JUNE 1968 2s 6d

tape recorder

REVOX A77 REVIEW

TAPED LANGUAGE COURSES—ARE THEY WORTH BUYING?

RECORDING FOR RADIO

GUIDE TO POST-BUDGET PRICES

ONE MAN'S MIXER

INTERVIEWING—THE PROFESSIONAL APPROACH

AKAI 3000D FIELD TEST

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	LIST PRICE	OUR PRICE
STANDARD PLAY		
5" 600' }	21/-	16/10
5½" 900' } Except Agfa	28/-	22/6
7" 1200' }	35/-	28/-
LONG PLAY		
3" 200' Not Scotch	9/-	7/3
3" 300' Scotch only	9/6	7/6
4" 450'	14/6	11/8
4½" 600' BASF, Agfa only	21/-	16/10
*5" 900'	28/-	22/6
*5½" 1200'	35/-	28/-
*7" 1800'	50/-	40/-
8½" 2400' BASF, Scotch only	72/6	58/-
10" 3280' Agfa only	85/-	68/-
10" 3600' BASF only	95/-	76/-
10½" 4200' Agfa, BASF only	112/-	90/-
SCOTCH DYNARANGE (L/P)		
5" 900'	32/3	25/10
5½" 1200'	40/6	32/6
7" 1800'	57/6	46/-
8½" 2400'	83/6	66/10
COMPACT CASSETTES		
C. 60	17/6	14/-
C. 90	25/-	20/-
C. 120	33/6	27/-

	LIST PRICE	OUR PRICE
DOUBLE PLAY		
3" 300' Not Scotch	14/-	11/3
3" 400' Scotch only	16/6	13/2
4" 600'	25/-	20/-
4½" 900' Agfa, BASF only	30/-	24/-
5" 1200'	42/-	33/8
*5½" 1800'	55/6	44/6
*7" 2400'	77/6	62/-
10" 4600' Agfa only	140/-	112/-
TRIPLE PLAY		
3" 450' Not Scotch	22/-	17/8
3" 600' Scotch only	24/9	19/6
4" 900'	39/-	31/3
*4½" 1200' Agfa, BASF only	49/-	39/3
5" 1800' Not Scotch	66/-	52/10
5½" 2400' Agfa, BASF, 7" 3600' only	90/- / 115/-	72/- / 92/-
QUADRUPLE PLAY		
3" 600' }	36/6	29/6
3½" 800' } Kodak only	46/-	37/-
4" 1200' }	64/6	51/6

GRUNDIG TAPE AVAILABLE ONLY WHERE MARKED WITH ASTERISK

Postage and Packing 2/-. ORDERS OVER £3 POST FREE.

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Brand New. Fully guaranteed and in normal manufacturer's pack.

	LIST PRICE	ONE	THREE	SIX
BN7 1,200' on 7" reel (Dynarange)	50/-	40/-	117/6	230/-
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BL7 1,800' on 7" reel (Dynarange)	70/-	56/-	165/-	324/-
BL8 2,400' on 8½" reel (Dynarange)	90/-	72/-	213/-	420/-

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ILFORD TAPE near HALF PRICE

A bulk purchase of premium grade, top quality POLYESTER MAGNETIC TAPE from one of the world's foremost experts in film coating technology. With FULL LEADER and stop foil, Polythene wrapping, and in original manufacturer's boxes. Available in long-play base only at these BARGAIN PRICES.

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Brand New. Fully Guaranteed, and in normal manufacturer's pack.

'500' SERIES AUDIO TAPE (MYLAR BASE)

TYPE	DESCRIPTION	LIST PRICE	ONE	THREE	SIX
541-9	900' Long Play on 5" reel	28/-	21/-	61/6	120/-
541-12	1,150' Long Play on 5½" reel	35/-	28/-	82/6	162/-
541-18	1,800' Long Play on 7" reel	50/-	32/6	96/-	189/-
551-12	1,200' Double Play on 5" reel	42/-	35/-	103/6	204/-
551-16	1,650' Double Play on 5½" reel	56/-	45/-	133/6	264/-
551-24	2,400' Double Play on 7" reel	72/6	55/-	163/6	324/-

'600' SERIES PROFESSIONAL AUDIO TAPE (MYLAR BASE)

641-9	900' Long Play on 5" reel	30/6	23/-	66/6	127/6
641-18	1,800' Long Play on 7" reel	52/6	39/6	116/-	226/-
651-12	1,200' Double Play on 5" reel	46/-	34/6	101/-	197/-
651-24	2,400' Double Play on 7" reel	80/-	60/-	177/-	348/-

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N.B. Other types and sizes available including the inexpensive "White Box" series.

