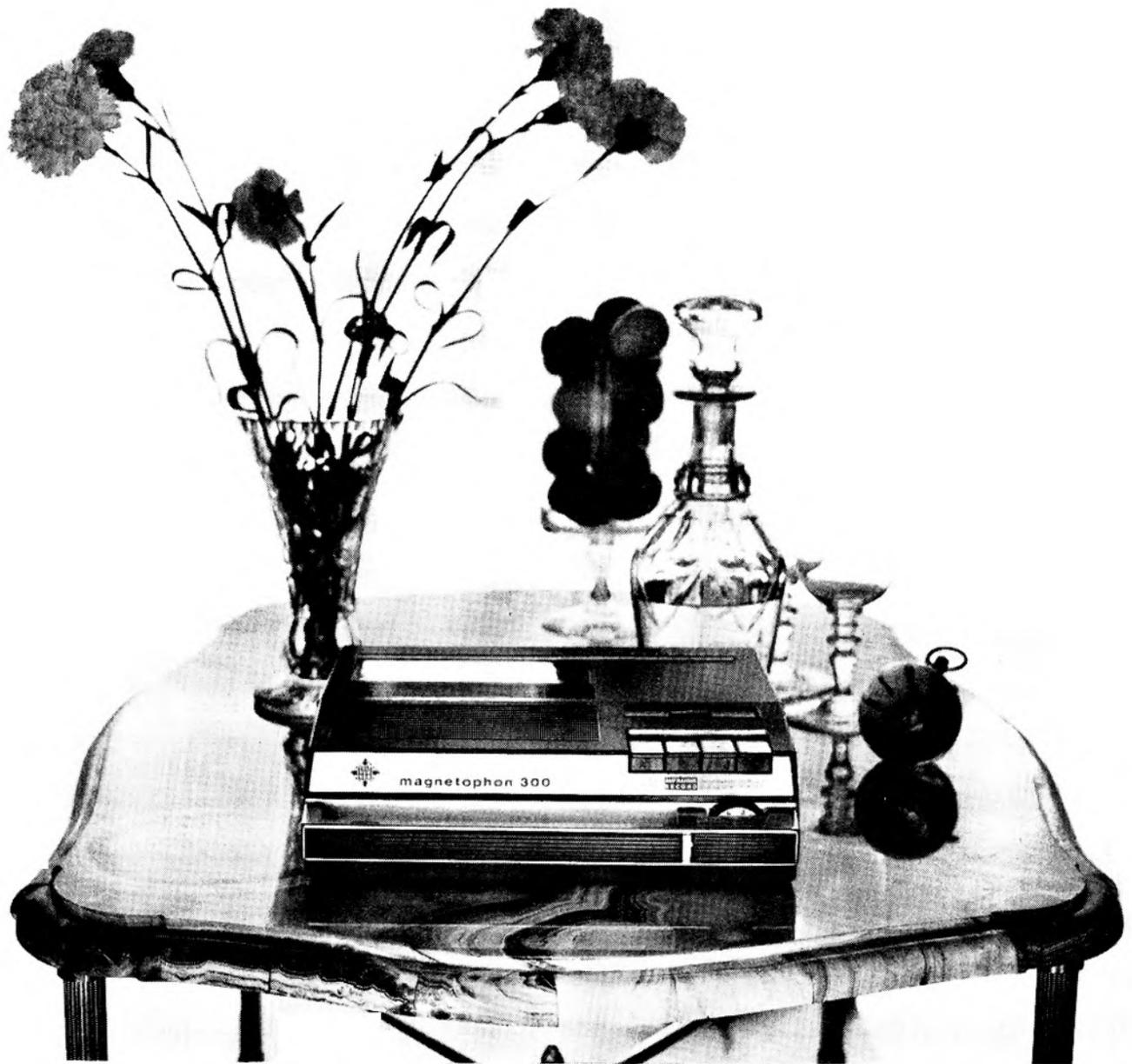


OCTOBER 1964 PRICE 2/-

tape recorder



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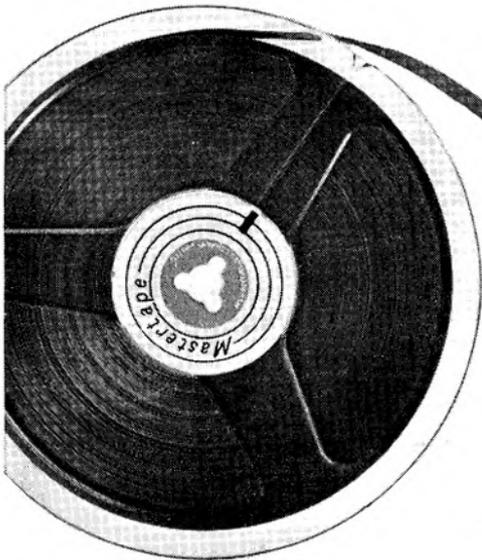
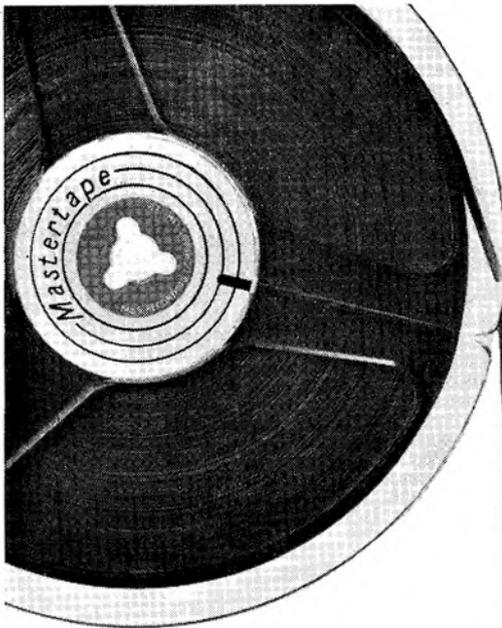


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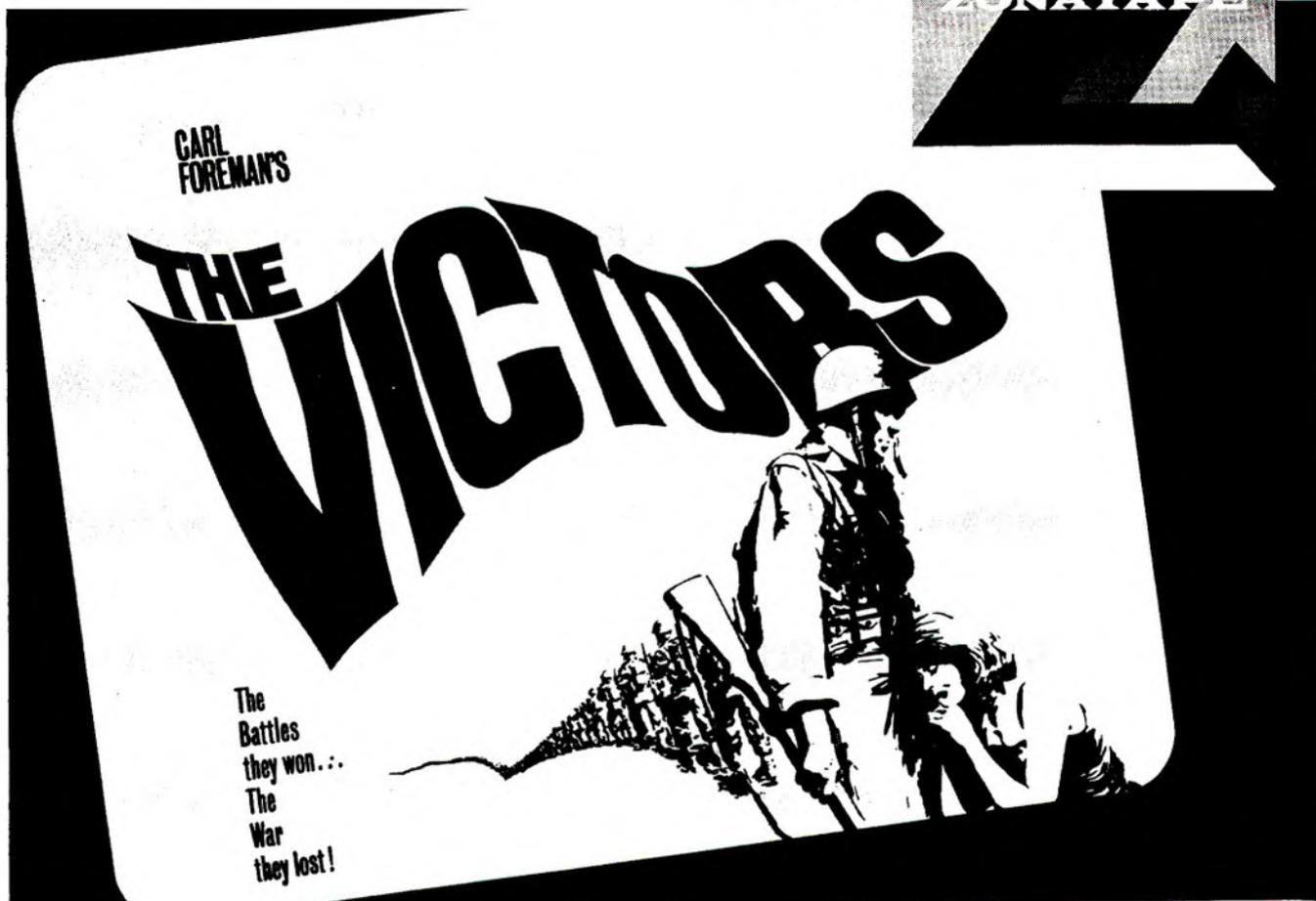


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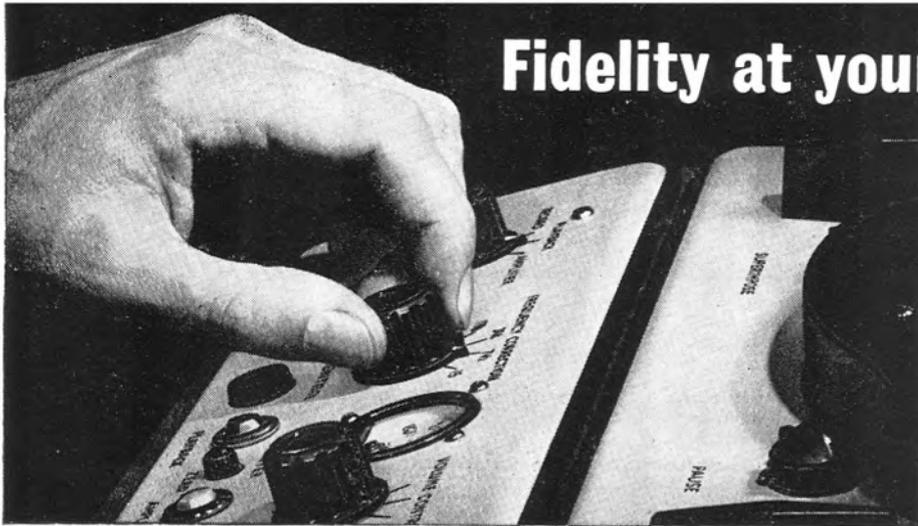
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Agfa tape is overloadable



tape recorder

INCORPORATING 'SOUND AND CINE'

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editorial

THIS ISSUE carries a report on new tape equipment seen at last month's Radio Show and other 'outside' exhibitions. What is the reason for these extra shows (some public, some for the trade only) and why should people wishing to see everything currently on offer in the domestic radio field have to tramp around London in addition to visiting Earls Court? The answer, alas, reflects badly on the radio industry, which specifies that the Show shall be a 'British-made only' event. We have heard lengthy and superficially plausible explanations offered in defence of this, but we are convinced that Earls Court remained closed to the outside world this year because the minds of a few key persons were cluttered with a mixture of old-fashioned national prejudice and fear of genuine competition. Other countries hold international radio exhibitions, and our own Audio Festival and Fair admits products from all over the world; but some people have never got over the excitement of the crystal-set and cannot face the fact that electronics (and its domestic applications) is now a world-wide industry.

After years of declining success and increasing pressure for its internationalisation, the Radio Show foundered over such trivial matters as the cost and style of display stands. In consequence there was no Show last year. Many people in the trade had assumed that the breathing space was being used for some vigorous new thinking—with a special eye on how the importers of non-British products could be included—but the Show organisers laboured mightily to produce a mouse: the trade-only hours were raised and the number of exhibitors and visitors fell.

Readers may wonder why a tape recording paper shows such concern for the radio and television trade. Well, the tape recorder is now an integral part of domestic electronics and is fully accepted by the Radio Show organisers, but the majority of machines available to the British public through the normal retail channels come from abroad and could not, therefore, be seen at Earls Court. If we take all types of recorder, ranging from expensive professional models to cheap battery portables, something like 55% are imported. For battery machines alone the non-British quota rises to 90% (or even higher if the various undesignated ultra-cheap Japanese units are included). Only in the ordinary general-purpose domestic region do the numbers of models from home and overseas find a rough balance, but even here the scales are tipped heavily in favour of the imports if we eliminate duplications arising from provision of $\frac{1}{4}$ - and $\frac{1}{2}$ -track facilities.

These figures all refer to individual models as detailed in catalogues, etc., but if there were a hundred British recorders for every imported one, the latter could still dominate the market in terms of numbers sold. In fact, we suspect that the slickly styled Continental machines—designed and produced as entities—are rather more popular with large sections of the public than the typical British recorder comprising some rather unimaginative circuitry housed in a box which is stylistic-

ally out of step with the deck. This may seem a rather severe judgement, and we would be the first to admit that the design of a recorder around a mass-produced deck by another manufacturer can produce superb results when handled by a painstaking firm of the calibre of *Reps*, for instance.

But the public should be free to make the choice, and it seems to us quite indefensible that an important and widely publicised exhibition should automatically exclude the majority of models available in a major segment of its supposed coverage simply because they are not 'made in Britain'. It is simply ludicrous that a firm like *Philips* may show its television and radio receivers which are produced here, but not its tape recorders because they are made a hundred miles further east in Holland. It is also ludicrous that an *International Radio and Electrical Trades Exhibition* (and a half-dozen other shows) should have to run at the same time as the Radio Show so that importers may exhibit goods which should be in Earls Court. Most of the showtime new products of interest to *Tape Recorder* readers were 'outsiders' this year, and those persevering individuals who did the Grand Tour—including many retailers eager to see the full range available for their customers—will no doubt join us in condemning the parochialism of the Show organisers.

This may have seemed a rather political Editorial, but we would point out that it is the British radio industry which insists on applying the politics with its parish-pump nationalism. We are interested in the art and technique of tape recording, and, frankly, we couldn't care less where the tape recorders are made.

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COVER PICTURE

Many of the Talking Books now giving pleasure to thousands of blind persons originate here. A member of the staff of the Royal National Institute for the Blind controls transcription of yet another publication from the world of sight into that of sound. More information of the service is given on page 353.

SUBSCRIPTION RATES

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



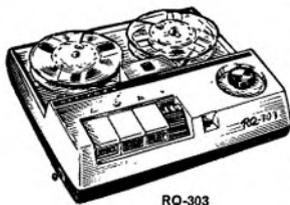
YOU SAID IT!
 (played it, sang it!)
NATIONAL
 HAVE IT TAPED
 SUPERBLY!

Just say the word — and it starts!
 You stop, and the recording stops,
 too! The **National RQ-150** is the
 first completely automatic **Voice-**
operated portable tape recorder in
 the world.

And this is only the beginning—the incomparably versatile RQ-150 also provides automatic slide and film synchronisation, automatic threading and remote control. If you really want to spread the word, there's a Public Address System that permits accurate monitoring through a built-in loudspeaker while recording. All this and *immaculate* reproduction—for precisely 44 gns!

