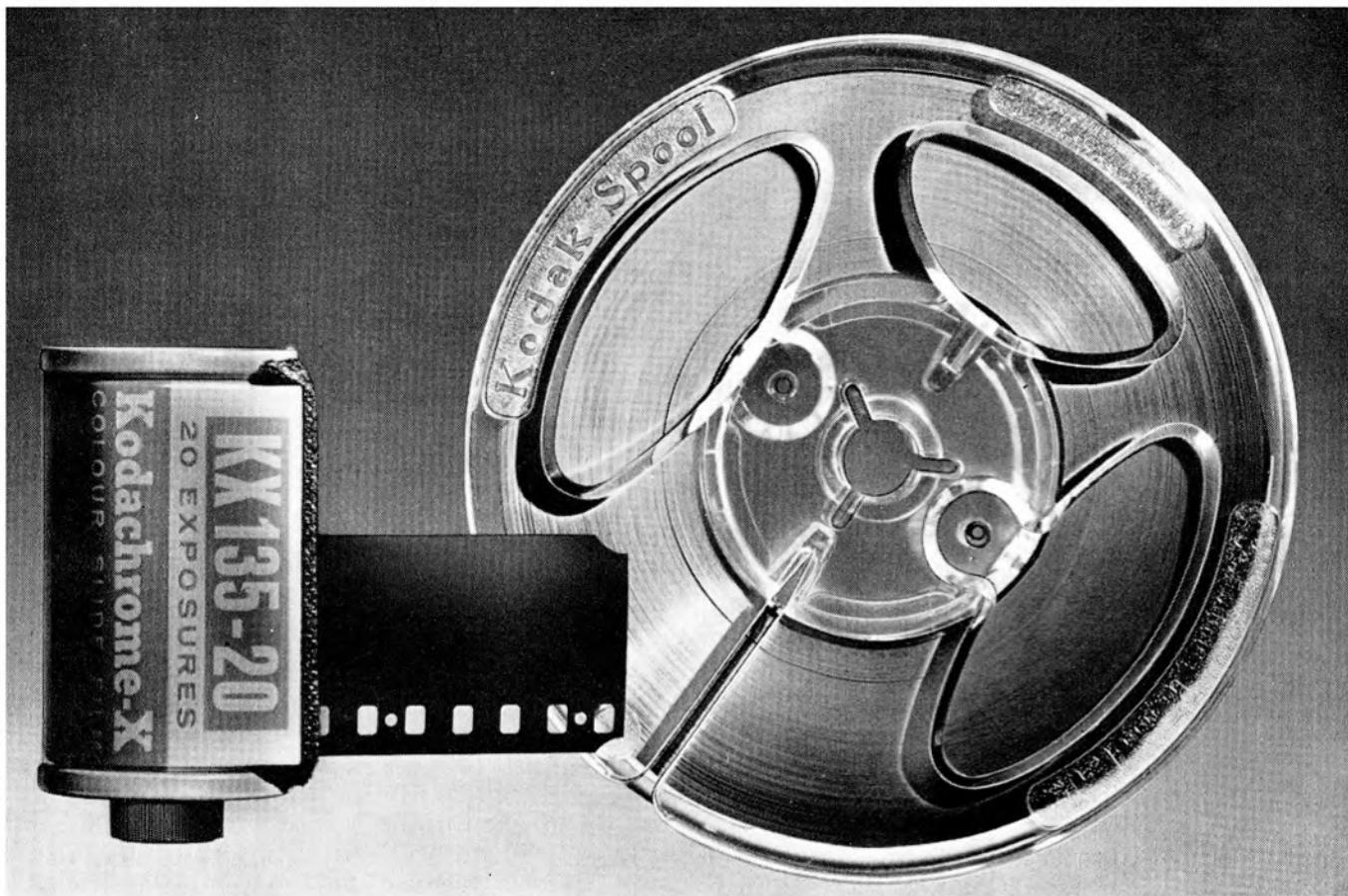
Send for full technical details and illustrated leaflet.

The world's largest manufacturers of
Tape Decks and Record Changers

MONARCH WORKS/OLD HILL/STAFFS

Look, too, at the elegant T.D.10 — a tape deck of functional excellence that sounds as good as it looks and is an established favourite throughout the world. Takes up to 7" spools with a choice of 3 speeds. It has fast forward and fast rewind, a 3 digit counter and space for a third head for monitoring which is available as an extra.





How Kodak's film-coating skills set today's highest standard in tape

Kodak know a lot about surface coating. More than any other manufacturer in the world, in fact. This isn't really surprising, because one of the reasons for the unrivalled high quality of Kodak colour films is the unique evenness of their emulsion coatings.

Now, Kodak have applied these advanced coating skills to the manufacture of sound recording tape. The result is a tape whose magnetic oxide layer is accurate to within *millionths* of an inch. No wonder that sound recording engineers all over the world have acclaimed it as the finest tape ever made.

Play it as soon as you can. You'll be getting a higher signal-to-noise ratio, better frequency response, a remarkable freedom from drop-out and print-through, and, above all, a *total* uniformity in performance.

There's a Kodak Tape for every recorder, of course, including the world's only Quadruple Play tape, for use with battery

portables (5½ hours playing time on a single 3½" reel!). So next time you buy tape do the sensible thing and specify Kodak Tape. It will do full justice to your equipment. And it costs no more.



© Eastman Kodak Company MCMXLI.

Post this coupon today.

Please send me full details of Kodak Sound Recording Tapes.

NAME.....

ADDRESS.....

Kodak Ltd., Dept. 70, Kodak House, Kingsway, London, W.C.2

6

Kodak sound recording tapes... the best tapes in the world

tape recorder

INCORPORATING 'SOUND AND CINE'

EDITOR

JOHN CRABBE

NEWS EDITOR

DAVID KIRK

ADVERTISEMENT MANAGER

ROBIN WELLS

Editorial and Advertising offices

LINK HOUSE, DINGWALL AVENUE, CROYDON, SURREY

Telephone MUNicipal 2599 (16 lines)

© Link House Publications Limited, 1965. All rights reserved.

editorial

AN ENTHRALING NEW DEVELOPMENT on the television recording scene, details of which have just been received at the time of writing, is the *Phonovid* video-disc system, lately announced in the USA by the *Westinghouse Corporation*. Although primarily conceived as an extension to the properties of the gramophone, *Phonovid* can easily be applied to the tape recorder and work is now going on to produce a domestic picture recording unit which may well fulfil market requirements until such time as 'conventional' video equipment becomes sufficiently reliable and inexpensive to suit the public pocket.

When vague whispers of experimentation in the field of pictures on disc were reported in October 1963, we were inclined to treat the news sceptically. On the face of it, a bandwidth of more than 2 Mc/s would be needed to record TV pictures; how, then, could a 33½ rpm gramophone record, with a bandwidth of certainly no more than 30 Kc/s, conceivably be used as the recording medium? The mistake we made was to assume that moving pictures were involved—a natural assumption in the light of contemporary television techniques. In fact the bandwidth problem has been overcome simply by reducing picture frequency from 25 frames per second to one 'still' every six seconds. Required bandwidth is thus reduced by a similar factor of 150 from 2.5 Mc/s to about 16 Kc/s. But the problem Westinghouse engineers had to solve when developing *Phonovid* was considerably more complex than that of bandwidth reduction. The information stored on a gramophone record could easily be arranged to reproduce one picture every six seconds—but the picture scan would be so slow that the human eye would see nothing more than an illuminated horizontal line sweeping from top to bottom of the cathode ray tube. Granted, it is possible to 'lock' the information required for each picture as it builds up over the six seconds, and store it for an indefinite period, by means of very expensive storage tubes; but the incredible aspect of the *Phonovid* system is that nothing more than "a simple scan conversion circuit" is required for the discs to be reproduced on a conventional gramophone and television receiver. Hardly less startling is the fact that an audio accompaniment is recorded in the same groove as the video information, though we do not yet know whether "the same groove" is mono or stereo.

A *Phonovid* disc of 12in. diameter provides up to 40 minutes of sound and pictures on two sides and is likely to give rise to a new art form, not unlike that practised by the tape-slide enthusiasts, of synchronising sound with pictures either of six seconds duration, or multiples of that figure. Some very accurate timing may be needed, unless the duration of a picture can be varied by any amount over 6 seconds.

Westinghouse state that a slow-scan TV camera will be needed to record the pictures and this is likely to keep the price of taping equipment fairly high. Nevertheless, we welcome the system as an ingenious stop-gap until such time as 25 fps video becomes practical with equipment totalling less than £100. The day when equipment becomes available offering reasonable television on ½in. tape at,

7½ i/s, may not be far distant. Modern high-definition tape should make an ideal recording medium, if only some means of transcribing the signal to and from the tape can be produced at a low price. It is not generally realised that audio recorders are extremely wasteful in their use of tape. Track widths could be reduced by a considerable degree before dropout became unbearable—forgetting those amongst us who use the 10s.-per-seven-inch-reel brands and the hi-fi enthusiasts who cannot tolerate *any* dropout. The only reason why 8-track tape recorders have not yet been foisted upon us is the extreme difficulty and high cost of manufacturing multi-segment heads. Rotating heads are the only solution to the problem of information condensing, since only by scanning the tape can the entire area be more-or-less effectively covered. A head of this type, incorporating several new ideas, is currently being developed by the technicians responsible for *Telcan* to operate on ½in. tape at 30 i/s. *Phonovid* or no, it is in this direction that the future of magnetic tape recording lies if we are ever to break the sound barrier and compete with television. A well known news-reel company has used the slogan "The Eyes and Ears of the World"—we have the ears, and before very long we shall have the eyes.

AUGUST 1965

VOLUME 7

NUMBER 7

- 283 WORLD OF TAPE
- 284 ABC OF TAPE RECORDING—PART 5
By David Kirk
- 287 MIND YOUR FEET
By Martin York
- 288 READERS' LETTERS
- 289 GEORGE AND THE DRAGON—TAPE PLAY
By David Haines
- 290 TOWARDS BETTER TAPING—PART 17
By Gordon J. King
- 293 THE DANISH WAY WITH TAPE
By Else Rasmussen
- 294 UNDER THE STAIRS
By Peter Turner
- 296 A HOSPITAL MIXER
By I. S. R. Haynes
- 301 FIELD TRIALS OF BATTERY PORTABLES—No. 11
By David Kirk
- 302 TAPE RECORDER SERVICE—No. 44
By H. W. Hellyer
- 305 NEW PRODUCTS
- 307 COSSOR CR1607 REVIEW
By A. Tutchings
- 309 KODAK TAPE REVIEWS
By A. Tutchings
- 311 READERS' PROBLEMS
- 312 CLASSIFIED ADVERTISEMENTS
- 314 ADVERTISERS' INDEX

COVER PICTURE

Careful examination of a multi-channel control console at *RCA Victor's* Hollywood studios is being carried out on this month's cover by tiny Vera Kilpatrick, one of the youngest recording artists under contract to the company. A slightly less elaborate mixer is the subject of an article on page 296.

SUBSCRIPTION RATES

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

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

Save 8 gns!

A special Currys purchase enables us to offer the internationally renowned Grundig TK 14 at only 27 gns.



P452

GRUNDIG

~~LIST PRICE 35 gns~~

**Currys price
only 27 gns
CASH**

GRUNDIG TK 14

Two-track piano key controls for simplicity. Tape position indicator. Complete with 7 gns moving coil microphone, 1,200 feet of Grundig L.P. tape, spare spool, radio recording lead and of course the quality that has made Grundig world famous!

Only £28.7.0 cash
or £5.2.0 deposit
and 101 weekly
payments of

5'6

(H.P. PRICE £32.17.6)

- * FREE HOME DEMONSTRATION
- * FREE FOR A WEEK HOME TRIAL
- * GENEROUS PART EXCHANGE ALLOWANCES

Currys
LTD

HEAD OFFICE: 46/50 UXBRIDGE ROAD, EALING W.5 EALING 6611

OVER 360 BRANCHES THROUGHOUT GREAT BRITAIN.

world of tape

HELICAL SCAN AT THE BBC

VIDEO recording at the BBC was the subject of a recent talk by P. Leggat to the IEE Electronics Division. Among the facts disclosed was the information that 30 video tape recorders are currently being used in various parts of the country. Comparing tape with film recording systems, Mr. Leggat stated that video tape is a little under half the cost of 35mm film recording, though film has many advantages in colour work.

The difficulty of editing tapes recorded on helical-scan machines was given as a major drawback to their employment in broadcasting, though their lower price makes them suitable for training and general internal use. Electronic editing is expected ultimately to overcome the former problem and the BBC are planning to begin using the recorders fairly soon. It was estimated that current tapes will operate efficiently for 60 passes through a video recorder, discounting further degradation caused by editing.



TRANSISTORISED
STUDIO
RECORDER

A NEW Ampex tape recorder, the AG-350, is the first fully transistorised professional studio tape recorder ever introduced by the Ampex Corporation. The AG-350 is an advanced version of the company's Series 351 recorder which has been adopted as the standard of recording and broadcast studios throughout the world.

Many original design innovations are claimed for the new Ampex, including automatic equalisation switching, easier threading and editing, simplified operation and improved ferrite-type erase heads. The AG-350 is available in two versions: one designed for 15 and $7\frac{1}{2}$ i/s operation, the other for $7\frac{1}{2}$ and $3\frac{3}{4}$ i/s. Frequency response, at 15 i/s, is ± 2 db, 30 c/s—18 Kc/s. Signal-to-noise ratio of the full-track model is 60dB peak level to unweighted noise. Flutter is below .11% rms at 15 i/s.

AMERICAN EQUIPMENT IN LONDON

TELEVISION recorders, educational and sales equipment—most being on show for the first time in Britain—were displayed and demonstrated at the United States Trade Centre, 57 St. James Street, S.W.1, from 11th to 21st May. Not all the products are being handled in this country and most are designed to work from 115V 60 c/s mains. An example is the *Curtin Duplicator*, essentially three tape machines in one, which follows conventional tape recorder styling but handles three tapes at a time. The three tapes, stacked on a single turntable, pass through a single head channel on to similarly stacked take-up spools. This process causes two copies to be made of a third master. Model 611M can also be combined with a 'slave' machine—the 611S, to produce a total of five copies for each run of the master tape. Approximate prices of 611M and 611S in the United States are £280 and £290 respectively. Copying speed, irrespective of playback speed, is 15 i/s.

The Rank Organisation are acting agents for the *Dage DV-300*

mains-portable transistorised video recorder which has many features—forgetting its price—of interest to the would-be amateur. Variable speed slow motion, simultaneous viewing and editing, remote control, long head life (5,000 hours is claimed), built-in monitor and easy maintenance seem to be eating into the old arguments regarding the lack of versatility of tape against cine systems.

Foot-in-your-door salesmen are catered for by *La Belle Industries*, who have produced a tape player, 35mm. transparency projector, and screen in a cabinet the size of, and styled after, a small briefcase. The *Courier* is powered by batteries and can provide up to fifteen minutes of 'canned' illustrated sales talk. Tape and film programmes can be changed and synchronised in seconds. The Courier is handled here by the *DTV Group*, who are also agents for *Precision Instruments*, manufacturers of industrial video recording equipment.

A tape playback system closely resembling that used on the *Melotron* organ forms the basis of a 'talking typewriter'—one of the exhibition's greatest attractions. The machine is used to teach young and handicapped children to read. The relationship between printed letters and spoken words is conveyed to the child who, on pressing a key, sees the letter printed in large type before it and at the same time hears the letter as it would be pronounced. Combinations of keys may be masked, leaving just a few letters for the learner to experiment with and an interlock protects the keys from jamming if more than one are hit at any instant. The process of writing and speaking spans several seconds after the key has been struck and the keys are locked during that period to render the machine completely fool-proof. Cost and bulkiness suggest the *Edison Responsive Environment System* will be impractical in teaching future generations to read, but the 'talking typewriter' is sure to find use in specialised fields of education since, so far as has been gathered, children actually enjoy learning with it.

RADIO SHOW CANCELLED

WOULD-be exhibitors to the 1965 Radio Show are currently vying for showroom space in West London hotels, following the recent announcement of the show's cancellation. Last year's 'outside' exhibitions by manufacturers unable, or not desiring, to support the Radio Show look like being repeated on a much wider scale—the limit being set only by the comparatively small number of hotels available. *Philips*, *Pye*, *GEC* and *Debenhams Electrical* are among the companies planning their own exhibitions.

NEW PREMISES FOR POLITECHNA

A GENTS for *AKG* microphones and headphones, *Politechna (London) Ltd.* and their associate companies *G.E. Industrial Supplies* and *G.E. Electronics (London)* have just moved to a factory and offices in West London. Their new address is: 182/4 Campden Hill Road, Kensington, London, W.8.

GRUNDIG ANNOUNCE VIDEO TAPE RECORDER

SEVENTY-seven transistors are used in the prototype video tape recorder recently announced by *Grundig*. The machine, which will sell in Germany for about £530, records on 1in. tape at $7\frac{1}{2}$ i/s with a helical-scan system providing a head-to-tape speed of some 70ft. per second.

Frequency response of the video channel is over 2.5 Mc/s, up to 12 Kc/s on audio, with a 40dB signal-to-noise ratio. Audio is recorded in conventional manner on a separate track.

VARIABLE SPEED CORRECTION

IT has been pointed out by a reader that the circuit diagrams in fig. 1 of the article *Variable Speed Tape Winding* on page 206 of the June issue were incorrectly labelled. The words 'wind-back motor' and 'wind-on motor' should be transposed, as should the letters A and B. Our apologies are extended to readers confused by this error.

NEXT MONTH

SATURDAY 14TH AUGUST is publication date for the September *Tape Recorder* which will contain a survey of stereophonic recording equipment supported by practical advice on stereo from David Robinson and Gordon King. The *Akai X4* battery portable will be field tested. This issue also sees the return of the Sound and Cine column, under the pen of Anthony Wigens.

Two low-priced
Acos microphones
available with
omni-directional
crystal or
moving coil
inserts.



abc of tape recording

USING THE MICROPHONE

Fig. 1:
Polar
characteristic
of an
omni-directional
microphone.

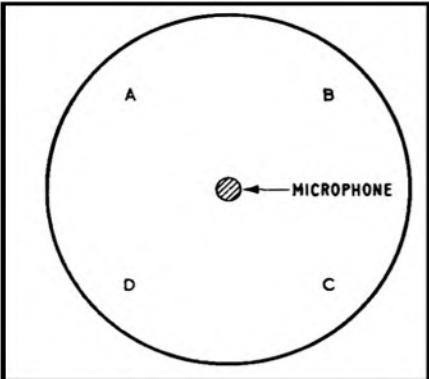


Fig. 2:
Figure-of-eight
characteristic of a
ribbon microphone.

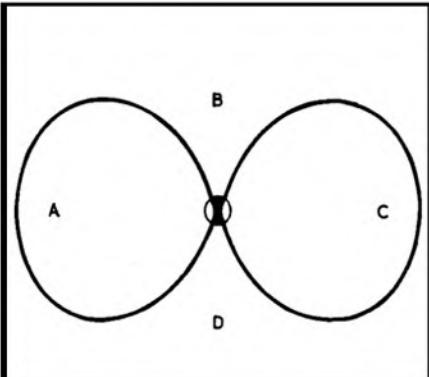
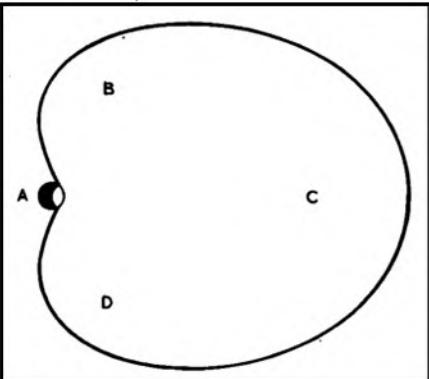


Fig. 3:
Cardioid (heart-
shaped) pickup
pattern common
to certain ribbon
and moving-coil
microphones.



WHICH microphone shall I use? The creative recordist is confronted with this problem—like the fisherman choosing his bait—before every taping session. When, last month, we examined the internal properties of the moving-coil, crystal, ribbon and capacitor microphones, no mention was made of the way in which the physical construction of a microphone affects its ability to 'hear'.

The first and most obvious consideration regarding the microphone is that the nearer it is to a sound source, the bigger the signal imparted by the microphone to the tape recorder. Some microphones, however, are subject to certain forms of 'deafness' and it is possible, with these designs, for sounds made close behind to sound lower in volume than sound made simultaneously from a point some distance away from the front. The two microphones attached to the sides of our heads—our ears—are not of this type and a voice 3ft. behind the head sounds just as loud as one spoken from 3ft. in front. We will overlook, for the moment, the fact that our two ears are really a very excellent stereo microphone, and continue to the *omni-directional* microphone pickup pattern shown in fig. 1. This illustration gives a bird's-eye-view of four sound sources—people if you like—labelled A, B, C and D, standing round a microphone. The microphone's pick-up pattern is shown by the circle surrounding the group of speakers. Its purpose is to show that any sound of fixed volume made from any point on that circle will be turned into an electric signal of similarly equal level. Thus, if A and C speak at once, their voices will sound the same in volume—provided one is not speaking louder than the other. Similarly, A and C will be heard equally well by the microphone. If one of the four were to change his position, moving closer to the microphone, his voice would become louder, resulting in the other three seeming to move into the background. Most (not all) crystal and moving-coil microphones are of this omni-directional type, due to the 'pressure-operated' diaphragm common to such units. The air vibrations act upon one side of the diaphragm, which is lightly sprung to return to 'rest' after each oscillation.

A quite different state of affairs applies to the ribbon microphone, the basic pick-up characteristics of which are shown in fig. 2. For obvious reasons, a pickup pattern of this type is known as a *figure-of-eight* while, perhaps less obviously, fig. 3 shows a *cardioid* (heart-shaped) pattern. Ribbon microphones come in three types, the most common being the figure-of-eight version, which is open to air vibrations from the front and rear of the thin metal diaphragm. Less common is the cardioid microphone—a conventional ribbon unit with one side of the diaphragm acoustically screened with felt or similar absorptive material. Finally, a few ribbon microphones may be switched mechanically from cardioid to figure-of-eight.

Messrs. A, B, C and D, grouped around the figure-of-eight microphone in fig. 2, would obtain results very different from those experienced in fig. 1. Although each member of the group is equally spaced from the microphone, A and C would find their voices reproduced

Left: Reslo figure-of-eight ribbon microphone; note grille at front and rear of ribbon housing.
Right: AKG moving-coil cardioid microphone.



at considerably greater volume than B and D. The drop in microphone sensitivity on either side of the ribbon microphone is quite simply explained by referring back to fig. 2(b) last month, which illustrates the internal construction of the ribbon microphone. For the ribbon to generate a signal, it must vibrate in the field of the surrounding magnet. This vibration is caused by movement of air in front, over and behind the ribbon, which tries to shudder with the air. But whereas a noise generated in front or behind the ribbon produces considerable movement of the diaphragm—even to the extent of blowing it out of its mounting on some sensitive studio microphones, vibrating air striking the narrow ribbon sides causes hardly any movement at all—and consequently hardly any signal. An efficient diaphragm must be of reasonable size and, more important, it must be very flexibly mounted. The fact that the voices of B and D would be picked up by the microphone—even though only softly—is due to reflection of the sounds from walls and ceiling re-routing a little of their voices into the front and rear of the microphone.

Blanking off one side of the ribbon alters the microphone to a more-or-less pressure-operated device, though this very act of screening reduces the pick-up response behind the microphone to a much lower level than that of moving-coil or crystal microphones.

Having described the various baits, we now go on to discuss their advantages and limitations. The omni-directional pick-up pattern is ideal for many recording tasks. Amateur and professional drama recordings are frequently made with a microphone of just such a characteristic, the actor-readers grouped in the manner shown in fig. 1. Outdoor reporting and interviewing require a good moving-coil microphone, whose omni-directional characteristic will pick up all sound within a fixed radius—that radius being varied with the tape recorder gain control to reduce unwanted background noise.

For indoor interviews between two persons, the figure-of-eight ribbon is unbeatable. Placed in the centre of a small table, the microphone will faithfully transduce the dialogue between A and C, keeping any noises generated by B and D well into the background. A good recordist will make quite sure that no B or D is present, but even then will find the figure-of-eight microphone more efficient than an omni-directional model. This is because unwanted reverberation from furniture and walls becomes lost to the sides of the microphone—though present to some extent at the front and rear; an omni-directional microphone would have no such selective properties.

It might be asked why the figure-of-eight microphone is never used for outdoor interviews—wind is the answer. The slightest trace of disturbed air that hits the sensitive ribbon will impose thunderous howls and thumps on the tape recorder, rendering the speakers quite

inaudible. And by the way, if you are searching for wind effects, the last thing you should try recording is wind itself. One final point: wind can play havoc with the ribbon diaphragm, straightening the corrugations or even blowing the metal strip from its mounting.

Straightforward recordings of a single speaker or musician are best accomplished indoors with a cardioid microphone, whether a modified ribbon or a suitably designed—but expensive—moving-coil type, since the construction generally offers superior quality to crystal or cheaper moving-coil models, and at the same time limits unwanted background noise and reverberation. The ideal position of sound source in relation to the cardioid microphone is that taken by C in fig. 3. Position A in this illustration would be as unsuitable—if not more so—than B or D in fig. 2, though once again some sound would find its way into the front of the microphone by wall reflection. B and D in fig. 3, although slightly nearer to the microphone than C, would not be picked up at greater volume, since the microphone sensitivity falls towards the sides—without cutting off as completely as occurs with the figure-of-eight. Since the rear of the diaphragm is screened, sound generated on either side of the microphone can only strike the diaphragm on one side—from the front—and cannot cancel itself out by affecting each side at once.

Knowledge of the three basic pick-up patterns enables the recordist to approach any subject from one-man-band to a full orchestra. The former presents little difficulty since one artist should require only one microphone; but an orchestra is a different matter . . . The term 'microphone technique' covers the use of more than one microphone and it is in multi-microphone mixing that the real enjoyment and craft of tape recording is to be found. Mixers range in price from a few pounds (a few shillings, if home-built) to over £100—and that without entering the professional price category.