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Compact Cassettes with 90 mins. playing time. Brand New and packed in normal plastic library box. Available at this exceptional price.

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3 ,, 54/-
6 ,, 105/-
12 ,, 204/-

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NOW FROM KJ THE FULL RANGE OF MUSICASSETTES

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	LIST PRICE	ONE	THREE	SIX
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600' on 3" reel Gevasonor	27/6	17/6	51/-	99/-
900' on 4" reel Gevasonor	39/-	24/6	72/-	140/-
1,800' on 5" reel Gevasonor	66/-	41/6	122/-	238/-
2,400' on 5½" reel Zonal	90/-	55/6	165/-	324/-

Post and Packing 2/-. ORDERS OVER £3 POST FREE.

20% off all Grundig and Philips Equipment

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The fabulous bookshelf speaker system designed and manufactured by Plessey, one of the country's largest electronics groups. Acoustically designed two-speaker system with crossover network.

ORIGINALLY SOLD FOR £18.0.0d.

NOW OFFERED AT £11-10-0d

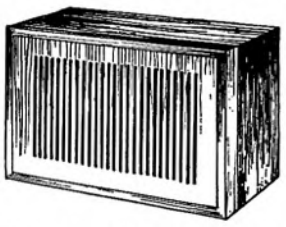
CARRIAGE 10/- EXTRA PER UNIT

THIS OFFER REMAINS OPEN ONLY WHILE STOCKS LAST!

WHAT THE REVIEWERS SAID:

"Recommended without reservation for this category of Loudspeaker". David Phillips & Donald Aldous.
"Sonotone 'Solent' deserves to reach a wide public." John Borwick.
"A worthy member of the Hi-Fi family." R. L. West.

Technical Specification:
Cabinet Size 14" x 9" x 8¼"
Woofer 6½", 10,000 Gauss, 1" pole.
Tweeter 3⅜" Acoustically loaded
Frequency response 40—20,000 cps.
Power Handling 12 watts.
Impedance 8—15 Ohms.
Scandinavian style finish.



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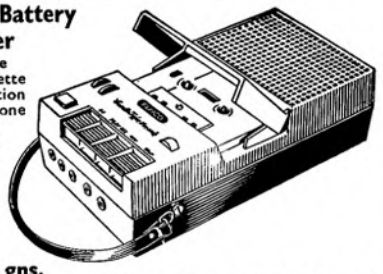
The ELPICO CTR 600 Battery Cassette Tape Recorder

Beautifully styled, pocket-size recorder with "snap-in" cassette loading. Press button operation with separate volume and tone controls. Up to 120 minutes playing time on a single cassette. Weighs only 3 lb. 5 oz. Supplied complete with C.60 cassette, remote control microphone, earphone and batteries.

Dimensions 4¾" x 8¾" x 2⅜"



ORIGINAL PRICE 24 gns.

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OTHER OUTSTANDING BARGAINS IN "COMPACT CASSETTE" RECORDERS AVAILABLE FROM K. J.

DESCRIPTION	*LIST PRICE*	*OUR PRICE*	*Post and Packing*
Philips 3302 Battery Tape Recorder	31. 10. 0	26. 7.6	7/6
Philips 3303 Battery Tape Recorder	37. 5. 9	31. 5.0	7/6
Philips 3312 Stereo Mains Tape Recorder (with two x GL 559 loudspeakers)	—— 66. 12. 7	42. 0.0 55.17.6	10/- 15/-
Grundig C 200 (New Model) Battery Tape Recorder	49. 7. 0	41. 7.6	7/6
Aiwa TP 1004 Mains/Battery Stereo Tape Recorder	62. 7. 3	51.17.6	10/-
Sanyo M.18 Battery Tape Recorder	29.12.10	26. 0.0	7/6