SPECIFICATION

- Power Source: 6 unit cells (U.2.), 9 V.
- Output: 500mW (700mW max.)
- Transistors: 9 Transistors, 1 Thermistor, 1 Diode.
- Tape Speed: 3½ i.p.s., 1½ i.p.s.
- Frequency Response: 100-7,000 c/s at 3½ i.p.s., 100-4,000 c/s at 1½ i.p.s.
- Recording Level Indicator: VU meter.
- Speaker: 3½" Permanent Dynamic Speaker.
- Dimensions: 3½" x 9" x 12½"
- Weight: 5 lb. 14½ oz.
- Accessories: Dynamic microphone with remote control switch; 5" recording tape (600 ft.); 5" empty reel; radio cord; leather case for accessories; hand belt; splicing tape; sensing tape; plug for slide sync.; magnetic earphone.



RQ-303

- Also from NATIONAL:**
- RQ-303, Mains, 2 track, single speed, 15 gns.
 - RQ-115, Battery*, 2 track, 2 speed, 35 gns.
 - RQ-116, Battery*, 4 track, 2 speed, 39 gns.
 - RS-753, Mains, Full stereo, 4 track, 2 speed, 76 gns.

*With optional mains adaptor available



RQ-115 & RQ-116



**TAPE
 IT
 EASY—**

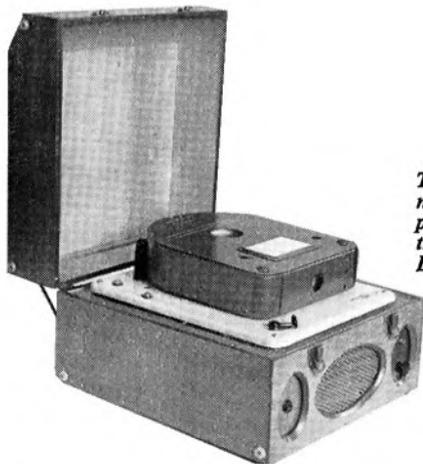
**with NATIONAL,
 naturally!**

UME 5-7658-100

world of tape

A SOUND COMPANION

WHEN, in 1959, it was decided to convert the *Talking Book* library for the blind from disc to tape, the organisers hoped for an expansion of their membership. So great was this expansion that it was not long before demand began to gain on supply. Improved recording and copying facilities at the West London branch of the Nuffield Library only added to the difficulties by increasing the demand. To ease the burden, therefore, it was decided to open a branch in Lancashire to cater for the northern half of Britain, the southern area remaining in the hands of the premises at Alperton. The result is an increase in efficiency of the service and a reduction of the waiting period for a Talking Book player. It now takes only a few weeks to join the ranks of the blind readership (at present in the region of 12,500). The library is expanding at a rate of 250 books each year, and some 622 titles are now catalogued. Choice of books covers a wide range of subjects, fiction and non-fiction, and is supplemented by a Braille library run by the *Royal National Institute for the Blind*.



The Clarke & Smith multi-track tape player, backbone of the Talking Book library

The present system provides a maximum of 21 hours playing time per cassette, using $\frac{1}{4}$ in. tape containing 18 tracks. A single spindle supports and provides the drive to the cassettes, making the equipment (manufactured by *Clarke & Smith*) easier to use than a gramophone.

Service and installation of the equipment is carried out by a network of volunteer electronic and recording enthusiasts. With rapidly expanding membership, the need for more such service volunteers increases.

Far from being restricted to its land of origin, the library has launched installations in Australia, New Zealand, Canada, Spain, India, El Salvador, Southern Rhodesia and South Africa. Pilot schemes have also been started in the U.S.S.R., U.S.A. and Mexico.

In the amateur field, as well, great opportunities are given for furthering blind welfare. Mr. M. Chambers of Birmingham began such a service several years ago, and subsequently left his job to devote more time to welfare work. In order to earn a living he worked at home as a distributor for Philips Electrical Ltd. *Tape Programmes for the Blind* has one interesting departure from the work of the R.N.I.B. It encourages recording as a creative art-form for the blind and has found the hobby easily mastered by blind members. Again, sighted members are welcomed to assist in the production of news tapes and help equip lonely blind persons with simple recorders.

The blind and handicapped will benefit from research at present being conducted into the problems they meet in everyday life. An interesting modification of the early *Collaro Transcriber* tape deck was recently announced by *St. Dunstan's*, a fund-raising organisation for persons blinded on war service. Use of large mechanical controls simplifies operation of recorders for handicapped users. The electrical relay switch and automatic gain control have much to offer in this field.



Readers interested in learning more about, or assisting with, blind welfare are invited to contact any of the above mentioned organisations. They are, respectively, the *Royal National Institute for the Blind*, 224 *Great Portland Street, London, W.1*; *Tape Programmes for the Blind*, 139 *Goldthorne Avenue, Sheldon, Birmingham 26*; *St. Dunstan's*, 191 *Marylebone Road, London, N.W.1*.

CHANGE IN SONY DISTRIBUTION

SONY tape recorders and associated equipment, until recently imported by *Tellux Ltd.*, are now being handled by the distributors of *Bang & Olufson* equipment. All queries regarding service and orders should be addressed to: *St. Aldate Warehouse Ltd., Electrical and Radio Division, Innsworth Lane, Gloucester*.

NO MORE CRICKET

AFTER angry citizens of Mitcham complained of disturbed sleep caused by an army of crickets, John Rhoney, of the Grundig Technical Sales Department, was called to the local rubbish dump.

Messrs. *Rentokil* had been employed by the council to eliminate the insects and, as a fitting memorial before their mass extermination, Mr. Rhoney taped the crickets for posterity. A *TK6* was used to make the recording, which now rests in the hands of the BBC.

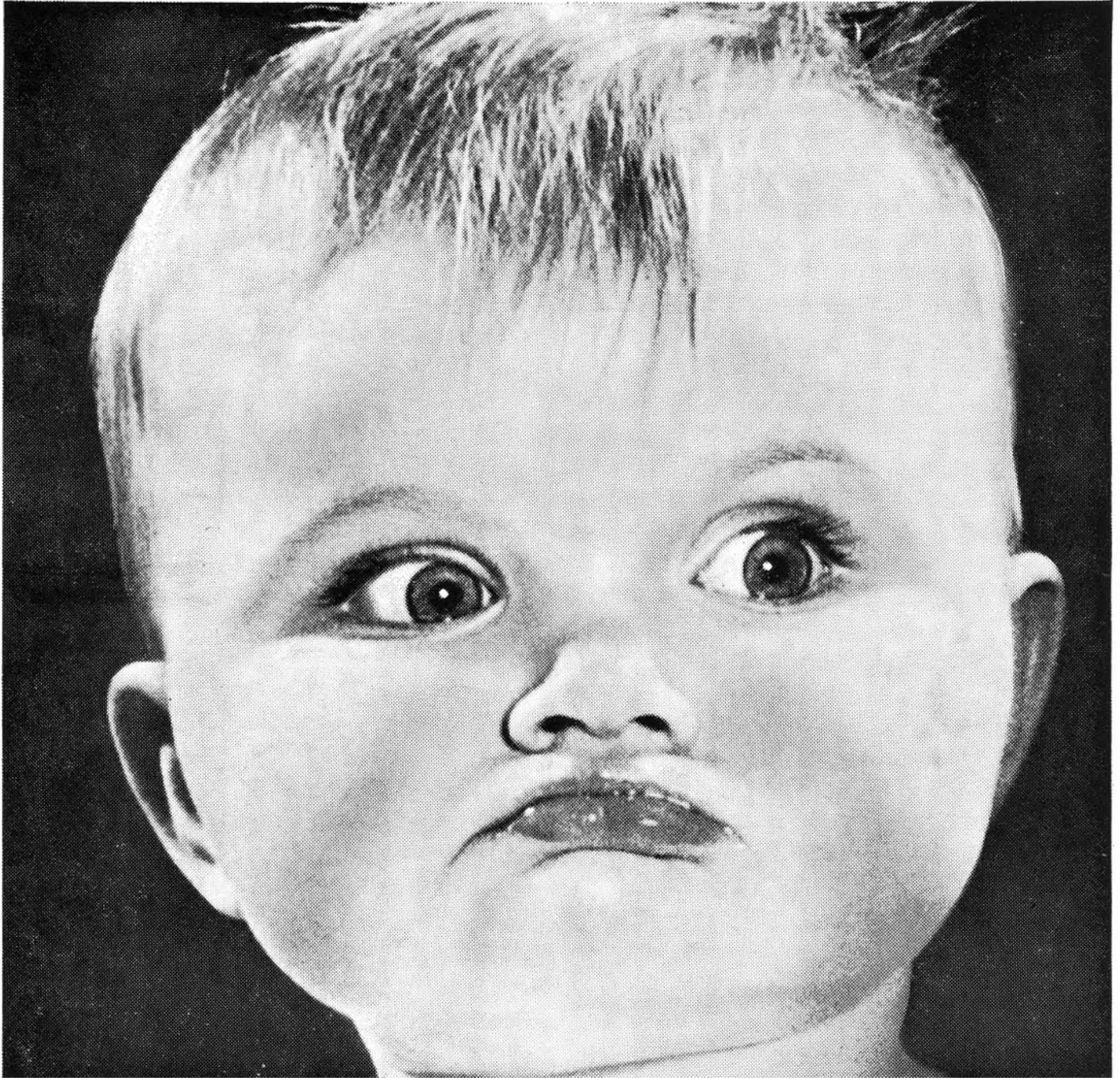


T. R. INDEX

INDEXES for Volume 5 of *Tape Recorder*, covering the period from February, 1963, to January, 1964, are now available, price 2s. (plus 3d. postage). Orders should be addressed to: *Subscription Department, Tape Recorder, Link House, Dingwall Avenue, Croydon, Surrey*.

NEXT MONTH

THE November issue will be published on October 23rd and will include an article on the joys of editing by P. D. Turner, a description of tape-making for the *Fletching Festival* by R. W. Griffin, Part 8 of *Gordon King's* series, Part 6 of D. P. Robinson's *Mixer* marathon, and a *Tutchings* review of the *Philips EL 3300*.



What does this mean to you?

What do you read in this baby's expression?

He's just found out Daddy is NOT using scotch Magnetic Tape to record baby's first words. Put these words into his mouth and you could win yourself a valuable prize in the scotch Magnetic Tape Sound & Vision Contest.

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graphic equipment. Each worth £200.

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MAGNETIC TAPE

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field trials of battery portables

MEDIUM-wave radio reception, a miniature record-player and portable tape recorder, all powered by batteries, and all under 'one roof'. The Stuzzi range is well-known for its combined radio receivers and tape recorders. Before the advent of the *Disc-Corder* these were all mains-powered, but it is now possible to purchase, for little more than £60, a complete transistorised battery-powered medium-fi set-up.



MANUFACTURER'S SPECIFICATION

Speed : $1\frac{1}{2}$ i/s. Spool Capacity : 4 $\frac{1}{2}$ in. Frequency Range : 60 c/s to 8 Kc/s. Signal-to-Noise : 40dB. Output Power : 400mW. Loudspeaker : 4in. Level Indicator : Meter. Miscellaneous : Facilities for playing 45rpm 7in. discs. Medium-wave radio reception from 190 to 580 metres. Dimensions : 10 x 9 x 3 $\frac{1}{2}$. Weight : 7lb., excluding batteries. Accessories : Shoulder case, microphones, combined mains unit and extension speaker. Price : £61 19s. 6d. Distributor : Recording Devices Ltd., 44 Southern Row, Kensington, London, W.10.

RECORD switch. This brings the modulation meter into action, recording level being raised or lowered by the volume control. The action of switching to RECORD automatically cuts the output through the speaker by about half. First reaction to this drop in volume is to increase the output level, but this inevitably means overmodulating the tape. Thus radio recordings must either be monitored at a level just below that required for comfortable listening, or the speaker should be cut out (by a switch located on the tone control), and the tape re-played later in the usual manner.

The maximum quality obtainable from recorded radio programmes to be extremely good for $1\frac{1}{2}$ i/s. It was found essential, however, to align the station as exactly as possible, and obtain the correct

NUMBER 4 Stuzzi Disc-Corder



Microphone, carrying-case and mains-unit are not included in the purchase price, but these were, however, supplied for the trial. The mains-unit is of some interest as it incorporates an extension loudspeaker. This speaker is of remarkably good quality, but the clarity and response of the recorder's internal speaker is astonishingly good for its size. Switching quickly from external to internal speakers revealed slight 'boxiness' in the latter, but this is of very low content.

The replay amplifier, shared by all three signal sources, is also of magnificent quality for a battery portable, with a tone control that gives brilliant treble response though appears to have no effect on bass frequencies.

CLEAR RECEPTION

Medium-wave reception on the transistor radio was clear, though heterodynes proved annoying on some stations of an evening. The internal aerial was quite sensitive and received many Continental transmissions without difficulty. Recording from the radio is "technically possible" (says the instruction booklet), and is accomplished by pressing one of three coloured push-buttons and the

BY DAVID KIRK

recording level. Minor mis-settings on either of these functions resulted in a high noise level or excessive distortion.

Turning now (upside-down) to the record-playing facility, this is reached by extracting the plastic base lid which is held in position by two catches. It was found necessary to exercise the greatest care when removing or replacing this lid, to prevent damaging the pickup and any possibility of the lid coming undone. Despite the greatest care taken to prevent such accidents, the pickup on several occasions slid over, or crashed down on to, the metal deck. It was enough to give a hi-fi enthusiast heart failure, but the stylus emerged without apparent damage.

Time Beat, a creation by the BBC's *Radiophonics* department, played very well through the external speaker, and quite satisfactorily through the internal one. Again, the good treble response made for

(Continued on page 364)



ROBERTS
1650

SIGNALMAN Magnetron, the doyen of the Army Stand at Earls Court, would have blown a fuse if someone had quizzed him: "What are the tape recording developments at the 1964 TV and Radio Show?"

In an atmosphere redolent of variety and change, only the tape recording field seemed to have been completely neglected. The novelty challenge came from the splinter shows around London, reported upon later. In the Exhibition Hall, the air was of audio consolidation. Several manufacturers showed products 'carried through' from previous years, and such items as were labelled new were re-styled models that *Tape Recorder* readers will have seen described in our pages. Only in the comparative secrecy of the Dealer Rendezvous could there be seen some presage of future releases.

In the tape market, two firms were showing their products, and each had something interesting to display. *Kodak*, with their wide experience of film techniques, had a display of use to the Ciné enthusiast. Linking a *Tandberg* 6 to their 500 projector, and playing back their prepared tape through a *Leak* transistorised amplifier and four 12-inch *KEF Celeste* loudspeakers, they gave continuous demonstrations of simple dubbing technique. 16mm. laminated stripe technique was employed and the tape medium was their double-play tape with acetate base—the difficulty of a weld-splice with polyester tape prevented the use of the latter in this instance. Each film and slide demonstration lasted 2 minutes 5 seconds, and as the demonstration ran at 5 minute intervals for the ten-hour daily period, it grew rather hot in that confined booth on Stand 28. Eventually, even the operators became tired of hearing the 'baby's cry' sequence!

The other feature of this stand was a *quadruple* play tape, type P400, especially developed for users of battery portables. Available on 3 and 3½ in. spools, prices £1 13s. 6d. and £2 2s., length, 600ft. for 3in. spool, 32 min. playing time at 3¾ i/s; 800ft. for 3½ in. spool, playing time 42 min. at 3¾ i/s.

On the *EMI* stand, the well-known range was displayed, hoop-la fashion, and a running, miniature 'Son-et-Lumiere', slide commentary, demonstration was the only concession to tub-thumping. The representative on the stand was concerned to attract interest to the excellent short-cut language courses marketed by this company on 3¾ in. twin-track mono tapes or 7in. discs.

On the *Tape Recorders (Electronics) Ltd.* stand, five new models were to be seen, in the *International* range. *Sound* have followed the trend of other makers with an eye to the 'pop' market and state that the 'automatic volume level for recording' can be supplied to any of this range, at no extra cost. Enthusiasts may deplore this trend, but the cheaper machines of *Elizabethan*, we note, have also gone 'automatic'. Of interest is the fact that *Grundig*, with their later model, T23A, have fitted an 'auto-manual' switch, and Messrs *Philips* will be doing the same on a machine soon to appear.