A few domestic recorders—alas too few—have mixing facilities for high level (gram) and low level (microphone) signals which enable the operator to vary the relative volume of voice and music by altering two input gain controls. Since the output of even a crystal microphone is insufficient to provide satisfactory volume through a high level input, some form of mixer is needed when more than one microphone is to be used at any one time. This mixer may be cheap and simple, or very expensive and fairly elaborate. But whichever type is chosen, the mixer adds so much to the versatility of even the simplest recorder that the user will wonder how he ever managed without one.

There are two species of mixer—the *passive* model and the *electronic* mixer. Passive mixers are quite inexpensive since they are merely attenuating devices, i.e. they will reduce the microphone level but they cannot amplify it. Electronic mixers incorporate—on the more expensive versions—a small amplifier on each input, while cheaper (£3 or so) models have a single amplifier which is shared by each channel. All mixers provide a means of feeding two signals into a single tape recorder socket, others having facilities for connecting three, four and even eight microphones at one time. In the same way, high level radio or gramophone signals can be mixed with voice and placed on a single tape.

Since more than one microphone can be used to make a recording, a simple solution to recording a small group or an orchestra is to use one microphone for each artist, or bank of artists. A single microphone placed haphazardly in the centre of, say, a five-piece band, would almost certainly result in an unbalanced recording. A saxophonist positioned perhaps just a little too close to the microphone would completely drown the two acoustic guitarists and vocalist a few feet away. These chaotic conditions are easily ousted by dexterous use of two or three microphones, carefully chosen for their pick-up characteristics, and a mixer. A figure-of-eight ribbon between the two guitarists, an omni-directional moving-coil for the vocalist and a cardioid microphone for each of the two other musicians, all suitably spaced by a few feet or so, enable the mixing controller to achieve, merely by experimenting with the signal level from each microphone, a well-balanced recording after only a very short test recording. It is, of course, an advantage for the recordist to be acoustically isolated by headphones, or in another room, and in touch with the signal emitted by the mixer.

All these remarks apply, of course, to monophonic recording, since with stereo it is possible by careful placing of a simple crossed pair, stereo microphone to sort out to some extent the various problems of balance without resort to separate microphones.

But interconnecting microphones, gramophones, mixers and tape recorders in this manner involves some electrical complications and these will be the subject of Part Six of this series, next month.



LOEWE OPTA

Hi-Fi Tape Recorders

FOR PERFECTION IN SOUND

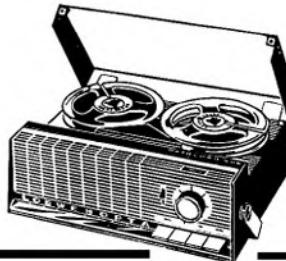


THE NEW OPTACORD 408

THE MOST COMPACT MAINS
AND BATTERY RECORDER

Single Speed 3½ i.p.s. Twin Track. For use on
Mains, Batteries and Car Batteries.

39 GNS



THE LATEST OPTACORD 416

OPTACORD 416

Specifications as Optacord 408 plus dig. counter,
tone and volume controls, 2 speeds: 3½ i.p.s. and
1½ i.p.s. Twin Track.

51 GNS

OPTACORD 416 DIA

As Optacord 416, with built-in Synchronisation
for Automatic Slide Projector.

62 GNS



THREE - IN - ONE MAINS - BATTERIES - CAR BATTERIES

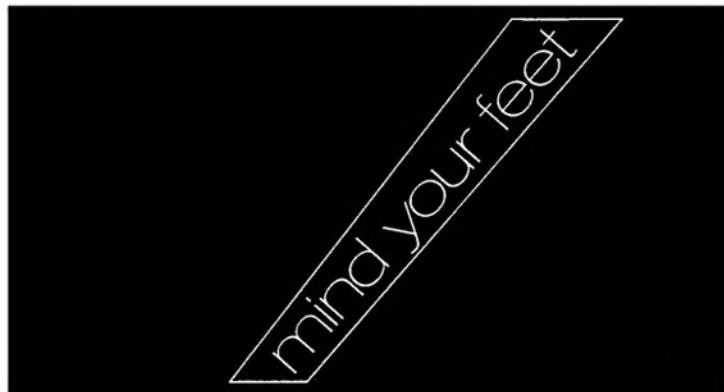
HIGHGATE ACOUSTICS

71-73 GREAT PORTLAND ST.,
LONDON, W.I.

Tel: MUSEum 2901/5

Approved Loewe-Opta Stockists

Alexanders, Holburn St., Aberdeen.	Bristol & Cardiff Tape Recorder Centres.	Gilbert Pianos Ltd., 37 Southchurch Road, Southend.	Joplings Ltd., John Street, Sunderland.	Piercey's, 60-62 Lupus Street, S.W.1.	G.H. Steel, 141 St. Georges Road, Glasgow.
J. J. Allen Ltd., The Quadrant, Bournemouth.	A. Brown & Son, Ltd., 24/28 George Street, Hull.	Grimes Ltd., King Street, Wigan, Lancs.	Kendal Milne & Co., Deansgate, Manchester 3.	Rackhams Ltd., Corporation Street, Birmingham 2.	Tape Recorder Centre, 82 High Holborn, W.C.1.
Arding & Hobbs Ltd., Clapham Junction, S.W.11.	Brown, Muffs, Bradford 1.	Guildhall Tape Recorders, 33 Guildhall Street, Folkestone.	John King (Films) Ltd., Film House, East Street, Brighton 1.	Recording Machines Ltd., 119 Victoria Street, S.W.1.	Tape Recorder Centre, 30 King Cross Street, Halifax.
AudioCraft, 20 Kettering Road, Northampton.	Camera Thorpe, 6/8 Osmaston Road, Derby.	J. E. Hargreaves Ltd., 1 Railway Road, Blackburn.	R. S. Kitchen Ltd., 22 King Edward Street, Leeds 1.	Tom Reekie Ltd., 10 Bridge Street, Stafford.	J. H. Tate & Co. Ltd., 45 Crowthorne Road, Sunderland.
Barkers Ltd., 31 Oxford Road, Worthing.	Campkins Audio, 21 Market Street, Cambridge.	Harveys, High Street, Guildford, Surrey.	Lancashire Hi-Fi Ltd., Tape Centre, 8 Deansgate, Manchester 3.	REW Earlsfield, 266 Upper Tooting Road, S.W.17.	K. A. Cheeseman Ltd., 32 Crouch St., Colchester, Essex.
Barretts of Canterbury.	Chelsea Record Centre, 203 Kings Road, S.W.3.	Hamilton Electronics, 35 London Rd., Southampton.	Leech & Haige Ltd., 112 London Road, Oxford.	Ryland Huntley, 15 Old Bond Street, Bath.	Teletape, 33 Edgware Road, W.2.
Battys (Rhyl) Ltd., Rhyl. (Tel. 2621)	Chiesmans Ltd., Lewisham, S.E.23.	J. Harris, 231 Baker St., N.W.1.	Massey's, 121/3 High Rd., Chiswick, W.4. CH1 208Z.	Selfridges Ltd., Oxford Street, W.1.	The Recorder Co., 188 West End Lane, N.W.6.
Wilf Plant, Asfordby, Melton Mowbray, Leics.	City & Essex Tape Recorder Centres, 228 Bishopton, E.C.2.	House & Son Ltd., Blake Street, York.	James McKenzie Ltd., Grange Road West, Birkenhead.	Sheen Tape Recorder Centre, 8 Station Parade, Sheen, S.W.14.	Turners Photographic Ltd., 9 The Walk, Ipswich.
Bon Marche, Northgate Street, Gloucester.	Courtney Davies, 12 Station Road, Harpenden.	Howard Tape Recorders, 218 High Street, Bromley, Kent.	Masons, Hi-Fi Specialist, Citadel Row, Carlisle.	J. V. Robinson Ltd., 91 High Street, Huntingdon.	Radio Maintenance (Leicester) Ltd., 111 Queens Road, Leicester.
Leonard Booth, 35 South Street, Eastbourne.	Croasdales (Nelson) Ltd., 41 and 58 Every Street, Nelson, Lancs.	R. H. O. Hills Ltd., Bank Hey Street, Blackpool.	Fairbotham & Co. Ltd., 58-62 Lower Hillgate, Stockport, Cheshire.	J. Smith & Sons, 184 The Rock, Bury, Lancs.	Lloyd & Keyworth, 26 Downing Street, Farnham.
Bourne Radio, 4 Albert Road, Bournemouth.	Dingles, Royal Parade, City Centre, Plymouth.	Imhofs Ltd., New Oxford Street, W.C.2.	Aldridges (Music) Ltd., 14/16 Hoghton Street, Southport.	Stanwood Radio Ltd. (All Branches), London-Essex-Herts-Suffolk.	Bristol Hi-Fi, 28 Upper Maudling Street, Bristol.
LOEWE OPTA	Francis of Streatham, 169 Streatham High Road, S.W.16.	Jones & Higgins, 1-41 Rye Lane, Peckham, S.E.15.	Parish & Co., 130 Union Street, Torquay.	Sport & Radio, 26/29 Aldwych Road, Bognor Regis.	J. W. Mansfield, 18 Liverpool Road, Worthing.



A SIMPLE AND ACCURATE FOOTAGE COUNTER BY MARTIN YORK

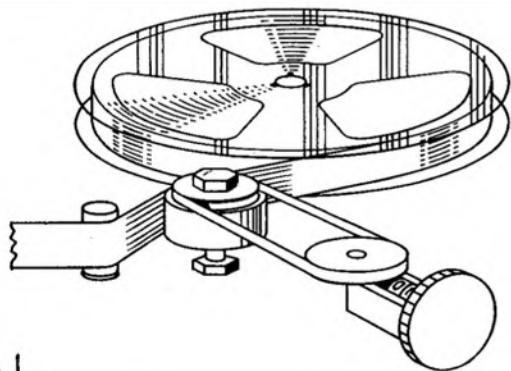


FIG. 1

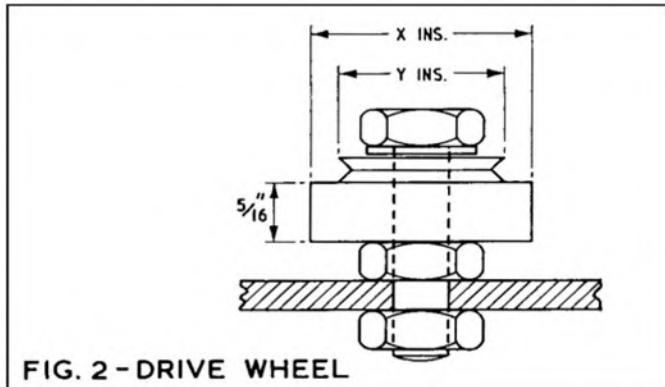


FIG. 2 - DRIVE WHEEL

IN her fruitless attempts to inculcate a sense of tidiness, Mama York used often to say, "Nothing is lost, if you remember where you put it." For many years I believed this to be true but the incautious placing of a penknife on the rail of a troopship in the Red Sea eventually "proved the rule". It does, however, remain true that a recording will remain in one place on a tape—all one has to do is to find it!

Present-day digital counters are, in general, reasonably accurate, though they are often so crudely attached to decks and recorders that it is hard to tell exactly what the counter is trying to count. Consider the advantages of a digital counter which registered tape length in feet. Firstly, a given point could be precisely spotted on any machine—a boon to rich and poor alike. The plutocrat could have one index for all three of his machines and the pauper would find his borrowing and lending of tapes so much less laborious. Correspondents could refer to "87 feet", instead of "just after the saxophone goes tiddly-oom-PAH-tiddle..." A second advantage would be that exact playing time of any tape could be calculated simply by fast winding. At present, the only way of finding whether the remainder of a spool will play 43 or 47 minutes is by running it through at playback speed against the clock. How simple the alternative—zero your counter, fast wind it through, a simple calculation, and there you are! This calculation involves merely substituting the appropriate numerals for the letters given in the following formula :

$$\text{Playing Time Formula : } P = \frac{12 \times F \times T}{60 \times S}$$

where P =Playing Time (in minutes)
 F =Tape Length (in feet)
 T =Number of Tracks
 S =Speed (in inches per second)

The most obvious difficulty to be overcome by a footage counter is finding a reliable source of drive—not the hub of a spool turntable, since counting ratio would vary with the quantity of tape on the spool. Applying the counter to the capstan or pinch wheel would provide a constant driving source—but only in RECORD and PLAY modes. Capstan and pinch wheel are invariably retracted from the tape during fast wind so, of course, the counter would not count. In fact, the only

moving component from which the counter can be driven effectively is the tape itself.

Fig. 1 and fig. 2 show the mounting position of a drive wheel and counter to register tape length. The size (X in fig. 2) of the fibre wheel is dependent on the arrangement of the gears connecting it with the counter but should not be allowed below about 1in. since counting accuracy might then be reduced. Similarly, too large a wheel might prove difficult to mount within the cramped confines of the deck. To the upper face of this fibre wheel a brass pulley of identical diameter (Y ins.) to the counter drive wheel must be attached, using Araldite, or a similar strong adhesive. Since the wheel-to-counter pulley is then of a 1:1 ratio, calculation of the fibre wheel diameter is quite straightforward. First consideration is the turns-per-digit ratio of the counter itself. The number of rotations of the counter wheel per digit varies between 1:1 and 12:1 and a suitable ratio that would give a practical fibre wheel diameter, one digit to read a foot, is 3:1—three turns to one digit. The counter should thus be chosen accordingly.

Assuming, then, we have a 3:1 counter connected to the fibre wheel by a 1:1 pulley, three turns of the fibre wheel will impose three turns on the counter wheel and register as 1 digit. Since one digit represents one foot, the circumference of the fibre wheel must be 4in. Twelve inches of tape passing a wheel of this size will thus give the required three turns.

Determining the diameter of a wheel of 4in. circumference involves the use of a simple formula. Diameter=Circumference \div 3.14. The latter numeral, known as π (pi) is a constant used in many problems involving circles. In this case : Diameter $= 4 \div 3.14 = 1.28$ in. The relationship between diameter and circumference is shown in fig. 3 which may be used as a rough guide to assessing wheel sizes.

Fig. 4 shows the location of the wheel and extra counter on the Magnavox Studio deck. It was found necessary to remove the tape spillage guard post and fit the drive wheel about $\frac{1}{4}$ in. behind that hole. A spring loaded tensioning peg was incorporated to maintain firm contact between tape and wheel—though it is not essential. The very small amount of drag imposed by this wheel during fast wind, incidentally, works wonders in controlling the slack spooling so prevalent on this particular deck.

(continued overleaf)

MIND YOUR FEET CONTINUED

Another method of layout, originally designed for a *Philips* recorder, is that shown in fig. 5. This arrangement, or the *Magnavox* version, should be applicable to almost any domestic recorder. The advantage of fig. 5 layout is that the counter wheel may be bypassed simply by threading the tape beneath the belt.

Readers with metal-work and turning facilities should experience no trouble in producing the required wheels while, if such equipment is not to hand, a local engineer or service-man may be able to assist. A wide range of counters—offering three or four digits and wheel or push-button reset are manufactured by *English Numbering Machines Ltd., Queensway, Enfield, Middlesex*. Turns ratio and digit arrangement—horizontal or vertical—should be specified when enquiring.

FIG. 4
TAPE TENSIONING PIN
EXISTING GUIDE POST HOLE

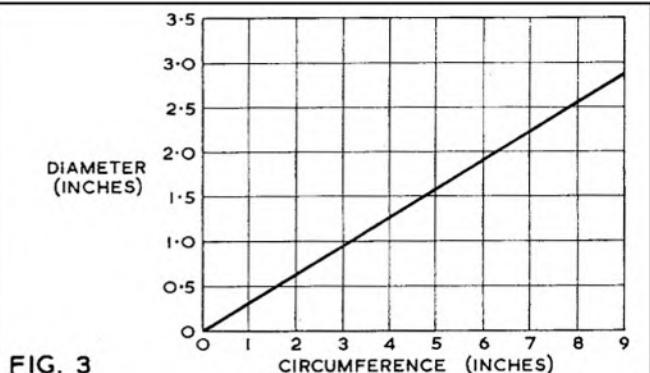
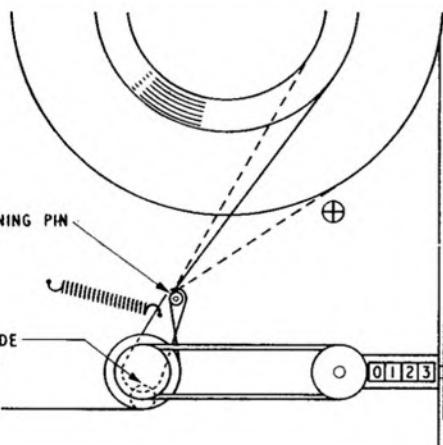


FIG. 3

FIG. 5
NOTE ORIGINAL TAPE RUN ALLOWS COUNTER TO BE BY-PASSED WITHOUT REMOVAL
PLASTIC DECKING CUT AWAY

FIG. 5

OUR READERS WRITE . . .

... about confidence in service staff

From : A. J. Brock, 98 Dora Road, Wimbledon, London, S.W.19.

DEAR SIR, Mr. Essenhigh may be thankful that he has suffered poor or non-existent servicing of only one tape recorder. (*Readers' Letters* June.) The same thing happened to me twice in four years.

My first recorder also cost £62 (could it be the same model ?) and gave trouble right from the start. The retailer could not put it right and its world-famous manufacturer refused to replace it under guarantee.

For the second one I paid £115 to much-advertised London recorder specialists who promised under bond "two years prompt service absolutely free if you buy from us". No good—the specialists were unskilled and far from prompt and, when I protested at the deception, claimed I had no right to complain because I had not paid for the (free) service.

If your magazine has some still unsuspecting readers who could benefit from the editorially recommended "spreading the word" I should like to start the ball rolling by warning them of these unscrupulous rogues who are neither willing nor able to honour their servicing promises.

Yours faithfully

... about confidence in sales staff

From : Barry H. Fox, Flat 2, 8 Frogner Gardens, London, N.W.3.

DEAR SIR, Having always felt very much out of sympathy with shops that know nothing about the goods they are selling, I was recently pleasantly surprised to see a well-known London departmental store offering fuller-than-usual technical details on some pieces of equipment. It was only on looking closer that I regained my customary feeling of no confidence in sales staff.

A tape recorder, I learned from the sign hanging over it, was equipped for "uni-directional twin back recording" and was fitted with "twin gauged and matched volume controls" and "a meter for record lever". A nice-looking speaker cabinet had inside it "a 13 x 8 in. magnet speaker unit and two 3½ tweeters". Despite this, however, its frequency range was "60-2000 c/s". Its impedance, I noted, was 15 O.H.M.S.

Yours faithfully

... about sleep learning again

From : Geoffrey Stocker, President, The Sleep Learning Association, 14 Belsize Crescent, London, N.W.3.

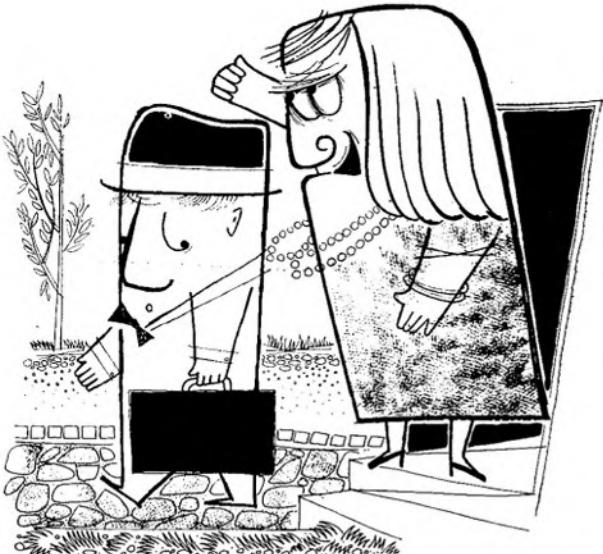
DEAR SIR, Mr. D. R. Garner, in his letter published in June, showed some concern over the use of sleep-therapy tapes and suggested that in many cases deeper analytical treatment of underlying personality problems would be necessary. He says that "correct diagnosis is essential". With this statement no-one can disagree.

He went on to say that "for optimum results individual induction tapes are essential". This pre-supposes that his specialised tapes provide the essential psychoanalytical treatment for each subject. Such tapes could only be made after many hours personal analysis in a Consulting Room. The cost of such would be prohibitive to all but millionaires.

Surely the point is this : no therapy treatment by doctor, surgeon, psychologist or psychoanalyst can guarantee a complete cure in every case. It is generally recognised, put very widely, that all kinds of treatment provide 75% of cures.

Mr. Rubin in his article on sleep-learning did not, as Mr. Garner says in his letter, give the impression that sleep therapy provides a therapeutical panacea and no such claims are made by anyone concerned with sleep learning or sleep therapy.

Yours faithfully



A TAPE PLAY FOR ONE VOICE

BY DAVID HAINEN

george and the dragon

INTRODUCTION

THIS MONTH's play departs from the previous examples published in *Tape Recorder*.

There are two characters but only one of them (the housewife) actually speaks. The other character (the husband) says nothing. His presence is denoted through simple domestic sound-effects.

Elementary as *George and the Dragon* may be, the recording will only be successful where the recordist possesses imagination. He must enact his George—and carefully record George's audible actions. Even where the effects are 'artificially' produced, George's spirit must motivate the operation of the ingredients.

This expression of a character, through sound-effects, can be defined as **aural mime**. It would require an entire volume to discuss a full theory, but it is hoped that the example here might stimulate further application. It is possible, for example, to depict three characters in a play—with only one of them giving tongue. It is even possible to have no dialogue at all—and yet to convey character and plot.

HOUSEWIFE: George, the front lawn is a disgrace. (*sharply*) George, go and mow the lawn.

EFFECT: *Instant and steady lawn-mowing.*

HOUSEWIFE: (*interrupting*) George! (*lawn-mowing stops*) I don't want to interrupt you, but I've just noticed the hedge. It's much worse than the lawn. (*sharply*) Clip the hedge, George.

EFFECT: *Instant and brisk hedge-clipping.*

HOUSEWIFE: (*interrupting*) George! (*hedge-clipping stops*) I've just noticed the front door-step. The milk-bottle has made a dirty little ring-mark on the left-hand side. (*sharply*) George, scrub the door-step.

EFFECT: *instant and brisk scrubbing.*

HOUSEWIFE: (*interrupting*) George! (*scrubbing stops*) George, I've just noticed the clock in the sitting-room. It's stopped ticking. You're supposed to wind that clock every day. Why d'you think I make you wear the key round your neck? (*sharply*) Wind the clock immediately.

EFFECT: *Instant and steady clock-winding.*

HOUSEWIFE: And now, George, go and saw some logs. Winter will be on us before we know it.

EFFECT: *Instant and steady log-sawing.*

HOUSEWIFE: (*interrupting*) George! (*log-sawing stops*) You haven't finished mowing the lawn.

EFFECT: *Instant and rapid lawn-mowing.*

HOUSEWIFE: (*interrupting*) George! (*lawn-mowing stops*) You haven't scrubbed the step properly. (*sharply*) Do it again.

EFFECT: *Instant and rapid scrubbing.*

HOUSEWIFE: (*interrupting*) George! (*scrubbing stops*) You haven't finished clipping the hedge.

EFFECT: *Instant and rapid hedge-clipping.*

HOUSEWIFE: (*interrupting*) George! (*clipping continues*) George, you're clipping too much. Stop it at once! (*clipping continues, defiantly*) George, you're nearly down to ground-level. (*clipping comes gradually to a stop*) Now we have no hedge. (*grimly*) George, I simply can't understand your behaviour. I feel quite upset—you must make me a cup of tea. Go and fill the kettle.

EFFECT: *Instant and fast filling of large kettle.*

HOUSEWIFE: Put it on the stove.

EFFECT: *Clank of kettle on stove; footsteps walk away.*

HOUSEWIFE: Light the gas, you ass.

EFFECT: *Footsteps return. Match-box opened; match struck; gas lit.*

HOUSEWIFE: Do something useful while you wait for the kettle. Clean my Sunday shoes.

EFFECT: *Instant and rapid shoe-brushing.*

HOUSEWIFE: (*interrupting*) George! (*shoe-brushing continues*) George, you're using the wrong colour polish. (*shoe-brushing stops*) You've deliberately ruined my shoes. (*sharply*) Go back and finish the lawn.

EFFECT: *Instant and very rapid lawn-mowing.*

HOUSEWIFE: (*interrupting*) George! (*lawn-mowing stops*) I told you to mow the *front* lawn—this is the *back*. (*sharply*) Go and mow the front lawn at once.

EFFECT: *Instant and very rapid lawn-mowing.*

HOUSEWIFE: (*interrupting*) George! (*lawn-mowing stops*) George, I've just discovered that you failed to clear the table after lunch. (*sharply*) George, clear the dining-room table.

EFFECT: *Tablecloth whisked instantly off table; crockery and cutlery crash to floor.*

HOUSEWIFE: (*sternly*) Get out of my sight—go and saw some more logs!

EFFECT: *Instant and steady log-sawing.*

HOUSEWIFE: (*interrupting*) George! (*log-sawing stops*) George, the kettle's boiling. It's time to make my cup of tea. (*pause*) George, I didn't tell you to start packing a suitcase. And you don't need to put on a hat and coat to make me a cup of tea.

EFFECT: *Heavy door opens: slams shut.*

HOUSEWIFE: (*indignantly*) Fancy him going off and slamming the door—without a word of farewell! And he didn't even stop to make my cup of tea. Men are so lazy.

TECHNICAL NOTES

In general, record effects separately and splice between pre-recorded dialogue. Make editing tight—to the split second. Avoid lags when recording speech and effects in conjunction; maintain a quick tempo.

Perspective

Speech: record at close-microphone voice position.

Effects: record fairly close to microphone, excepting (a) lawn-mower which should be in background; and (b) door-slam which is 'distant'.

Acoustics

Speech: record in 'dead' (i.e., blanketed) room.

Effects: clock-winding, kettle, shoe-cleaning—"dead" acoustic. Crockery-crash and door-slam slightly echoic. Other effects outdoors (even if faked) to ensure distant birdsong.