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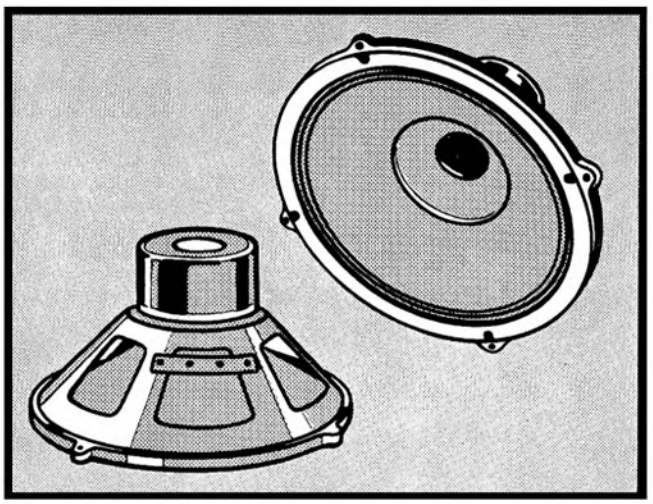

with the Grampian TC12 loudspeaker

The Grampian TC12 loudspeaker is a high quality twin cone unit at a reasonable price. The loudspeaker is built of high quality materials to a rigid specification and is eminently suitable for good quality sound reproduction. Let us send you full details or better still go and hear one at your local dealers now.

Design for suitable cabinet available.

Grampian manufacture high grade microphones, parabolic reflectors, windshields and accessories, also mixers and amplifiers.

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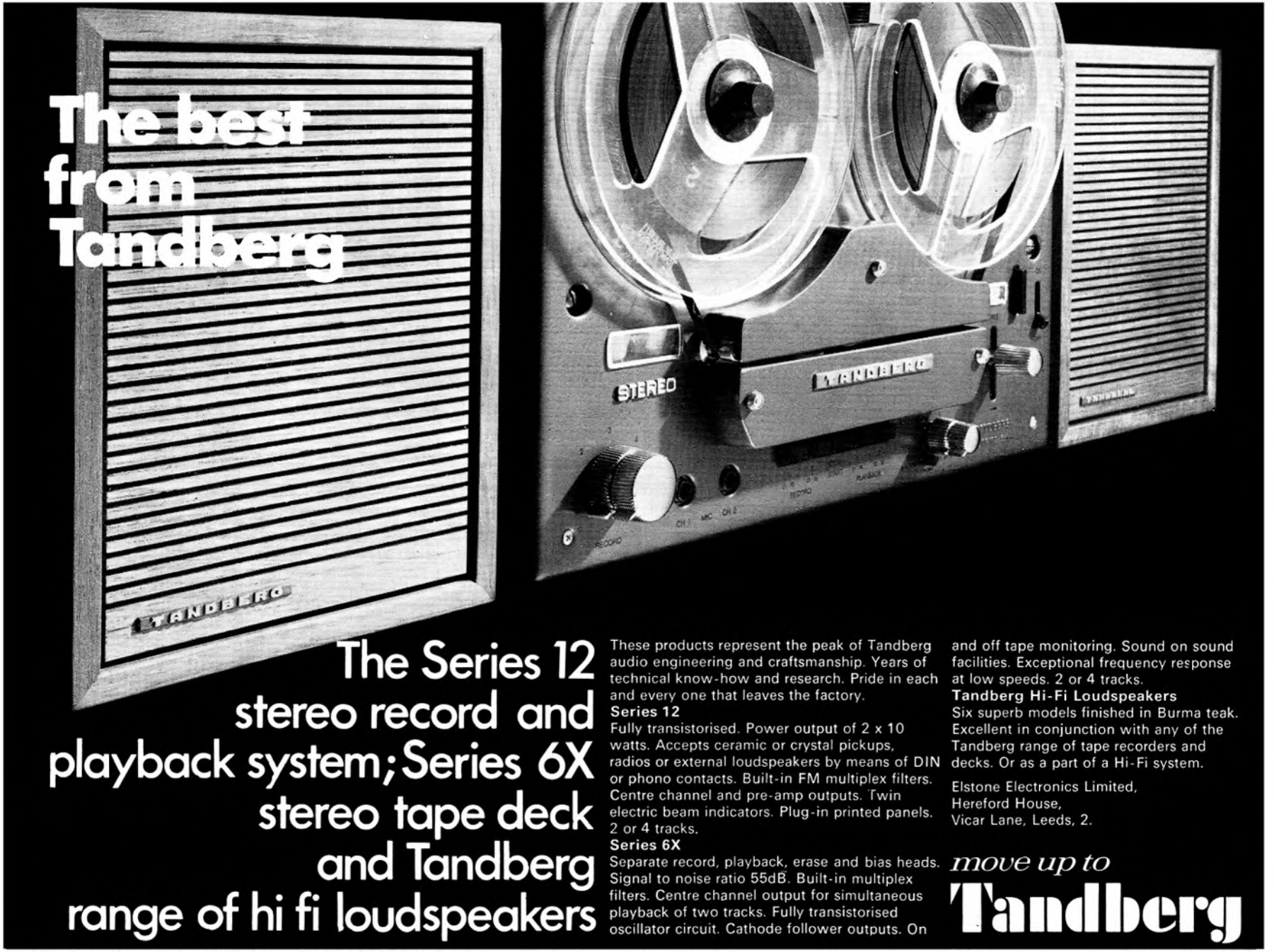
Tel: 01-894 9141/3 Cables REAMP, FELTHAM