Details of the *Sound International* range, briefly, are as follows: TRE 14, ½-track, 3¾ i/s, 5½ in. spools, 24 gns; TRE 23, ¼-track as above, 27 gns; TRE 32, ½-track, 3-speed, 7in. spools, 30 gns; TRE 34, ¼-track version, 33 gns; and TRE 40, ¼-track, 3-speed, with parallel track superimposition, bass and treble tone controls, loud-speaker monitoring, straight-through amplifier facility and three speakers, 45 gns. All models have tape position indicators and use *BSR* decks; all use magic eye recording level indication, have a stated

frequency response of 60 c/s to 13 Kc/s ±3dB, 3W output, signal-to-noise ratio of better than 40dB, and all, we are pleased to note, have been fitted with DIN sockets. Promise of a more robust amplifier panel has been made, in answer to enquiries.

In the same price range were the three models displayed by *Fidelity*. These were the *Playmaster-2* (21 gns), *Playmaster-4* (24 gns), and *Playmaster Major* (35 gns). These models, released in August 1963, have been successful and production continues. No new line in this field was added for the Show.

The latest *Thorn* tape deck could be seen in several models marketed by this Group, including *Ferguson*, *Ultra*, *H.M.V.* and *Marconi*.

Ferguson showed the 3204, ¼-track, 2-speed machine, retailing at 33 gns, with all the usual features and styled to match the 3006 record player, link leads being provided for direct recording of discs, or straight amplifier, or voice over disc as required. Styling in the now familiar blue and silver made a very tasteful pair.

Ultra also had these two competitive models on show, with a glass-cased version for good measure. The deck has many attractive

showtime tape report

features and the basic models, 4204, ¼-track and 4202, ½-track in the *H.M.V./Marconi* range retail at 33 and 25 gns (*Ultra* ¼-track model 6202, 33 gns; *Ferguson* 3206 ½-track, 26 gns). The *H.M.V.* 2204B is 36 gns, and has a different styling, with a very good quality output for its price from the 8 × 5in. loudspeaker. Price variations are due to styling differences; decks are basic, piano-key operation, with digital reset (push-button), pause control, DIN sockets and facilities for connection into any of the modern range of *British Radio Corporation* radiograms.

A new tape recorder that attracted some attention was the *Dansette Empress*, at 37 gns. This ¼-track, 3-speed machine uses the *BSR* TD10 deck, has a professional style control panel, feeds 3½W to the 8 × 5in. speaker and is tastefully finished in blue. The well-known *Consort* (22 gns) and *Cadet* (26 gns) models were displayed also. The latter is a portable, transistorised machine with the *Garrard* magazine deck.

Also of interest on this stand was a new venture for *Dansette*, a range of P.A. equipment especially designed for the electric guitar. The most competitive model of its size is as yet un-named, but retails at (provisionally) 132 gns, including legs, gives a 30W undistorted output from two 15in. and two 7 × 4in. loudspeakers, has three-channel mixing, uses printed circuitry and a novel valve and transistor circuit. Interest in this has already led the firm to produce to an 8-week delivery schedule.

Another amplifier of interest to *Tape Recorder* readers was displayed on the *Heathkit* stand. Established for two years, the TA-1M and TA-1S are mono and stereo versions of self-built printed-circuit valve amplifiers with provision for matching any tape deck and an output

suitable for matching to any main amplifier. It is possible to build the mono version and convert later to stereo. A separate power supply is available from the MGP-1 kit. Prices: TA-T1 £19 18s., TA-IS £25 10s., and MGP-1 power supply kit £5 2s. 6d.

A firm new to the electronics business were showing their first-ever tape recorder, the RT18 *Revelation*, the brand-name of Wood & Son, the well-known luggage makers, covers a range of tasteful products. The tape recorder uses a *Magnavox Studio* deck, ¼-track, has a hand-built, 4W amplifier, superimposition, monitoring, tone control, extension L/S and rev. counter, and retails at 42 gns. The finish is in the latest American *Boltaron* thermo-plastic, with exceptional resistance to impact and abrasion.

Defiant, the C.W.S. firm, brought a restyled offering, the T16, with specifications similar to their previous range of T14, ¼-track, 3¾ i/s, but with a larger loudspeaker and cabinet. This unit is free-standing, but designed to match with their CPI console record player as part of the C.W.S. 'Unit-Plan'. Price: 38 gns.

Messrs. *Bush* showed their established TP50, ¼-track model which

NEW TAPE EQUIPMENT SEEN AT THE RADIO SHOW AND OTHER EXHIBITIONS

sells for 38 gns, using the later *B.S.R.* deck. No change in production is envisaged.

It was interesting to note that *Dynatron* have now dropped the opulent model that caught the eye of so many people at the last Radio Show two years ago. But the *Buckingham* radiogram was displayed with a 4T tape deck of their own make as part of its design. Enquiries failed to elicit any production date for this attractive-looking deck as a self-contained tape recorder.

Alba have continued with their R16 and R17 range, 2- and 4-track versions using *B.S.R.* deck, at 24½ and 27 gns. Also re-issued is the *K.-B. WT 20*, of similar specifications, and similar price (24 gns).

Although not on show, because of the restriction on 'foreign-made' goods, the *Philips/Cossor/Stella* range was expanded around the Showtime period. One thought for the future from *Philips* is a car-mounting case to enable the road user to link his radio to the EL 3300 recorder. *Philips* also have a 'new-look' family recorder at 39 gns; ¼-track, 2-speed, with separate input and output regulation, straight-through amplifier and mixing facilities, taking a 7in. spool, parallel playback, with push-button tape indicator reset and the usual stereo output socket. This model, to be known as the EL 3548, bids fair to claim a good share of the 'family' market.

Another forthcoming attraction, not yet released, is a single-speed, ¼-track model for the teenager, with the gimmick of an 'auto-manual' switch, whose price will probably be around £25. The diligent could also obtain information on *Cossor* models CR 1606 and CR 1607 (see page 309 of *Tape Recorder* September issue). The latter is reputed to be the least expensive fully transistorised stereo machine yet marketed.

Machines in these categories are following the clean-up styling inaugurated last year by the *Philips* company, and a brief opportunity of handling these models indicated that control systems, too, had been improved. We look forward to seeing more of these 'adopted' British machines, despite the restrictive practices of the Radio Show organisers which make it necessary to have private viewings outside Earls Court until models become available to the retail trade.

Leaving the Radio Show for the semi-trade exhibitions, a tour of hot, sticky summer London began. The majority of manufacturers who had decided to exhibit their products did so in some of the many hotels scattered around the West of London. It was a relief for tired feet to find a large number of companies exhibiting in a single building. The *International Radio & Electrical Trades Exhibition* at the Prince of Wales Hotel, was an intelligently organised attempt to compete with 'big brother' at Earls Court.

Layout of products in rooms occupied by individual manufacturers gave something of an *Audio Fair* atmosphere; with one important difference—this exhibition was almost deserted.

A closer look at the products on display revealed more new equipment than was to be found at all the parallel shows put together. Importers of Japanese commodities had some impressive-looking battery recorders discernible beneath mountains of portable radios. *United Africa Mechanical and Electrical Ltd.*, distributors of *National* equipment, displayed what is probably the first ¼-track battery recorder to be marketed in this country. This was the RQ-116, selling at £40 19s. Like its ½-track equivalent (the RQ-115, price £36 15s.), this machine operates at 1¾ and 3¾ i/s. Maximum spool capacity is 3in. and claimed wow and flutter at 3¾ is 0.35% RMS. Frequency range at this speed is 100 c/s to 7 Kc/s.

Even more original is the feature incorporated on the *National* RQ-150. This machine can be operated, during RECORD, by voice alone. Tape drive begins almost immediately the microphone picks up a sound and stops about two seconds after the sound is halted. The level of sound required to operate this 'voice-relay' can be varied by a rotating control. Turning this to a low level allows use of the switch in noisy surroundings, as only a sound made close to the microphone will start the machine.

Though not strictly in the enthusiasts' field, an interesting miniature mains recorder, selling at 15 gns, was also displayed by the importers of *National*. Measuring 8 × 7½ × 4in., the RQ-303 would make an ideal gift for a very young 'possible enthusiast'. Four piano-key buttons operate the transport, with a single gain control to set recording and playback volume. The former is judged with the aid of a small neon indicator. Wow and flutter is said to be less than 0.5% at the single, capstan driven, speed of 1¾ i/s. Rising to the 'hi-fi' price range, the RS-753 ¼-track stereo recorder was another item on display. A 'Reverberation Adapter' is available for this machine. Three speeds, 1¾, 3¾ and 7¾ i/s are featured, and the manufacturers claim a 'special circuit design' to permit recording of multiplex stereo broadcasts (presumably a pilot signal filter or exceptionally high bias frequency).

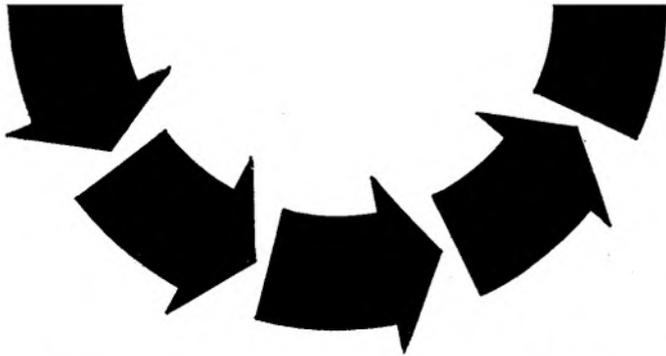
Also on show at the Prince of Wales was the *Belzona TRA-500*. It was interesting to note the similarity of the various new features introduced to the domestic recording market this autumn. *Belzona*, along with *Elizabethan Sound*, *Philips* and *Grundig* have all added automatic-gain to some of their latest products. This leaves the TRA-500 with only two controls—one for playback volume and one to operate all mechanical functions. The latter has a 'built-in' record interlock.

One manufacturer went out of his way to be original and succeeded

(Continued overleaf)

ELIZABETHAN
LZ24





How fast is Speed ?

Among the many factors taken into consideration by Tandberg engineers when designing semi-professional tape recorders are Tape running speed and maximum reel size.

It is now more than ten years since Tandberg demonstrated their ability to produce a standard of performance at $7\frac{1}{2}$ i.p.s. better than that previously achieved by many expensive 15 i.p.s. tape recorders. Since that time the completely dedicated Tandberg tape recorder research team have progressed from one outstanding development to another.

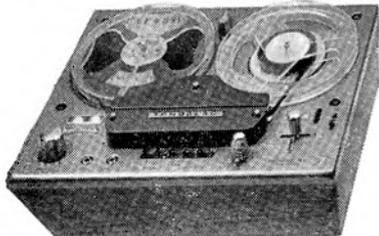
With a speed of 15 i.p.s., and before the advent of modern Long Play tapes, a $10\frac{1}{2}$ " reel was essential. The modern Tandberg Series 6 or 7 use 7" reels and with L.P. tape will play 45 minutes at $7\frac{1}{2}$ i.p.s. or 1½ hours at $3\frac{1}{2}$ i.p.s. uninterrupted. This has enabled Tandberg to produce semi-professional tape recorders weighing only 25 to 28 lbs. and measuring $15\frac{1}{2}$ " x $11\frac{1}{2}$ " overall.

Due to their modest dimensions and absence of overhanging reels, Tandberg Series 6 and Series 7 have therefore established themselves as first choice for inclusion in permanent Hi-Fi installations.

With final reference to Tape Speed as related to performance we quote:—

"At $7\frac{1}{2}$ neither he nor the reviewer could distinguish the tape from the original. At $3\frac{1}{2}$, the two could be barely distinguished. The reviewer made his differentiation largely on the basis of slightly higher background noise when the tape was played". (Tandberg 64 reviewed in AUDIO March 1963).

"Even at the lowest tape speed of $1\frac{1}{2}$ i/s it needs a sharp ear and a really good performance source to be sure, every time, whether you are listening via tape or directly". (A. Tutchings reviewing Series 6 (2-track) in The Tape Recorder).



Write for details of
Tandberg Series 6 & 7
Tape Recorders and
28 page booklet of
Technical Reviews.

Tandberg

ELSTONE ELECTRONICS LIMITED
Edward St., Templar St., Leeds 2. Tel : Leeds 35111 (7 lines)

SHOWTIME TAPE REPORT CONTINUED

in producing an entire stereo recording and dubbing studio in a single box. For the first time, the amateur will have access to features only recently added to professional equipment in the U.S.A. Mechanically, the *Korting* MT 3624 is little more than a polished stereo version of M. H. Amersham's suggestion in *Readers' Problems*, August 1964, but the price, just under £100, is certainly not excessive for so versatile a recorder. Another new *Korting* was the MT 3623, equipped with full $\frac{1}{2}$ -track recording and playback facilities and using low-noise transistorised input stages.

Argelane Ltd., distributors of *Braun* audio equipment, are now importing the *Roberts* 1650, manufactured by the United States importers of *Akai* recorders. Two basic speeds, $3\frac{1}{2}$ and $7\frac{1}{2}$ i/s are offered, and a 15 i/s 'accessory kit' is available. Designed for vertical or horizontal operation, claimed frequency responses are 50 c/s to 10 Kc/s, 30 c/s to 18 Kc/s, and 30 c/s to 20 Kc/s, all ± 3 dB, at $3\frac{1}{2}$, $7\frac{1}{2}$ and 15 i/s respectively. The 1605 is fully equipped for $\frac{1}{2}$ -track stereo recording, with twin VU meters, and costs £175.

Still within the boundaries of the International Exhibition, the full range of *Siemens* stereo recorders were on show. Models 10, 12 and 14 are identical in all respects other than their cabinet style and speaker arrangements. The first incorporates a single forward-facing monitor loudspeaker while Model 12 has two speakers with side-reflectors. The last, as Model 10, has one forward-facing speaker, but a different outside finish.

Moving out of this combined exhibition, Messrs. *Elizabethan* were found at a nearby hotel. Several models made their debut, including

SOUND
TRE34



re-styled versions of recorders intended for the American market. An AUTOMATIC GAIN recorder was displayed, along with a $\frac{1}{2}$ -track stereo model with detachable speakers, the latter to sell at £61 19s.

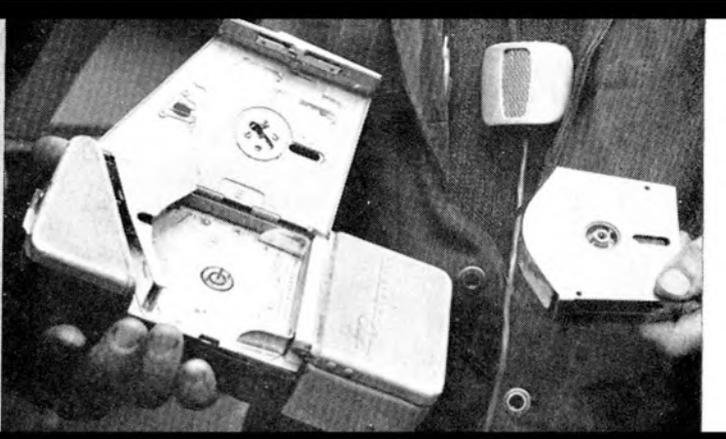
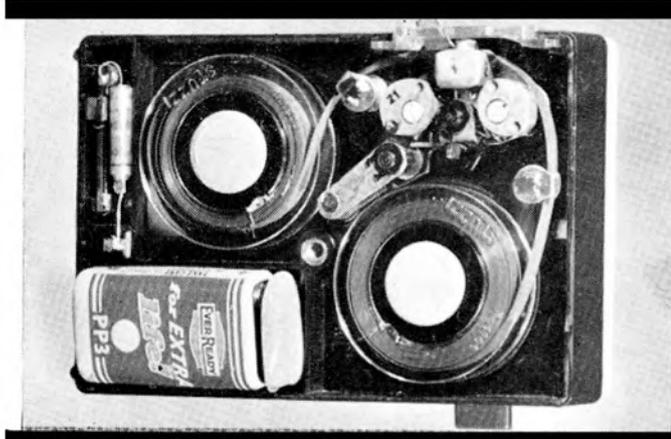
The *Grundig* display, on the second floor of the *Hilton Hotel*, proved very similar to the one organised last year. While the layout of shrubbery, miniature fish ponds and forest was a little different, the only addition to the range of tape recorders was the TK23A, a second model with automatic gain to be produced by the company. Deck styling is slightly different to the rest of the range, although controls are kept in the same position as on the TK 18 (the first *Automatic*). The $\frac{1}{2}$ -track TK23A retails at £51 9s. compared with £40 19s. for the $\frac{1}{2}$ -track TK18.