Sound-effects

Lawn-mower: preferably push-type. To fake—stroke tin can on wire-netting, rotate marbles in saucepan. But motor-mower can achieve much expression in throttle.

Hedge-clipping: cut small pile of raffia or recording tape with shears.

Clock-winding: to fake heavy key-twists—twist cork in resin.

Log-sawing: to fake—hold string taut and 'saw' across cardboard box.

RECENT articles in this series have shown how small transistor amplifiers can be employed to boost and equalise the signal EMF which is induced into a second 'monitor' playback head. Such an amplifier may also be used to provide sufficient level of signal for operating a second channel of a stereo set-up. Before we delve into the 'stereo conversion' problem, let us see just how our small transistor head amplifier can be powered.

One thing about transistors is that they require only a single power source, unlike valves which call for both a low-tension (LT) supply for heating the cathodes and a high-tension (HT) supply for powering the anodes and screens. The LT voltage is frequently 6.3V and the HT some 200 to 300V, depending on the valves, the type of circuit and so forth.

The voltage applied to transistors is often called the 'supply' or 'bias' voltage. It cannot really be termed high-tension because transistors usually operate at a relatively low voltage. A typical value is 9V, but some circuits operate at lower and higher voltages than this. Transistors, as we have already seen, depend more on current than voltage for their operation. The term LT is rarely used as this may be confused with the LT of a valve circuit.

Transistors have two semiconductor junctions and both are biased. The two junctions have one common electrode which is the *base*. This, then, gives the *emitter* junction and the *collector* junction, with the base common to both. Each junction can be considered as a 'diode' or 'rectifier'. The emitter junction is biased for forward conduction while the collector junction is biased for reverse conduction. With ordinary diodes so biased, this would mean that the one in forward conduction would pass current while the one in reverse conduction would pass virtually no current at all (there would be a very small value of current, called 'leakage current', since a semiconductor is not 100% perfect).

In a transistor, the emitter passes forward current in this way, but the collector also passes a relatively high value of current. This

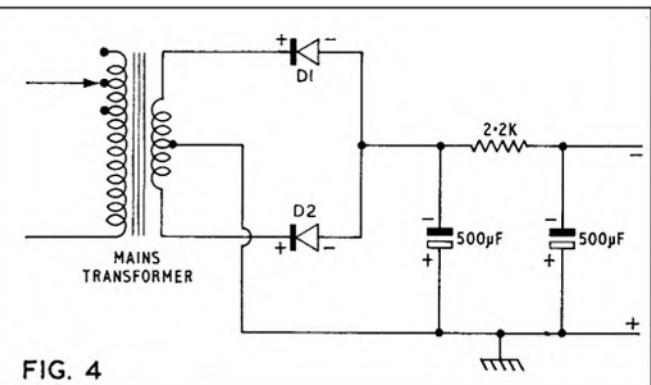
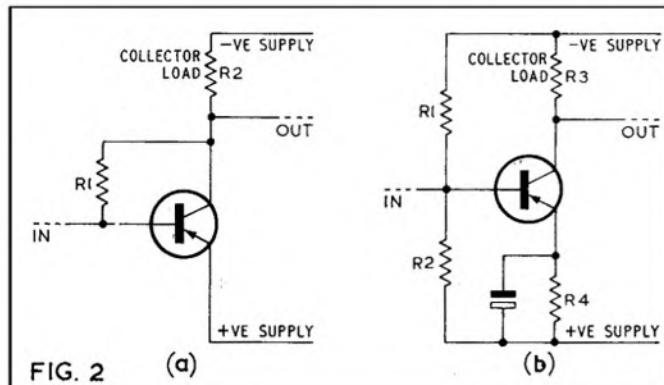
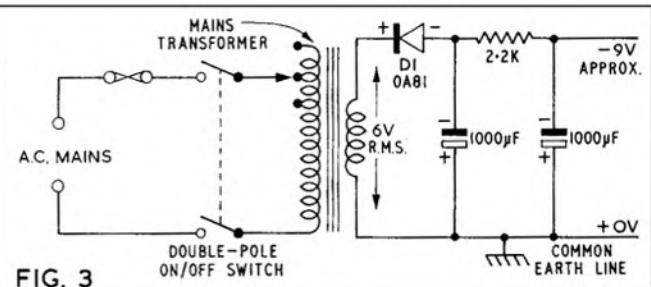
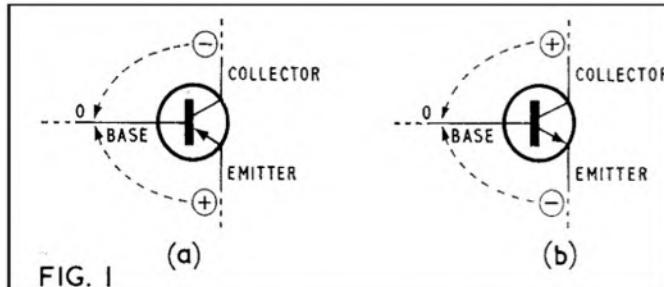
collector current is due to the 'transistor effect'. The greater the forward current in the emitter junction, the greater the current in the collector circuit, in spite of the collector junction being biased for reverse conduction. There is, of course, a 'saturation' limit to the amount of current that the collector will pass, depending on the nature of the transistor and circuit. Above that limit there will be no increase in collector current with increase in forward emitter current. Moreover, if excessive forward current is applied to the emitter junction, the junction will fail due to overheating.

This biasing is revealed diagrammatically in fig. 1(a) for a *p-n-p* transistor and (b) for an *n-p-n* transistor.

In practice, the small forward bias required by the emitter junction is derived from the collector supply either via a current limiting resistor as shown in fig. 2(a) or from a resistive potential-divider as shown in fig. 2(b). The bias applied to the emitter junction is generally called the 'base bias'. Thus, the base bias of a *p-n-p* transistor is negative and of an *n-p-n* transistor positive. The greater the negative or positive bias respectively, the greater—within limits—will be the collector current. There, then, we have the whole basic story. The problem now is to find a suitable power supply.

Since a small-signal transistor amplifier needs little more than a milliamp of current for efficient operation, an ordinary dry battery of the kind used in small transistor radio sets can be employed to power it. Some commercially-produced head amplifiers are, in fact, self-contained complete with battery power supply.

Battery powering is convenient but it has its drawbacks. One is not always sure as to the state of the internal battery, which may become exhausted sooner than expected due to the amplifier or booster being left switched on. A partially exhausted battery can not only introduce excessive noise to a low-level audio circuit (such as at the front-end of a tape playback channel), but it can also corrode and eat into circuit and internal metal parts of the amplifier. A solution is to arrange for the main tape recorder switch also to control the battery amplifier.



Alternatively, a small mains power unit can be constructed solely for powering the transistor amplifier.

This latter need not be an elaborate affair as the very small power requirements greatly facilitate the design. All that is generally necessary is a simple half-wave rectifier circuit fed from a 6V mains transformer, as shown in fig. 3.

Here D1 can be an ordinary germanium or silicon diode, depending on the current requirements, while the mains transformer can be the 6.3V heater winding on the mains transformer already employed in the main equipment. For really first-class smoothing a pair of 15V 1,000 μ F electrolytics and a 2.2K surge limiting resistor are desirable.

A circuit for full-wave rectification is given in fig. 4. This uses a pair of diodes in conjunction with a special 6.3V-zero-6.3V winding on the mains transformer. With full-wave rectification the smoothing electrolytics need not be of such a high value.

Full-wave rectification is possible in conjunction with an untapped winding, as shown in fig. 5, by the use of a *bridge rectifier* system. This takes the form of four diodes connected in the manner shown for a negative supply. This is the most efficient type of circuit available, and good smoothing is possible by the use of a pair of 250 μ F electrolytics.

Another supply source is across the cathode resistor of a power valve, as shown in fig. 6. Here the voltage at the cathode is positive with respect to the common 'earth' line. This source should only be used where the cathode resistor is bypassed by a large electrolytic capacitor. The capacitor holds the voltage steady, audio-wise. In amplifier circuits where negative feedback is taken via the cathode circuit serious feedback could result by using this source for powering the transistor sub-section. This may result in oscillation or negative feedback, depending upon the type of circuits and the phase change across them. Of course, sources of that nature should not be employed.

It is possible to energise a small transistor amplifier from the HT line of the main equipment, as shown in fig. 7. Here a potential-divider is formed across the HT supply circuits by the bleeder resistor R1 and

the associated zener diode ZD1. The zener diode is biased for reverse conduction (that is, the positive side to the supply positive), and the voltage developed across the diode is that used for the transistor circuit. Smoothing is effected by the 2.2K resistor (or larger value) and the 1,000 μ F electrolytic capacitor.

The zener diode produces a source impedance so low that it is comparable with that of an ordinary battery. This sort of diode when back-biased (i.e., biased for reverse conduction) also exhibits the property of a voltage stabilising device. This is because beyond the zener or turnover region of the diode characteristics the voltage across the diode remains substantially constant for small changes in current, as shown in fig. 8.

Thus, should the HT voltage in the circuit of fig. 7 rise, the current in the zener diode would increase, as also would the voltage dropped across the associated resistor R1. The net result would then be that the difference between the input voltage (i.e., HT line voltage) and the output voltage (i.e., 9V supply) would all be developed across R1, thereby holding the output voltage constant.

When selecting a zener diode for this application consideration must be given to the output voltage required (i.e., the voltage across the zener diode), the minimum current required by the zener diode to bias it past the turnover region to produce stabilisation, the maximum current permitted in the diode by reason of its maximum power dissipation rating, and the zener slope resistance.

Zener diodes are available over a wide range of voltages and minimum stabilising currents. The power rating of the component is somewhat influenced by its operating temperature, in common with transistors and other semi-conductor devices. The bleeder resistor, of course, must be adjusted to pass the necessary zener current to give the voltage required across the diode.

Where possible it is generally desirable to derive a negative supply
(continued on page 304)

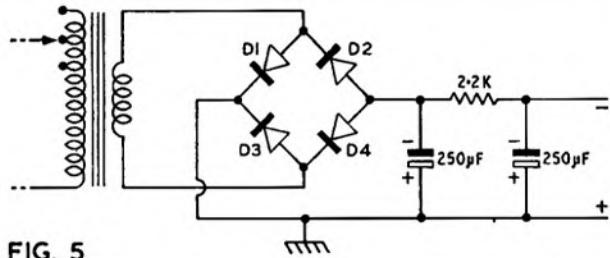


FIG. 5

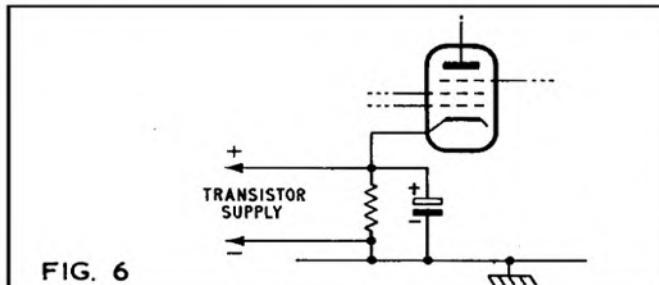
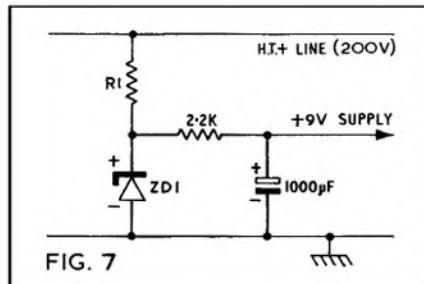


FIG. 6



The HT line of the main equipment can be tapped down by a potential-divider comprising R1 and the zener diode ZD1.

FIG. 7

part 17 powering transistor circuits

BY GORDON J. KING

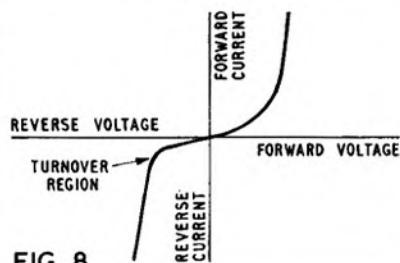


FIG. 8

Zener diode characteristics, showing that beyond the turnover region the voltage across the diode remains substantially constant for small changes in current.

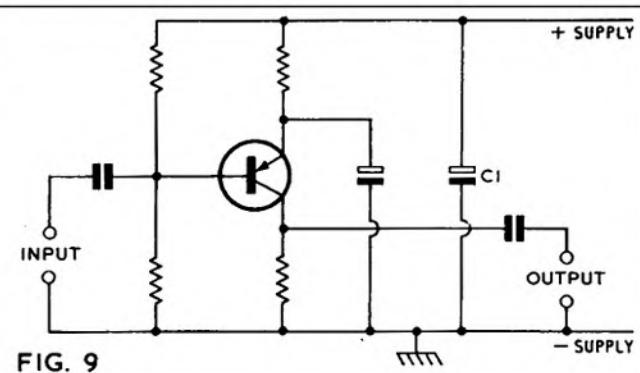


FIG. 9



Invest your Money wisely
Choose British Heathkit models
AND SAVE £ £ £'S BY BUILDING ANY MODEL YOURSELF
All models covered by the Heathkit guarantee



**A Tape recorder
requires a
quality tuner**

FM TUNER

HI-FI FM TUNER, Model FM-4U
 Available in two units which for your convenience are sold separately : Tuning unit (FMT-4U—£2 15s. 0d., incl. P.T.) despatched wired and tested, and I.F. amplifier (FMA-4U—£13 3s.). Printed circuit for I.F. amplifier and ratio detector. Built-in power supply : 7 valves. Tuning range 88-108 Mc/s. Total price Kit £15 18s. 0d.

HI-FI EQUIPMENT CABINETS
 A range of over a dozen equipment cabinets is now available to meet the differing needs of enthusiasts. Designed for maximum operating convenience or for where room space is an over-riding consideration, this range includes kits, accurately machined for ease of assembly and "left in the white" for finish to personal taste, ready assembled cabinets or RECORD HOUSING assembled and fully finished cabinets, and has at least one model to meet your requirements. Why not send for full details ? Prices from £7 15s. 0d.—£44 2s. 0d.

ALL BRITISH MODELS AVAILABLE ASSEMBLED PRICES ON REQUEST

Deferred terms on orders over £10

Tape Recording and Replay Hi-Fi Amplifiers
 Models TA-IM (Mono) and TA-IS (Stereo). For use with most tape decks. Thermometer type recording indicators, press-button speed compensation and input selection. 3-position bias level and printed circuit construction.

TA-IM	Kit £19 18s. 0d.
TA-IM and Magnavox "STUDIO"	£31 5s. 6d.
TA-IM and TRUVOX D93/2	£52 18s. 0d.
TA-IS (Illustration Centre) Kit	£25 10s. 0d.
TA-IS and TRUVOX D93/2	£58 10s. 0d.
TA-IS and TRUVOX D93/4	£58 10s. 0d.

A WHOLE RANGE OF PACKAGED DEALS (INCLUDING "CONNOISSEUR CRAFTSMAN" TURN-TABLE and DECCA fits PICK-UP) NOW AVAILABLE TO SAVE YOU FURTHER MONEY.



"Malvern"

"Cotswold"

Get best possible recordings with a tuner



AM/FM TUNER

HI-FI AM/FM TUNER, Model AFM-1

Also available in two units as above : Tuning heart (AFM-TI—£4 13s. 6d. incl. P.T.) and I.F. amplifier (AFM-AJ—£21 16s. 6d.). Printed circuit board. 8 valves : consecutive FM limiting and ratio detector. Tuning range FM : 88-108 Mc/s : AM : 16-50, 200-550, 900-2,000m. Switched wide and narrow AM bandwidth. Built-in power supply. Total price Kit £26 10s.

COTSWOLD HI-FI SPEAKER SYSTEM

This is an acoustically-designed enclosure 26" x 23" x 14" housing a 12" bass speaker with 2" speech coil, elliptical middle speaker, together with a pressure unit to cover the full frequency range of 30-20,000 c/s. Delivered complete with speakers, cross-over unit, level control, grille cloth, etc. Ralph West ("Hi-Fi News") says : "The reviewer was very impressed and places this design among the top few and unhesitatingly recommends it to the most critical music lover."

"COTSWOLD" MFS SYSTEM

Similar performance to standard "Cotswold" but designed for the smaller room. Size 36" high x 16" wide x 14" deep. Either model £23 4s. 0d. kit.

Send for FREE illustrated catalogue of the full range of British Heathkit models



MA-12
AMPLIFIER



MA-5
AMPLIFIER



SSU-1
SPEAKER



AG-9U

MONO CONTROL UNIT Model UMC-1. Designed to operate with the MA-12 or any amplifier requiring 0.25v or less for full output. Suitable for cabinet mounting or free standing. Size 10" x 7" x 4". Assembled £13 12s. 6d.

DELUXE 6 WATT STEREO AMPLIFIER Model S-33H. A stereo-mono amplifier with the high sensitivity necessary for lightweight ceramic pick-ups (e.g. Decca Déram). Deluxe version of the S-33. Kit £15 17s. 6d. Assembled £21 7s. 6d.

HI-FI STEREO 6 WATT AMPLIFIER Model S-33. Attractively styled, completely self-contained. Printed circuit makes it easy to build. Only 0.3% distortion at 2 1/2 W/chal. U/I output, ganged controls. Kit £13 7s. 6d. Assembled £18 18s. 0d.

HI-FI MONAURAL AMPLIFIER Model MA-5. An ideal general-purpose reasonably priced mono amplifier, 5 watts output at only 0.5% distortion, has inputs for Gram, Radio. Printed circuit board. Kit £10 19s. 6d. Assembled £15 10s. 0d.

HI-FI SPEAKER SYSTEM Model SSU-1. This kit is easily assembled. It contains speakers and balance control in its direct ducted port reflex cabinet. It is equally suitable for stereo or mono in average room. Kit £10 17s. 6d. (Legs 14/6 optional extra). Available for vertical or horizontal use. (Prices include P.T.)

AUDIO SIGNAL GENERATOR Model AG-9U. Delivers up to 10 volts pure sine-wave (less than 0.1% distortion. 20 c/s to 20 Kc/s). Decade switch-selected frequencies from 10 to 100,000 c/s. Kit £22 10s. 0d. Assembled £30 10s. 0d.

POWER-AMPLIFIER 12-WATT Model MA-12. Single channel, ideal for stereo conversion. Kit £11 18s. 0d. Assembled £15 18s. 0d.

MAGNAVOX "STUDIOMATIC" DECK. Two tracks, "Wow" and "Flutter" not greater than 0.15% at 7 1/2 p.s. Long Term Speed Stability better than 0.5%. £14 19s. 6d.

SUGDEN MOTOR UNIT "CONNOISSEUR CRAFTSMAN". Heavy duty motor, operating at 33 1/2 and 45 r.p.m. Very heavy 12" turntable. £17 2s. 11d. (incl. P.T.)

ALL ORDERS DELIVERED FREE IN U.K.

MONEY BACK GUARANTEE

Daystrom Limited unconditionally guarantee that each Heathkit product assembled in accordance with our easy-to-understand instruction manual must meet our published specifications for performance or the purchase price will be cheerfully refunded.

**DAYSTROM LTD. DEPT. HT6
GLOUCESTER, ENGLAND**
 A subsidiary of Weston Instruments Group, manufacturers of
THE LARGEST-SELLING ELECTRONIC KITS IN THE WORLD

HI-FI STEREO 18-WATT AMPLIFIER Model S-99. Within its power rating, this is the finest stereo amplifier available, regardless of price. U/L push-pull output. Printed circuit. Kit £27 19s. 6d. Assembled £37 19s. 6d.

TRANSISTOR INTERCOM. Models and XI-IU XIR-IU. Ideal for office or home. Each Master operates up to five Remotes.

Master Kit £10 19s. 6d. Assembled £16 19s. 6d.

Remote Kit £4 7s. 6d. Assembled £5 16s. 0d.

STEREO CONTROL UNIT Model USC-1. A deluxe stereo control unit with variable filter, switched rumble filter, printed circuit boards and many other refinements. Operates direct from tape heads. Kit £19 10s. 0d. Assembled £26 10s. 0d. "OXFORD" PORTABLE RADIO Model UXR-2. Superbly styled hide case, with Golden trim and slide-rule tuning scale ; this completely self-contained transistor dual-wave set performs brilliantly everywhere. Reproduction is exceptionally good. Printed circuit. Kit £14 18s. 0d. (including P.T.)

SHORTHAWE TRANSISTOR PORTABLE Model RSW-1. Four wave-band seven transistor portable with telescopic and ferrite aerials, slow-motion tuning. Covers Medium, Trawler and 6-26 Mc/s in four switched bands. Uses printed circuit board and latest circuit technique. Superbly styled leather case. Kit £19 17s. 6d. (incl. P.T.)

TRUVOX D93/2 AND D93/4 TAPE DECKS. High quality mono-stereo Tape Decks. D93/2 1/2-track for highest fidelity. £36 15s. 0d. D93/4 1/2-track for most economical use of tape. £36 15s. 0d.

GARRARD AUTO-RECORD PLAYER Model AT-6. A 4-speed stereo-mono unit with manual or fully automatic record selection ; adjustable counter-balanced arm. Fitted with Decca Deram ceramic cartridge

£14 6s. 1d. or Ronette 105 mono/stereo cartridge £13 12s. 1d. (incl. P.T.)

GOLDRING LENCO TRANSCRIPTION RECORD PLAYER Model GL-59. Fitted with the G.60 pick-up arm and Ronette 105 mono/stereo cartridge, it has infinitely variable speed adjustment between 33 1/2 and 80 r.p.m. and four fixed speeds. 34lb. turntable to reduce rumble, "wow" and "flutter". £20 1s. 3d.



S-99
AMPLIFIER



UMC-1
CONTROL
UNIT



UXR-2
PORTABLE



GL-58
PLAYER

JUST POST THIS COUPON FOR FURTHER INFORMATION

Without obligation please send me

FREE BRITISH HEATHKIT CATALOGUE . . .

FULL DETAILS OF MODEL(S)

TICK HERE

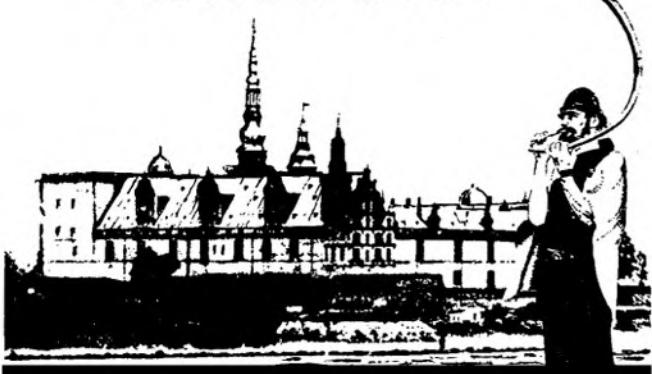
Kindly write below in BLOCK CAPITALS

NAME

ADDRESS

HT6

THE DANISH WAY WITH TAPE



an informal survey of tape recording in Denmark

BY ELSE RASMUSSEN

TAPE recording is an important feature of daily life in Denmark nowadays. The Danish radio has large sound-recording archives containing recordings of many famous persons. Mogens Wieth, the young gifted actor who died far too early, is often heard over the Danish Radio, and coming generations will be able to share the enjoyment of his talented performances. You might recollect that he was engaged to *The Old Vic* when he died quite suddenly.

The tape recorder is also used for our automatic telephone service. This is a special service offered through The Danish Telephone Company. A tape recorder is connected to the telephone and delivers a short message dictated by the subscriber of the telephone. If the message is not understood the first time it is repeated. The service is comparatively cheap and a welcome solution for many businesses as the staff question is quite acute in Denmark.

The tape recorder is also to a certain extent used for advertising through the telephone. If you call *Tuborg* and *Carlsberg*, the two largest breweries in Denmark, on a certain number you will hear a little tune. The theme is, of course, beer.

The *Sale and Reklame Association* in Sønderborg (a small town in Denmark) uses the tape recorder in another way. When the members have to be called in to an urgent meeting or if they have to be reminded about a meeting already fixed they will be called over the telephone and the message will be delivered by a tape recorder. Much time is saved this way and the members will be sure to get exactly the same message. In other cases the members will be called to a telephone meeting and then a tape will be played to all of them at the same time.

The Danish Institute for the Blind makes extensive use of tape recording. A blind person can apply for a tape recorder. He might have to wait a little time for the delivery, but it will eventually be handed to him on loan. An instructor will be sent to show him how to handle the recorder. This instruction is very often a difficult job. People who have always been blind find it easy to handle the recorder, but persons who became blind later in life often find it difficult. But it pays. As soon as they master the recorder they will enjoy the benefit of the full service given from the institute. They will receive recorded news twice a week. The tapes are sent by mail and returned to the Institute when finished with. The institute also has a library of books on tapes. At the moment there are between 1,000 and 1,400 different titles in the library, each title existing in several copies according to the demand. Also, trade papers and some scientific papers are available on tape. There is also a special branch for religious work. Various recorded sermons are available. The blind person will receive a catalogue of the avail-

able tapes from which he can make his choice (assisted by a sighted friend) and he will then receive successive chosen tapes.

I have two blind friends myself and therefore I know by experience what this work means to them. It is just unbelievable how much happiness is spread by this service. One of my friends is totally blind and he has always been so. He is, of course, a master in tape recording. He even makes minor repairs himself. He is very musical, plays the organ and is a member of a 'Music on tape' circle. The music circulated is either of live recordings or recordings of gramophone records.

My other friend is an old lady of 84. She is not quite blind and can see a little with one eye. But she gets very tired. Her glasses are like magnifying glasses and they give her a terrible headache. She was told by the doctor that there was no likelihood of improvement. Having a very active brain, she was therefore slowly turning melancholic and apathetic. When I was introduced to her for the first time she had not yet made the acquaintance of a tape recorder. I remember distinctly that she once told me that she often wished to die—and actually she looked to me as though she was withering away. I told her about the service run by the Danish Blind Institute. I must admit she was not very optimistic to begin with and it was a hard job before the old lady had learned to master the tape recorder. But it certainly has been a rewarding job. If you met her today you would find her full of life, she speaks in a lively manner about many subjects of current interest, she has read the newest books and has an opinion about almost everything. She says that she feels happy and looks forward to every new tape. Life again has a meaning for her.