The Series 12 stereo record and playback system; Series 6X stereo tape deck and Tandberg range of hi fi loudspeakers

These products represent the peak of Tandberg audio engineering and craftsmanship. Years of technical know-how and research. Pride in each and every one that leaves the factory.

Series 12
Fully transistorised. Power output of 2 x 10 watts. Accepts ceramic or crystal pickups, radios or external loudspeakers by means of DIN or phono contacts. Built-in FM multiplex filters. Centre channel and pre-amp outputs. Twin electric beam indicators. Plug-in printed panels. 2 or 4 tracks.

Series 6X
Separate record, playback, erase and bias heads. Signal to noise ratio 55dB. Built-in multiplex filters. Centre channel output for simultaneous playback of two tracks. Fully transistorised oscillator circuit. Cathode follower outputs. On and off tape monitoring. Sound on sound facilities. Exceptional frequency response at low speeds. 2 or 4 tracks.

Tandberg Hi-Fi Loudspeakers
Six superb models finished in Burma teak. Excellent in conjunction with any of the Tandberg range of tape recorders and decks. Or as a part of a Hi-Fi system.

Elstone Electronics Limited,
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Vicar Lane, Leeds, 2.

move up to
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Series 6X from 138 guineas, Series 12 from 120 guineas, Loudspeakers from 14 guineas

tape recorder

JUNE 1968 VOLUME 10 NUMBER 6

INCORPORATING
SOUND AND CINE

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COVER PICTURE

Tape recorders find their way these days into all kinds of industries and activities. Our picture shows two quantity surveyors at work on a building site. Here they are pausing to examine the architect's plans, but just before our cameraman arrived they were taking a mass of measurements on some concrete foundations, noting the figures *orally* into the microphone. This technique speeds up operations considerably, for lists must in any case be typed in due course, and office staff prefer a clear recording to crumpled, concrete-stained scraps of paper. Our thanks to *Algrey Contractors Ltd.* for this small intrusion into their building activities.

SUBSCRIPTION RATES

Annual subscription rates to *Tape Recorder* and its associated journal *Hi-Fi News* are 36s. and 41s. respectively. Overseas subscriptions are 38s. 6d. (U.S.A. $4.60) for *Tape Recorder* and 42s. 6d. (U.S.A. $5.10) for *Hi-Fi News*, from Link House Publications Ltd., Dingwall Avenue, Croydon, CR9 2TA.

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

THE MARCH BUDGET caught us at an inconvenient moment in our monthly printing schedule, allowing time only for a short news item and a thoroughly disrespectful cartoon. Mr. Jenkins' levies really warrant rather more lengthy treatment than we were able to give last month, though we do not propose to follow a contemporary journal in publishing a naïve and hysterical Open Letter to the Chancellor.

We really have little cause to complain of the 33% levy imposed on 'non-industrial' tape recorders, unless it is to question the entire principle of selective purchase tax. It is difficult to imagine a more extravagant luxury than a domestic tape recorder—even a car has become essential to a moderately comfortable life. One is tempted to regard the past tax-free 20 years as a deliberate government concession to an over-taxed nation; could the tape recorder really have been erroneously overlooked for so long?

Touring the Tottenham Court Road area nearly three weeks after the budget, we could find little evidence of the impending price increases. Most dealers were still offering recorders held in stock before March 20th. Although reputable recorders were difficult to spot in such a profusion of electronic indecency, they nevertheless could be traced after a little exploration. As stocks are replaced, however, we shall be obliged to adopt quite literally a new set of values. We move into a world where the £130 *Bang & Olufsen 2000* costs nearly £180 and where the £46 three-speed *Thorn* gives little change from £60.

Several companies have absorbed significant fractions of the tax in order to offset the overall price increase. A £28 *Fidelity* will cost £32 and the £120 *Tandberg 6X* becomes £145. These companies—and others who can be identified from page 257—deserve commendation for their long-sighted view of the tape recorder market.