Bang & Olufson hi-fi equipment and portable radio receivers were well to the fore at the *Carlton Tower Hotel*, where they were being displayed by *St. Aldate Warehouse Ltd.* No new tape equipment was to be seen, and the *Stereomaster* held the recording field on its own. Likewise, the *Highgate Acoustics* and *Bosch* exhibitions showed nothing new in the tape range. The *Optacord* 414 performed through one of the latest *Loewe Opta* tuner-amplifiers as yet another example of the growing quality expected of a battery machine.

Likewise, the *Saba* exhibition showed no new recorders to have been added to the range since the announcement of the TK23OS $\frac{1}{2}$ -track stereo.

These, then, are the Autumn additions to the recording market. Thanks to active support from importers of Japanese goods, the stocking is quite a full one, though the three British manufacturers—*Fidelity*, *Sound* and *Elizabethan*, have added admirably, in their own way, to the tape scene. Let us hope these activities will be centred under one roof in the not-too-distant future.

SPOOLS OR CARTRIDGES— MAGAZINES OR CASSETTES?



BY KENNETH GLENWOOD

One point of view on a future controversy

IN the beginning, man created tape. He wound his tape on double-flanged metal spools. Then came the *single*-flanged metal spool (mainly patronised by the 'Professionals'), and finally the plastic spool.

As if this wasn't sufficient variety, tape manufacturers decided to provide boxes for their spools. Thus the market was filled with *cassettes*—square ones, round ones, cardboard ones, wooden and plastic ones.

Hard on the heels of the cassette came the *magazine*. This was the name given to a plastic box containing two spools and a quantity of tape. Unlike plain spools the magazine would only fit recorders made by its own manufacturer. The majority, however, could be re-loaded, by the owner, with other standard spools. This was a disadvantage, however, from the commercial point of view. It was consequently not long before the *cartridge* finally made a freedom jump from its prior confinement in the world of the dictaphone.

The cartridge was something very special. It could *not* be loaded with 'cheap tape', or interchanged from one model of recorder to another. Machine A would only accept Cassette A. Cassette B would be as useless to Machine A as a GPO Jack Plug is on the Continent.

The battle for plug standardisation was given up as lost many years ago (*not by everyone—Ed.*), but the battle of cartridge against spool is only just beginning.

In the past few years cartridge-recorders have followed a tendency to die out rather than increase in popularity. A year ago there were only four such machines on the recording market. The *Eumig T5*, specifically intended to provide sound facilities for Eumig Cine Projectors, cost £25 and used cartridges of tape playing at $3\frac{1}{2}$ i/s on two tracks. Batteries provided the power to this, and to the *Midgetape Chief 400* and *500* which also used cartridges. Manufactured by *Thomas A. Edison Ltd.*, the two recorders followed American styling and looked more suited to secretive use by 'Private Eyes' than high quality recording. The retail prices are £129 and £160 respectively.

The *Stuzzi Memocord* is probably the most well-known of this quartet. Quarter-track recording at approximately $1\frac{1}{2}$ i/s was offered,

on cartridges lasting one hour. Priced £26 5s., it was intended as a dictaphone. Stuzzi have never advertised the Memocord before serious recording enthusiasts, though it is known to have been popular as a cheap battery recorder in its day. That day is no longer, however, and the four machines have disappeared from catalogues and year-books listing tape equipment.

Having apparently lost interest in cartridges the 'trade' appeared to be concentrating on retaining present-day standards of tape, tracking and spool uniformity. It was therefore with considerable shock that news was received of a new battery recorder, using cartridges and claimed as a high quality recorder of music and speech. The company were known to be respected by both amateur and professional recordists and had often led the way in introducing new facilities to the domestic machine. Having been pioneered by this firm, *multi-play*, *inter-track recording*, and *add-on stereo* were quickly copied by others catering for the amateur market. Indeed $\frac{1}{4}$ -track recording might not be where it is today had this company not switched the majority of its products to that system.

It is not only the hi-fi perfectionists who have frowned on the advent of $\frac{1}{4}$ -track recording, as many recordists searching for a reasonable compromise between quality and cost agree that domestic $\frac{1}{4}$ -track has many limitations compared with domestic $\frac{1}{2}$ -track. But the confusion and argument caused by narrow tracking systems may well be forgotten should the cartridge grow in popularity.

Will this new recorder herald the approaching end of tape standardisation? Admittedly the cartridges at present supplied for it can be opened by the operator; but what purpose would this fulfil? Presuming that $\frac{1}{4}$ -inch tape could be sliced in half, it would still be the wrong size. Future cartridges may well be riveted so no such re-filling with unused tape would be possible. The purchaser of a cartridge-recorder would then be forced to pay any exorbitant price its manufacturer dare ask for extra tapes.

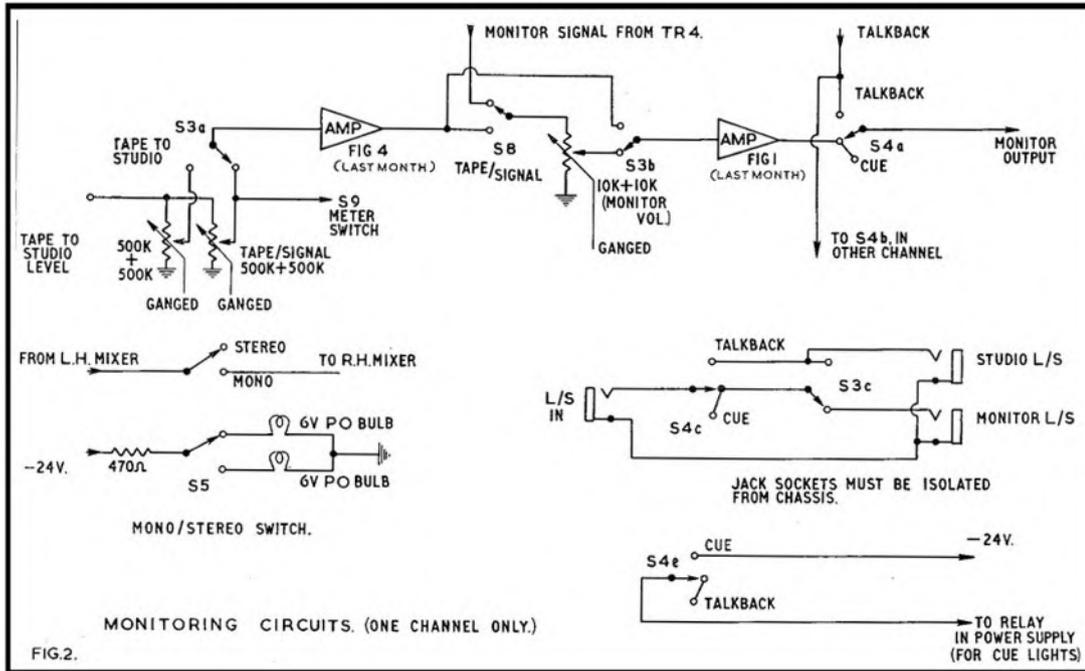
Having made one's recordings on a cartridge machine there is no alternative but to copy them on to another recorder, should editing or exchanging be required. Even if a narrow tape splicer were introduced, editing such expensive tape would be a questionable operation—conducted, moreover, at the risk of losing the cut lengths of tape inside the cartridge case. Dubbing from one machine to another invariably means unnecessary losses in quality.

For the 'one-machine' owner of a cartridge recorder, such pastimes as tape correspondence will be rendered impossible unless contact is made with another owner of an identical machine. Outdoor interviews, recordings of sound effects, and even recordings of music taken from radio broadcasts will be on a hit-and-miss basis because, with tape-cutting difficult and expensive, 'programmes' will be difficult to

(Continued on page 376)

A STUDIO QUALITY MIXER

PART 5- FINAL MONITORING DETAILS AND A PEAK PROGRAMME METER



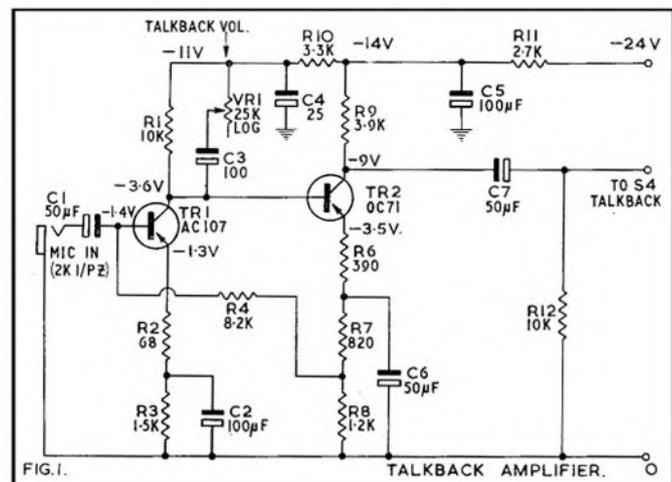
THE other monitoring facility yet to be mentioned is the talkback amplifier, which enables the operator to talk to the studio to stop a bad recording, or announce the various 'takes'. When the key is pressed the output from a general-purpose low quality microphone is amplified and fed to the studio loudspeakers only—the monitor loudspeaker is cut to avoid acoustic howl-round. A separate volume control is fitted. The circuit is shown in fig. 1, and will be recognised as being similar in design to previous units; the use of DC feedback pairs provides a very useful stable building brick which can be adapted for many purposes, and readers will have noticed that they form the backbone of the mixer. The first transistor, a low noise type, is DC stabilised by a feed from the emitter of the second, and since the feedback is negative a very stable working point is reached. Local feedback is applied to each amplifying stage by using undecoupled resistors in the emitters. Overall gain is controlled by varying the AC collector load in the first transistor. The input impedance is about 2K which means it is suitable for any 600 ohm microphone, or for any of the cheap imported types, about 1 to 5K, now on the general market.

The connections to all these last described units are shown in fig. 2, for one channel in the stereo system, and fig. 3 (photo) for the layout used on the front panel. In the prototype only one of the volume controls was labelled since the remainder are colour-coded to the row of keyswitches above. The extreme left-hand switch is the TALKBACK/CUE control, coloured red, and the control for the talkback volume is underneath the switch and is also painted red. TAPE TO STUDIO and the second volume control from the left are coded yellow, and the extreme right-hand volume control and switch are green. This last is the tape level control (VR2 in fig. 4 last month). The other volume control is labelled MONITOR and is the level adjustment for the monitoring amplifiers and speakers in the control room. The MONO-STEREO switch connects the two mixing stages together for AC signals, and was made rather stiff to operate so that it could not be accidentally moved instead of one of the adjacent keys. This was painted white. The control keys are black, and connections from these are wired to

suitable sockets on the rear panel. The object of these is to facilitate control of the simple stop-start function of up to two recorders, and since different machines use different systems for this, no further details are given, it being left to each constructor to wire these to suit his own machine.

There remains one more monitoring circuit to discuss, that dealing with metering arrangements. For most of the time it is the incoming or recording signal that is monitored, but there are occasions, such as the initial line-up of the recorder, when it is useful to switch the meter to the tape playback. Using the oscillator which is built into the mixer, this enables the frequency response of the machine to be checked

(Continued on page 363)



A STUDIO QUALITY MIXER

BY D. P. ROBINSON

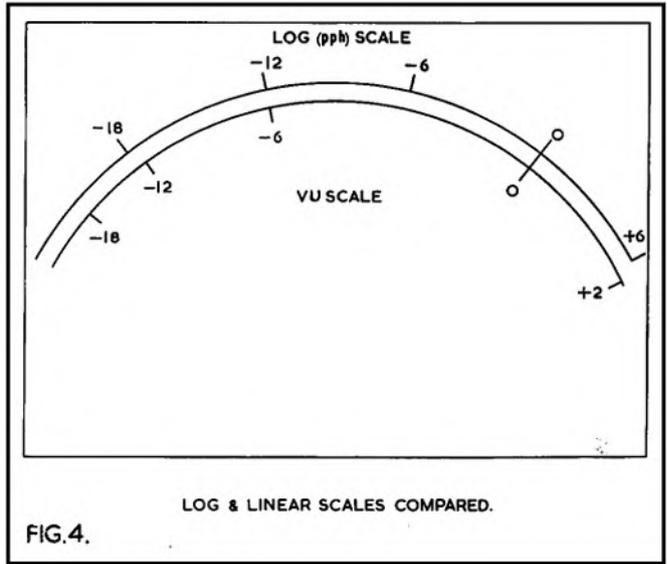
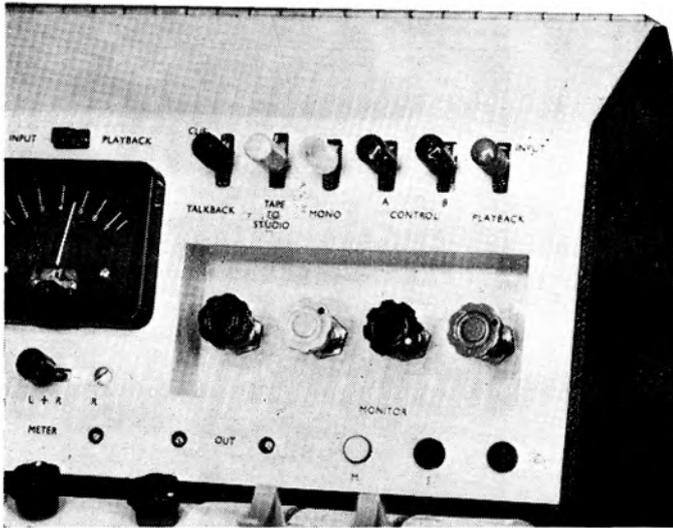
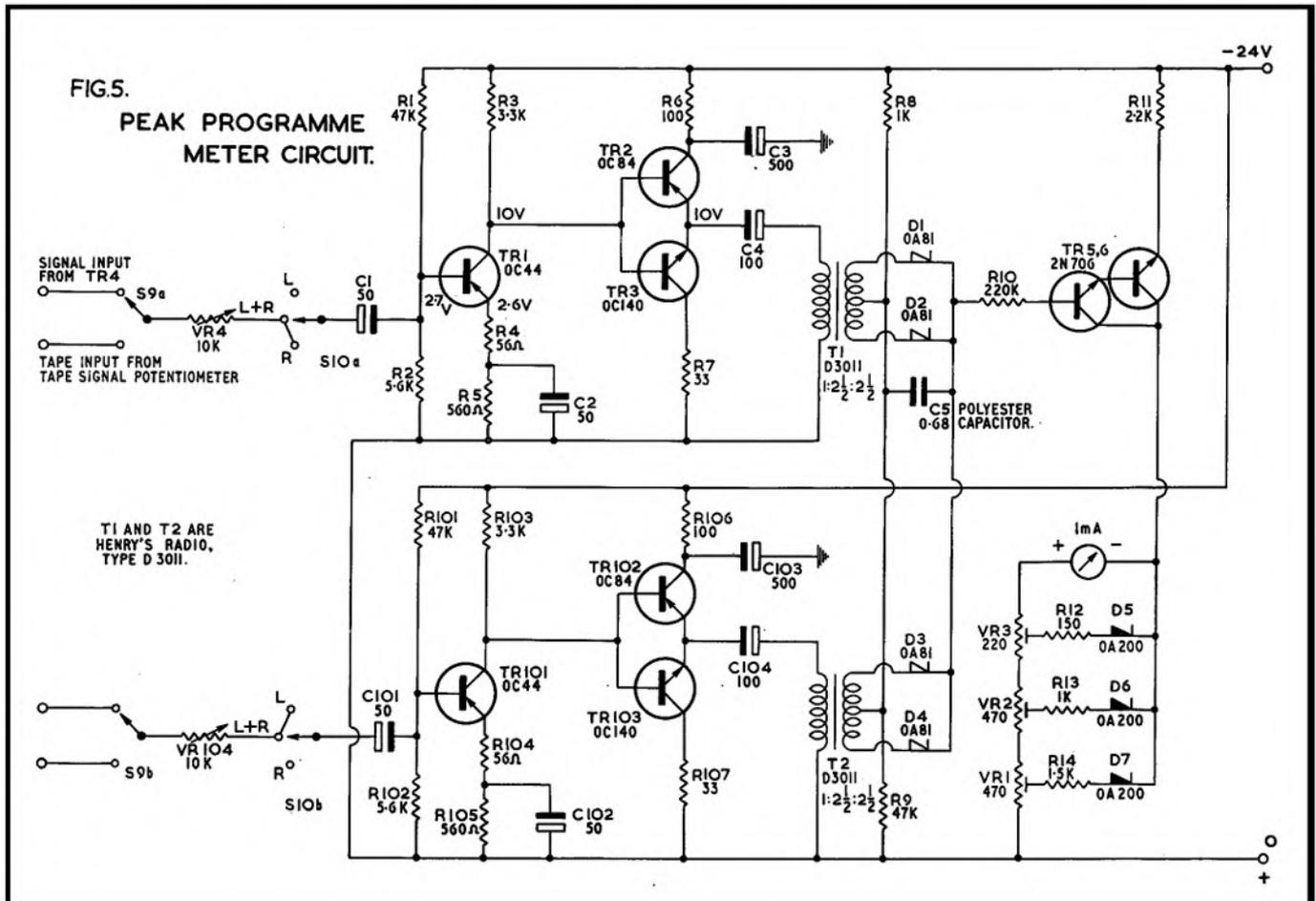


FIG. 4.