The tape recorder is also often used for the announcing of bargains, especially in department stores.

The Danish libraries have large collections of music and prose (often in English, German or French) on discs. As there is a growing demand for this service one can keep the records for a very short period only. You can, however, copy the record on to tape and this will give you more time to study it. (Here I should add that this must, of course, not be done on a commercial basis but strictly for your private use.)

The Danish Radio provide school broadcasts and various languages are taught through these programmes. For a long time it was difficult for me to be able to listen to these lessons as I was usually somewhere else when they were broadcast. However, this problem has now been solved as I have obtained a clock control which automatically switches on and off according to the setting. I am now able to hear what I want. It means that the radio set and the tape recorder are automatically switched on and off and when I come home in the evening I listen to what may have been transmitted in the morning.

Concerning language teaching, a tape recorder is a 'must'. I have for the last two winters given language lessons. Learners soon get used to it and invariably find study hard without it. In some cases I have recorded the entire lesson and let the learners listen to the whole thing through on their own. This means that they get the whole thing twice—first the lesson itself and afterwards a repetition on the tape recorder. This procedure has proved to be very successful.

At the institute where I am working we have a tape recording system, mainly used for correspondence, but also for other purposes. This system is certainly used to its full capacity. A tape recorder, situated in one of the offices, is in connection with the telephone system. When you dial "6" you are connected and can dictate your letter or something else. If it is already occupied you will hear a certain signal. The tapes will be changed by the correspondence clerks and typed. The finished letter will be brought to you shortly after you have dictated it—ready for your signature. The system takes some time getting used to, but it takes only a little time to get accustomed to comfort in life!

For a great many people tape recording has become an interesting hobby. As a result of this, tape clubs are currently growing like mushrooms. One category of clubs is dealing mainly with tape correspondence. Lists of the members, stating their names, addresses, age, interests, languages, etc., are circulated. This can, at least for a time, be very interesting. I have had contacts in Africa, America and in various countries in Europe, especially England and Germany. Although I have never seen any of my contacts I feel that I know quite a lot about them—it is a pleasure to talk to them and a thrill to receive the tapes. My contact in Nyasaland has told me many

(continued on page 311)

GET a few keen recording types together, and before long the conversation will enter what I call the ain't-it-all-a-bleedin'-shame mood : somebody will remark, sadly shaking his head, that it's a pity that so many recorders lie wasting beneath the stairs or moulderding in attics. Another, agreeing with a sigh, will add that there are supposed to be something like two million recorders around the place ; and how many ever get used ?

The theme is familiar : somebody gets the idea that it would be fun to own a tape-recorder ; they think of all the money they can save on records by taping stuff from the radio ; they build up, in their minds, vast collections of family memories ; they see themselves as the life and soul of innumerable parties, with everybody screaming at the sound of everybody else's voice. They may even see advertisements which add to their euphoria : long-haired virtuosi are, it would appear, only too ready to play for them to record ; great orchestras are just dying to be enshrined for ever on their hi-fi tapes (replayed through the giant six-inch elliptical in the recorder case, to judge from the illustration) ; birds sit chirruping on branches while they stand a few inches away and tape them with the crystal mike supplied with the equipment. In all, it's a wonderful world ; and all you need to enter it is a tape recorder—price immaterial : they're all better than the others anyway, according to the advertisers.

The reality is rather different, when the recorder actually arrives. To begin with (and I am assuming that the thing works, which is a big assumption as many of us know from experience) it really is fun : there is the slight challenge involved in operating the controls; there is a period when the sound of one's own voice has a horrible fascination (don't worry, brother : that experience is as nothing compared with the first sight of one's face on a television screen) ; and there is still quite a good supply of victims who have never been subjected to this revealing torture. The recorder as a status symbol is declining with the increasing numbers sold ; but there is still the element of one-upmanship to be savoured while it lasts. But then, somehow . . . the virtuosi don't seem to turn up ; the orchestras dwindle to some budding group in the hall at the end of the street ; the birds fly away or just won't sing ; Aunt Mabel cannot believe she sounds like that, and is affronted, muttering things about her will. Altogether, the wonderful world of sound is not entered by handing over the cash. There is, of course, the radio ; but few sets make provision for coupling to a recorder ; and recordings through the microphone don't sound quite *right*, do they ?

So it is that your millions lapse into inactivity ; but what surprises me about the discussions that proliferate on this topic is that the keen types seem surprised about it. What do they expect ? The tape recorder is not a gramophone ; and though one can buy recorded tapes to play instead of discs, the repertory is limited and the quality, in my experience, well below that of good disc-recording. If one happens to live within range of the Wrotham VHF transmitter it may be possible to make mono recordings comparable with mono discs ; but, good as it is, provincial FM is rarely thrilling, and live performances are ruined by coughing and shuffling which may not be greatly noticed on a first hearing but become unbearable when they come to be expected on a recording. The BBC does wonderful work for music ; but it does not claim to supply material for collecting on tape in place of gramophone records.

One has also to face the fact that amateur performances which are worth recording as *music* are very rare. To record them for the purpose of helping the performers or getting practice in the art of recording is one thing ; to listen to them for musical pleasure is quite another. To suppose that these performances, even the best of them, can compete with the professionalism of the recording-studio is to long for the moon. To be sure, there are talented amateurs whose playing or singing gives true pleasure and I have had the good fortune to meet a number of them ; but I am not likely to build up a library of my favourite music in that way ; and there must be very few who can. In my experience, the easiest kind of music to get access to at a high level is organ music : there are still many good organists about in churches and chapels over the land ; but of course church organ music is not everybody's idea of heaven.

To get musical satisfaction as a listener, one has to turn to the professionals. These people play for a living, and they are subject to the rules of their professional union. Rarely can one get the opportunity to record a professional ; even more rarely a group of professionals. In my view the manufacturers do little service to the amateur recording world by implying that amateur equipment will

UNDER THE STAIRS



BY PETER TURNER

be used for such purposes ; and anyone who buys a recorder with this in mind will certainly make little use of it. The professionals themselves make use of recorders in order to study their own technique ; but that is a different matter.

The recorder as a gramophone, then, can be dismissed : at most tape is a facility to be added to a gramophone, not a substitute for one. As soon as this illusion is removed, one is left with a very large hole where most people's ideas of a recorder used to be ; but in fact it is only here that the real purpose of the domestic recorder begins to emerge. If it isn't a gramophone, what is it ?

To many, it is a toy : what fascinates them is the way the thing works : their pleasure is in making sure that it meets the maker's specification, and getting it to exceed it, if possible. For these types, signal-to-noise ratio is an end in itself, and a kilocycle added to the top response is a triumph. They modify machines to suit their own ideas ; they add facilities ; they make recorders stand on their heads at the touch of a switch. And then, so far as I can make out, they sit speechless in admiration, and look round for fresh worlds to conquer. These people need no further justification : recording, as a process, is the thing they are seeking : musical pleasure is quite secondary to quality of signal. Who shall seek to deny them the satisfaction for which they work ?

But most of us are not like that. Some of us are specialists : the train men, the bird men, the organ men, the hurdy-gurdy men, the bell men, the mammal men. They have in common one thing : they use tape to aid them to study something : they have an interest, and they find that tape adds to it. They bring to the art of recording the same methodical, scholarly, painstaking patience which their other studies have taught them. They may be enthusiasts for tape, but they are enthusiasts for something else first. They have something else in common—a very important something : they spare no effort. By this very fact they are set apart from the run-of-the-mill tape user. A man who can record the Dartford Warbler has first to be able to recognise one when he sees it : he must know where he is likely to see one and go there ; he must be prepared to spend hours waiting for that improbable moment when the bird is there, when it bursts into song, when the microphone is in the right place and the tape runs true. When you hear recordings like these, they sound so easy. That they are not adds to the zest of the true bird-man. Anyone with the right gear can pirate the top twenty from the radio ; but if you want to compare baroque organs you must know where they are.

It is here, I believe, that we meet the explanation for those recorders under the stairs. Advertisements make it all sound too easy : pay up and it's yours. It isn't true ! Recording is a skill which has to be acquired. That few bother to acquire it should surely not astonish anyone ? Many will be content to record badly : it is their privilege

so long as it satisfies them. But to become a recordist you have to enjoy recording, and far too many people are defeated by it. They try, and the result does not come up to their expectation. They get discouraged and give up. Who shall blame them? They have been told that recording is simplicity itself, and that the whole world of sound is there for the asking. Neither of these things is true: recording is an art, and as difficult as all art; and we have seen that the world of music—which is the obvious target—is difficult of access. Your beginner finds that his recordings are not what he hoped for, and that there is little for him to record. So he gradually gives up.

It is my belief that people should not be discouraged to think that a recorder, by itself, is the automatic provider of any satisfaction at all, other than that of pure pleasure in possession—which applies more to a picture by Cezanne than to a tool like a recorder. It will not enable you to win friends or influence people. It will not transform a drab life into a romance. What it will do is to enable you, if you are the kind of person who is seeking just that, to exercise a skill.

SOME THOUGHTS ON A FAMILIAR THEME

The first question to ask is: In what am I interested? If the answer is: nothing—then don't buy a recorder because it will not create an interest in anything. But suppose the answer is quite vague, such as: I like people? Then, as I see it, you have the best possible answer: we cannot all record Menuhin but we can all record people. I've written about the interest of people before, and I shall not repeat it here, except to say that my wife and I have met lots more in the interval. I believe that a degree of specialisation is a good thing: a collection can be too eclectic. But one does find how much other people are interested in people: how much they enjoy one's recordings. I have occasion, from time to time, to visit a university town in the course of my work. When I am going there, I am invariably asked to take a recorder with me so that I can play my latest tapes. None of the people who listen there were born in my part of the world, or have any intimate connection with it; but they are none the less fascinated by my local voices and people. I believe that almost everybody could find something which they could make it their hobby to record; that they could learn a great deal as a result of it; that they could become more interesting people by doing it.

But I recognise that I have been fortunate: I caught the recording germ from experienced friends, and was never really floundering about on my own. In order to make recording more popular, we need to do two things, in my view: the first is to get rid of the high-falutin nonsense about recording which at the moment is often used to induce people to buy gear. The second is to face the very real problem of the beginner. When a recorder is bought, it usually comes complete with tape and microphone. The microphone is bound, by the nature of the market, to be a rather indifferent instrument. It will be a high-impedance device, which will limit the length of cable that can be used with it. This means—and I am convinced that this is important—that the beginner is tied to his recorder by a yard or so of wire. Hang it, an expert would almost never think of operating under such conditions; yet your tyro is expected to. Is it any wonder that his early attempts at recording disappoint him?

More: the most likely instrument for early experiments is a piano. Most experts regard a good piano recording as about the most difficult exercise of the lot. Your beginner starts at the summit and does not know why he inevitably falls off. Again, that short length of cable keeps him within range of the mechanical noise which many recorders make; and so from the beginning he gets used to background noise which ought not to be there. In other words, the beginner not only has to face the difficulties of working the machine—often after a cursory "demonstration" by a salesman who knows little more about it than the customer himself—he is shackled by circumstances which he has not the experience to recognise.

What do I suggest? Well, every instruction manual could to some

extent deal with these things. It could state frankly that the microphone supplied is not a very good one (and say why), and that it is supplied only in order to allow the user to familiarise himself with the operation of the machine. It could point out the limitations of the short cable. It could give some general hints on recording technique. It ought, that is, to be a manual and not just a short pamphlet. Here, I think, *Ferrograph* have the right idea: they issue a stout card with the main operating instructions on it, and a manual which gives information. The latter can be studied at leisure.

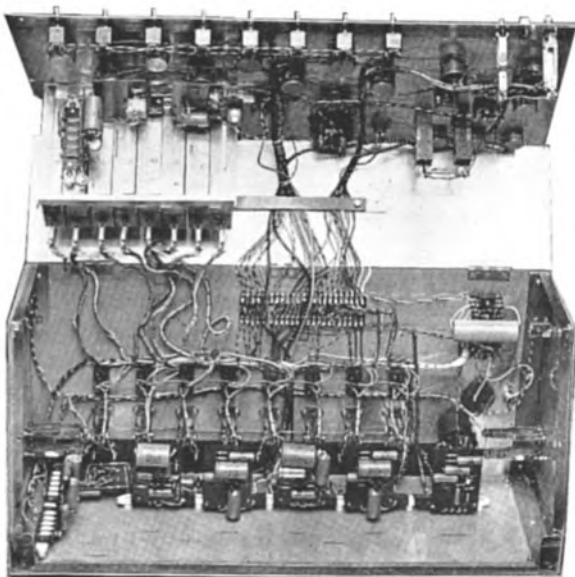
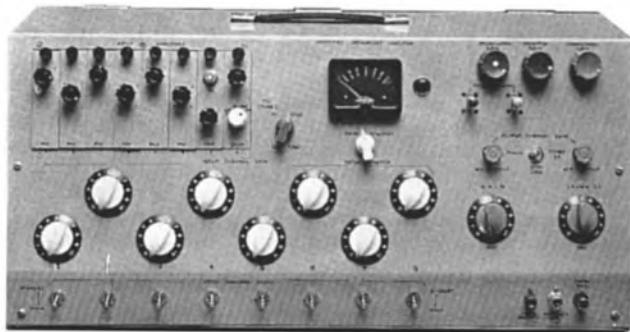
I have mentioned salesmen. Not long ago I asked a manufacturer to visit the recording club of which I am joint secretary. They replied by putting me in touch with a retailer, who said he would come to demonstrate their products. He came, bringing several machines with him. He handed them over to us, together with instruction books, with the remarks that he knew nothing whatsoever about them and that we were welcome to try them! One of our own members—a professional engineer—took over without having previously used any of them, and gave us a good demonstration. Now, this particular salesman was honest enough to admit his limitations. Few are so honest; yet I suppose that most recorders are bought from non-specialist shops: some even from furniture stores. How can these people demonstrate machines adequately, let alone service them? Yet the beginner does not think about these things. To me, this raises the ethical question of whether manufacturers ought to permit sales through such incompetent avenues. One can get washing machines and refrigerators demonstrated by professionals. Why not tape recorders? How many housewives take delivery of a dish-washer with no more than an instruction-sheet to guide them in its use? They expect, and get, a proper lesson. So they should with a recorder. I am always meeting people who have an adequate idea of the facilities their machine offers, and who are quite bewildered by the various switches and sockets; who have never realised that they can plug in an external speaker quite simply and get vastly better quality by doing so; who are quite ignorant of the fact that a competent serviceman will make a diode connection to their radio-set in a few minutes. No wonder they lose heart and interest!

But when all is said, it remains true that recording demands effort; and effort puts a lot of people off. But get them interested and the effort becomes enjoyment. Beginners are often too much on their own; and that is where the clubs should come in: there is nothing so infectious as enthusiasm. However, it is widely admitted that recording clubs have not had the success one might expect, and I should love to know why. They have been accused of being too technically-minded; of being snobbish cliques where expensive gadgets are paraded in order to keep up with the Jones's; of despising beginners; of positively wanting to remain small and exclusive. In my experience, these things may be dangers, but they are rarely facts: I have found recordists to be friendly, willing people who are generous in giving up time to help the less experienced. Yet I do know that beginners join clubs only to leave them shortly afterwards. It is difficult to know why. I suspect that it is because the clubs, though they exist to be helpful, cannot conceal the truth of the matter: that there is no short cut to skill in this or any other activity. French may be learned without tears, indeed; but not without effort. And the experience of working with experts can be an inspiration to some, but a discouragement to others. I think people come to a club because they need help, and leave because the kind of help they are seeking cannot be given. Some react more rationally, and stay on to become good members.

Manufacturers could help more than they do: they could provide training facilities for dealers so that dealers could be more helpful to the users. They could put on special visits, with demonstrations, properly supported by advertisements. They could be a little more exacting in their choice of retailers, and make more detailed enquiries into service facilities before appointing agents. And, as I said, they could produce better literature.

There is one final point I should like to make. Much has been said about the enjoyment we can get from tape: one hears less about the enjoyment we can give with it. There is limitless scope for recording work in connection with the care of the blind, the old, the handicapped, the household, the young, the lonely, the sick in mind and body. Recording with this as the end takes on a new dimension. If only the need were realised, there would be fewer recorders under the stairs: there is not a village anywhere in which there is not somebody to help, and in towns they are waiting in their hundreds. The need is becoming recognised. Where are the volunteers?

▼ Front view showing revised layout of mixing potentiometers



a hospital mixer

BY ISR. HAYNES

SOME MODIFICATIONS TO THE ROBINSON STUDIO MIXER FOR HOSPITAL BROADCASTING

READERS will remember the excellent series of seven articles by Mr. D. P. Robinson last year (June-December 1964), describing the construction of a studio-quality audio mixer. At the time of publication of the first article, the Bishops Stortford and District Hospital Broadcasting Service was seriously considering the possibilities of a second portable unit for use in outside broadcasts and it was thought that the circuits being described had great potential for adaptation to the requirements of this specialised task.

Very little has been published in the past about hospital broadcasting and the writer has often felt that there is a need for some degree of liaison for the exchange of new ideas, technical material and other items of interest. It is hoped that this will be possible in the future, and that this article may be of some interest and assistance to the many people involved in this worthwhile work.

There are, no doubt, many readers who know very little about Hospital Broadcasting and its functions, so it would perhaps be appropriate at this stage to mention briefly that the mode of operation falls into two categories : (1) organisations that operate from the hospital premises, either by the use of tape recorders moved from ward to ward, or from a central point in the hospital to the bedside earphones via internal circuits ; (2) organisations operating from studios or control points outside the hospital premises to the bedside earphones via GPO lines.

It is mainly for the benefit of these latter organisations that this article has been compiled, due to the special requirements of the P.M.G. regarding all equipment for connection to a GPO line.

The circuits described by Mr. Robinson for the audio mixer were first of all studied with GPO requirements very much in mind and the most important problems to be resolved were as follows :

- (1) Could the mixer be provided with a 600-ohm output balanced to earth ?

The original output impedance of the mixer was 600-ohms

unbalanced, and by the insertion of a 600-ohm 1:1 transformer with a centre-tapped secondary winding, the required output was easily achieved. A suitable transformer for this purpose is the MU 7524, made by *Gardners Transformers Ltd.* (see fig. 1.)

- (2) Could the output be adjusted for 1V peak-to-peak (-6dB) ?

The peak programme meter circuit in the original was designed to read peak at an output of 0dB, but reference to the designer provided the information that the circuit had sufficient control to be adjusted between -10dB and signals greater than zero level, so there should obviously be no difficulty here.

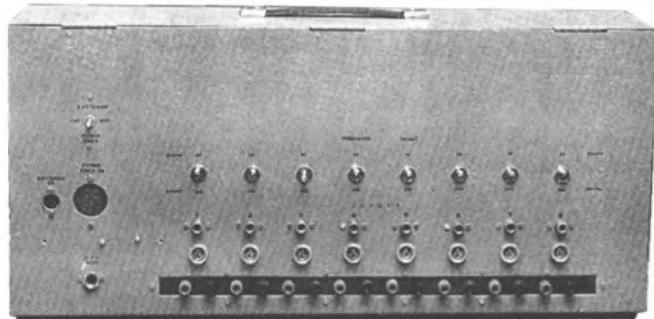
Having satisfactorily answered these two questions, attention was now turned to the modification of the block schematic diagram. It was immediately decided that stereo, oscillator, warning lamp and echo facilities were not required. However, although stereo was out of the question, it was felt that a very useful purpose could be achieved by the inclusion of the second mixing line and channel. The advantages here are twofold : the second channel would not only provide a built-in stand-by amplifier, but would also enable the operator to set up microphones and other equipment quite independently of signals being fed to line by the main mixing channel. This is a most important facility, and coupled with a simple switching of both PPM and monitor circuits to either channel, has proved well worth while.

The plug-in preamplifier modules were then studied for suitability, and found to be ideal for the following reasons :

Microphone Amplifier : All 60 or 600-ohm balanced inputs, matching with all microphones used within our organisation.

High Impedance Amplifier : Variable switched input matching from 30-ohms to 1 Meg, suitable for accepting inputs from gram units, tape decks and other audio equipment.

Line Amplifier : Can be used for capacitor microphones or for accepting an incoming signal from GPO lines. The primary of the input transformer in this module has been wired via a switch to the primary of the output transformer (see fig. 1). The reason for this is that it provides facilities for monitoring a programme being fed to line from another source. The practical application of this can be very useful, especially when a relay from an outside source immediately follows a previous one from the studio. In these circum-



▲ Versatile connecting system on rear of mixer. Photos by L. Slade

SOME MODIFICATIONS TO THE ROBINSON STUDIO MIXER FOR HOSPITAL BROADCASTING

stances, the operator at the outside source can monitor the programme from the studio, and upon hearing his cue can immediately switch to the OUT position with negligible break in continuity. The studio will, of course, have a similar monitoring system. The only modification to the output of the preamplifier modules is the exclusion of the phase reversal switch.

The number of preamplifier modules was increased over the original

The only modification to the two main mixing amplifiers was the use of switched potentiometers, enabling one channel to be switched off when not required. This helps prevent excessive drain on the batteries when these are being used in preference to the power unit. The interconnection between the two mixing amplifiers following Tr2 in the original circuit is, of course, omitted.

The output from each mixing amplifier buffer stage to both monitor and PPM stages was through a double-pole two-way changeover switch mounted on the front panel immediately below the meter. In one position the output of the MAIN mixing channel buffer is fed to both monitor and meter stages, and in the other the output from the STAND-BY channel buffer is in circuit (see fig. 2).

The output from the monitor stage will be described in conjunction with the talkback system adopted later in the article.

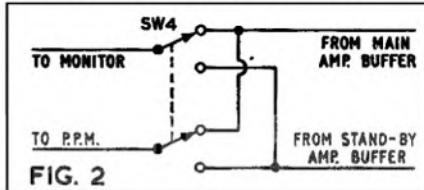


FIG. 2

One addition to the PPM circuit was made which has proved very useful in operation. This is a method of checking the state of charge of the batteries on the meter. This was achieved simply by mounting a small push-button on the front panel, adjacent to the meter, connected in series to a resistor network between the 24V line and the collectors of Tr5 and Tr6, as shown in fig. 3. The series resistor is chosen so that the meter reads one quarter of the supply, that is a reading of 6 corresponds to a 24V supply. Since the log network is in circuit during this measurement, it should only be made during no signal conditions.

To align the meter for a 1V peak-to-peak output at the GPO line socket, the same procedure for the adjustment of VR1, VR2 and VR3 is followed as described in Part 5 of the original article. The adjustment of VR4 is as follows : Connect a meter to the output and, with -6dB leaving the mixer, adjust VR4 for a reading of 6 on the PPM.

The talkback circuit was designed to provide a two-way system : (a) from the operator to one or both of two commentators, and (b) from the commentators to the operator. Also required was a feed from the monitor stage to the commentators. It should be mentioned here, that the monitor and talkback stages are fed to headphones, and therefore the circuit used for the monitor stage was that shown in Part 6 of the original article. The talkback amplifiers in the original

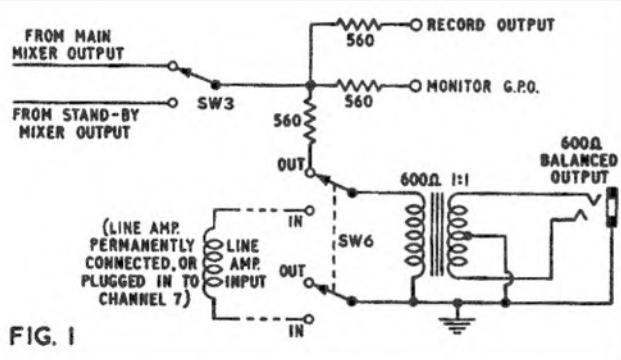


FIG. 1

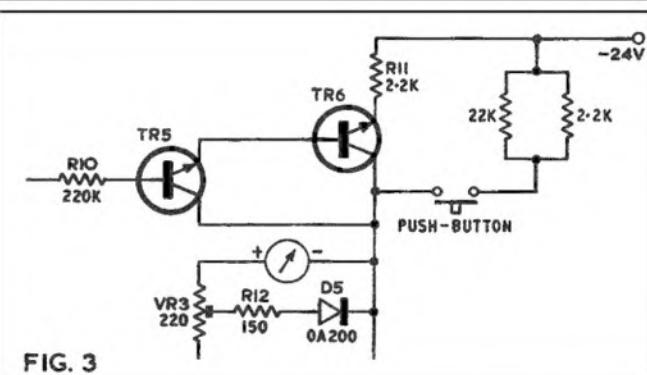


FIG. 3

to eight, comprising six microphone amplifiers, one high impedance and one line. The input sockets decided upon were one screenector, one jack and one set of terminals, paralleled together for each preamplifier channel. This provides for fairly extensive coverage of the various cord terminations.

The output of the preamplifiers is via the channel gain potentiometers to the mixing channel selection switches (i.e. MAIN or STAND-BY). It should be mentioned here that the preamplifier channel gain potentiometers were mounted on the front panel and operated in the conventional manner (see photo); but there is no reason why the original fader rack should not be used—it is purely a matter of choice.

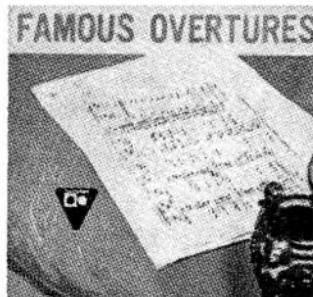
were slightly modified to increase the gain for feeding headphones. This was done by re-connecting C6 ($50\mu F$) to the other end R6 (390-ohms)—see fig. 4.

In describing the way in which the talkback arrangement operates, it is first necessary to mention that three sets of split headphones were used. The cords of each set were terminated with a GPO type jack plug with one phone connected to the tip, the other to the ring and the common connection of both to the sleeve. The appropriate sockets to receive these were mounted as follows : The operator's on the front panel, the commentator's on one side panel, with a parallel

(continued on page 299)

TEMPTAPE

SUPERB PROFESSIONALLY RECORDED
MUSIC—PLUS 600 ft OF EXTRA TAPE
FOR YOUR OWN HOME RECORDINGS
ALL FOR 21/- (3 $\frac{3}{4}$ I.P.S. $\frac{1}{2}$ track)



Why consider ordinary magnetic recording tape when you can buy the wonderful new TEMPTAPE, 600 ft. of super quality long play polyester on 5" reel, with the top track professionally recorded by skilled engineers on the latest Danish Lyrec equipment costing many thousands of pounds.