The *Sony TC530*, on the other hand, has risen from £126 to £165. Several importers have chosen this inappropriate time for a general increase in profit margins. In the long run, these disproportional increases may serve merely to force certain brands right out of the British market.

Much of our correspondence with readers relates to the selection and recommendation of recorders in the £100 to £130 category. £130 is the critical figure: only rarely are correspondents content to pay more than, for example, the price of a *Revox 736*. Until recently this machine, the stereo *Ferrographs* and the *Tandbergs*, completely satisfied the demands of such customers, leaving the *736HS* and the larger *EMIs* for the most discriminating enthusiasts. In this post-budget era, however, £130 can easily be thrown away upon a formerly £100 stereo toy.

It has long been our policy, when asked to recommend reliable equipment in the lower price bracket—£25 to £70—to advise the purchase of second-hand *Ferrograph* recorders. These are so solidly constructed that it is flatly impossible to find an unserviceable model. Our own experience of eight or nine year-old youngsters from this family is that they are superior in almost every respect to the belt and ball-race abominations that find their way here from abroad, even when the latter are new. The budget should serve to emphasise the wisdom of favouring the solid old dependables to the very much more costly new generation. A potential customer's choice should not now lie between this or that £120 domestic, but, for instance, between an old *Ferrograph 2, 3, 4, 5* or *6*, *Revox E36*, or *736* (on the one hand) or a new *Revox A77* or *Ferrograph 7* (on the other). The price gap is considerable but there will fortunately always be people ready to buy new equipment solely for its newness. These are the folk who littered the classified advertisement columns of audio journals with *736* recorders the moment Revox announced the *A.77*, regardless of whether the new model was likely to prove better or worse. (It evidently is better but that is by the way.)

The Chancellor chose to make "industrial recorders" exempt from his tax and we now appear to enjoy a situation where a £250 semi-domestic plus tax, costs practically the same as a professional-cum-audio-industrial *Nagra* free of tax. Although several companies have boldly declared their products to be free from tax, no company has yet received a definite assurance from the Customs and Excise Department. So if you want a *C37* or *BTR4* for the front parlour, you'd be wise to buy it now.

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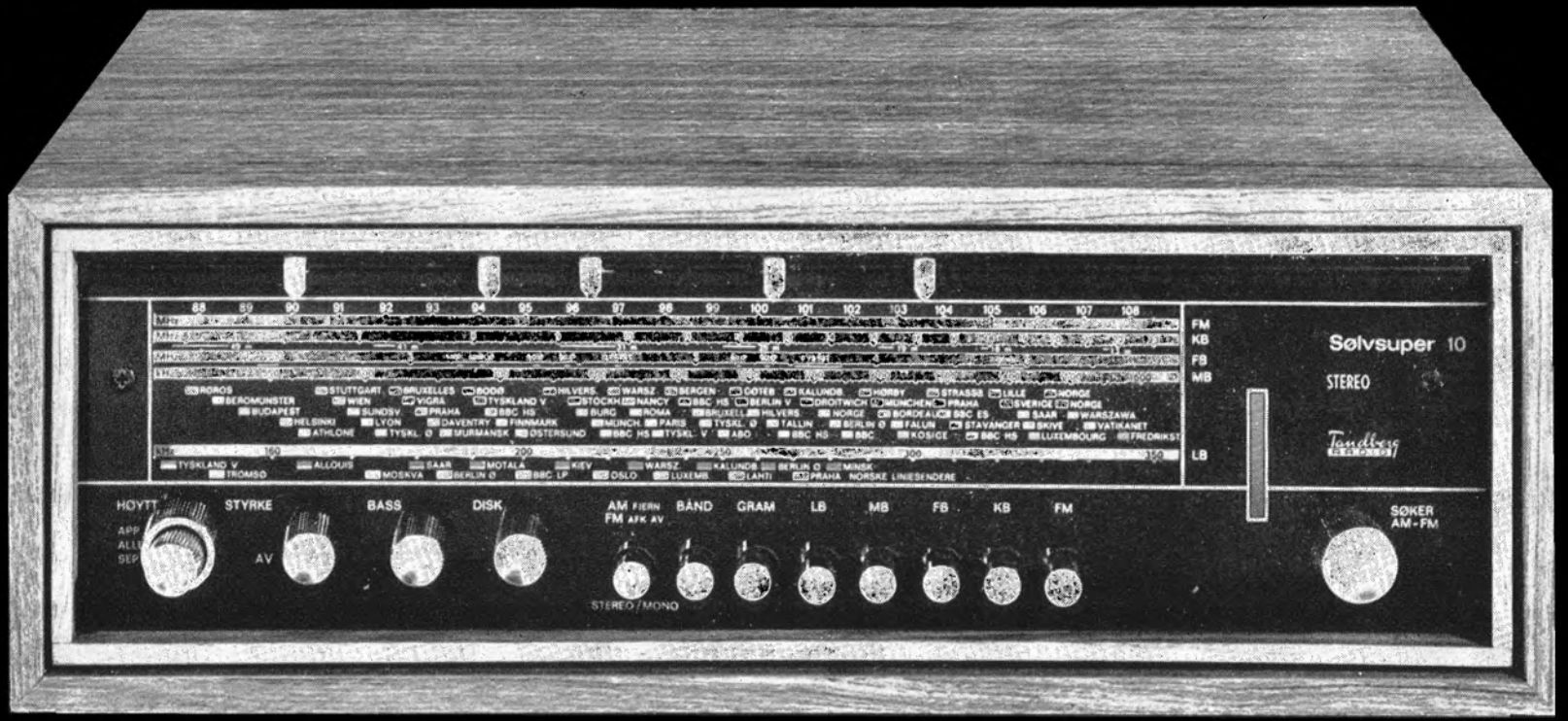
New from Tandberg