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at the upper frequencies. Switch S9, above the meter (fig. 3), is included so that the inputs to the meter circuit can be switched.

For stereo systems there is the choice of having either two independent meters and drive amplifiers, or having electrical switching to one. In a correctly balanced system any difference between the two channels must be intentional, so that a single meter which reads the greater of the two signals is satisfactory, since in tape recording it is the amplitude of the signal compared with the tape saturation level that is important. This system is considerably cheaper than two meters, or the twin-pointer versions which can be obtained at fabulous expense.

The mixer has a three-way switch so that the meter can be switched to read the signal level on the left channel only, right channel only, or a centre position, which is the normal mode, where the greater of either is read. This last position is labelled rather unfortunately on the prototype as 'L + R' which is quite wrong, since the one thing that it must not do is read the *sum* of the two channels! There should be a computer-language symbol for 'L or R whichever is the greater' which would be ideal.

AN AREA OF CONTROVERSY

The next, and most important decision to make concerns the type of circuit to adopt. Here is an area of great controversy; in the USA the VU or volume-unit is universally adopted, while in Britain the BBC uses only Peak Programme Meters; on the Continent both are in sway. The VU measures loudness—and hence is useful for determining the effectiveness of the commercials—but because of the integrating action it is highly dependent on the type of programme being recorded. This can be demonstrated easily by aligning a VU on continuous tone, and then switching to a music source of the same level; the VU meter will hardly leave the zero end stop. In recording it is the amplitude of the *peaks* that is important, for the tape overloads at a well defined level, and the type of programme has only second order effects—for example, very short peaks appear to distort less than long signals of an equal amplitude. The peak-programme-meter responds to these peaks and will give an accurate reading irrespective of the content: tone and music give exactly the same reading. Incidentally, the common magic-eye also responds to peaks, and in the author's opinion a good 'eye' is to be preferred to a VU, and the trend to small (useless) VUs is nothing but an unfortunate sales gimmick.

Implied in the term PPM is the type of display and also its calibration. In order that the signal can be measured, observed, and any correcting action taken by the operator, the circuit together with the meter has an extremely fast rise-time, and will reach full scale in less than 12mS from the initial impulse. On the other hand, the decay time is long, and the pointer will take 3-4 seconds to reach zero from full scale. The circuit is designed around a special meter which has closely controlled electrical and mechanical damping so that this rise-time can be obtained with no overshoot. The VU has a tiring rapid movement both ways and, in cheap meters, very bad overshoot characteristics. The VU has a linear voltage scale, but the PPM is logarithmic or linear with dB's. The effect of this is that the PPM covers a wider usable range, and is much more precise near the critical point of overload and in the region immediately above. Fig. 4 gives a comparison between the two.

In fig. 5 there is given a practical stereo circuit for a peak-programme-meter. A voltage proportional to the input level is set up on C5, and measured by the super-alpha pair of transistors Tr 5 and 6. This connection gives a very high input impedance of about 1.5M, including R10 which is added only to give a small range of control. The discharge time of C5 through this part of the circuit is therefore governed by the time-constant C5 times Rin, or one second. This ensures that the meter takes several seconds to decay from full scale. For good stability the two transistors used here are the 2N706 or 2N706A, which maintain their current-gain until a very low collector current. These can be obtained from either *Texas Instruments* or *ST & C* at just under 10s. each.

The voltage on the capacitor C5 appears almost entirely on the emitter of Tr 6, the only losses being a small drop across R10 and the two Vbe drops in the transistors, thus setting-up in R11 an accurately known current which is exactly proportional to the input voltage. This current then flows into the non-linear network in the collector

circuit. At first all the current will flow through the meter, but as the current increases the voltage developed across VR1, 2, and 3 increases and eventually diode D7 starts to conduct. This is at a typical forward voltage of 0.5V for the OA200, but any similar diode can be used provided that it is a silicon type. Germanium diodes have a much lower conduction voltage which will not suit the other values in the non-linear circuit. As the collector current continues to rise, the other two diodes will conduct, progressively by-passing a larger fraction of the total current from the meter; using the variable resistors, the scale can be arranged to be to the BBC standard of 4dB-per-division as shown in fig. 3. The meter used is supplied by *Ernest Turner & Co. Ltd.*, and is ordered as "1 mA forward reading peak-programme meter, model 702, to Ernest Turner Drawing DM 486".

The first part of the circuit is driven by two identical amplifiers, one to each channel. The drive amplifiers never have to supply a large continuous amount of current, since once C5 is charged very little extra drive is required to keep it so. However, to charge it rapidly, a large peak current is demanded, so that the amplifier is designed as a Class-B push-pull amplifier, and C3 supplies the surge current and not the supply. The standing current of the whole amplifier is about 8mA, rising to 16mA under full drive, of which 4mA are flowing in the non-linear network.

Transformer coupling is used for two reasons: on music or speech, positive and negative peaks in the waveform may differ by as much as 8dB, so that to read peaks a phase-splitter, bridge-rectifier, or centre-tapped transformer is necessary. The second reason is to provide the stereo connection. With S9, either or both of the two drive amplifiers are switched on, and the signal is then rectified to C5. Assume that the signal is greater at T1 than at T2, then no signal at T2 will be large enough to overcome the back bias on D3 and D4, so that the signals in T2 can have no effect on the meter. But as soon as the signal in T2 is greater than that in T1, the reverse is true and T1 can have no effect on the reading. Thus the transformers have performed the operation of selecting the greater of the two stereo systems. A suitable type is the D3011 from *Henry's Radio*. The output impedance of the amplifier and the resistance of the transformer together give the time-constant on the charging side of C5 as 2 ms; the correct figure for a PPM circuit is 2.5 ms, and this is made up by the mechanics of the meter.

SIMPLE ALIGNMENT

The circuit is quite easy to align. First, the meter zero should be checked to ensure that mechanically it is in the correct position, and then the electrical zero is adjusted. R11 is increased until the meter needle just begins to move away from zero, and then the next standard value resistor of lower value is chosen. This then allows for the two voltages of about 0.5V each which must exist between base and emitter of each of the two silicon devices. There will be no drift in this so that it is not necessary to make R11 variable—once fixed it will remain at that value; 1K is very near to the required value for typical 2N706s.

An audio signal is then applied to the input of one of the amplifiers until the meter reads 1½; there is no marking at this point so that the position must be estimated. The input is then increased to exactly twice its value, and VR1 adjusted until the meter reads 3. Doubling the input again, adjust VR2 to read 4½ on the meter, and finally double the input yet again, adjusting VR3 to give an indication of 6. This procedure should then be repeated once more, after which the circuit is aligned, and this takes as long to write about as it does to perform! If it is so required the potentiometers can then be replaced with fixed resistors, since here also there will be no drift problems.

The gain adjustment is then made. With 0dB leaving the mixer on the recording output, or that level which comfortably drives the recorder to full modulation, the meter switch is put to the Left channel only and VR104 set so that the meter reads 6. The switch is then set to the Right channel only and VR4 set for 6. With the switch in the centre position there may be a change of ½ dB in the reading owing to the diode characteristics at the instant when all the diodes D1 to 4 are conducting, but this is not important. If for special applications more gain is required from the meter circuit so that smaller signals can be measured, then C2 and C102 can be taken to the other end of R4 and R104 respectively, which will increase the gain considerably.

Next month we will start by describing a simple VU meter circuit for those who prefer that system.



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FIELD TRIAL — CONTINUED

very satisfying results. Speed fluctuations were not detectable on this and other light music played on the small turntable.

Recording from discs was again "technically possible" by pressing the appropriate coloured button and the RECORD switch. (No interlock is provided but the bright red switch contrasts with the other black controls.) With the tape deck facing downwards, this switch could only be reached satisfactorily by moving the unit out over the edge of a table and peering underneath to select it from the adjacent controls. It would not take much experience before the Disc-Corder could be operated by 'touch', so there need be no fear of incurring a stiff neck through frequent contortions of this kind. The act of playing discs without recording was found to be more difficult than setting the machine to record them. After depressing the coloured button, any one of the tape deck controls could be carefully pressed—not fully home, as would be the case with pressing to RECORD for example, but 'half way' between on and off. This set the turntable in motion. A simpler switching arrangement might be to the user's advantage, the present one relying heavily on the user's dexterity.

FRICION — FLUTTER

Recording with the tape upside-down was not entirely satisfactory. Quite a high level of flutter was generated by friction between the spools (which rested on small elevations of the lid) and the Perspex lid itself. Small rubber hub caps would solve this problem, though some modification to the lid and hubs would be required.

The mains adapter, which was positioned in the space behind the extension-speaker drive unit, proved a reliable hum-free alternative to batteries. The four 1.5V steel-lined cells showed little sign of wear after many hours of use. According to the instruction booklet (one of the most comprehensive ever produced for a battery machine) a new set of batteries will push the VV-meter/battery-life indicator to the red 'overload' position. In practice this does not occur—but it took a second set of batteries to find this out. Cells in perfect condition deflect the pointer to the edge of its green calibration, but not quite to the red. As the batteries grow weaker the meter moves further and further into the green section (when switched to PLAY). The mains unit, however, deflects this pointer well into the red area. But this is nothing more than slight mis-wording of the booklet.

OCCASIONAL JAMS

After some use, the three green push-buttons on the front of the recorder began, on rare occasions, to jam. The yellow TAPE button was particularly fond of this and would, every so often, fail to return when other buttons were pushed. This meant the other buttons would not move into position, and proved a source of annoyance until it was discovered that, by 'hammering' fairly softly on the yellow button with a finger, it was possible to cause it to spring back outwards. That the buttons should show signs of wear after a comparatively short period of use was an annoying betrayal of the other excellent controls used on the model.

The Disc-Corder is not the lightest of machines to carry, and is rather bulky when supported from the shoulder. It may be peculiar to me, but I have always found the average battery portable easier to carry by hand than on the shoulder.

USE OUT OF DOORS

Inconspicuous outdoor recording was easily accomplished, thanks to the provision of a microphone case on the shoulder strap. The nature of this case allows one to plug the microphone into the recorder and pick up sound through the holes in the case. General recordings made indoors and out were well reproduced and the recording side alone seems worth at least half the £62.

If you are wealthy enough to desire a battery portable audio system (which by its nature is more expensive than a comparable indoor system) the Stuzzi Disc-Corder is fully recommended. It is far from being an expensive gimmick and is certainly one of the most versatile machines ever to be offered on the domestic recording market.

a transistor tape amplifier

BY S. WELLDON.

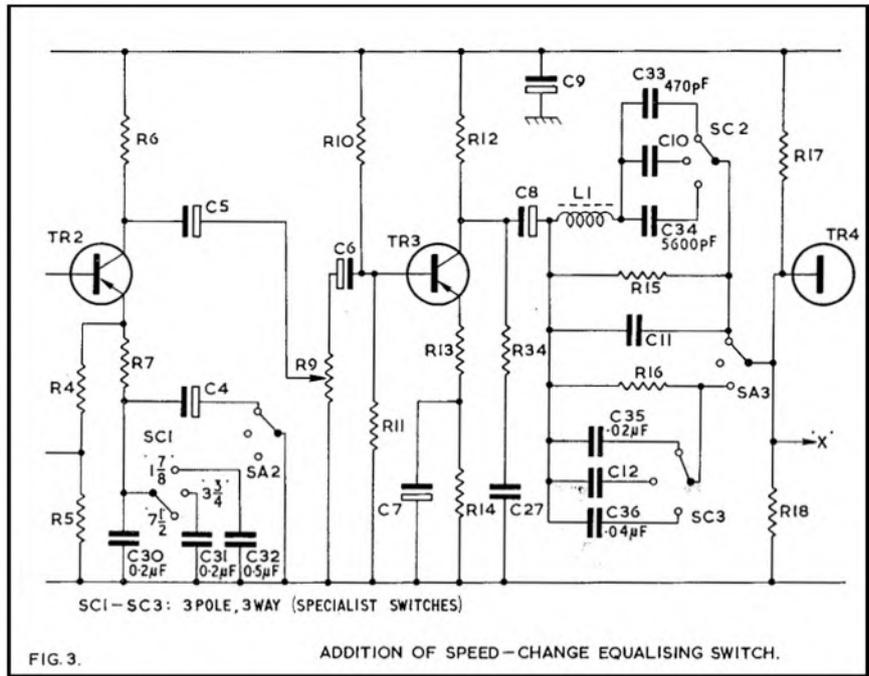


FIG. 3. ADDITION OF SPEED-CHANGE EQUALISING SWITCH.

PART 3 — POWER SUPPLY AND SWITCHED SPEED CORRECTION

THE amplifier can, of course, be operated from a battery of bell cells or accumulators, but since the tape-deck is mains-operated, a mains power pack is the obvious choice.

A power pack for use with this amplifier must satisfy three requirements. Firstly, the supply voltage should be sufficiently stabilised to avoid over-running the erase oscillator and audio output stage. Secondly, the power pack should present a low source-impedance to the amplifier, because of the Class-B audio stage. Thirdly, the ripple voltage must be adequately smoothed, the effective full load being about 40 ohms.

A simple power pack is shown in fig. 2. Two silicon diodes are used in a normal rectifier circuit, the rectified voltage being fed into the collector of a power transistor Tr1, the base voltage of which is determined by the breakdown voltage of a zener diode D3; The stabilised voltage is taken from the emitter, which is effectively tied to the base voltage. In addition, the capacitor (C2) at the base of Tr1 appears to the amplifier to have an effective value of $C_x h_{fe}$, where h_{fe} is the current gain of the transistor, thus greatly reducing the ripple voltage.

Component values are given for a mains transformer having a secondary voltage of 15-18V. Under these conditions the collector-to-emitter voltage of Tr1 will not exceed 6-8V, nor will the collector dissipation exceed 3-4W, so that any cheap, down-graded, device from the OC25 family (for example) would be suitable. A cooling fin is required having a total thermal resistance of about 10°C/W. This can be achieved by mounting the transistor (via a mica washer) on the power pack chassis.

Small resistances (R1 and R2) are placed in series with the rectifiers to limit switch-on surges due to the capacitive load; with some transformers the DC resistance of the secondary winding will be adequate for this.