Here is the list of titles available:

1 EROTIC PERCUSSION. 2 BIG BAND BLAST. 3 GUITAR BOOGIE.
4 TCHAIKOVSKY'S PIANO CONCERTO. 5 THE KING AND I.
6 CAMELOT. 7 FEATURING BILLY DANIELS. 8 HAPPY HARMONICA.
9 SOUTH PACIFIC. 10 ANDRE PREVIN. 11 GREAT THEMES FROM GREAT MOVIES.
12 BIG BAND SWINGS THE CLASSICS. 13 TRIBUTE TO DUKE ELLINGTON. 14 FLAMENCO.
15 UNDER PARIS SKIES. 16 ROMEO AND JULIET OVERTURE.
17 ORGAN POP CLASSICS JOHN KILEY. 18 TCHAIKOVSKY'S 1812 OVERTURE.
19 L'AMORE D'ITALIA. 20 OKLAHOMA.
21 FAMOUS OVERTURES. 22 MUSIC FROM IRVING BERLIN.
23 MUSIC FOR LOVERS. 24 THE GOLD RECORD. 25 SOUND OF MUSIC. 26 TRIBUTE TO WOODY HERMAN.

All are specially selected for your enjoyment and equivalent in playing time to both sides of an L.P. record.

In addition to providing you with a pre-recorded tape of superlative quality, TEMPTAPE provide a bonus of 600 feet of blank tape, and all you do is turn over the reel and make your own recordings on the bottom track. You can later erase the top pre-recorded track making a further 600 ft. available for your own use and at 21/- you can afford to do this.

Ask your dealer for details or write to:

Tempotape Division, A. C. Farnell Limited, Hereford House,
North Court, Vicar Lane, Leeds 2. Phone: 35111.

REPS R10 MkII VERSION

AN IMPROVED MODEL IS NOW AVAILABLE MAINTAINING A HIGH STANDARD OF PERFORMANCE

Exclusive professional type idler wheel for reliability and reduced wow.

D.C heating on pre-amp valves.

Modified Magnavox Studio deck with improved wow/flutter.

Bogen micro-gap two or four track heads fitted.

10 watts nominal R.M.S. Rating.

Calibrated Bass and Treble controls

Mic. Gram/radio inputs, separate controls for mixing.

7 $\frac{1}{2}$ i.p.s. 40—15,000 C.P.S. \pm 1dB 100μS
3 $\frac{3}{4}$ i.p.s. 40—10,000 C.P.S. \pm 2dB 200μS
1 $\frac{1}{2}$ i.p.s. 50—5,000 C.P.S. \pm 3dB 400μS } to C.C.I.R.

5 ECC83. 2 EL84. 1 ECC82. 2 Contact Rectifiers.

Pre-amp Signal/Noise > —55dB at all speeds.



Fully illustrated literature
available on request to—

2 Track 59 gns.
4 Track 69 gns.

REPS (TAPE RECORDERS) LTD.

44 Packington Road, Acton,

London, W.3

Phone: Acorn 4141

A HOSPITAL MIXER CONTINUED

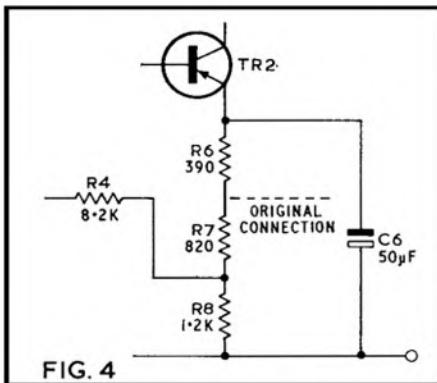


FIG. 4

connection to two identical sockets on the other side panel (one socket for each commentator, of course). Now we shall describe each function separately.

The operator receives the monitor signal in his right-hand earpiece, he also has the additional facility of being able to monitor the signal being fed to the GPO line independently of the monitor amplifier. This is achieved by taking the output from the monitor amplifier to a press-button on the front panel. When in the normal position, this press-button connects the operator's phone to the monitor amplifier output. When pressed, the button connects the phone to the output from either the MAIN or STAND-BY mixing channel (see fig. 5). This additional facility enables the operator to make occasional checks that a signal is in fact leaving the mixer. The operator's left-hand phone is connected to the output of one of the talkback amplifiers, which will be described as the COMMENTATOR/PRODUCER amplifier. The word producer has been introduced for the first time by reason of the fact that the operator and producer are invariably one and the same person!

The second talkback amplifier will be referred to as the PRODUCER/COMMENTATOR amplifier. This is fed by a hand microphone, the input of which is terminated on the front panel by a co-axial socket. The output of this amplifier is connected to two switches on the front panel, one of which connects the signal to Commentator 1, and the

other to Commentator 2. The commentators will hear the producer's instructions in their right earpiece when one or both of these switches is pressed. In the normal position, the switches connect a feed from the monitor amplifier to the commentators. The commentator's left earpiece is connected to the input of the COMMENTATOR/PRODUCER amplifier, thereby enabling him to acknowledge instructions. The complete block schematic diagram (fig. 6) shows the connection of the talkback and monitor stages.

The final requirement was for a 'record' output enabling a recording to be made as the programme was relayed to line. The connection for this is shown in fig. 5.

The use of colour coding throughout the final wiring has proved to be of great value in tracing the various circuits whilst testing, etc., and the writer has no hesitation in recommending this procedure. The batteries used are of the 6V lantern type, four of which are used in series. In practice, these batteries have been found to have a life of

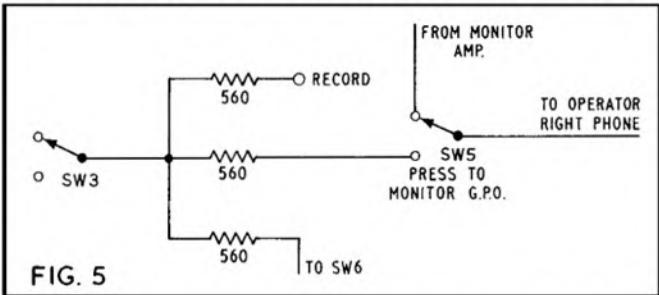


FIG. 5

approximately seven hours, which is more than sufficient for the duration of even the lengthiest outside broadcast.

The completed Hospital Broadcasting unit has been subjected to some very extensive tests with gratifying results. The frequency response was measured at both the GPO and record sockets. At the GPO socket it was 3dB down at 30 c/s and 60 Kc/s, and at the record socket 3dB down at 25 c/s and 170 Kc/s. The unit has since been used with great success, and has been found to be extremely portable and of very high quality.

Finally, the writer would like to express gratitude for the assistance given to our organisation by D. P. Robinson, both during the planning of the modified version and in the construction and testing of the finished unit.

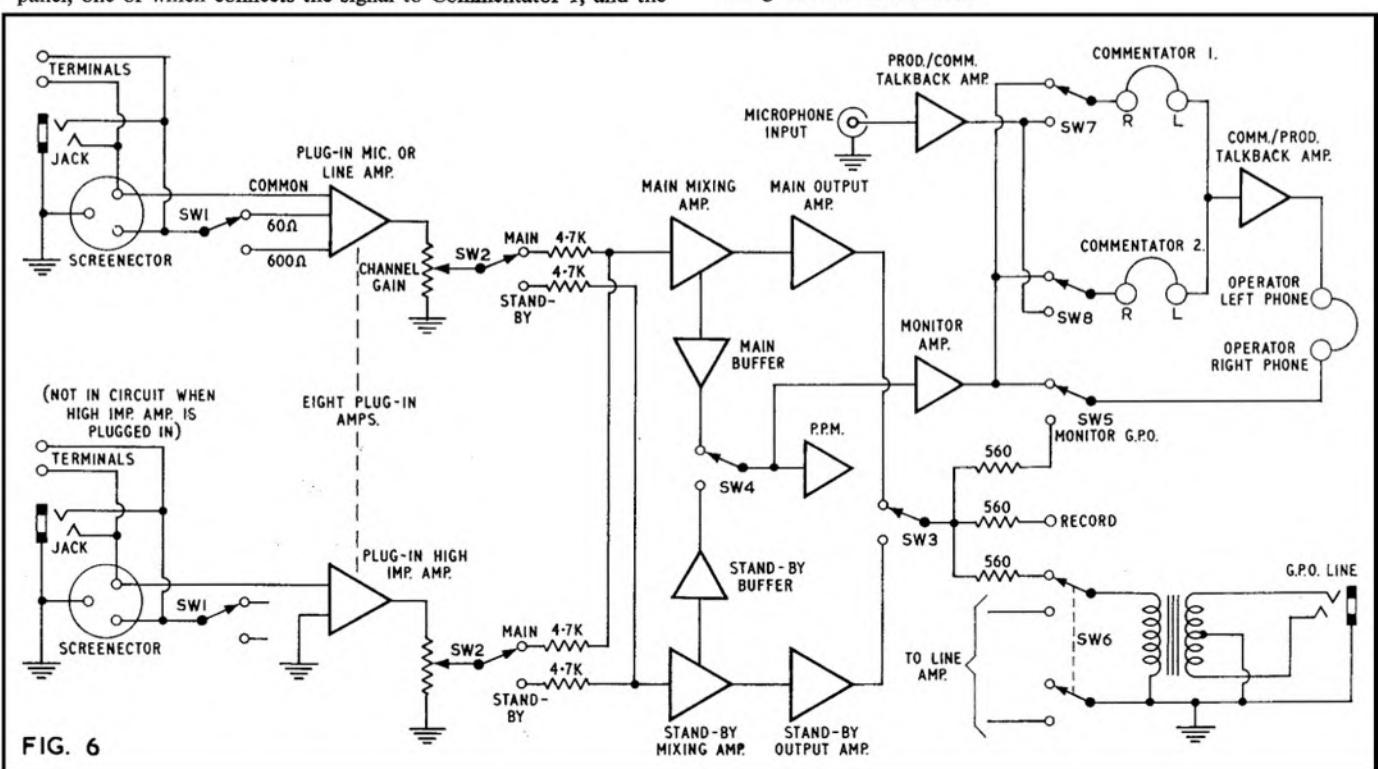


FIG. 6

“Q”-CORD

RI19K 33 Gns NOW 29 Gns

203 34 Gns NOW 29 Gns

60-10,000 c/s \pm 3db. sig/noise 38db. below test level weight 5lb. 50db. below peak.

3½ I.P.S. NARTB standard, wide tone control, 4½" spools, over 2 hours recording time, 2-track. Heads by Bogen, AC bias and erase. Straight through amplifier.

Accessories, headphones, remote control mike, foot control accumulator, mains adapters, 110V—240V AC.

Delivered anywhere in the U.K. carriage and insurance paid.

6 months FULL GUARANTEE—NO LABOUR COSTS.

NO INCREASE !!! Reduced 15%. Both machines “NOW” 29gns. !!! Hurry whilst present stocks last !!!

We are passing on to you the benefits from our anticipation prior to the surcharge !!! Still supplied with all basic accessories.

Write now for full details to :

C. Braddock Limited

266 Waterloo Road, Blackpool, Lancs.

Telephone : 45049

Hi-Fi News

Britain's best magazine
for the hi-fi enthusiast

REGULAR FEATURES INCLUDE

- ★ Details of new products
- ★ Hi-fi equipment reviews
- ★ Readers' problems answered
- ★ Stereo record reviews



Hi-Fi News

**2/-
MONTHLY**

Published on the 28th of the month.
From newsagents and bookstalls or 2/4 (pp)
from Link House,
Dingwall Avenue,
Croydon, Surrey.

TAPE RECORDER COVERS



Smart waterproof cover to give complete protection to your tape recorder. Made from rubberised canvas in navy, wine, tan, grey and bottle green with white contrasting pipings, reinforced base, handy zip microphone pocket and name panel.

Philips EL3538	...	...	63/-
" EL3542	...	...	63/-
" EL3536	...	...	70/-
" EL3515	...	...	57/6
" EL3541/15	...	...	57/6
" 3541/H	...	...	72/-
Starmaker	...	...	66/-
Cossor 1602	...	...	57/6
" 1601	...	...	63/-
" 1604	...	...	79/-
" 1605	...	...	84/-
Stella ST455	...	...	63/-
" ST454	...	...	57/6
" ST458	...	...	79/-
" ST459	...	...	84/-
Saba	...	...	63/-
Elizabethan FT.I	...	...	66/-
" FT.3	...	...	75/-
" LZ29	...	...	75/-
Fi-Cord IA	...	...	52/6
Fidelity Argyle	...	...	55/-*
Clarion (with strap)	...	...	52/6
Brenell Mk.5	...	...	77/-
" 3 star	...	...	69/-
Truvox R92 and 94	...	...	99/-
Robuk RK.3	...	...	67/6
Ferrograph	...	...	88/-
Sony 521	...	...	90/-
Revox	...	...	84/-
Optacord 414+412	...	...	63/-

* Without pocket

A. BROWN & SONS LTD.
24-28 GEORGE STREET, HULL. TEL. : 25413, 25412

Synchrotape

**HIGH FIDELITY
RECORDING TAPE**



**BRITAIN'S FINEST VALUE IN
P.V.C. RECORDING TAPE
STANDARD, LONG, DOUBLE & TRIPLE PLAY**

Adastra Electronics Ltd 167 Finchley Rd. London NW3

field trials of battery portables

BY DAVID KIRK



Number 11. SANYO MICROPACK

MANUFACTURER'S SPECIFICATION Tape Speed : Continuously variable. Recording System : Double-track, DC Bias. Recording Time : 17 minutes per track. Rewind Time : 4 minutes approx. Output Power : 100mW undistorted, 250mW maximum. Loudspeaker : 2in. elliptical. Batteries : Four 1.5 Penlight or rechargeable Nickel Cadmium cells. Microphone : Crystal. Earphone : 200 ohm magnetic. Dimensions : 6½ x 3½ x 1¾in. Weight : 2lb. Price including leather case and accessories : £20 9s. 6d. Distributor : Marubeni-Iida Co. Ltd., Moor House, London Wall, London, E.C.2.

THE Sanyo Micropack M35 is a most unusual tape recorder. It is cheap, it is small and it has a primitive transport system—but what does it represent in terms of value for money? Little equipment exists at a similar price with which some sort of comparison might be made, discounting the toy recorders selling at under £12. But there is something about the Micropack that lifts it right out of the toy category—it is an efficient, simple and very sturdy little recorder.

A thick leather case, carrying strap and accessory container, a crystal microphone, an earpiece and a tape magazine are included in the cost price. And oddly enough these accessories lack the inferior 'feel' common to so much Japanese equipment. The recorder itself, as can be seen from the photograph, is very attractively finished in a black and chromium steel case. Input and output sockets are of the miniature jack type enabling connection of microphone and external loudspeaker. Monitoring is possible whilst recording, through the earpiece, gain being varied by a single rim-operated control.

The Micropack magazine contains two spools mounted on a single axis and containing standard ½in. tape, oxide facing outwards at the open end towards the heads. Two guides incorporated in the magazine are set at such an angle that the tape threads diagonally from spool to spool. Inserting the magazine entails merely sliding it into a slot in the base of the recorder, to face the record-play and erase heads fitted to the inside roof of the case. Tracks may be changed by extracting the magazine and replacing it upside-down.

The two heads are offset to the same angle as the tape. Although a permanent magnet might have been expected, erasure was via a DC-energised head. Tape drive was ingeniously accomplished with a narrow-spindled motor acting on the rubber coated adjacent rims of the tape spools. When the magazine was inserted, a plastic slot provided a path for the motor spindle to engage. Switching to play or rewind caused the entire motor to move towards one or other spool and work against the rim. The principle is similar to—and indeed

less complex than—that employed on the infamous £5 portables, though needless to say the motor is a great deal more powerful. Switching to rewind from RECORD or PLAY increased the motor current, thereby increasing speed. Recording speed was continuously variable between about 1 and 2½ i/s, being governed by the somewhat crude method of reducing the DC motor supply.

Mechanical functions were controlled by a single rotary switch. When not in use, this folded flush against the top of the casing. REWIND was selected by twisting this control to the right, PLAY by twisting from OFF to the left and RECORD by twisting to PLAY and, at the same time pulling the control upwards. Forward wind, of course, was obtained by extracting and reversing the magazine. The playing-speed control had no effect on fast wind.

Access to all controls, including magazine, was possible with the recorder in its leather case though this had to be removed to get at the batteries. Battery and recording level were shown in the conventional manner through a small meter. The recorder was, in fact, very easy on batteries and, using penlight cells, proved very cheap to run.

At this point we turn to recording quality which indeed by normal standards was very poor. It is difficult to know whether a cure could be found but wow played havoc with music and was audible on most speeds. Something in the machine was causing the speed to go up and down by irregular amounts every few seconds. Although this irregularity generally hovered around a steady average speed, it was found necessary to use the variable speed control on several occasions to correct a tendency to Goon-like reproduction and similarly to compensate on occasions by increasing speed. Thus, running the recorder at maximum possible speed did not necessarily give the best quality, since no action could then be taken to compensate for any increase in speed whilst recording or decrease during playback.

But if recording was poor, as it must surely have been expected to be, why was the machine field tested in the first place? If you plan to collect the sound of the skylarks, record outdoor documentary tapes or dub from this to a mains machine, the Micropack is not for you. DC bias and a high wow level make the machine quite impractical for creative recording. But if you are looking for a sturdy little dictaphone to take down notes for later transcription to paper, the Sanyo Micropack has no equal for its size and price. A very important feature was that, however wide the tape speed went of its average mark, speech was always very clear and could be heard without strain.

Somewhat mysterious was the small push-button positioned close to the selector knob. This appeared to play no part in controlling the recorder and the only information offered by the instruction leaflet was the arrowed label announcing that this was a "starter button". By chance, I later discovered that pushing the button increased the motor speed slightly when the recorder was switched to rewind with the magazine removed. When tape was loaded into the recorder, the button had no detectable effect on playing or rewinding speed.

SMALL REQUEST

And while on the subject of instruction leaflets I should like to make a small request which I am sure can only benefit the manufacturers of Japanese equipment, should it ever reach their eyes. Please, ingenious gentlemen, replace your American-speaking Japanese translators with Japanese-speaking Englishmen. Of course, with equipment imported from non-English-speaking areas—be it Europe, Scandinavia, or even America, one expects to find the occasional clumsy translation. But Japanese equipment—from the £20 battery portable to the £150 mains stereo—is supplied with instructions which, though comprehensible, often border on the hysterically funny. As it happens, the Sanyo interpreter is a good deal more efficient than some of his rivals, though several faults still show through : "The sensitive microphone of your 'Micropack M35' will record noises and sounds if the recording were made in noisy place." "For cleaning the magazine, use damp cloth without such volatile oil as benzine or gasoline". Rather than "using the batteries for long hours, it is better to use them 1-2 hours and keep intervals." Small points, but their correction will prove yet another step along the road to perfection.

The labelling of a tape recorder as 'dictaphone' is generally the signal for the manufacturer to push prices to exorbitant levels since, so the logic goes, everything in the business-man's life is judged in terms of pounds, shillings and pence and an expensive product can only be better than a cheap one. The Sanyo Micropack is the first true dictaphone ever field tested, though it is by no means the only one tried, but it stands alone in being the only model I would recommend as offering reasonable value for money.

tape recorder SERVICE

BY H.W. HELLYER

Number 44 ELIZABETHAN TAPE RECORDERS

SINCE this series of articles began, three-and-a-half years ago, the aim has been to deal with as wide a variety of decks and complete machines as possible. This means that a number of tape recorders using decks that have already been discussed have had to be omitted in favour of others. Some readers have complained that their favourite machines appear to have been overlooked.

To these keen gentlemen, I must offer apologies and something in the way of a palliative by the present short look at the wide range of tape recorders put on the market under the *Elizabethan* trade mark. Ten years ago the company was known as *E.A.P. (Tape Recorders) Ltd.*, and the term Elizabethan was given to those products which achieved popularity. Notable among these were the *56* and the *Essex*. Previous models included the *Avon*, *Bandbox* and *Princess*, and various decks were used. The company took the name Elizabethan, invested in an effective (and no doubt expensive) advertising campaign, and continued to bring out competitively priced models such as the *Standard* and *Popular*, followed by the *LZ* ranges.

More recently, some changes have come about. Since the automatic model was introduced little over a year ago, and a completely transistorised version launched at the time of the 1964 Radio Show, Elizabethan Tape Recorders have twice changed hands. First, the company was bought out by *Algry Holdings*, then the whole share capital passed to *John Dallas & Sons*, an associate of *Lee Products*, whose name will be familiar to readers as distributors of *Elpico* and *Dulci* equipment. This should make no difference to the excellent service arrangements that Elizabethan have always enjoyed.

However, the servicing of Elizabethan tape recorders seldom calls for urgent application to the makers for rare parts. As we said previously, popular decks are generally employed, with standard 'non-

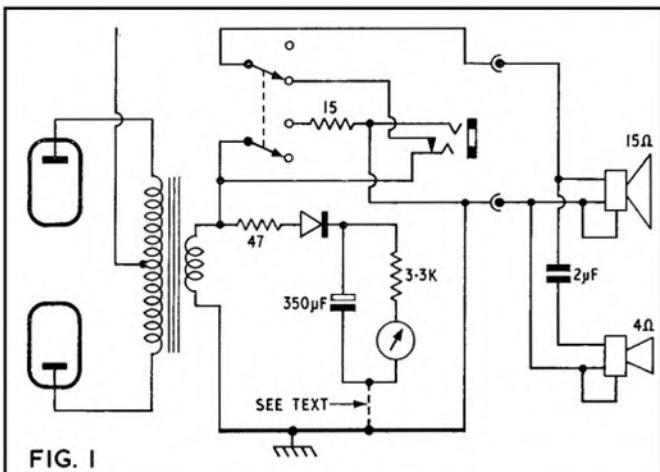


FIG. 1

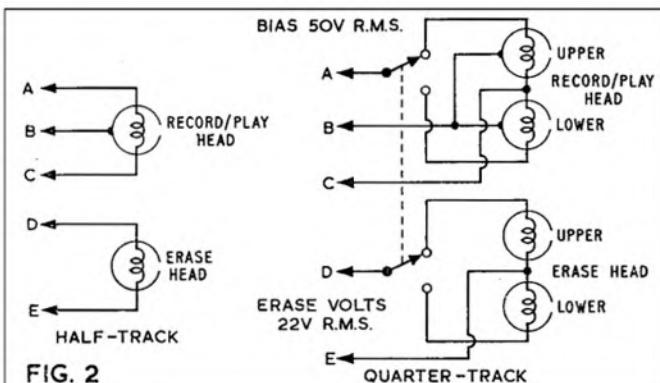


FIG. 2

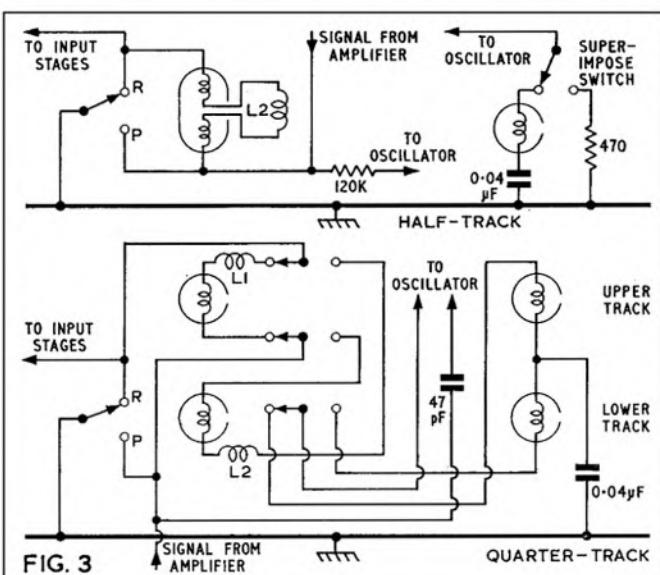


FIG. 3



'gimmicky' circuits. The exception was an attempt to break into the fiercely competitive simple-deck market with the LZ30, again using a standard circuit but with a deck mechanism obviously made with the twin aims of economy and simplicity in mind.

Going back to the beginning, the 56 and the model known as the De Luxe captured a large part of what was (in 1956) a tentatively growing market. The 56 used an early Motek deck, the K8. One important difference was in appearance of the press-button assembly, which used FAST and SLOW in place of RECORD and PLAY. The amplifier and power pack were connected by plugs and sockets, and servicing presented no particular problems, except that, with the four chrome-plated screws removed and the deck plate lifted, it was almost impossible to eradicate hum. This rather complicates matters when the fault which has beset the machine is a higher than usual hum level! If this is indeed the case, look for the two 100-ohm resistors, to deck via the mains connector plug, from each side of the heater line, particularly if one has gone open-circuit. A good wirewound preset of about 250-ohms tapped to chassis is an inexpensive solution—but take care to mount it in a position that permits its adjustment with the deck in place, or you will find the trial-and-error work rather tedious.

The amplifier of the 56 was similar to the De Luxe, except for differences required by the deck, as regards solenoids used with the Collaro deck, and the different impedance erase heads of the Motek. This last meant that a quite different oscillator coil is employed, and the two amplifiers are not interchangeable. The De Luxe uses a separate winding on the oscillator coil, which is tuned, and the erase head winding is taken to deck from a 0.04 μ F series capacitor. In addition, bias is variable, by the 50K series preset used in the De

Luxe, whereas the 56 has a fixed series circuit of 200 pF. and 22K in series.

An EF86 preamplifier is used, with ECC83 two-stage amplifier and EL84 output valve, doubling as oscillator during the recording function. A 6X4 full-wave valve rectifier is used, with a 100-ohm surge limiter in the output side of the circuit. Information has been requested about replacing this valve with a metal rectifier, the 6X4 being prone to flash-over if the machine is knocked while in use, or moved too soon after being switched off. If this is done, it is advisable to use a 100-ohm surge limiter in each branch of the AC feed, to protect the transformer. These resistors should be 3-5W, wirewound, and mounted so that the heat they will develop has the chance to dissipate efficiently.