Sølvsuper 10.71 combined FM/AM Tuner and Stereo Amplifier

It's all there. Everything the heart of your Hi-Fi system should have. A 12 watt stereo amplifier. An exceptional FM/AM tuner with provision for a stereo reception decoder. Combined in an elegant low line teak case.
The Solvsuper 10.71 incorporates these features :—

- ★ 5 wavebands ; long, medium, short, coastal and FM.
- ★ Automatic frequency control on FM.
- ★ Push button selection of wavebands, or external gramophone tape recorder etc.
- ★ Separate bass and treble controls.
- ★ Adjustable FM station indicators.
- ★ Separate gain controls on each channel.
- ★ Electronic beam tuning indicator.
- ★ 2 x 6 watts output.
- ★ 15″ long x 9″ wide x 5¼″ high.
- ★ £65.0.0.

The Solvsuper is also available in two other versions :—
10.70 with a single built in speaker (mono)
10.72 with two built in speakers (stereo)

Elstone Electronics Limited,
Hereford House,
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move up to **Tandberg**

See and hear Tandberg at the Audio Fair Stand 24. Demo Room 504

EMIEX 68

FROM May 14th to 17th an exhibition of television, audio recording and automation equipment will be held at the Prince of Wales Hotel, Kensington, London, W.8. The exhibition is organised by EMI Electronics, and other members of the EMI Group, and will be open to all interested visitors.

TURNER AND WEST AT THE NGMW

OCCASIONAL contributor Peter Turner will be among lecturers at the *National Gramophone Musical Weekend*, being organised by the *National Federation of Gramophone Societies Ltd.* The programme includes talks by Ralph West on the evolution of loudspeakers, Arthur Dakin on the virtues of *Tandberg* equipment, and Mr. Turner on the creative use of the tape recorder. The weekend will be held at High Leigh, Hoddesdon, Hertfordshire from May 24th to 27th. Booking details may be obtained from **J. R. Bulman, NFGS, 42 Holmfield Avenue, Stoneygate, Leicester, LE2 2BF.**

NEW STUDIO

A NEW recording and tape-to-disc studio has been opened in Kingston. Of particular interest is an instant disc service, customers tapes being transferred to disc immediately after a recording session. The new company is Eden Studios Ltd., 11B Eden Street, Kingston-upon-Thames, Surrey.

EDUCATIONAL TELEVISION FROM GLASGOW

IN the foreground a reel of *Scotch 379* video tape and a *Series 5 Ferrograph*—not compatible. In the background, a transmission control system newly installed by *Pye* at the Television Centre in Glasgow's Bath Street. The system was built to the Educational Television Service's specification and is in use from 8.30 a.m. to 7 p.m. on weekdays. Evening educational programmes for adults will commence in the autumn.