With C1 and C2 at 1000µF, the ripple voltage is about 10 mV peak-to-peak on minimum load, rising to 30 mV peak-to-peak on full load. If these capacitors are doubled in value then the ripple voltage is reduced to 3 mV and 10 mV on minimum and full load respectively.

The 1A fuse included in the negative supply lead to protect the amplifier circuit will also protect the stabilising transistor against a short-circuit load (this fuse was included in the main circuit in Part 1). It is also advisable to include a 0.5A fuse in the mains input lead as a protection against transformer or electrolytic capacitor breakdown. The fuses can be included in the power pack, although it is probably more convenient to mount them elsewhere, since it is usually necessary to orientate the power pack for minimum hum pick-up in the R/P head.

To test the power supply, connect a 39ohm 6W resistor (representing the maximum load) across the output terminals, and check that the voltage across this resistor is between 11.5 and 12.5V, this margin being due to the spread of zener breakdown voltage. The output voltage on full load should not exceed 13.5V. The typical output voltage variation from minimum to maximum load is 0.5V.

The current through the zener diode can be checked if desired by connecting a milliammeter in series with it. This current, which is greatest under no-load conditions, should not exceed 110 mA.

The record/playback amplifier can easily be modified for use with a two- or three-speed tape-deck by the addition of a standard single-bank three-pole two- or three-way rotary switch.

The circuit modifications given in fig. 3 show a three-way switch, component values being given for tape speeds of 7½, 3¾ and 1½ i/s. The

(Continued overleaf)

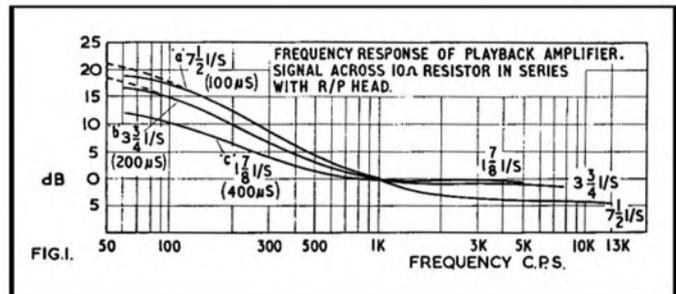


FIG. 1.

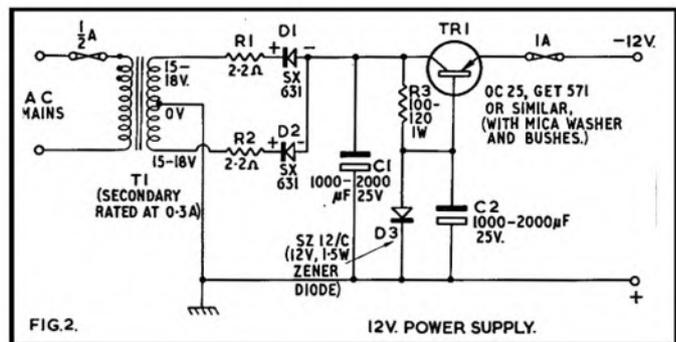


FIG. 2.

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A TRANSISTOR TAPE AMPLIFIER — CONTINUED

amplifier on record should give 12-14 dB of boost at 12 Kc/s, 7 Kc/s and 3.5 Kc/s respectively, as already noted. The playback responses are based on 100, 200 and 400 μ S time constants for these respective speeds, as shown in fig. 1.

With the speed-change equalising switch added, the amplifier is suitable for use with the B.S.R. TD10 deck and the Magnavox (Collaro) Studio deck. For use with the Brenell and Collaro Transcriptor decks: omit R34 and C27; increase C23 to 47pF to give an HF bias current of 800 μ A; and increase R25 to 27K, using a peak recording current of 100 μ A.

For the Truvox deck: omit R34 and C27; replace the oscillator transformer (T3) by the type shown in the components list (Table 1); change C24 to 680pF; retain C23 at 27pF, giving an HF bias current of 800 μ A; increase R25 to 27K, and use a peak recording current of 100 μ A. Finally, there are a few more small errors on the original circuit (page 267, August): C16 and C25 should be 0.1 μ F; C20 should go to the right hand side of R25; and R30 is 27 ohms, not 270 ohms, which could cause a transistor breakdown.

THE MYSTERIOUS BEAT

An odd effect described by the late Percy W. Harris

A FRIEND and I recently had a discussion about the lasting qualities of musical records on tape. Few of us can speak from personal experience on such matters, because popular tape recording has only come to prominence within the last few years, but I was surprised to hear from my friend that a recording he made two or three years ago had deteriorated to such an extent that it was virtually unplayable. As other recordings of his, taken even earlier, were still perfectly good, I asked to hear the particular tape to see whether or not I could explain the deterioration.

The recording started at the point where a BBC announcer was giving an introduction. This came over perfectly well, with no distortion whatsoever, and no apparent deterioration; but as soon as the music started it was broken up into a rhythmic beat at intervals of about one second, the distortion being so bad as to make the record completely useless. This beat continued right through the record. Other recordings, of a similar nature, taken from the same source before and since, have shown no such distortion, or for that matter any deterioration.

There were several puzzling features about this distortion. First of all, why was there neither beat nor distortion on the announcer's introduction, and why had no other recording, made from the same tuner and on the same brand of tape, shown a similar effect? The recording had been made on a full 8 $\frac{1}{2}$ in. spool at $7\frac{1}{2}$ i/s and the fault was obviously nothing to do with the reproducing equipment as this was the only tape which showed the defect; however, we solved the problem.

With the recorder running, and looking at the apparatus working, I soon found that the passing of a spoke of the metal spool past a given point coincided with the beat frequency. Obviously then, the spokes were playing some part. Next I enquired where the spool had been kept since it had been recorded. I discovered that this spool alone had been kept in a cupboard immediately adjacent to a fairly high-power 16mm. cine projector, the magnetic field from the motor of which could reach the spool. If this were so it might very easily have de-magnetised the tape, but I had always understood that aluminium spools used in the larger reels were non-magnetic and could not affect the magnetism. However, reference to *Magnetic Tape Recording*, by H. G. M. Spratt, gave me the following information: "With a bulk-eraser it is quite possible that difficulty will be experienced in achieving full erasure if the reel is wound on a metal spool, since even with non-ferrous metals, the spokes are often found to have an appreciable shielding effect on the portions of tape immediately behind them".

Here, then, was the answer. Prolonged storage immediately adjacent to the magnetic field of the motor of the 16mm. projector had reduced the magnetism of the recording, not uniformly, but partially, due to the shielding of the spokes. The announcer's introduction was not affected due to complete shielding by the rim.

tape reviews

CHARLIE BARNET has been a bandleader since 1932. He achieved recognition as one of the top leaders in 1939, and has remained on the jazz scene long after the end of the 'big-band' era. The special distinctive feature of the Barnett band has been its use of, and feeling for, Ellington type material: on this tape there are two Ellington features, *Things Ain't What They Used To Be* and *Blue Rose*, as well as the Ellington-inspired composition *Blue Hound Bus Greys*.

Charlie Barnett was among the first white leaders to feature Negro stars extensively. In addition to arranging, he plays alto, tenor, and the much neglected soprano saxophone. Although a very good soloist he has never dominated performances by hogging solos like some other leaders in the swing era; possibly this is one reason why he did not rival the popular acclaim of the Goodman and Dorsey orchestras.

CHARLIE BARNET and his orchestra. Who's Your Hoosier; Blue Hound Bus Greys; Things Ain't What They Used To Be; Argo; Keep The Home Fires Burning; Let's Blow The Blues; Rhubarb; Swinging Down the Lane; Lumby; Blue Rose; Hear Me Talking To You; Lemon Twist. **World Record Club TT 303**, 3½ i/s mono twin-track, 29s.



The recordings on this tape come from three sessions in the fifties, and included in the three different bands are a number of star jazzmen such as Willie Smith and George Auld (saxes), Maynard Ferguson and Charlie Shavers (trumpets), Hank Jones and Bob Harrington (piano), and Barney Kassel (guitar). Apart from the excellent solos from Barnett on alto and soprano sax., Bob Harrington should be mentioned for his solo piano contributions.

This is outstanding big-band jazz. If you are already an admirer of Charlie Barnett, or if you are just drawn by the sound of sixteen or more jazzmen playing together, this one is for you. An additional reason for buying this tape is that it is very good value in playing time—it runs for nearly fifty minutes.—T.F.



WALTZING IN VIENNA. 12 Vienna Waltzes by various composers. Vienna Volksoper Orchestra conducted by Joseph Leo Gruber, **World Record Club TT 305**, 3½ i/s mono twin-track, 29s.

THIS is the third volume of Viennese waltzes issued by the World Record Club. This fact, and the fact that the leaflet supplied with the tape goes into such detail in outlining the development of the waltz and in giving biographical information on the composers, suggests to me that the Viennese type of waltz has a specialist following. I must confess that I do not belong to this group. For me the waltzes are pleasant background music, but not music for concentrated listening. However, the recording quality is quite good, being free from any serious defect, and the playing sounds accomplished, so there must be some who will give this issue a warm welcome.—G.G.

SYMPHONY No. 5 IN D MAJOR, Shostakovich. Stadium Symphony Orchestra of New York conducted by Leopold Stokowski, **World Record Club TT 281**, 3½ i/s mono twin-track, 29s.



SHOSTAKOVITCH is, of course, a contemporary composer, and there are some who tend to put all contemporary composers in a compartment of their own labelled "For experts only". None need be afraid of this work however. Those who enjoy the symphonic works of Sibelius or Berlioz will find no cause for musical alarm in Shostakovich's fifth symphony.

The general impression of the work is that it is the result of much serious thought and industry. There is an abundance of musical ideas which are allowed to develop freely but never unrestrainedly so. Melodies abound, often being given fugue-like entries on different instruments. In character the music is profound, although there are less serious moments here and there: there is a grand gallop in the last movement, for instance, and the scherzo-like second movement is a gay minuet, though even here the choice of harmonies gives a sombre touch to the gaiety.

Stokowski and the orchestra give a warm and friendly account of the symphony, the orchestra being made to show off its capabilities when required. The recording has a rich quality about it without losing clarity at all, but on the review copy the concerted string tone was slightly distorted in places. The distortion was more noticeable in the louder 'tutti'. Application of top cut made it less disturbing and it is possible that most people would tolerate this defect for the sake of the music.—G.G.

YOU'RE GETTING TO BE A HABIT WITH ME. Ruby Braff and his trumpet. Ten recordings on **World Record Club TT321**, 3½ i/s mono twin track. 29s.

THE easily recognisable trumpet style of Ruby Braff has been widely acclaimed by the critics over the last ten years. One of the younger mainstream jazzmen, he was born in 1927. His style has been well described by Nat Hentoff as "heatedly tender, richly swinging, and melodically flowing and imaginative". Braff's playing has been strongly influenced by Louis Armstrong and Bunny Berigan and this is very clear from some numbers on this tape.

On this session Braff plays with Don Lamond (drums), Don Elliot (vibes), Mundell Lowe (guitar) and Milt Hinton (bass); while Hank Jones plays piano on four tracks, Nat Pierce on the others. The backing and short solos from the group are adequate, but undistinguished. The tape is a showcase for Braff who has the major share of the solos on ten jazz standards in his own easy, relaxed style. The best numbers are *Someday sweetheart*, *When your lover has gone*, and *You'd be so nice to come home to*.

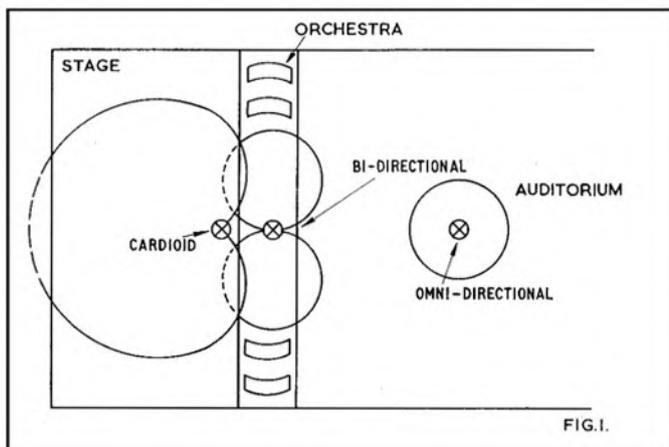
It would be very nice if someone would follow up this recording of Ruby Braff with one made up from the best of the Vic Dickenson Septet sessions, featuring Ed. Hall and Sir Charles Thompson, in addition to Braff and Dickenson, thus making available at one and the same time some of the best of Braff together with some of the finest recorded mainstream jazz of the fifties.—T.F.

THE skill necessary to handle more than one microphone successfully rises in greater proportion to the number of microphones employed. Indeed, while a knowledgeable enthusiast may have a high score of good recordings to his credit derived from just a single microphone, he may have an almost equally low score when he first attempts live recordings through the medium of two or more microphones. We are at present, of course, considering mono recordings where the signals from the microphones are mixed (and probably balanced) in some way before the composite signal is applied to the tape recorder.

There is absolutely no point whatsoever in using more than one microphone indiscriminately. Multi-microphone networks need to be properly planned, not only in terms of the number of microphones, their placement and balance, but also from the aspects of frequency and polar response—factors which were considered last month.

Generally speaking, one microphone at a time can cater for almost all recording requirements so far as the enthusiast is concerned. The type of microphone adopted will, of course, influence the results, and while there are good 'all-round' microphones it can pay to employ a microphone to suit the specific recording circumstances. This technique is in many cases better than endeavouring to use a number of microphones simultaneously.

Thus, while it is a very good idea for the enthusiast to invest in more than one microphone, there may be only a few cases where



these microphones could be put into service *together*, and then their signals need to be carefully balanced and mixed, as we shall see later.

Last month the basic applications of the omni-directional, the bi-directional and the cardioid microphone were discussed. It was revealed that the all-directional characteristic of the omni-directional microphone gave it advantages in an environment which is acoustically dead, as it responds fully to the weak reflected sounds. It was also shown that both the bi-directional and the cardioid microphone reduce the reverberation or pick-up of reflected sounds by a factor of 3 to 1. Thus, the use of this type of microphone in a 'dead' room would aggravate the lack of reverberation on the recording.

Directional microphones thus have the reciprocal effect of suppressing the reverberation in an 'over-live' room. Such microphones are employed for sound reinforcement applications in areas where a high level of reverberation can result in disturbing acoustic feedback effects between the microphone and loudspeakers, giving rise to the characteristic 'howl' to which so many otherwise good public address systems are subject.

We are not normally so bothered with acoustic feedback effects during a recording session unless we are both relaying the sound through a public address system and recording simultaneously. We often need to monitor the programme material, however, but as this is usually done through headphones the sound level is rarely sufficiently high to promote an acoustic feedback loop.

Both the bi-directional and the cardioid microphone are useful devices for keeping unwanted sounds relative to the wanted sounds at a low level. In many cases, the straight bi-directional unit, in spite of its two-directional response, can be orientated to give the required ratio of unwanted sound suppression without reducing the level of the wanted sounds too much.

In cases where the required sounds are on a broad front and the unwanted sounds emanate from the opposite direction, a cardioid microphone may be the answer. It should be remembered, though, that a suitable response pattern may be obtainable from a ribbon unit with an acoustic damping pad fitted.

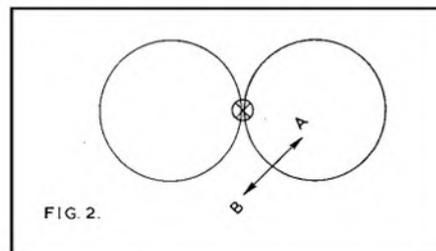
It is a good idea to run several experimental tapes as a means of discovering the limitations and possibilities of a new microphone before seriously engaging it in more aesthetic applications. One test should relate to the distance of the microphone from the sound source. Some microphones, notably the ribbon variety, tend to produce exaggerated bass response when placed too closely to the sound. This applies to speech and singing as well as to other sounds. It may be possible to exploit this effect to advantage in some applications—for instance, when recording dance bands and rhythm groups, where plenty of bass may be required!