The extra efficiency may also require that the filter resistor needs increasing. In the De Luxe, this is a 350-ohm component, but the 56 may already have a 1K resistor fitted. In any case, a 1.2K should be used in conjunction with the existing 40 + 40 μ F electrolytic capacitors for best performance.

The magic eye is an EM34. Often, a complaint is received that efficiency of the amplifier is below par where the trouble is simply that the magic eye is not indicating modulation correctly. Check the WX6 diode, and replace with an OA70, or similar component. Then, it may be necessary to juggle with the value of the series resistor which brings the signal to the rectifier, and a variation from 100K to 220K will prevent the magic-eye from showing over-modulation when the input is normal. But inadequate display usually means an amplifier fault, and this 100K should not be reduced.

Other Elizabethan machines using the Motek deck, this time the improved, three-speed K10, were the *Escort* and *Princess* versions. Both these dispensed with the preamplifier, using triode input, one half of an ECC83, with an ECL82 as driver and output stage, an EM85 record level indicator and a metal rectifier as means of HT supply. In the case of the Princess, a separate oscillator stage was employed, using a 6BW6. In each case, the circuit was conventional, and the superimposition feature, then a leading selling point simply consisted of a 470-ohm resistor switched across the separate winding of the oscillator coil in place of the Erase head.

The Avon had a very similar circuit, but used the first of the BSR decks, the TDI. (This was the deck with the belt-driven flywheel instead of the later, idler-wheel drive.) As modifications were introduced and different heads used, slight changes were to be noted on these machines. In particular, the oscillator coil of later versions had a different sequence of connections, the 350 pF capacitor on the record play switch was omitted, and the input resistor was reduced in some cases from 2 Meg. to 560K, although this is a matter for experiment, a high value being required for good bass response with the *Acos Mic 40* crystal microphone.

A machine that went one better in several respects—to jump ahead a bit and return later to the 'popular' range—was the Major. In particular, a ribbon microphone was used, quite comprehensive mixing facilities, $\frac{1}{2}$ -and $\frac{1}{4}$ -track versions were available, and it incorporated a push-pull output stage with a 15-ohm loudspeaker handling the bass and a tweeter for the high frequencies. This gave a good 5W output. The tape deck was the 'old faithful' three-speed *Magnavox Studio*.

Other features of this tape recorder were the use of a moving coil meter as modulation indicator, two neon lamps for function indicators, and a triple-winding oscillator coil. This made things a bit tricky at first, as it was then possible to have bias without erasure or erasure without bias and which undoubtedly led to the unnecessary changing of suspected faulty Record/Play or Erase heads before the circuit was studied.

The modulation indicator cheated slightly. It was a heavily damped moving-coil meter across the secondary of the output transformer, in series with a small diode and 3.3K resistor (with 47-ohm resistor as isolating input feed) with a 350 μ F electrolytic across meter and series resistor network to by-pass audio frequencies. The return path of the meter circuit went 'round the houses', being returned to chassis via the 7-pin socket, the record play switch and the second of the two octal plugs and sockets (one being used for power supplies). The loudspeakers can be muted by the appropriate switch, of course, with a 15-ohm resistor substituted as correct load for the output stage.

At this point I should perhaps interpose a note: there is nothing to prevent one hooking up a similar circuit, if the thought of a meter (continued overleaf)

"WHENEVER THE DEMAND IS FOR PRECISION RELIABILITY AND NATURAL SOUND REPRODUCTION—THE CHOICE MUST BE TANDBERG"

SERIES

6



Model 64 4 track
Model 62 2 track
Price 110 gns. each.

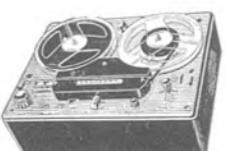
Semi professional
Stereo/mono tape
recorders with cathode
follower output. Three
speeds — Three heads
— Four amplifiers —
"Sound on sound" etc.

Model 74 4 track
Model 72 2 track
Price 93 gns. each.

Build-it-in or carry-it-around. Complete stereo/mono record and playback with own power amplifiers and speakers. Three speeds — dual record indicators — output for hi-fi pre-amps — centre channel for language teaching or cine work.

SERIES

7



SERIES

8



Model 823 2 track
(teak case) 54 gns.
Model 822 2 track
(Portable with lid) 57 gns.
Model 843 4 track
(teak case) 59 gns.
Model 842 4 track
(Portable with lid) 62 gns.

High class monaural tape recorders suitable for home, business, education, photo sound, etc. (3½ and 1⅓ I.P.S. speeds — 7" reels).

SERIES

9



Model 92 2 track only
(teak case) 69 gns.

High class monaural 3 speed (7½, 3½, 1⅓, I.P.S.) tape recorder, with quality comparable to the famous Stereo models. Extremely reliable machine recommended for all home and educational purposes, etc.

Tandberg

Send for further information and specifications stating the model number you are interested in, to:-

Elstone Electronics Limited, Edward Street, Templar Street, Leeds 2. Telephone: Leeds 3-5111 (7 lines)

TAPE RECORDER SERVICE CONTINUED

as modulation indicator is imperative. Practically any moving-coil instrument could be used, and the diode characteristics are not important. It needs only a little juggling with the value of the series resistor (the multiplier, to be exact) to obtain full-scale deflection for any level of modulation you require to be your upper level.

But a meter for a meter's sake is rather akin to those ridiculous puppets bobbing in the window of the car in front—idle decoration. Unless one is going to construct a decent circuit, the magic eye indicator is more efficient. Several circuits have appeared in articles that have been published in these pages, and it is not my place to enter the VU versus PPM controversy, or to offer constructional guidance. This did not stop one irate reader from basing a construction on the circuit published with my article for January this year, which gave the details of the alternative magic-eye and meter modulation indicators used by Truvox. He wrote accusing me of not "trying out circuits before rushing into print". Which, when one considers that these articles are based on service work at the bench, and deal entirely with commercial products, not do-it-yourself designs, is really somewhat laughable. However, I should perhaps have mentioned that the meter used by Truvox is a 'front-to-back' type, and indicates null point at full scale deflection, not vice-versa, as would be normal with the type of meter shown in the Elizabethan Major circuit of fig. 1.

THREE VERSIONS

Mention of do-it-yourself brings me to the reason for the next item on this month's agenda : dealing with the $\frac{1}{2}$ and $\frac{1}{4}$ -track differences of the 'Popular' models. These use the BSR TD2 deck, and there are really three versions. The 'standard' circuit is the simplest, with an ECC83 feeding an EL84, which doubles as oscillator. This was a $\frac{1}{4}$ -track version only, and need not concern us further, except to mention that the production run included models with DM70 and with EM84 modulation indicators and had the same oscillator coil changes mentioned above to allow for the later types of head fitted to the BSR deck.

A De Luxe version of the Popular has a totally different circuit, with ECC83 driving an ECL82, the pentode doubling as oscillator. Here we come to the four-track differences, which in this model simply concerned the head switching. Fig. 2 gives these details, and shows that a double-pole, double-throw switch does the job quite well.

The Popular 200 and 400 machines enjoy a similar circuit, with the BSR TD2 deck and the former model having $\frac{1}{4}$ -track Bradmatic heads and the latter, $\frac{1}{4}$ -track Marriott heads. Fig. 3 shows the differences. This time we need a three-pole switch to allow for the head reversal method of record play switching, and in this case also there is a change in the equalising circuit. The 150K feedback resistor, starred in my skeleton diagram, is increased to 560K. To allow for different head impedance and maintain adequate current without blocking off the oscillator circuit it is also necessary to change the bias feed resistor, another 150K, to a 47pF capacitor.

TOWARDS BETTER TAPING CONTINUED

for *p-n-p* transistor amplifiers and a positive supply for *n-p-n* circuits. However, it is not impossible to use a positive supply for a simple *p-n-p* amplifier, provided care is taken to see that the transistor junctions are not biased round the wrong way, since such an error could permanently damage the transistors. Of course, the circuit would not work with the supply reversed in polarity, but the collector junction would then be biased for forward conduction and a heavy current could result.

The circuit in fig. 9 shows a simple common-emitter amplifier powered from a positive supply. Actually, all that has happened is that a conventional circuit is inverted and the negative line instead of the positive line is earthed. The capacitor C1, which is a large value electrolytic, makes both sides of the power supply equal so far as signal is concerned.

We have seen how small transistor amplifiers can play an important part in tape recording, and this month we have seen how such amplifiers may be powered. Next month we shall discuss the use of head amplifiers of this nature in connection with 'converting for stereo'.

NEW PRODUCTS

NEW PRODUCTS

NEW PRODUCTS



NEW
FACILITY
ON
GRUNDIG
RECORDER

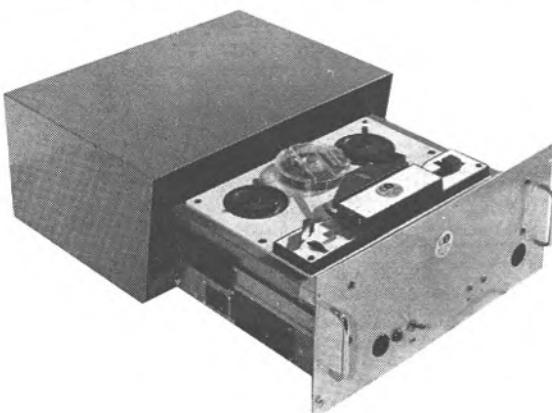
GRUNDIG have just announced a new $\frac{1}{2}$ -track automatic tape recorder, the TK400, selling at £49 7s. Speeds are $7\frac{1}{2}$ and $3\frac{3}{4}$ i/s and spool capacity is 7in. An interesting feature of this machine is variable speed winding, governed by a single sliding control, which permits inching, with the speaker in circuit, simplifying editing and the task of locating recorded passages. Cross-track recording and headphone monitoring can be achieved, using the MA2 accessory preamplifier. DIN sockets permit connection of microphone and high level signal sources together with external loudspeaker. Moving-coil GDM 311 microphone, tape and connecting lead are included in the price.

Manufacturer: Grundig (Great Britain) Ltd., Newlands Park, Sydenham, London, S.E.26.

WEST HYDE AUTOMATIC TAPE PLAYER

AMONG the many applications conceived by the manufacturers for the West Hyde Automatic Tape Player are: message repeating in supermarkets, guiding visitors around museums, sleep-learning and providing sound accompaniment to exhibition slide displays. Based on a modified BSR TD.10 tape deck, the player accepts spools of up to 4 $\frac{1}{2}$ in. diameter and endless loop magazines. A variety of accessories are available for the ATP/4, which retails at £97 10s., including coin-box start mechanism, press button, capacity touch, voice-operated and vibration operated switches. Four-track operation permits instant selection of four different messages, or a single message in four languages. An internal power amplifier supplies up to 1W for 25-35 ohm loudspeakers. Service is simplified by mounting the deck, amplifier and control panel on slides.

Manufacturer: West Hyde Developments Ltd., Ryefield Crescent, Northwood Hills, Northwood, Middlesex.



TUTCHINGS TEST TAPES
FOLLOWING the recent introduction of new CCIR record/playback characteristics Tutchings Electronics Ltd. has produced a range of moderately priced test tapes to suit these time constants. The five tapes making up the new range are available, cash with order, for 30s. each.

Test Tape 1 contains pure tones from 40 c/s to 10 Kc/s recorded to the 70 μ s characteristic at $7\frac{1}{2}$ i/s on Track 1, and a continuous 7.5 Kc/s tone for azimuth alignment on Track 2.

Test Tape 2 is recorded to 140 μ s at $3\frac{3}{4}$ i/s and comprises four frequency runs of pure tones from 40 c/s to 7.5 Kc/s on Track 1 and a 5 Kc/s azimuth alignment tone on Track 2.

Test Tape 3 carries pink noise in one-third octave bands from 40 c/s to 10 Kc/s, recorded to 70 μ s at $7\frac{1}{2}$ i/s.

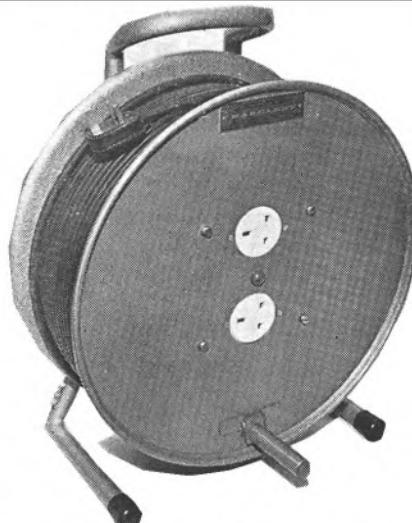
Test Tape 4 is again recorded to 70 μ s at $7\frac{1}{2}$ i/s and carries pink noise in one-octave bands with centre frequencies from 100 c/s to 6.4 Kc/s on Track 1 and unfiltered (white) noise on Track 2.

Test Tape 5 is a full-track recording with Track 3 blank. It contains white noise and can be used without test equipment to check head azimuth and vertical alignment on $\frac{1}{2}$ and $\frac{1}{4}$ -track recorders. Spoken identification of each band is given on Tapes 1 to 4. The tapes can also be supplied, at the same price, with the earlier 100 and 200 μ s time constants at $7\frac{1}{2}$ and $3\frac{3}{4}$ i/s respectively. Full-track recordings of any fixed frequency and with very low wow and flutter content are available in 3in. reels for 25s. Manufacturer: Tutchings Electronics Ltd., 14 Rook Hill Road, Friars Cliff, Christchurch, Hants.

RESLO MICROPHONE BOOM

RETAILING at £7, an 8ft. microphone boom is the latest addition to the Reslo range of recording accessories. Designed on the counterweight principle, the stand can be placed at any angle with the microphone up to eight feet from the base. Manufacturer: Reslosound Ltd., 24 Upper Brook Street, Mayfair, London, W.1.

MARCADDY
CABLE
REEL



MAINS tape recorders used at points remote from power facilities, in gardens, halls and similar situations requiring battery portability with mains quality, often present a problem when long cables need to be used. The new Marcaddy Handreel is designed to simplify storage and use of such cables, preventing tangling and eliminating potentially dangerous splices. Type and number of output sockets may be varied to order, with all models including a neon indicator set into the drum. Two sizes are available—Model 380.SO with 15in. drum diameter and 460.SO with 18in. drum. Effective spool depth is 6in. enabling between 200 and 500 feet of cable to be stored on the 15in. model, 320 to 800 feet on the 18in., depending on size of cable. Finish is in grey hammertone.

Manufacturer: V. L. Martin Ltd., Witney Works, Southall, Middlesex.

Exceptionally wide frequency response—virtually level from 40 c/s to 15 Kc/s—combined with excellent transient response, makes this the ideal instrument for the studio and wherever a high standard of fidelity is essential. Two models are available, each in three impedance sensitivities.

Model G.R. 1, having a semi-cardioid response, gives approximately 10 db suppression to high frequencies at the rear face. It is ideal for overcoming problems of feed-back between microphone and speakers.

Model G.R. 2, having a bi-directional "figure of eight" sensitivity pattern, discriminates against unwanted side noise both in the vertical and horizontal planes.

Supplied in attractive, padded instrument case, complete with 18ft. screened lead, swivel holder and connector.

A full range of accessories are available. Please send for illustrated leaflet.

Enquire too for details of the famous Grampian DP4 range of Moving Coil Microphones.



Grampian

GRAMPIAN REPRODUCERS LTD
Hanworth Trading Estate, Feltham, Middlesex.
Feltham 2657

We are happy to announce that we can now supply

BRAND NEW BRITISH & GERMAN P.V.C. RECORDING TAPES

High quality performance at lowest ever prices

Both manufactured by famous firms. All tapes are splice free and have fitted leaders and stop foils.

Not rejects or sub-standard, all tapes are boxed. Every tape is fully tested and guaranteed.

WHY NOT TRY A SAMPLE SPOOL?

Remember: full refund plus postage should goods not meet with full approval. To date no refund has been requested.

Standard Play	Length	English price	German Price
3"	150'	2/6	2/3
4"	300'	4/-	3/9
5"	600'	9/-	7/6
5½"	900'	11/6	9/-
7"	1200'	16/-	12/-
Long Play			
3"	220'	3/-	2/9
4"	450'	6/-	5/-
5"	900'	11/6	10/-
5½"	1200'	16/-	11/6
7"	1800'	23/-	15/6
Double Play			
3"	400'	6/-	5/-
4"	600'	8/6	7/6
5"	1200'	21/-	14/-
5½"	1800'	24/-	19/-
7"	2400'	39/-	23/-
Triple Play			
4"	1200'	15/-	14/-
5"	1800'	29/-	28/6
5½"	2400'	38/-	36/-
7"	3600'	49/-	47/6

Postage and packing 1/- per spool, 4 or more post free.
EMPTY SPOOLS: 3" 9d. 5" 2/-, 5½" 2/3, 7" 2/6.

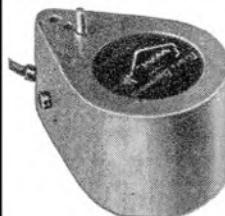
N. WALKER Ltd.

28 Linkscroft Ave., Ashford. Phone: 53020 Middx.



HEAD DE-MAGNETISER

De-magnetises tape heads quickly and simply... Also for pin-point erasing on striped film and tape recordings—removes local unwanted noises without detriment. Has nylon-cushioned twin probes with a concentrated de-magnetising field in the $\frac{1}{8}$ " gap between the arms. Pistol grip. A.C. mains. Professionally designed for professional recording engineers. £2.10.0.



TAPE ERASER

Erasers both sides of a 7" tape reel in 30 seconds and positively removes even the very low frequency portions of a recording. Use the WAL Tape Eraser, the only way to ensure an absolutely clean tape—quicker and better. Mains operated. Also erases sound from 16mm. film, 10" aluminium reels. Professionally designed for professional recording engineers. £6.18.6.



PRE-AMPLIFIERS

WAL pre-amps are made for every purpose. Fully transistorised, battery-operated, give high gain, completely hum-free. Laboratory built and fully tested. Professionally designed for professional recording engineers. Ask for details of WAL-GAIN Mono, £5.10.0. STEREO WAL-GAIN £7.10.0 and the superb WAL HI-GAIN with built-in switched equalisation for monitoring, dubbing, etc., etc. £7.16.0.

Free leaflets available on these professional aids to perfection... please write to:—



ELSTONE ELECTRONICS LTD

EDWARD STREET, TEMPLAR STREET,
LEEDS 2

SCOTCH MAGNETIC TAPE AT NEARLY HALF-PRICE!

Over 3,000 REELS of top quality MAGNETIC TAPE, double coated, SCOTCH. Made to best possible specification. Intended for electronic industry. This type rarely offered for domestic consumption. Unobtainable elsewhere.

THIS UNREPEATABLE OFFER REMAINS OPEN ONLY WHILE STOCKS LAST! DON'T DELAY—SEND NOW!

SCOTCH (type 150) Polyester L/P, 900ft. on 7in. reel. ONLY 15s. 6d. p. & p. ls. 6d. Three reels for 45s., post free; six reels for 84s., post free. Boxed, add ls. per reel. Spare Reels (unboxed) 7in. 2s. 6d. 5½in. 2s. 3d. 5in. 2s. 0d. 4in. 1s. 9d. 3in. 1s. 6d. Spare Reels (boxed) 7in. 4s. 6d. 5½in. 4s. 0d. 5in. 3s. 6d. 4in. 3s. 0d. 3in. 2s. 6d.

Other Half-Price Bargains—Agfa Tape, 1,200ft. 7in. reel, brand new, fully leadered. Normally 35s. only 19s. 6d., p. & p. ls. 6d. or 3 for 57s. 6d. post free. Boxed, add ls. per reel. Gevaert Tape, 600ft. 5½in. reel, brand new and boxed. Normally 21s. only 10s. 6d., p. & p. ls. 6d. or 3 for 30s. post free. Tape-Head Demagnetizer, ready for immediate use. Full guarantee. Worth 50s. only 27s. 6d. p. & p. ls. 6d. Tape Splicer, fully automatic, no razor blades. Worth 32s. 6d. only 16s. 6d. p. & p. ls. 6d. METRO ANTISTATIC TURNTABLE MAT, 12/3d. POST FREE.

SUMMER CLEARANCE SALE

TURNTABLES

Garrard 301/SABE £20

Garrard 4HF/GC8 £14

Garrard AT6/EV26 £11

Decadee De Luxe £15 (Slightly marked)

Thorens TD135 £32

AMPLIFIERS/TUNERS

Eagle TSA218-Stereo Transistor Amplifier ... £39

Rogers Cadet III AMP/control Unit £26

Truvox TSA-100 Stereo Transistor Amplifier ... £43

Eagle FMT640 F.M. Tuner ... £19

SPEAKERS, Etc.

Kelly Mini Mk.III Enclosures (pair) £13

Kelly 8" Enclosure (A few only) £10

Goodmans Maxim £14

Deram Transcription Cartridge 75/-

Diamond Stylus (most types) ... 10/-

Carriage and packing free (U.K. only) all new equipment but slightly shop soiled.

Our "UNIVERSAL" equipment case, which is a plinth designed to take almost all tape decks, Gram Turntables and Transcription Units is now available at the NEW LOW PRICE of 45/- CARRIAGE FREE. Dimensions: 18in. x 18in. x 4½in.

CLEARANCE below Motor Board, 3½in. Finish: Two-Tone Grey or Walnut.

K. J. ENTERPRISES (Dept. T.R.3) 7 Mason's Ave., Wealdstone, Middx.

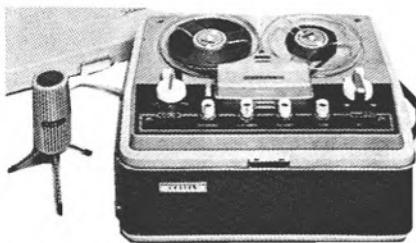
HAR 0395 (closed p.m. WED. and SAT.)

● 24-HOUR RETURN MAIL ORDER SERVICE

● ALL MAKES OF AUDIO EQUIPMENT SUPPLIED

equipment reviews

COSSOR
CR1607
STEREO



MANUFACTURER'S SPECIFICATION: Transistorised 2-track stereo tape recorder. Speeds: 3½ and 1⅓ i/s. Spool Capacity: 5½ in. Frequency Response: 80 c/s to 13 Kc/s ±3dB at 3½ i/s; 80 c/s to 10 Kc/s ±3dB at 1⅓ i/s. Two internal speakers. Multiplay facilities and straight-through amplification. Stereo microphone supplied. Headphone monitoring whilst recording. Automatic stop. Fast wind: 900ft. in 3 minutes. Power consumption: 35W. Inputs: Microphone—1K at 1mV. Gram.—500K at 150mV. Diode—20K at 2.5mV. Outputs: Diode—20K at 1V. Headphones—1.5K at 200mV. Speaker—3 to 7 ohms at 1.5W. Dimensions: 17 x 13½ x 7in. Weight: 20lb. Price: £59 17s. Manufacturer: Cossor Radio & Television Ltd. 233 Tottenham Court Road, London, W.1.

READERS of my recent reviews will have noticed that most all-in stereo recording and reproducing systems have been very heavy and barely transportable. Here we have one weighing a mere 20lb. This has been made possible by completely transistorising the electronics and by using a lightweight cabinet and speakers and a single motor drive two-speed deck.

For some reason, the designers have chosen to place one loudspeaker on the side of the cabinet and the other at the front. The result of this is that the stereo effect on the internal speakers is reduced almost to vanishing point, unless one rests one's chin on the front left-hand corner of the cabinet. I would have preferred a speaker on each side

for the widest possible spacing, but perhaps they are being realistic in presuming that, after a few stereo experiments, the machine will be used mainly for mono and that a front facing speaker is an advantage for this application. If an external speaker is to be used for better stereo spacing, it should be plugged into the LH speaker socket, and placed to the left of the recorder. This then leaves the front speaker in the recorder as the RH stereo source.

A single switch, on the right, controls all tape movement. It is pressed down to start the tape, down again to stop it, turned to the left for rewind and turned to the right for forward wind.

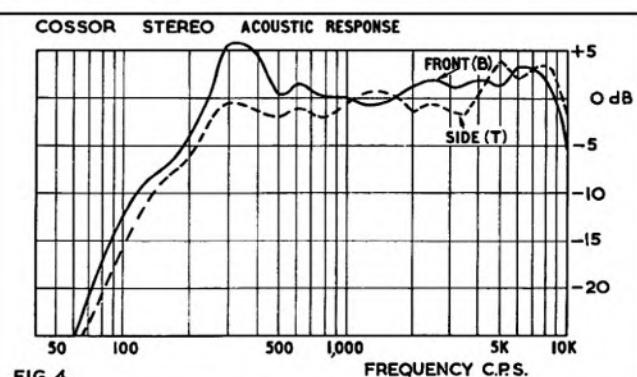
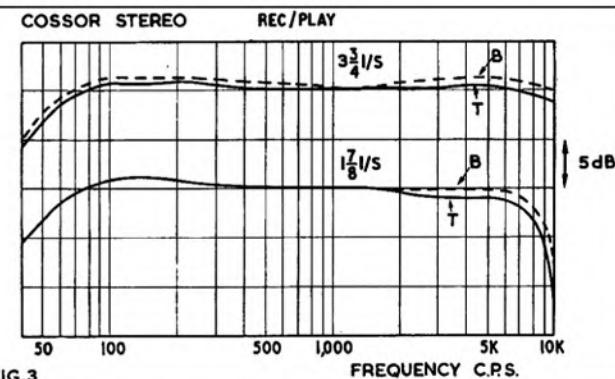
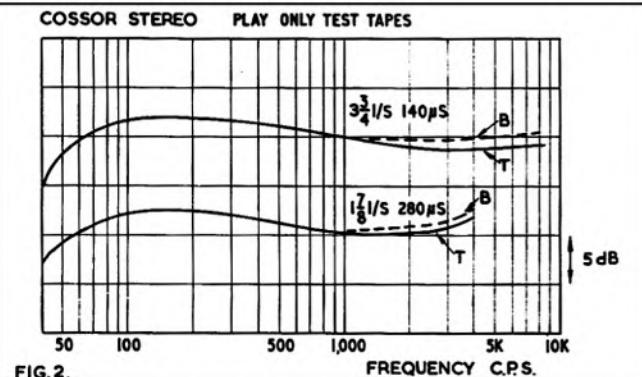
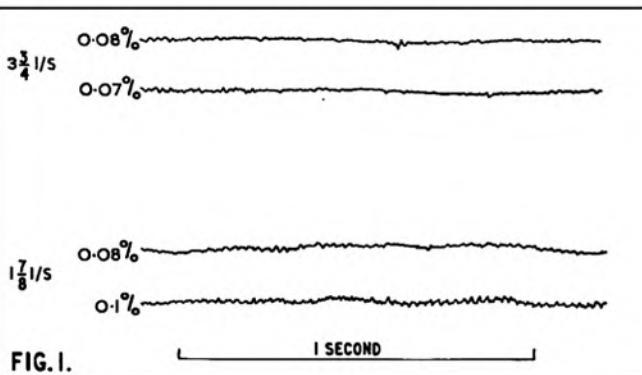
The matching knob to the left gives two mono positions: upper and lower track, a central stereo position, where each track plays through its own amplifier and speaker, and a PA position where the recorder is converted to a mono or stereo amplifier for playing records or for public address via the microphone.