INDIVIDUAL TESTING

IN co-operation with Mr. John Shuttleworth, *V. J. Monk Ltd.* of 140 Plumstead Road, London, S.E.18, have formed a department devoted to the sale of high quality recorders. Only models of a certain standard are being handled, currently the *Ampex 2100*, *Ferrograph Series 7* and *Revox A77*. Each will be tested for wobble, signal-to-noise ratio, frequency response and distortion, and each will be sold with a certificate carrying the results of these measurements. A tape recorded on each machine will also be supplied to demonstrate the model's capabilities. V. J. Monk established a good reputation in the audio field for their manufacture of the *Paraline* loudspeaker.

PROFESSIONAL RECORDING EXHIBITION

THE Hotel Russell plays host to another audio exhibition on Saturday 25th May when the *Association of Professional Recording Studios Ltd.* are holding a display of professional recording equipment. Sound recorders, microphones and tape will dominate the exhibition which is being organised for the benefit of all who are engaged in broadcasting or the recording profession. Admittance is by ticket only, available from the **Secretary, APRS, 47 Wattendon Road, Kenley, Surrey.**

LATE PRICES

SEVERAL manufacturers omitted from our post-budget price guide (page 257) are still awaiting clarification of the new budget proposals relating to industrial and non-industrial tape recorders. Purchase tax liability is currently under discussion between *C. E. Hammond Ltd.* and the Customs and Excise authorities, relating to *Revox A77* equipment. Under the circumstances, we have chosen to quote the following prices for the A77 review on page 285 of this issue: Complete transportable model—£173 5s. Unit in chassis form—£140 14s. Unit in teak case—£145 19s. Stereo power amplifier for unit versions—£21.

SAJA SPARES DRY UP

PURCHASE tax, plus duty, plus devaluation have resulted in a decision by the *Tape Recorder Centre* (*Blackpool*) to discontinue handling *Saja* spares. Service and spares for these recorders will be available only until existing stocks of parts are exhausted.

TAPE CONTEST RESULTS

WINNING tapes in the 1967 *British Amateur Tape Recording Contest* were picked at a final judging session held in London at Mullard House on March 20th, and awards were made at a prize-giving ceremony during the Audio Fair at the Hotel Russell. A pre-judging committee comprising C. Rex-Hassan, Brenda Marriott, John Bradley (*FBTRC*), Donald Aldous (*Audio/Record Review*), John Borwick (*The Gramophone*), Douglas Brown (*Tape Recording Magazine*), John Crabbe (*Tape Recorder* and *Hi-Fi News*) and F. C. Judd (late of *Amateur Tape Recording*) picked winners in the various classes, and a panel of distinguished judges then chose the *Tape of the Year* from these.

The final judging team comprised Anne Duchene, Basil Boothroyd, Eric Robinson and Christopher Bishop, and their choice for the overall winner was *Lover*, a skilful multi-track guitar recording "made in the garage on Boxing Day" by Paul Griffin. This was

WORLD OF TAPE

also winner in the 'Technical Experiment' class.

Drakesbroughton Hall led in the 'Speech and Drama' section, a ghost-laden, blood-curdling melodrama by Peter Bastin, and *Bells and the Art of Ringing* by E. R. Levett came out as top 'Documentary'. The 'Music' prize went to D. Rivett for *Bohemian Picnic*, composed and played by a group of students. *Protest '67* was the winning tape in the 'Reportage' class, a well presented news report of demonstrations against a *Polaris* launching, prepared by the Barrow Sound-Track tape recording club; this was also judged to be the best tape from a club. Leader in the 'Schools' section was *Page d' Fortune*, a clever and imaginative fantasy in the form of a mathematical French lesson submitted by John Shuttleworth for Eltham College; this was from 'Seniors'. Revenda House led the Juniors with a version of Dickens' *Christmas Carol*, while Infants from the Walter Leys school showed great industry with *Ukelele's Adventure*, a jungle story complete with imitation animal sounds.

The 'Set Subject' prize (for the best tape letter to someone overseas) went to D. C. Burton, who supplemented his 'letter' with some beautifully recorded sound-effects. Award for the best entry from a handicapped person favoured R. Bannister, who managed an excellent multi-track electronic organ recording despite his blindness; the committee was also impressed by a tape on employment problems from P. Stevenson, a spastic, and Mr. Rex-Hassan kindly decided to make an extra award for this. Best stereo recording was an extract from *Belshazar's Feast* by Philip Towell—who has written for *Tape Recorder*—and as a final extra delight the committee and judges heard and commended a tape from the youngest entrant, 7½ year old Susan Corfield, who offered an innocently humorous recording of a conversation with a friend of similar age.

Details of the 1968 Contest will be announced shortly.