Sibilants may also be emphasised when speaking close to certain microphones, and this often applies in particular if one speaks directly into the microphone rather than across it. Some microphones seem to amplify the effects of moving the instrument more than others, producing a high level rumbling noise which can completely destroy an otherwise good recording. These effects should also be investigated so that the best type of damping—such as foam rubber and the like—between the microphone handle (in the case of a hand microphone to be used for interviewing, for example) and the hand, can be explored.

TOWARDS BETTER TAPING

BY GORDON J. KING

When the enthusiast has graduated to the stage of exploring the effects of new microphones, he will be conversant with the behaviour of the microphone which was originally supplied with his recorder, but this should not influence his judgement of the new microphone being tested. A world of difference will be found between a good quality moving-coil or ribbon microphone and one of the inexpensive crystal microphones supplied with many popular recorders.



The novice will have probably started his tape experience simply by standing the original microphone on the mantelpiece at a family party. From that stage he has now graduated towards a professional viewpoint.

He will have discovered that one rule is to place the microphone as near to the sound source as is practical (having in mind the bass-boost effect of the ribbon microphone, of course) so as to avoid the cavernous and booming characteristics which colour some of his earlier record-

ings. He will, nevertheless, have also discovered that certain subtle recording effects can be created by *wider* spacing, and it is at that point that his attention may have been turned towards the possibility of employing more than one microphone.

Other precautions that he will have found out for himself include simple things like the avoidance of walking across the room when recording and preventing extraneous noises—the ticking of the clock, ringing telephone, passing traffic, rain on the windows or on the roof, coughing and so forth—from marring his recordings.

TAPE AGAINST REEL

Right from the beginning he will have been aware of the effect of recording the regular scrape of the tape against a reel and the whine of the motors by having the microphone too close to the recorder. He will now, of course, ensure that the microphone cable is of sufficient length to allow a goodish distance between the microphone and the recorder or—better still—to arrange for the recorder to be placed in another room or a cupboard (well ventilated !) while making a recording demanding the utmost of silence. Remote control of the recorder now becomes useful.

Indeed, the enthusiast will have a wealth of basic practical experience on which to call when judging the performance of a new microphone.

When it is required to use several microphone points there are one or two factors that should be kept in mind. Firstly, of course, each

PART SEVEN exploiting directional microphones

microphone must be properly matched to the input circuit and thence to the input of the tape recorder. This is where the microphone coupling network or mixer comes in. Secondly, the microphones should be spaced sufficiently from each other to avoid so-called microphone interference troubles. Such interference may result if a microphone 'sees' a sound-source in virtual balance with its partner.

That is, if, say, two microphones are responding equally to a sound-source there could be cancellation and/or addition of certain frequencies. Distortion can arise due to this, particularly if signals due to direct sounds at a specific frequency happen to be exactly 180 deg. out of phase with each other. If the signals are combined in a mixer or coupling network a certain amount of cancellation will result. Since the signals due to *indirect* sounds are unlikely to be in anti-phase under this condition, these signals will not cancel so there will remain a nett output from the mixing device, though of poor balance and quality.

Should this trouble be suspected it can be checked either by reversing the connections on *one* of the microphone circuits or, in the case of a bi-directional microphone, by turning it through 180 degrees.

Apart from spacing, therefore, this reveals the third factor, which is the desirability of orientating the microphones so that their 'dead' angles fall in line with direct or reflected sounds that need to be suppressed. The basic idea can be gleaned from *fig. 1*. Here is shown the use of a pair of microphones in a theatre. A cardioid is used on stage so that its 'dead' side is facing the auditorium, while a bi-directional (ribbon) is placed in the centre of the orchestra and orientated so that its 'dead' angles point towards the stage and the auditorium.

If a mixer is employed (which is most likely in such an installation !), a third microphone channel could be established from an omnidirectional microphone within the auditorium. Just a little gain could, if needed, be given to that channel to introduce 'atmosphere' to the recording. That is, to introduce the 'feeling' of an auditorium, since this is not likely to be obtained from the cardioid or bi-directional ribbon which are orientated for local intimacy at the stage end of the theatre.

Mixing facilities are also useful when it is required to make somewhat complex recordings of dramatic productions and similar items. A channel may be required to add sound effects or music. With a mixer such things can happen without disturbing the original balance established for the microphones.

Note, however, that the ribbon microphone by itself is useful for group discussion and studio drama, since two groups, one at each 'live' side, can be readily accommodated. The scripts of the participants can then be held in such a way that they fall in line with the 'dead' axis of the microphone and thus cause the least interference (incidentally, a special rustle-free script paper is available and is used by the broadcasting authorities).

Owing to the relatively sharp directivity characteristics of the ribbon, a small movement of an actor appears to be considerably greater on the recording. If the actor is well placed, for instance, it may be necessary only to shift the head a few inches while speaking

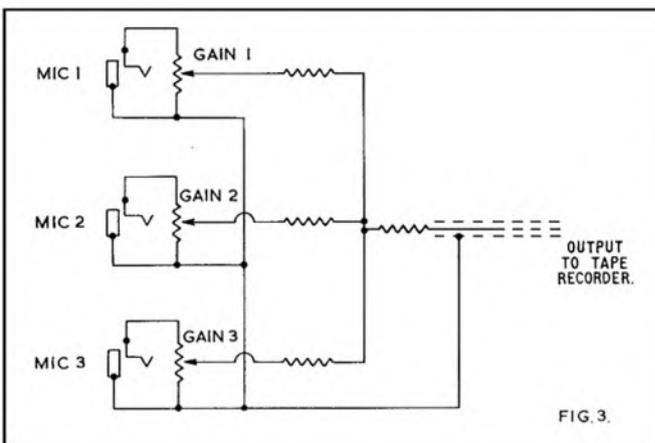


FIG. 3.

normally to give the impression of advancing or receding through a far greater distance. The effect is particularly marked if the movement is instigated towards the side of the microphone, as shown in *fig. 2*.

The ribbon microphone is also well suited for intimate musical group recording, for it is a relatively simple matter to arrange the group in conjunction with the orientation of the microphone for the most desirable balance. If, for instance, there is too much piano or too much rhythm on the monitor, the correct balance can often be struck simply by turning the ribbon microphone through a few degrees. This, of course, is where the value of headphone monitoring really shows up. We will deal more with this aspect of tape recording in a later article.

SIMPLEST MIXER

The simplest microphone mixer is a device which has the required number of microphone or input jack sockets and associated gain controls. The three channels are then tied to a common output lead which plugs into the microphone jack socket on the tape recorder. This type of mixer usually operates at high impedance and employs a circuit rather like that shown in *fig. 3*.

Its main disadvantage is that only high impedance microphones can be used and that even on full gain the output of each microphone to the tape recorder is below what it would be individually connected to the recorder.

More elaborate mixers employ amplifiers, transformers (for low impedance work) and modulation level indicators. These will be considered next month.

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equipment reviews

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The essential difference between a general-purpose ribbon microphone and one designed for broadcast use, lies in the method used to control the very low frequency ribbon resonance.

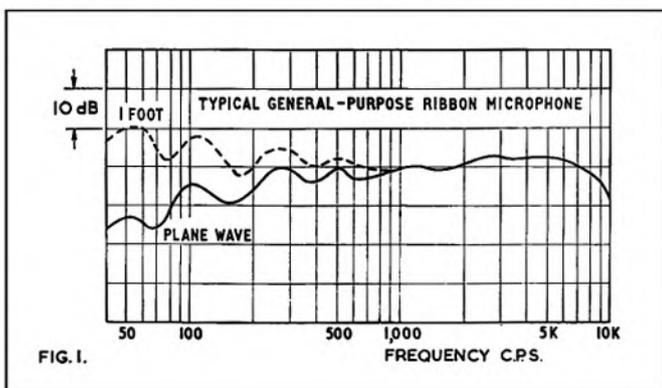
The general-purpose microphone will be used by dance bands, public address engineers and amateur recordists. It must stand up to fairly heavy handling and have a response which is a good compromise between adequate musical reproduction and non-boomy speech quality free of breath noises and "puffs" due to close speaking.

Such a microphone often uses a hard dural ribbon of 0.25 thou. or less, which is relatively springy and cannot easily be blown out of the gap by careless handling. It does, however, suffer from multiple peaks due to harmonics of the fundamental ribbon resonance unless very severe acoustic resistance damping is used. This damping usually takes the form of interleaved fabric and wire mesh screens, which are placed in close proximity to the ribbon. Further electromagnetic damping can be applied by making the primary inductance of the ribbon-to-line transformer low, so that a "shorted turn" effect generates a current in the ribbon which opposes any sudden movement of the ribbon. The combined effect of the acoustic and electrical damping is to cause a progressive fall in response at low frequencies when the microphone is used in a plane wave-front sound field, i.e., at a long distance from the sound source. When the microphone is

RESLO VRT/L MICROPHONE



Manufacturer's Details: High quality ribbon microphone manufactured to broadcasting standards. Frequency response: ± 3 dB, 30 c/s to 16 Kc/s. Field of pick-up: figure of eight, unless modified by acoustic correction pads. Sensitivity: 58 dB below 1V/dyne/cm² at 40 K ohms. Impedance: 30-50 ohms. Finish: satin chrome overall. Price: £15 15s. Manufacturer: Reslosound Ltd., 24 Upper Brook Street, Mayfair, London, W.1.



energised by a spherical wave-front, as in close talking, the force acting on the ribbon increases at low frequencies so that a sensibly level response is obtained under these conditions. In addition, the acoustic resistance screens shield the sensitive ribbon element from breath noises and puffs due to explosive speech sounds. The response curves of fig. 1 show a typical performance of a general-purpose ribbon microphone under close talking and distant sound pick-up conditions. It will be seen that there is likely to be slight coloration due to the relatively undamped harmonic peak around 300 c/s.

Ribbon microphones used for broadcast or professional studio work can be kept in a plane-wave sound field at all times by working at a sufficient distance from the sound source.

The ribbon element is usually soft aluminium with a thickness of less than 0.1 thou. This ribbon is so light that it is sufficiently damped by the air load on either side, and the case serves only as mechanical protection and must be made as acoustically transparent as possible. On the other hand the ribbon is sensitive to the slightest draught and must be handled very carefully at all times. The usual blowing into the microphone to see if it is "live", so beloved by dance-band crooners, would blow the ribbon straight out of the gap and at the same time straighten out all the corrugations so that it would sag limply, ruined for ever more.

The microphone under review steers a mid course between these extremes. A thin soft ribbon is used with the lightest possible

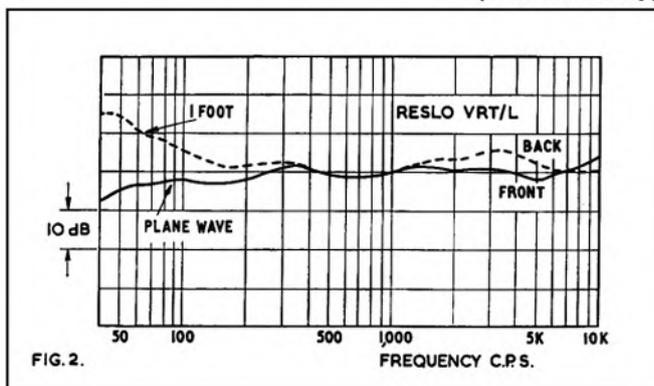
acoustic screening and with a transformer primary inductance sufficient to give a level response down to the fundamental ribbon resonance. Even so one is warned not to shut the lid of the carrying case too sharply as the change in air pressure may deflect the ribbon beyond its elastic limit, and it must on no account be moved suddenly or used in the open air.

The responses of fig. 2 show that the low frequency response is completely smooth and free of ribbon resonance effects, and that the response is level in a plane-wave sound field at some distance from the sound source. The response for a point sound-source at a distance of 1 ft. is shown by the dotted low frequency curve.

The high frequency response is somewhat dependent on the direction of the sound wave. The most level response is obtained when the sound is directed to the front (label side) of the microphone. The response from the back of the microphone shows a slight mid-high-frequency peak which may be useful under certain conditions to add "presence" to an otherwise dull sound.

The polar response is true figure-of-eight at low frequencies, but the front and back lobes sharpen at high frequencies as the magnet

(Continued overleaf)



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RESLO REVIEW—CONTINUED

cavities are used to maintain a level response on the axis at the expense of sounds arriving at an angle of about 45 degrees.

The open-circuit voltage of this 30-50 ohm unit is 30 microvolts for an applied sound field of 1 microbar which means that the normal 50:1 transformer would bring the voltage up to 1.5 mV per microbar ; this agrees closely with the specified output of 58 dB below 1V/dyne/cm² at an impedance of 40 K ohms.

This is an excellent microphone for professional or amateur recording of music. For speech a well-damped studio must be used so that the speaker can be placed at least 3 ft. from the microphone, alternatively an electrical bass-cut must be used to cut the 50 c/s response by 10-12 dB for speech at 1 ft.

An A-B test against a standard Reslo type RB shows almost identical sensitivity with complete lack of mid-low frequency coloration which is so often evident on certain types of male voice.

A. Tutchings.

our readers write . . .

. . . about the EL3536

From : L. J. Bishop, 5 St. James Court, College Lane, Durban, South Africa.

Dear Sir, Your readers may be interested in the modifications I have carried out on my Philips EL3536 stereo recorder. The first is an extra socket (Continental three-pin type) which I put in next to the existing microphone socket. The result is that two microphones can be used independently. The stereo socket is still wired to receive the stereo microphone. All that was done was to wire the stereo Point 3 to Point 1 on the new socket.

The second modification is the head output socket wired direct from the track selector switch. Now the heads can be fed into a good amplifier. The internal amplifier can then be turned off via the gain controls. This must be well screened or else, on record, the bias from the head can creep into the input leads via a capacitive effect.

The third modification is a separate magic-eye for both channels. Here a little cutting and screwing of the deck cover and plastic have to be undertaken. I feel that this arrangement is much better, as the comparison between the two channels is now easier to see. I can give more details of this to anyone interested as it entails slightly more intricate modifications.

The fourth and fifth are : (1) A plug-in socket for mains cord at the rear of the recorder. This saves putting it on its side every time it must be used. (2) A switch to cut out the motor on P.A. (straight-through amplification). This was done by making the speed change buttons cut out the motor, so alleviating flats on the idlers, and substituting a mains switch on the end of either volume or tone control. It means in effect a new potentiometer will have to be fitted, with mains switch attached. All gain and volume controls are now concentric as opposed to ganged, giving independent control of each channel.

Yours faithfully,

. . . about creative experiments

From : Gordon Rimmer, 39 Howard Road, Coulsdon, Surrey.

Dear Sir, There was a macabre fascination about Mr. Finlayson's palindromic article in your April issue. His experiments in the backwards recording of piano music are a classic example of misplaced ingenuity.

However, the world would be a duller place without such people and I look forward with eager anticipation to another equally erudite and pointless paper from him in the near future. May I suggest for his consideration "How to Play the Bagpipes in Six Fathoms of Water". He could start practising now !

Yours faithfully,

TAPE RECORDER SERVICE

MODEL 464 of the Sony range, until recently marketed in this country by Messrs. Tellux (see page 353), is a two-speed, $\frac{1}{2}$ -track tape recorder, with some stereo facilities. There are two separate pre-amplifier and amplifier channels, but a single driver and output stage, thus allowing stereo playback from the line outputs. Operation of each channel is independent and each has its own modulation level indicator. Channel mixing is possible via the internal amplifiers and a jumper lead allows trick recording. For normal recording purposes, $\frac{1}{2}$ -track mono facilities are the limit of its capabilities. The two microphone inputs are only provided for channel mixing. There is a single oscillator, using the output valve in a double function as on many simpler machines.

INDEPENDENT CHANNELS

The special feature of this machine is the entirely independent operation of each channel. Thus, for TRICK recording, it is only necessary to connect a pre-recorded track of CHANNEL 2, switched to PLAYBACK, via the line-out 2 and high-level 1 jacks, to re-record on CHANNEL 1, mixing with the low-level 1 input. By monitoring with earphone at line-out 1, a respectable result can be obtained. This system is far superior to the hit-or-miss SUPERIMPOSITION, which it is hoped will soon be relegated to history, giving our friends Mr. Bargery and Mr. Ford something else to write about in our companion volume, *Hi-Fi News*.