AUTOMATICALLY RELEASED

For recording, a red button must be depressed when the tape is started, but it is automatically released, to revert to playback, when the tape is stopped. The adjacent white button is for 'Multiplay' or track to track transfer with extra recording, and these facilities are fully explained in the comprehensive instruction book.

The tape speeds were about 0.5% fast at both 1⅓ i/s and 3½ i/s. Wow and flutter were very low at 0.07-0.08% RMS at 3½ i/s and 0.08-0.1% RMS at 1⅓ i/s. Pen recordings of the short term speed fluctuations are shown in fig. 1. A very slight trace of capstan wow at 3 c/s is visible on the 1⅓ i/s traces. A year or so ago such figures would have been considered excellent for tape speeds of 15 i/s and 7½ i/s. Nowadays they are commonplace on good quality Continental machines and, what is more important, they are maintained consistently from machine to machine, and over the lifetime of any given recorder.

Test-tapes with 140μS and 280μS recording characteristics were played at 3½ i/s and 1⅓ i/s to give the responses of fig. 2. It will be (continued overleaf)



ANOTHER 'SPECIAL' FROM **R.E.W.!**

**The FAMOUS
ROBUK RK4
3-Speed—2-Track
TAPE RECORDER**

BRIEF SPECIFICATION

Three speeds : $1\frac{1}{2}$, $3\frac{1}{2}$, $7\frac{1}{2}$ i.p.s. Twin track • Simplified "Piano-Key" operation—just press to "Record", "Rewind", "Replay" • Frequency Response : $7\frac{1}{2}$ i.p.s. 60-14,000 cycles ± 3 db. $3\frac{1}{2}$ i.p.s. 60-7,000 cycles ± 3 db. $1\frac{1}{2}$ i.p.s. 60-3,500 cycles • Signal to Noise Ratio : Better than 40 db. • Total Wow and Flutter : Less than .2% at $7\frac{1}{2}$ i.p.s. Less than .3% at $3\frac{1}{2}$ i.p.s. • Output : 2.5 watts • Amplifier compensated at all speeds • Recording level indicator "magic eye" • Mains Voltage : AC only 200-250V. • Consumption : Approx. 95 watts • Max. tape spool size : 7in. (accommodated with lid closed) • Tape running time : Tape length of 1,200ft. to 2,400ft., will play from 64 mins. to over 84 hrs. according to type of tape and speed used • Separate gain controls for gram. and mic. to facilitate mixing • Separate monitor gain control with listening through speaker while recording. (Avoids accidental feed-back). • Separate on/off switch, enables tone and volume controls to be set correctly and not disturbed when switching off • Separate tone control • Rapid rewind and fast forward speeds (1,200ft. in less than 1 min.) • Safety record button to prevent accidental erasure • Superimposition switch on deck • Pause control • 7in. x 4in. high flux elliptical speaker • Socket for external amplifier • Socket for extension speaker • Size : 16in. wide x 11in. deep x 7in. high • Weight : 23lb. • Attractively styled two-tone case in scratchproof washable plastic.



Current Price 36gns.

R.E.W. Special Offer !

10 gns. allowed without question in part exchange on your old equipment—any age, any type, any condition—try us with an offer!

ONLY 26GNS.

OR ON INTEREST FREE TERMS £4.6.0 deposit,
and 12 monthly payments of £1.18.4

Supplied complete with microphone, 7in. spool of tape, wind-on spool.
Guaranteed.

We always carry a comprehensive stock of over 400 machines—including the latest Ferrograph 631 at 88gns.—also a large selection of shop soiled and second-hand tape recorder bargains. Ask for lists !

Post the Coupon NOW!

I enclose £..... Cash/Deposit for Robuk RK4....

I have to offer in part exchange.

Name.....

Address.....

R.E.W. (Earlsfield) Ltd., DEPT. T.R., 266 Upper Tooting Road, London, S.W.17. Telephone BALham 9174-5

COSSOR CR1607 REVIEW CONTINUED

seen that the bottom head—or amplifier—equalisation is very slightly better, but that both tracks are very close to the desired playback characteristic.

System noise, with no tape running, was 40dB below test-tape level at both speeds.

Overload tests were first carried out at a test frequency of 500 c/s, and the magic-eye beams just closed at a level 11dB above test-tape level. Waveform distortion of the recorded signal was just evident at this point.

Next, test tones were recorded at test-tape level to give the record-play responses of fig. 3. The test signals were fed to the diode input, and measured on playback at the diode output socket.

Peak recording level signal was erased and the ratio found to be 50dB. Once again, the effortless ease with which this recorder achieves test figures at the lower limit of probability must be remarked upon!

Bands of filtered white noise were recorded at $3\frac{1}{2}$ i/s on both tracks and the sound output of each speaker measured separately to give the responses shown in fig. 4. Responses are smooth from 500 c/s upwards, but the front facing speaker shows a slight cabinet resonance at 300 c/s. Sound output falls sharply below 250 c/s on both channels.

The stereo microphone supplied with this recorder consists of two dynamic cardioid microphones in a single case with facilities for setting the forward axis of the two microphones at various angles ranging from approximately 75° to 180° ; red dots on the supporting ring allow the angle to be set at 90° for normal use.

The frequency response and front/back ratio of one microphone was measured in a white noise sound field and these responses are shown in fig. 5. It will be seen that the front-to-back ratio is better than 10dB over the range 500 c/s to 5 Kc/s, but that the units are nearly non-directional above and below these frequencies.

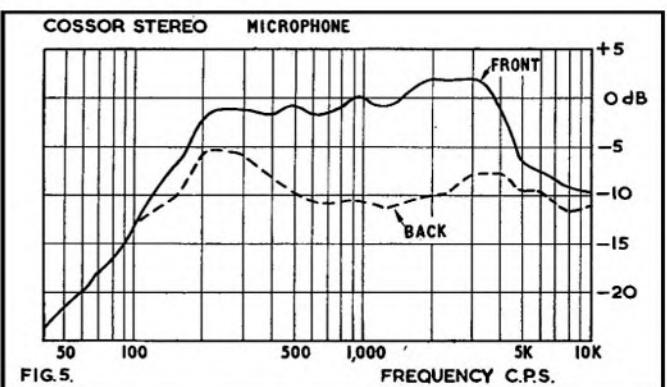
COMMENT

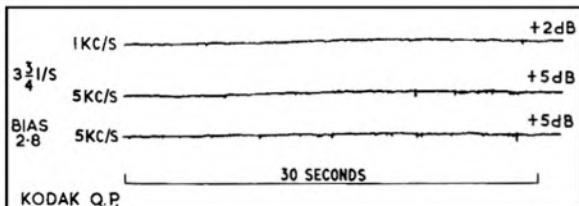
Technically, this recorder is as near perfect as is commercially possible at this time and at this kind of price. As a stereo recording and reproducing system, I am less optimistic. It will let the recording enthusiast experiment to a limited extent with stereo techniques, particularly if external speakers are used, but stereo sources other than the microphone will have to be used if the full recording potentialities of the machine are to be realised. Like so many other stereo recorders, it is a little before its time; we need stereo broadcasting before we can build up a library of decent stereo recordings. Otherwise, unless we have musician friends, we are reduced to copying gramophone records or marching up and down in front of the microphone to demonstrate that the voice comes first from one loudspeaker and then the other!

It is also a pity that a $7\frac{1}{2}$ i/s speed was not provided (even as an alternative to $1\frac{1}{2}$ i/s) as most good quality commercial stereo tape recordings are only available at this speed.

I think the real possibilities of this recorder are in the simultaneous recording of two quite different tracks, or the transfer of information from track to track with added material from microphone or disc; the excellent response, low wow and flutter and good signal/noise ratio would all be exploited to the full using these 'Multiplay' facilities.

A. Tutchings.





KODAK QUADRUPLE PLAY

KODAK tape is manufactured in France and distributed in this country by Kodak Ltd., Kingsway, London, W.C.2. The very thin base and oxide layer allows 800ft. to be placed on a 3½in. spool. It is particularly recommended for battery powered portable recorders, although it can be used on mains recorders in good condition if care is exercised.

My tests show that the sensitivity at optimum bias is higher than normal, that the high note response is much improved over normal tapes and that the drop-out count and amplitude fluctuations are the lowest of any tape yet tested.

Test conditions were the same as the other tapes reviewed in this issue, i.e., ½-track, 3½ i/s, 1 Kc/s and 5 Kc/s test tones and 500 c/s overload test. Fig. 1 shows the drop out chart and sensitivity figures for optimum bias which gives maximum output at 1 Kc/s. The drop-outs and random amplitude modulation are completely negligible and seldom exceed 2dB. This is almost certainly due to the very thin limp base and the fine grain and surface finish of the oxide. Test tones and sustained musical notes showed a smoothness seldom heard at this tape speed. The 2dB increase in general sensitivity shows that the oxide is very potent, as the improved sensitivity is achieved despite the very thin oxide layer which must be used in tape of this overall thickness. The extra 3dB in sensitivity at 5 Kc/s is partly due to low spacing losses due to the intimate contact this tape makes with the recording head, but even allowing for this, the coercivity of the oxide must be considerably higher than usual. This suggests that 'print through' might also be very low, and staccato speech tests, with silent intervals between words, recorded at full recording level showed no evidence of print through whatever, even when the tape was stored at a temperature of 40°C for several hours.

Optimum bias for maximum sensitivity was 30% lower than normal (2.8 against four units of bias), but increasing the bias only reduced the sensitivity without altering the frequency response at all, which remained at plus 3dB at 5 Kc/s at any bias. The 1 Kc/s sensitivity figures for various bias settings were: +2dB at 2.8 to 3.0, 0dB (normal sensitivity) at 3.5, -3dB at 4.0 (normal bias). This effect occurs because the full oxide thickness is used at all times. The same effect was noted in a recent (June 1964) review of certain Soundcraft magnetic tapes.

Overload tests at 500 c/s showed that waveform distortion began at approximately 9dB above test tape level. This is also explained by the extreme thinness of the oxide layer (normal tapes accept 12dB without distortion). This 3dB reduction in peak recording level is the only price we have to pay (apart from the slightly delicate handling necessary for this extremely thin tape) for all its other virtues.

I can wholeheartedly recommend this tape for all low speed, four-track recorders which are able to handle the tape in a satisfactory manner.

Mechanically it must necessarily be rather delicate, but technically it is superb, and I look forward with great interest to testing further samples from the Kodak range of recording tapes. A. Tutchings.

KODAK STANDARD, D.P. AND T.P. TAPE

THE above review of Kodak quadruple play tape was written before Graham Balmain's excellent article on tape testing appeared in last month's issue, and the present review is a sequel to my final paragraph which expressed a wish to test further samples from the Kodak range.

I am afraid we have only one sample of each type, although Kodak did offer to select tapes from various batches to meet the criticism of limited sampling. Nevertheless even these single samples show that Kodak have indeed got something rather special in a high potency (continued overleaf)

get tape recorder regularly

Make sure and order your copy from your newsagent NOW! or use the coupon below and have Tape Recorder sent to your home by post each month

ORDER FORM

TO 'TAPE RECORDER', LINK HOUSE,
DINGWALL AVENUE, CROYDON, SURREY

Please send me a copy
of 'Tape Recorder' every
month for
months

commencing with the
issue

for which I enclose
remittance value

NAME.....

ADDRESS.....

POSTAL RATES

GREAT BRITAIN: POST PAID FOR 12 MONTHS

30/-, 6 MONTHS 15/-

OVERSEAS: POST PAID FOR 12 MONTHS 32/6

6 MONTHS 16/3

— YOUR TAPE DEALER —

London Area

CITY & ESSEX TAPE RECORDER CENTRES

242/4 Pentonville Road, Kings Cross, London, N.1 TERminus 8200
 228 Bishopsgate, London, E.C.2 BiShopsGate 2609
 2 Maryland Station, Stratford, London, E.15 ... MARyland 5879
 205 High Street North, East Ham, London, E.6 GRAngewood 6543

BRITAIN'S LARGEST TAPE RECORDER SPECIALISTS

Disc and Tape Reproducing Equipment and Tape Recorders
by Leading Manufacturers

Custom Built Installations

All High Fidelity Requirements and Services Available

Estimates Free

Personal Service

Custom High Fidelity

371 Green Lanes, Palmers Green, N.13 PALmers Green 5228

hifi

**FOR ALL LEADING
AUDIO EQUIPMENT**

call, write, or telephone

hampstead HIGH-FIDELITY

91a Heath Street, Hampstead, London N.W.3 Telephone HAMpstead 6377

**LASKY'S
RADIO**

ALL LEADING MAKES IN STOCK

Cash or Easy Terms

LONDON'S FINEST SERVICE

207 EDGWARE ROAD, W.2

PAD 3271/2

152-153 FLEET STREET, E.C.4. FLE 2833
33 TOTTENHAM COURT ROAD, W.1. MUS 2605

★ PART EXCHANGES WELCOMED ★

- ★ ALL MAKES Hi-Fi and Tape Recorders supplied
- ★ PART EXCHANGES. Terms 12, 18 or 24 months
- ★ SONY Specialists. Full Range Stocked
- ★ GUARANTEED Recorder Repair Service

MAC'S CAMERA SHOPS LIMITED

250-252 KING STREET, HAMMERSMITH, LONDON, W.6
RIV 8581-2 Hours 9-6 Thursday 9-1

SHEEN TAPE RECORDER CENTRE

SPECIALISTS IN TAPE RECORDERS, ACCESSORIES, HI-FI EQUIPMENT
YOUR CENTRE FOR FRIENDLY HELP—SALES AND SERVICE

8 STATION PARADE,
SHEEN LANE, SHEEN,
LONDON, S.W.14

Showrooms Open until 7 p.m.
PROSPECT 0985
(Opposite Mortlake Station S.R.)

WIMBLEDON'S TAPE RECORDER CENTRE

Agents for : FERROGRAPH, VORTEXION, SIMON,
BRENELL, GRUNDIG, PHILIPS, COSSOR, ETC.
GET IT TAPE THE EXPERT WAY—By letting us install your apparatus

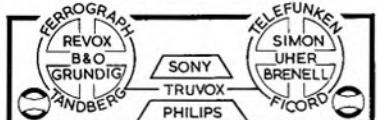
TEL-LEE-RADIO
LIBerty 4946 220 The Broadway, WIMBLEDON, S.W.19

Cheshire

STOCKPORT AUDIO CENTRE

FINEST IN NORTH WEST

★
ALL MODELS
ON
COMPARISON
DEMONSTRATION



★
EVENING
DEMONSTRATIONS BY
APPOINTMENT

FAIRBOTHAM & CO. LTD., 58-62 Lower Hillgate, STO 4872

KODAK TAPE REVIEW CONTINUED

oxide and a coating technique which, to quote from their advertisements "is accurate to millionths of an inch".

All tapes were tested at 3½ i/s, half track, at fixed frequencies of 1 Kc/s and 5 Kc/s for periods of 30 seconds. The second 5 Kc/s test was on track 2. Bias and sensitivity are relative to a standard reference tape which was selected to have a good average sensitivity, frequency response and bias requirement. Fig. 1 shows high speed pen recordings of each 30 second test, with sensitivity figures on the right of each trace, and type and bias information to the left.

T-100 is a professional grade standard play tape on a 1.5 mil Triacetate base ; this has been selected to break cleanly in the event of

excess tension so that it may be spliced without loss of signal.

We have been taught to expect a high drop out count on domestic acetate base standard play tape, but examination of the relevant pen traces show that this tape is blameless in this respect ; few drop-outs exceed 3dB and the average is well under 1dB. Bias for maximum output at 1 Kc/s is identical to my reference tape. Sensitivity is up 2dB at 1 Kc/s and a further 1.5dB at 5 Kc/s.

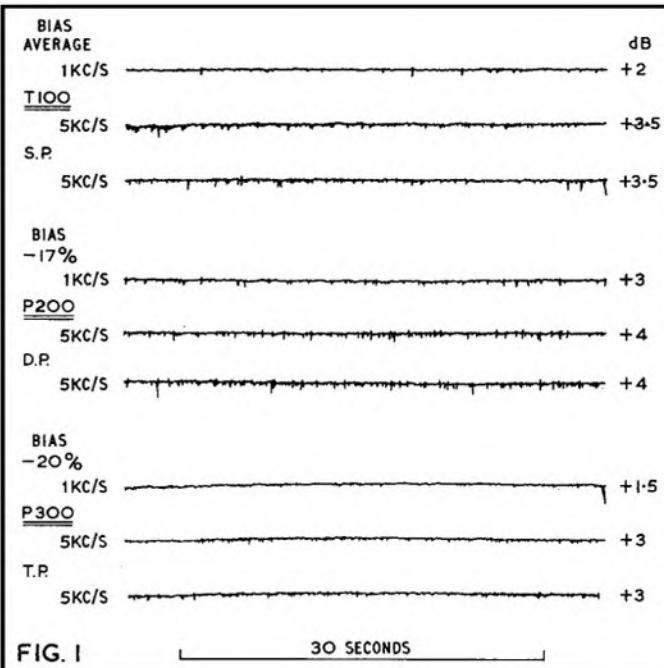
P-200 is a double play tape on a pre-stressed polyester base. Drop-outs are of low amplitude and seldom exceed 1dB. Occasional 3dB drops showed on the second 5 Kc/s test. Optimum bias for maximum output at 1 Kc/s was 17% lower than average bias. Sensitivity was up 3dB on average at 1 Kc/s and a further 1dB at 5 Kc/s.

P-300 triple play polyester based type is still 1.5dB above average sensitivity despite the reduced oxide thickness. Bias for maximum 1 Kc/s output is 20% below average. The 5 Kc/s is 1.5dB above the mid range sensitivity. Drop-outs are all below 1dB on both 1 Kc/s and 5 Kc/s test runs.

Thus, all Kodak tapes show a significant increase in sensitivity and improvement in high note response together with outstanding output uniformity. These characteristics are used in different ways depending on the application. The T-100 for example (or its long play equivalent V.150) would use the increased sensitivity to improve the signal-to-noise ratio and reduce distortion at the higher speeds by overbiasing to drop the 1 Kc/s output by 1-2dB without the usual sacrifice of short wavelength response.

The P-200, P-300 and P-400 tapes are designed for use at the lower speeds, 3½ i/s or below, and the lower bias requirements shown in these tests are generally met by the almost universal practice of underbiasing on recorders in this speed range. Even if your recorder is properly biased for normal tape, the Kodak tapes will still show a marked improvement in high note response, as overbiasing only

(continued on page 311)



READERS' PROBLEMS

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

SQUEAKING TAPE

Dear Sir, I own a Philips EL3548 tape recorder and a number of World Record Club tape records. One or two of these tapes now 'squeak' when the machine gets warm, to such an extent that the music cannot be heard. The tapes in question also give trouble when played on a friend's Grundig. The noise is most annoying, to say the least, and I would be grateful for suggestions as to how it can be stopped.

Yours faithfully, L.R., Ikeja, W. Nigeria.

The squeaking you complain of is probably caused by a coating which has been slightly over-plasticised. The best remedy, of course, is to object strongly to WRC and ask for a replacement; they may not know about the trouble and might be glad to hear of it so that they can be more careful in future. In any case they will certainly want to protect their good reputation.

You can check whether or not the coating is at fault very easily by lifting the pressure pads slightly away from the heads while the tape is running, whereupon the squeaking should stop. In a bad case, however, the squeak may remain by virtue of simple tape/head or tape/guide contact.

If you do not want to return the tape to WRC, there are two possible remedies. One, which is permanent, is to fix a short length of PTFE (Polytetrafluoroethylene) rod on your machine in such a way that the tape has to pass over it before reaching the heads. The tape then retains a molecular layer of this very efficient lubricant each time it passes over the rod. The other, which may have to be repeated every few playings, is to spray the heads and guides lightly with a PTFE aerosol, which will have much the same effect. You may have to spray the pressure pads also, but probably not more than once.

THE DANISH WAY WITH TAPE CONTINUED

things which I never knew before. It is also an art of its own to make a good tape. It might start with a short piece of music or something else characteristic of the sender. Using modern double and triple play tapes allows scope for such things as sound pictures from other countries when you have been on holiday.

I had two English friends visiting me last summer. We made a diary on tape. Every evening we had a discussion about the events of the day and it was all taken up on tape. Later some suitable music was added and altogether it made a very pleasant souvenir of their holiday in Denmark.

Some other clubs are entirely different. They have a very full and varied programme and most amateurs will find something to cater for their own interest or ability. A beginner might, for instance, join the evening for beginners, where his problems will be discussed and instruction given.

For the more experienced members there are various competitions—the best tapes being awarded prizes. New aggregates will be demonstrated, for example, the Philips video tape recorder. Instruction in the recording of sound pictures (documentaries) will be given on outdoor excursions.

One of the amateur clubs runs a welfare operation. They collect

MAGNETISED HEADS WITH THE LINEAR 45X

Dear Sir, I have an early Linear 45X tape amplifier which, when switched from record to replay, has the annoying fault of causing head magnetisation and consequent hiss. I can overcome this by switching the mains supply off and waiting for about 40 seconds before changing functions and then switching on again. I have changed the main 30 + 30 µF smoothing capacitor and the EL84 valve but to no avail.

Yours faithfully, K.R.W., Leeds 12.

You do not say which deck is being used with the Linear 45X, but your letter suggests that it may be a deck incorporating a neutralising STOP action. Correct procedure is for the oscillator to be switched out and for there to be a slight delay before playback is engaged. This is a matter of less than a second, and is normally taken up by the STOP action between record and playback functions. You should insert your own isolating switch, in series with the oscillator HT, superceded by the replay switch selection (i.e. the two in parallel). The oscillator then dies away decrementally, allowing the head to magnetise in the same way as you are doing manually by switching off the mains supply. But 30 to 45 seconds is not necessary if such a 'break-before-make' switch device is made. Depending on the deck, this can be either a Taxley wafer, with the wiring such that the wiper of the engaged section leaves the oscillator feed line before, making the head connection for replay, or simply on/off switch mechanically coupled to the STOP button, switch or key, in series with the oscillator HT feed and in conjunction with the normal amplifier switching.

FLUTTER ON THE MOTEK DECK

Dear Sir, I recently purchased a Regentone RT 50 for dubbing purposes and find it an excellent recorder, despite the need to familiarise with the Motek K9a deck, which spools from right to left. The deck is now giving pronounced flutter at 3½ i/s and I am suspicious of the capstan bearings. If these are maladjusted the capstan may be leaning to one side slightly. Could this be the cause?

Yours faithfully, E. M. Winchelsea.

It seems unlikely that the flywheel capstan is out of alignment and causing flutter. Much more likely is a discrepancy in pad pressure or excessive take-up snatch. These points are dealt with in Tape Recorder Service No. 3 (April 1962). In addition you may care to check the idler wheel, which is a prevalent offender. Usually this can be heard when the machine is operating with no tape loaded. If you want to check the upper bearing of the flywheel shine a bright light sideways along the tape path and note the reflected shine. Check also the pinch wheel for deformation. Light lubrication may also help, especially at the bottom bearing of the flywheel, where a graphite grease is needed. You should also check that the spools are level and note that any discrepancy here requires adjustment of the spring-loaded motor screws.

local news of general interest and once a week visit the local hospital and the home for old people to play their tapes. Also short sound pictures of local places of interest will be played for the old people. This welfare operation has become very popular and it also gives much pleasure to the members themselves.

KODAK TAPE REVIEW CONTINUED

reduces output (and distortion and intermodulation) without affecting frequency response (see P-400 review). This effect (no change of frequency response with increase of bias) was first noted in a June 1964 tape review and is now thought to be due to the use of a very thin oxide layer. As it is relevant both to the present review and Mr. Balmain's recent article, I would like to quote my final comment : "... it is not difficult to devise tests which will show up the most subtle differences in the performance of magnetic recording tapes, but the spread in characteristics within any one manufacturers product may be comparable to that between different manufacturers. Thus, spot checks on random samples of tape from different sources may give a false picture of the average performance and consistency of any one manufacturer's output. As a reviewer, I can only test the samples submitted to the best of my ability and hope that the occasional 'flash in the pan' exception may point the way to better things." Apparently it did !

A. Tutchings,

— YOUR TAPE DEALER —

Devon

PLYMOUTH

TOM MOLLAND LTD.

102 CORNWALL STREET

Phone 69282

FERROGRAPH, REVOX, TANDBERG, SIEMENS, AKAI, UHER, SONY,
B & O STEROMASTER, FI-CORD, AND

The largest selection of Hi-Fi equipment in the West

Gloucestershire

CHELTENHAM

MODERN RADIO (Cheltenham) LTD.

Service and Hi-Fi Dept.

40/42, St. James Street

Ferrograph, Revox, Telefunken and Truvox always in stock
TELEFUNKEN appointed Service Agent
Phone : Cheltenham 21216/7

Hampshire

BOURNEMOUTH

FORRESTER'S NATIONAL RADIO SUPPLIES

70-72 Holdenhurst Road

LTD
Tel. 25232

Radio-TV components.