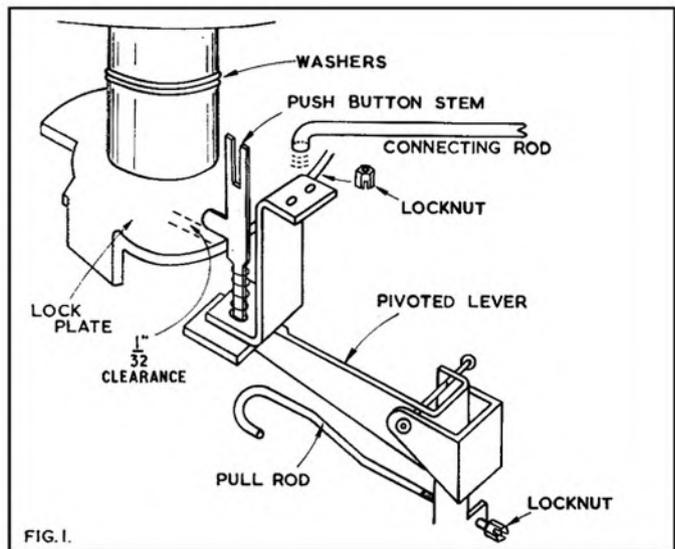
This also means, of course, that recording and playback is independent on each channel. So it is possible to use the machine as a form of language teacher by listening on CHANNEL 1 while recording on CHANNEL 2. Then the whole shebang can be played back with the SPEAKER SELECTOR switch operated to give a direct comparison.

From the servicing point of view, this gives only a little extra trouble, and it is not proposed to spend a lot of time on this model. The mechanics are very similar to the 362 and previous models, and reference to the preceding articles should be sufficient. There are a couple of small differences. Dismantling, for example: to take off the cabinet, after removing the top covers as previously described,

first turn the machine upside down, and take out the four Phillips screws. There are two on the handle side and two on the opposite side. A screw near the ventilation grille has to be removed to allow the base to be taken off. The cabinet can be lifted clean away, or the machine re-inverted and the chassis lifted clear.

To get at the printed circuit board for electrical servicing, remove the screw between the motor and the enamelled resistor that lies laterally to the rear of it. Then, shift to the right and you will find the output transformer. Between this and a trimmer capacitor there is another chassis screw that must be removed. Then there are two more near this angle-bracket assembly, one between the output transformer and the other trimmer; the other beneath the oscillator transformer, which is the one to the extreme right. Finally, one screw at the left centre of the board itself and another down to the right, near the RECORD-PLAYBACK switch. Removal of this assembly allows access to the slider switch, and when re-assembling, care must be taken to get the guide levers in the slots.

Mention of the trimmers, above, reminds us that there are also a couple of coils in this machine, with iron-dust core slugs that can tempt the wandering screwdriver. Do not be tempted. These are 'trap' coils; the first, in the cathode circuit of the second stage of each channel, tunes in parallel with .005 μ F capacitors to give very high impedance at the bias frequency, removing all traces from the signal. Alteration of the bias frequency will require retuning of these. The other two eliminate bias frequencies from the magic-eye circuits, forming series resonant circuits with .002 μ F capacitors, giving a minimum impedance at bias frequency, shunting it to chassis. The bias frequency is approximately 60 Kc/s. The two trimmer capacitors mentioned previously are used to set the bias level, which should give an indication of about 65V on a valve-voltmeter connected across



the appropriate head winding. This is not a maximum reading, but a just-over-the-peak setting, for the benefit of those who wish to adjust with only the aid of a multimeter. (See later notes on the S21, and fig. 2.)

Pre-set potentiometers are incorporated for adjustment of the 6ME10 magic-eye closure. To adjust, switch to RECORD, 'kill' the oscillator by shorting the grid of the 6AR5 to chassis (pin 1), feed in a 1 Kc/s signal at 1.35mV to the appropriate microphone input and adjust the signal level for a reading of 6V at the anode of the second stage. Then set the potentiometer until the beam is not quite closed.

Before saying too much about the 521, which is a much more comprehensive job, let me refer readers to the review by A. Tutchings, which appeared in the September 1962 issue of *Tape Recorder*. Apart from the fact that his comprehensive notes save me the task of describing the facilities and much of the operation, his final comment may be of interest. I quote: "This is a lovely machine to handle; it has that indefinable 'professional' feel . . ." The fact that it also has a professional price tag automatically follows!

(Continued on page 375)

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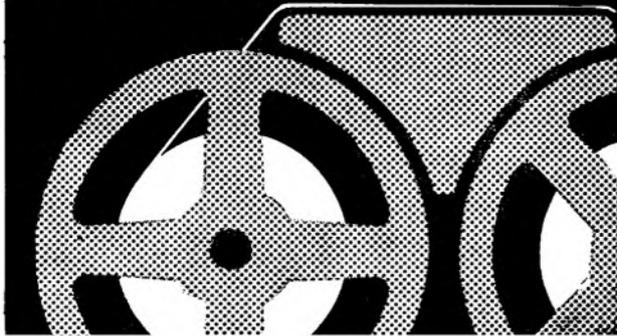
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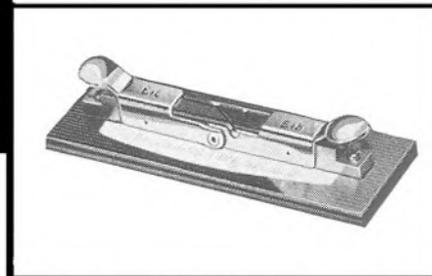


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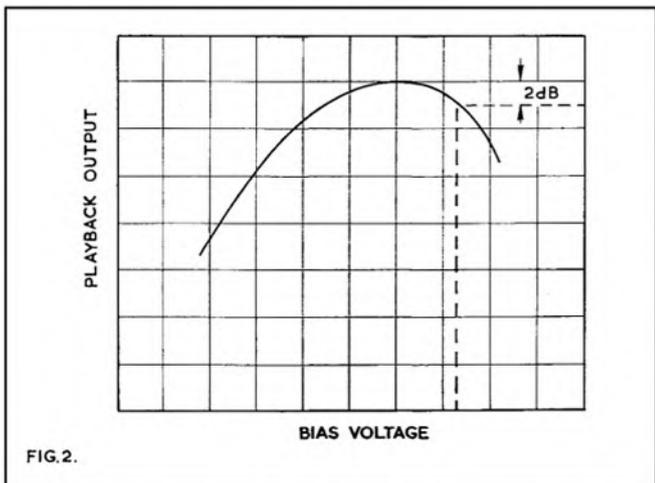
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CHMS 13

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The brakes on this machine are somewhat similar to those described earlier, with separate take-up and feed-spool braking, and an 'instant-stop' brake combined with a hold-off lever for pause action. The right-hand brake contacts the friction drum, just beneath the spool carrier. There is a felt ring between these two parts, with a helical spring pressing them together, giving a slipping torque. Beneath this again there is an oil-absorbing washer, a felt ring, idler disc and spacer, the whole being retained by spring washer and nut. Note that



the angled arm, which is held off by a spring, must not come into contact with the friction drum during PLAY. Clearance is very small. Similarly, when at STOP, the other end of the lever must be clear of the cam. Turn the take-up spindle clockwise by hand and note the throw action, which causes the lever to approach the cam, then bend the angled end to clear.

The feed spool is braked by the action of the left idler, which is in turn impeded by a brake-block. The setting of both idlers is quite critical. The right idler butts against a stopper, formed by a punched-out flap from the chassis and in the STOP position there should be a $\frac{1}{32}$ in. clearance, no more. When the machine is switched to PLAY the minimum distance between the left idler and the friction drum of the feed spool should be $\frac{1}{32}$ in. also. The other brake shoe, actuated by the instant stop, should touch the friction drum exactly as the pinch roller leaves the capstan. The assembly is held by two screws and the tongues, both for the instant stop button and the pinch arm actuator, protrude upwards. The latter can be bent for correct throw, as can the auxiliary plate, adjacent to the bar of the brake arm. The slipping torque of the feed spool is arranged so that a slight delay in disengagement of the pinch roller will not overstrain the tape. This consists of a felt ring and disc above the spacer and below the carrier. Hardening of this disc can cause erratic action due to drag.

An important setting on this machine is the RECORD button locking. Fig. 1 shows the assembly. Clearance between the lock plate and the lug on the record button stem must be $\frac{1}{32}$ in., when FORWARD is selected. The washers shown in the diagram must be in place and can be added to or subtracted from to give this clearance before any

(Continued overleaf)

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TAPE RECORDER SERVICE CONTINUED

other adjustment is attempted. Then, the locknut on the pull-rod is adjusted so that the pivoted lever touches the lower end of the stem at STOP.

The tape shifter is an interesting arrangement. A lever attached to the head plate swivels the pallette-shaped plate, raising or lowering the complete assembly, which is mounted on springs, giving downward tension by the screws. Protrusions at the periphery of this plate allow exact locking into position and the cut-out portion in the centre lets the tape shifter (see last month's diagram) move freely. The wings of the tape shifter are bent to clear head shield and erase plate in the PLAY position, and retract completely when STOP or FAST WIND is selected. There is a single Phillips screw at the base of the shifter allowing some adjustment.

Speed change follows the pattern previously described, with a stepped crescent arm altering position of the drive idler relative to the motor pulley, and engaging the flywheel directly, by the swivel action of a rod. Note that the rod moves down and clockwise from $3\frac{3}{4}$ to $7\frac{1}{2}$ i/s, and the knob of the speed selector should never be turned without this pressing action, allowing the spring to revert to normal when returning from $7\frac{1}{2}$ to $3\frac{3}{4}$ i/s.

Electrical adjustments are straightforward, but it may illustrate a point, and underline some of the cogent remarks of K. R. Wicks, to give some detail of the bias setting method. This is done using the step-by-step setting, as would be used when adjusting any tape recorder for which no data was available. First, the valve-voltmeter (or alternative indicating device, such as a high impedance multi-meter) is connected across the appropriate head winding. Then, a 1 Kc/s signal is recorded, at 55dB below saturation, setting the volume control for 100% reading on the VU-meter. Where these readings cannot be checked, record at 'normal level' with the gain at about two-thirds up. As this recording is being made, adjust the trimmer behind the slide switch at the base of the amplifier in steps of ten seconds or so, from its minimum position, so that the VVM reads increases of 10V each time. A lower reading than this will be obtained with a meter of lower impedance. Plot the settings by marking the voltage points at particular footage points, using the position indicator.

Now play back this recording, measuring the output. A curve something like fig. 2 should be obtained, and it will be noted that a slow peak is reached as the bias is increased, falling away until at a point around 2dB below maximum the correct setting is found. Drop the vertical from this point on the rough graph and note which bias voltage it cuts. Note the angular setting of the trimmer which gave that voltage and set the trimmer to that angle for the best results. With practice, it is possible to make this test quite quickly, and almost 'play it by ear' on any tape recorder.

SPOOLS OR CARTRIDGES? CONTINUED

build up without the intrusion of such interference as the disc-jockey's voice or the clicks and ear-blasting noises caused when setting recording level.

This argument also applies to the very non-technical non-creative person for whom the cartridge is presumably intended. The manufacturers feel great sympathy with the mythical millions who are unable to thread a spool of tape. Rather than design head-channels with the pressure-pads and pinch wheel completely withdrawn in the Stop position—and spools which do not require eleven fingers to thread—they suggest making tapes as easy to 'thread' as gramophone discs. Admittedly cartridges are much easier and quicker to change than spools, but what is the non-technical non-creative recorder-owner going to do with his (or her) machine? Sound effects, interviews, and editing will hold no interest for him—not surprising considering he is unable to thread a spool of tape. No doubt he is expected to derive pleasure from recording his favourite music from friends' gramophone equipment to carry with him and play when sitting on the seafront. Even allowing for the long delays and chopped-off ends between records, this person is likely to meet up with the employee of a recording or broadcasting company before his love of music wears off, and he stands a much greater chance of being charged with breach of copyright than the cut-and-splice addicts sitting quietly in their 'studios'.

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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.

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Q-Cord battery portable, mains unit, car lead. Cost £47. Used one hour. Bargain £30. Box No. 372 (Lancs.).

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continued on page 378



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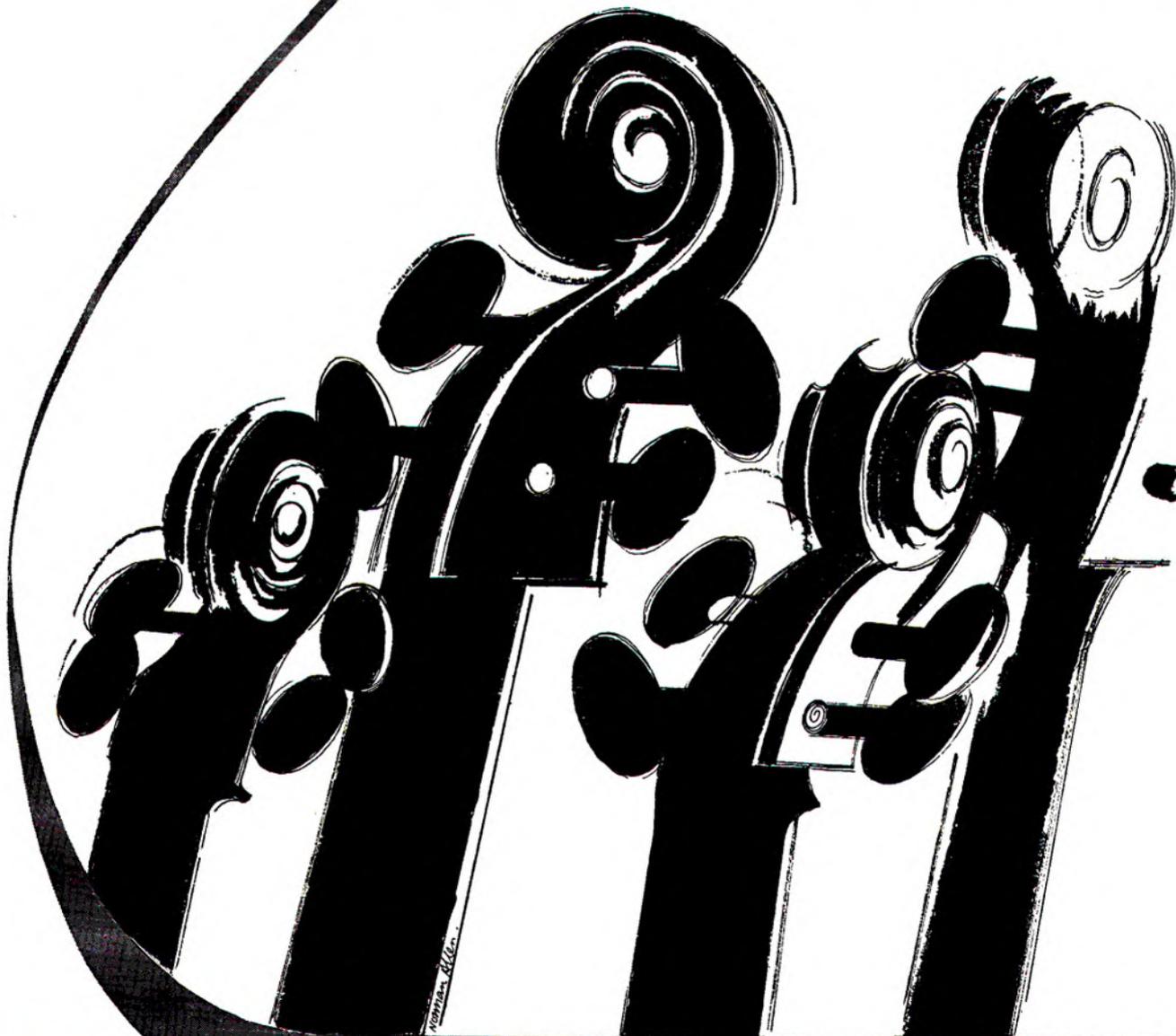
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