High-Fidelity.

Tape

HAMILTON ELECTRONICS

HIGH FIDELITY AND
TAPE RECORDER
SPECIALISTS

35 LONDON ROAD

TEL. 28622

SOUTHAMPTON

Hertfordshire

HAMMONDS OF WATFORD

(Your Hi-Fi centre for advice & service)

Agents for all leading makes of TAPE - RECORDERS - AMPS
TUNERS - SPEAKERS & ACCESSORIES

Terms & P/E

Evening Demonstrations

63 QUEENS RD. WATFORD 27187/36136

Lancashire

NOT THE LARGEST SELECTION

NOT THE CHEAPEST SELECTION

JUST THE BEST SELECTION

No High Pressure Sales—Just High Pressure SERVICE After Sales
Manufacturers' Official Agents for :—
REVOX, TANDBERG, TELEFUNKEN, GRUNDIG, B. & OLUFSSON, SONY,

"Q"-CORD, etc.

Largest Selection of Pre. Rec. Tapes in the North

SPARES, ACCESSORIES and "EXPERIENCE"

"THE" TAPE RECORDER CENTRE (Blackpool), 266 WATERLOO ROAD

Tel. 45049

H.D. KIRK



LIMITED

Specialists in High Fidelity

150 HIGHER BRIDGE STREET

Phone: 23093

BOLTON

MANCHESTER

TAPE RECORDER CENTRE

Revox, Ferrograph, Brenell, Tandberg, Bang & Olufsen, and all well known makes.

LANCASHIRE HI-FIDELITY LTD.

Fully equipped SERVICE Dept. to provide expert installation and service after sales

8 DEANSGATE NEXT TO GROSVENOR HOTEL.

CLASSIFIED ADVERTISEMENTS

Advertisements for this section must be pre-paid. The rate is 6d. per word (private), minimum 7s. 6d. Box Nos. 1s. 6d. extra; trade rates 9d. per word, minimum 12s. Box Nos. 2s. extra. Copy and remittance for advertisements in SEPTEMBER 1965 issue must reach these offices by 21st JULY addressed to : The Advertisement Manager, Tape Recorder, Link House, Dingwall Avenue, Croydon, Surrey.

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

FOR SALE

Sony TC 200. Latest model. New, unused, £64. I. C. Redfern, 1 Perth Road, Cowdenbeath, Fife.

Revox F36 2-track stereo tape recorder, as new, £70. Box No. 381 (Middx).

TRADE

Lafayette "International" Tape. Polyester : 7in. 2400ft. 22/6 ; 5½in. 1800ft. 19/- ; 7in. 1200ft. 14/- ; 7in. 1800ft. 19/- ; 7in. 1200ft. 12/-. Acetate : 7in. 1800ft. 14/9 ; 5in. 900ft. 10/6 ; 5in. 600ft. 8/-. Refund guarantee. 'Bib' Tape Splicer 14/11. We also have a full range of Message Tapes and Triple Play Tapes all at lowest ever prices. P. & P. 2/- per order. S.A.E. list. Leda Tapes, 30 Baker Street, W.1.

A Unique Buy! Recording tape, top brand. 7in. 2400ft. D.P. 25/-, 5½in. 1200ft. 19/6, P. & P. 1/6 per spool. Bargains in all sizes. S.A.E. for list. We repair, buy and sell recorders. E. C. Kingsley & Co. Ltd., 132 Tottenham Court Road, London, W.1. EUSton 6500.

Speedy and Expert Tape Recorder and Hi-Fi repairs by England's leading Hi-Fi Specialists. Telesonic Ltd., 92 Tottenham Court Road, London, W.1. MUS 8177.

Learn While You Sleep. Learn languages, memorise speeches and sales presentations, absorb business statistics or the highway code while asleep with Learnasleep Equipment. Details from : Sleep Learning Supplies (Dept. T.R.), 245 Capworth Street, Leyton, E.10.

"Gevaert" New boxed recording tapes 600ft., 5½in. spools at 9/- each or 6 for 50/-. "Grundig" 2-Transistor pre-amplifiers suitable for boosting microphones and tape head monitoring—listed at 4½ gns—offered new and boxed at 57/6 each. Lee Electronics, 400 Edgware Road, Paddington 5521.

Tempotapes—Music 3½ i.p.s. and Castle copyright free sound effects 45 r.p.m. discs. Wide selection of titles. 6d. stamp for catalogues to : Recorded Tuition Ltd., 174 Maybank Road, South Woodford, London, E.18.

Telefunken M24 Studio Recorder chassis model, excellent condition, £75; ditto in lockable oak cabinet, £95. Tandberg Model 74, new, £80. B. & O. latest model 2000T Portable, new, £110. Leak Stereo 20 with Point One pre-amp., £28. Radford stereo 15 watts amp. with SC2 control unit, new, £55. Pair Radford Bookshelf speakers, new £42. Credit facilities available. Box No. 382 (London).

Pre-sleep Study. Learn difficult lessons or parts or improve your mental power while you sleep! Send now for price list of materials ; including the perfect tape machine, time switch, pillow speaker, endless tape cassettes, pre-recorded tape for learning or therapy, language course, etc. Psychology Tapes Ltd. (TR), 16 Kings College Road, London, N.W.3. PRI 3314.

American 4 Track Stereo Tapes covering most famous labels at realistic prices. Why pay more? Imported directly by us, saving distributors profits. Vast selection at 75/- each—send S.A.E. for free lists or call at London showrooms Teletape of Marble Arch, 33 Edgware Road, W.2.

Apply to the Sleep-Learning Association for free booklet on Tapes Subjects, Method, best equipment to use for sleep-learning. Also for details of residential sleep-learning facilities available in London and Cheltenham Spa. 14 Belsize Crescent, London, N.W.3. Tel. SWI 6160.

New World famous recording tapes, Polyester base and fully guaranteed. 5in. 600ft. 7/-, 5½in. 900ft. 9/6, 7in. 1200ft. 12/-, 5in. 900ft. 9/-, 5½in. 1200ft. 12/6, 7in. 1800ft. 13/6, p/p 1/- per spool. Starman-Tapes (T.R.), 421 Staines Road, Bedfont, Middx.

WANTED

Lee Electronics. The Tape Recorder and Hi-Fi Specialists wish to purchase good quality Tape and Hi-Fi Equipment for cash. 400 Edgware Road, W.2. Phone : PADdington 5521.

Highest cash prices offered for good quality Tape Recorders and Hi-Fi. See our ad. page 308 this issue. R.E.W., 266 Upper Tooting Road, London, S.W.17.

STUDIO FACILITIES

John Hassell Recordings. Tape to Disc. Latest high level micro-groove cutting system. Competitive prices. Studio and Mobile Services, 21 Nassau Road, London, S.W.13. RIVerside 7150.

Rapid Recording Service. Records made from your own tapes. (48 hour service.) Master Discs and pressings. Recording Studio—Demo Discs. Mobile Recordings, any distances. Brochure from 21 Bishops Close, E.17.

PUBLICATIONS

Get "Do It Yourself Annual 1965". Special features include : Installing solid fuel fires and stoves; All about ring circuits; Brickwork for beginners; Bringing your plumbing up to date; The maintenance and repair of chimney stacks; D.I.Y. central heating systems; Paints to use in 1965; Power tool review, etc. *Do It Yourself Annual*. 2s. 6d from newsagents and bookstalls, or 3s. 4d. (postage paid), from Link House, Dingwall Avenue, Croydon, Surrey.

Get "Do It Yourself Gardening Annual 1965". Main features include: Growing peaches and grapes; A garden pond for £4; Wine making at home; How to run electricity to garage or greenhouse; Sensational new flowers to grow this year; All about geraniums; Using black plastic to keep down weeds; Solve your soil problems; Complete guide to path making, etc., 2s. 6d. from newsagents, or 3s. 4d. (postage paid), from Link'House, Dingwall Avenue, Croydon, Surrey.

- TAPE TO DISC SERVICES -

The following are members of the Association of Professional Recording Studios who can be relied on to give satisfaction

MJB RECORDING & TRANSCRIPTION SERVICE

specialise in the production of microgroove records from Professional and Amateur recordings (Acetate copies; Mono and Stereo pressings). Extended playing times achieved by controlled cutting techniques. Studio, Mobile, "Off the Air" and all recording services. Detailed booklet available.

7 HIGH STREET, MAIDENHEAD (Tel: 25630)

TAPE RECORDERS - AUDIO EQUIPMENT - DISC CUTTING STD & LP FROM TAPE - STUDIO FACILITIES - HIRE SERVICE - SALES - EXCHANGES

MAGNEGAPH

I Hanway Place, London, W.1.

Tel. : LAN 2156

- YOUR TAPE DEALER -

Leicestershire

LEICESTER

ALL YOUR HI FI REQUIREMENTS

Speakers by :	TANNOY	MORDAUNT	LEAK	ROGERS
	WHARFEDALE	GOODMANS		LOWTHER
Tape :	FERROGRAPH	REFLECTOGRAPH		GRUNDIG
	SIMON	BRENNELL		

Record Department : ALL LABELS-PARASTAT SERVICE

LEICESTER CO-OPERATIVE SOCIETY LIMITED, High Street, Leicester.

Tel. 20431

Northamptonshire

PETERBOROUGH, NORTHANTS

Tel : 5643/5644

CAMPKINS RECORD SHOP

RECORD TAPE AND HI-FI EQUIPMENT SPECIALISTS

NEW ADDRESS **15 LONG CAUSEWAY** LARGE STOCKS
(IN CITY CENTRE)

Oxfordshire

WESTWOOD'S *of* **OXFORD**
46 GEORGE STREET PHONE: 47783

Staffordshire

WOLVERHAMPTON

WE ARE

WARNERS for TANDBERG

AUDIO DEPARTMENT,
CHAPEL ASH,
Tel. Wolv. 26581

"The World's Finest Tape
Recorder"

SPECIALISTS
SALES AND SERVICE

Surrey

FARNHAM, SURREY

The finest selection of Tape Recorders, Hi-Fi Equipment and quality Radiograms in the Provinces is awaiting you at:—

LLOYD & KEYWORTH LTD

26-27 Downing Street, Farnham, Surrey. Telephone: 5534
Comparative Demonstrations, Large stock of Cabinets and Pre-Recorded Tapes.

CROYDON'S TAPE RECORDER CENTRE

All leading makes in stock. Hi-Fi equipment, cabinets, etc.
Service agents for AKAI Tape Recorders

SPALDING ELECTRICAL LTD.,

352/354, Lower Addiscombe Road, CROYDON ADDiscombe 1231/2040

Sussex

WORTHING, SUSSEX

Stocking Ferrograph, Revox, Sony, Tandberg, Truvox, Philips, EMI, Luxor, etc., on fully comparative Demonstrations

BOWERS & WILKINS LTD.

I Becket Bldgs., Littlehampton Road, Worthing 5142

NEW PREMISES

NEW PREMISES

NEW PREMISES

132 montague street

telephone 2585

CRAY CRAY OF WORTHING LTD

— YOUR TAPE DEALER —
Warwickshire

For tape recorder service in the Birmingham area

L. BISHOP LTD.

1708 Bristol Road South, Rednal, Birmingham

Telephone: RUBery 2709

GRUNDIG SPECIALISTS

COVENTRY
& DISTRICT
CO-OPERATIVE
SOCIETY LTD.

HIGH FIDELITY SOUND EQUIPMENT TASTEFULLY
DISPLAYED FOR YOUR "BROWSE AROUND" ENJOYMENT
All leading makes: Amplifiers, Control Equipment,
Loud-speakers, Cabinets, Tuners, Microphones, Tape
Recorders and Ancillary items in stock or quickly
obtainable.

Coventry & District Co-operative Society Ltd., High Fidelity
Sound Section, Electrical Dept., First Floor, Central Premises,
Corporation Street, Coventry. Tel. Coventry 24031-10 lines

AUDIO & TAPE SALES & SERVICE HIG. 4182

COLIN G. TURNER M.I.P.R.E.

QUAD. LEAK. ROGERS. TANDBERG. TRUVOX. BRENNELL

All makes in stock and on demonstration

39 YORK ROAD, KINGS HEATH, BIRMINGHAM 14

Wiltshire

SOUTHERN ENGLAND

HI-FI AND RECORD CENTRES

J. F. SUTTON

SALISBURY
18 QUEENS STREET

SOUTHAMPTON
421 SHIRLEY ROAD

Yorkshire

TAPE RECORDER CENTRE (HALIFAX)

Stock all the best Tape Recorders; Hi-Fi Equipment;
Tape; L-P Records, etc.

DEMONSTRATIONS DAILY BY EXPERT STAFF
2 years FREE SERVICE ON NEW RECORDERS over £35

30 King Cross Street, Halifax. 'phone 66832

Scotland

Edinburgh's TAPE RECORDER

specialist, **Hi-Fi Corner**

Ferograph—Grundig—Telefunken—Philips, etc.
W. G. Graham, Assoc. Brit. I.R.E.

Tape to Disc Recording Service

Agent for The Famous Heathkits.

I Haddington Place,
EDINBURGH.
Phone WAY 7901



**LEARN WHILE
YOU SLEEP!**

played at a whisper through under-
pillow speaker.

SLEEP-O-MATIC UNIT

including two speed tape recorder complete with microphone, time-switch
and under-pillow speaker £27/10/- post 6/- (Batteries 5/-). Two models
available, one for mains only and one for batteries which can be supplied with a
mains power pack at 50/- extra. Both will take our special radio tuner at 42/-.
Publications: "Sleep Learning, Its Theory, Application and Technique" and
"Mental Power Through Sleep Suggestion". Full details on request.

RAPID RECORDING SERVICE

21 BISHOPS CLOSE, LONDON E.17

People in search of Perfection Choose

FILM INDUSTRIES

RIBBON MICROPHONES

and ACCESSORIES



M8. Ribbon Microphone available in low, medium or high impedance 3 Pin plug and socket connection between microphone head and flexible.



M8S. Ribbon microphone supplied complete with desk stand.

Write for full details

FILM INDUSTRIES LTD.

90 BELSIZE LANE, LONDON, N.W.3 HAM 9632/3

ADVERTISERS' INDEX

Adastra Ltd.	..	..	..	..	..	..	..	300
B.S.R.	..	..	..	..	..	..	..	279
Bosch Ltd.	..	..	..	..	..	..	..	<i>outside back cover</i>
Braddock, C., Ltd.	..	..	..	..	..	..	..	300
Brown, A., & Sons Ltd.	..	..	..	..	..	..	..	300
Currys Ltd.	..	..	..	..	..	..	..	282
Dansette Products Ltd.	..	..	..	..	..	..	..	<i>inside back cover</i>
Elstone Electronics Ltd.—Tandberg	..	..	..	..	..	..	..	304
Elstone Electronics Ltd.—W.A.L.	..	..	..	..	..	..	..	306
Ever Ready (Great Britain) Ltd.	..	..	..	..	..	..	..	<i>inside front cover</i>
Film Industries Ltd.	..	..	..	..	..	..	..	314
Francis of Streatham	..	..	..	..	..	..	..	<i>inside back cover</i>
Grampian Producers Ltd.	..	..	..	..	..	..	..	306
Heathkit (Daystrom Ltd.)	..	..	..	..	..	..	..	292
Highgate Acoustics	..	..	..	..	..	..	..	286
K. J. Enterprises	..	..	..	..	..	..	..	306
Kodak Ltd.	..	..	..	..	..	..	..	280
Rapid Recording Service	..	..	..	..	..	..	..	314
R.E.W. (Earlsfield) Ltd.	..	..	..	..	..	..	..	308
Reps (Tape Recorders) Ltd.	..	..	..	..	..	..	..	298
Tempotape—Elstone Electronics Ltd	..	..	..	..	..	..	..	298
Walker, N.	..	..	..	..	..	..	..	306

THESE ARE THE FEATURES THE EXPERTS LOOK FOR

GET THEM ALL ON THE DANSETTE EMPRESS

- 4 tracks, 3 speeds with pushbutton selection and 16 hours playing time.
- 8" x 5" high. Flex elliptical speaker.
- 3½ watts maximum undistorted output.
- Frequency response flat from 75 c/s to 13,500 c/s at 7½ p.s.
- Stereo output socket.
- Transistorised recording level meter.
- Separate Bass and Treble tone controls.
- 3 digit programme indicator.
- Radio/pick-up and external speaker sockets.
- Recording monitor throughs speaker or headphones.
- Wooden cabinet with washable two-tone finish.
- Specially designed storage space for microphone, leads and tapes.
- 7" reel of L.P. tape.
- Microphone and leads included.



only 37 GNS. 

Full details of the Empress and other top value Dansette tape recorders from

DANSETTE PRODUCTS LIMITED, Dansette House, Honeypot Lane, Stanmore, Middlesex.

Telephone WORDsworth 0021

FRANCIS OF STREATHAM

MAINS TAPE RECORDERS

*Beocord 2000	112 gns.
*Beocord 1500	89 gns.
Brenell STB2	£150
Brenell Mk 5/M Series 3	93 gns.
Brenell Mk 5 Series 3	74 gns.
Cossor 4 Tr. 1604 2 sp.	39 gns.
Cossor 4 Tr. 1605 4 sp.	62 gns.
Cossor 1606 4 Tr.	29 gns.
Cossor 1607 Stereo 4 Tr.	57 gns.
Elizabethan LZ24	34 gns.
Elizabethan Auto	26 gns.
Elizabethan LZ24	32 gns.
Elizabethan LZ32	29 gns.
Elizabethan 511 4 Tr. St.	37 gns.
*Ferrograph 631	88 gns.
*Ferrograph 632 Stereo	115 gns.
Fidelity Major	35 gns.
Fidelity Playmaster 2 Tr.	21 gns.
Fidelity Playmaster 4 Tr.	23 gns.
Grundig TK14L	37 gns.
Grundig TK17	43 gns.
Grundig TK18L	41 gns.
Grundig 23L Auto	49 gns.
Grundig TK40 4 Tr.	87 gns.
Grundig TK41 2 Tr.	83 gns.
*Grundig TK464 4 Tr. Stereo	107 gns.
Philips 4 Tr. 3549	62 gns.
Philips 4 Tr. Stereo 3534	92 gns.
Philips 3548 4 Tr. 2 sp.	39 gns.
Philips 2 Tr. Auto 3552	24 gns.
*Revox 736	124 gns.
*Saba Stereo TK230	94 gns.
Sony 200	72 gns.
Sony 500	105 gns.
Stella 458 4 Tr.	39 gns.
Stella 459 4 Tr.	62 gns.
*Tandberg Series 6	110 gns.
*Tandberg Series 7	93 gns.
*Tandberg Series 8 2 Tr.	54 gns.
*Tandberg Series 8 4 Tr.	59 gns.
*Tandberg Series 9	69 gns.

Telefunken 55

*Telefunken 85 de luxe ... 43 gns.

*Telefunken 96 4 Tr. ... 83 gns.

*Telefunken 98 ½ Tr. Stereo 95 gns.

*Truvox R.102 ... 76 gns.

*Truvox R.104 ... 79 gns.

*Truvox PD.102 Stereo ... 93 gns.

*Truvox PD.104 Stereo ... 89 gns.

*Vortexion WVA 3 sp. ... £96.70

*Vortexion WVA-H 3 sp. ... £107.30

*Vortexion WVB 3 sp. ... £115.10

*Vortexion WVB-H 3 sp. ... £128.00

*Vortexion CBL Stereo ... £172.00

*Vortexion CBL-H Stereo ... £180.00

Wyndson Sabre ... 23 gns.

Wyndson 707 2 Tr. ... 29 gns.

Wyndson 707 4 Tr. ... 32 gns.

BATTERY PORTABLES

Akai X-IV 4 Tr. Stereo ... 131 gns.

Grundig TK6 ... 69 gns.

Grundig EN3 Notebook ... 23 gns.

Cossor 1621 ... 26 gns.

Loewe Opta 416 ... 51 gns.

Loewe Opta 408 ... 39 gns.

*Butoba ... 59 gns.

*Fi-Cord 202/A ... 66 gns.

Philips EL3301 ... 26 gns.

Philips 3586 ... 26 gns.

Stella 471 ... 26 gns.

Uher 4005 ... 99 gns.

Telefunken 300 ... 49 gns.

*Microphone extra

Philips, Stella or Cossor ... £5.12.0

Butoba ... 11 gns.

Fi-Cord ... £7.10.0

Uher 4300, with rechargeable cell ... 18 gns.

Telefunken 300, with rechargeable cell ... £19.10.0

Tape Deck by Brenell,
Wright & Weaire
Tape to disc and copy service.

LEADING STOCKISTS OF EQUIPMENT FOR

TAPE and HI-FI

. . . and NO EXTRA FOR CREDIT TERMS

★ Minimum Deposit

★ No Interest or Service Charges on H.P. up to 18 months

★ Free Service during Guarantee Period

● MICROPHONES, MIXERS, ETC.

Grampian Reflector ... £6.15.0

Grampian Ribbon ... £11.10.0

Grampian DP/4 Dynamic ... £8.5.0

Reslo Pencil Dynamic ... £11.12.6

Reslo Ribbon ... £10.12.6

AKG D.119 ... £24.10.0

AKG Stereo D.77A ... £15.10.0

AKG D.19C ... £17.10.0

Eagle Mixer ... 3 gns.

Grundig Mixer Stereo ... 18 gns.

Ficord TM.11 Mixer ... £11.5.0

AKG K.50 Headphones ... £7.10.0

Philips Pre-amp ... £6.10.0

Also in stock: microphones by ACOS, FILM INDUSTRIES, TELEFUNKEN, BEYER, etc.

All WALGAIN PRODUCTS

● TAPES & ACCESSORIES

Standard, Long, Double, Triple Play

in all sizes by all leading makers.

● DEFLUXERS BY WEARITE, WALGAIN

● Pre-recorded Tapes by Columbia,

H.M.V. and all E.M.I. Labels, Crown,

Phonoband, etc.

Bib, Bond and E.M.I. splicers. Matching

transformers. Plugs, sockets, etc.

Prices subject to alteration as announced

by manufacturers.

STANDS OF ALL TYPES

HI-FI DEPT.

● STEREO AND MONO AMPLIFIERS

Quad Pye Rogers Cadet Mk III

Leak Armstrong Tripleton

Scott Loewe Opta B & O, CSL

● TUNERS

Quad Rogers Pye Leak

Armstrong B & O Tripleton

● LOUDSPEAKERS

Quad Pye Rogers W.B. Kef

Wharfedale Goodmans Tannoy

Lowther Leak Elac Eagle Kelly

B & O, Shb, Tandberg

● MOTORS, PICKUPS

GARRARD incl. Acos

AT6, 401, etc. Thorens

Goldring Tannoy EMi

Connoisseur LencoShure

DECCA incl. Ronette

fss Mk III Sonotone

Deram, etc. B & O

Philips SME Mk II

Ortofon ADC BSR

All types of Diamond and Sapphire

stylus, stereo and mono. Microlifts,

Garrard, Goldring, and Acos Pressure

Gauges. Disc Preener. Acos Dust

Bug. Cabinets by Record Housing

and G.K.D.

169-173 STREATHAM HIGH ROAD, LONDON, S.W.16

STREATHAM 0466/0192

Please note this is our only address
OPEN ALL DAY SATURDAY—EARLY CLOSING WEDNESDAY



UHER

4000
REPORT-S

the incredibly versatile portable tape recorder

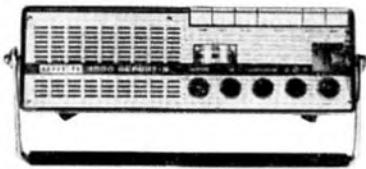
Ready for recording and playback anywhere and at any time the UHER 4000 Report-S satisfies the most exacting demands of both amateur and professional and offers virtually every facility provided by a mains-operated recorder. It requires only five flashlight cells as a power supply, and is even more economical when operated from a rechargeable "dryfit" battery. It can also be used with any type of storage battery from 6 to 24 volts.

Four tape speeds provide a wide variety of recordings—from HI-FI to extensive conference minutes. Compact and light in weight the UHER 4000 Report-S permits the use of tape reels up to 5"—and a playing time of up to 8 hours per reel of tape. It is the *complete* portable—operable in any position and undisturbed by normal manhandling during recording or playback.

The many accessories available include the AKUSTOMAT—an automatic switch which will start and stop the tape motion whenever sound begins or ceases.

An award winner for industrial design at the HANOVER TRADE FAIR in 1963 and 1964, the UHER 4000 Report-S has won enthusiastic approval in professional circles and is now widely used in industry and commerce, in Government Departments and by the B.B.C.

It is one of a range of superb recorders—which also includes the UNIVERSAL 5000 and the ROYAL STEREO—demonstrated by discriminating dealers throughout the U.K. In case of difficulty write for descriptive literature to the address below.



TAPE IT WITH YOU... ANYWHERE!

Technical Specification: Two tracks to international standard reel size: up to 5" four tape speeds: 7½ ips, 3½ ips, 1¾ ips, ½ ips frequency response ($\pm 3\text{db}$); 40-20,000 cps at 7½ ips, 40-17,000 cps at 3½ ips, 40-10,000 cps at 1¾ ips, 40-4,500 cps at ½ ips contrast ratio; 55 db wow and flutter: $\pm 0.15\%$ at 7½ ips (audible frequencies only) output power; 1 watt (push-pull power stage) power supply; five flashlight cells (1.5 volts each) or "dryfit" storage battery model Z 211 or model UHER Z 114 mains-operated power unit and battery charger or an automobile battery via automobile adaptor cable inputs; Micro 0.1 mV at approx. 2 kilo-ohm; Radio 1 mV at 47 kilo-ohms; Phono 25 mV at 1 megohm outputs: 2 volts at 4 ohms; 1 volt at 15 kilo-ohms. operating time: intermittent operation of approx. 12 hrs; continuous operation and intermittent operation respectively from the "dryfit" storage battery—approx. 8 hrs. dimensions approx. 11" x 8" x 3" weight without batteries: approx. 6 lbs. Price 103 Gns. Including microphone and L.P. Tape.

BOSCH LIMITED Radio & Domestic Appliance Division,
205 GT, PORTLAND STREET, LONDON, W.1. LANGHAM 1809/1800/6708