NEXT MONTH

MICROPHONES are concentrated upon in the July issue, to appear on 14th June. A complete survey of all current models will be supported by reviews (Alec Tutchings) and practical tests (David Robinson) of *Grampian*, *STC*, *Walchris* and *Sennheiser* equipment. C. N. G. Matthews describes the principles of crystal, dynamic, capacitor and ribbon microphones while John Fisher constructs a versatile microphone mounting adaptor.

The new Series 15 combines Tandberg's world renowned qualities of faithful sound reproduction, reliability and compact modern design at a quite remarkably low price.
It incorporates many superb features:—

- ★ Programme mixing facilities with separate controls for microphone and line inputs.
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- ★ Signal to noise ratio 55db below maximum recording level.
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  7½ ips : 30-20,000 Hz (± 2dB40-16,000 Hz)
  3¾ ips : 30-13,000 Hz (± 2dB50-10,000 Hz)
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A GUIDE TO POST-BUDGET PRICES

MODEL	TYPE	NEW PRICE	FORMER PRICE
Akai			
X355	¼- or ¼-track stereo	£331 8s. 6d.	£250 0s. 0d.
X300	¼- or ¼-track stereo	£263 18s. 3d.	£199 10s. 0d.
M9	¼-track stereo	£195 3s. 5d.	*new model*
X4	¼- or ¼-track stereo m/b	£169 7s. 11d.	£123 18s. 0d.
X150D	¼-track stereo	£130 2s. 4d.	*new model*
1710W	¼-track stereo	£109 17s. 3d.	*new model*
3000D	¼-track stereo	£105 11s. 4d.	£78 15s. 0d.
(Pullin Photographic Ltd., 11 Aintree Road, Perivale, Middlesex)			
Alba			
R18	¼-track	£36 13s. 0d.	£29 18s. 6d.
R19	¼-track m/b	£29 11s. 6d.	£24 3s. 0d.
R20	¼-track battery	£24 8s. 6d.	£18 7s. 6d.
(Alba Radio & Television Ltd., Tabernacle Street, London E.C.2)			
B & O			
1100K	¼-track mono	£98 0s. 0d.	£72 9s. 0d.
1500K	¼-track stereo	£134 15s. 3d.	£101 17s. 0d.
2000K	¼-track stereo	£177 10s. 0d.	£131 5s. 0d.
2000T	¼-track stereo	£183 15s. 0d.	£135 9s. 0d.
(Bang & Olufsen U.K. Sales Division, Eastbrook Road, Gloucester)			
Braun			
TG502	¼-track stereo	£404 16s. 11d.	*new model*
TG504	¼-track stereo	£404 16s. 11d.	*new model*
TG502/4	¼-track stereo and ¼-track replay	£404 16s. 11d.	*new model*
(Fi-Cord International, Charlwoods Road, East Grinstead, Sussex)			
Crown International *No changes anticipated*			
(Carston Electronics Ltd., Electra House, Wiggenhall Road, Watford, Hertfordshire)			
Dansette			
Consort 4	¼-track	£37 16s. 0d.	£25 4s. 0d.
(Dansette Products Ltd., Honeypot Lane, Stanmore, Middlesex)			
Dual			
TG27/2	¼-track stereo	£82 19s. 0d.	£61 19s. 0d.
TG27/CV	(chassis only)	£69 6s. 0d.	£56 14s. 0d.
(Dual Electronics Ltd., Radnor House, London Road, Norbury, London S.W.16)			
Dynatron			
STR1	¼-track stereo	£100 13s. 10d.	£82 19s. 0d.
(Dynatron Radio Ltd., St. Peter's Road, Furze Platt, Maidenhead, Berks.)			
Ferrograph			
713	¼-track	£135 13s. 4d.	£110 0s. 0d.
713H	¼-track	£141 16s. 8d.	£115 0s. 0d.
715	full-track	£172 13s. 4d.	£140 0s. 0d.
702	¼-track stereo	£160 6s. 8d.	£130 0s. 0d.
702H	¼-track stereo	£166 10s. 0d.	£135 0s. 0d.
722	¼-track stereo	£185 0s. 0d.	£150 0s. 0d.
722H	¼-track stereo	£191 3s. 4d.	£155 0s. 0d.
704	¼-track stereo	£160 6s. 8d.	£130 0s. 0d.
724	¼-track stereo	£185 0s. 0d.	£150 0s. 0d.
(The Ferrograph Co. Ltd., Ferrograph House, 84 Blackfriars Road, London S.E.1)			
Fidelity			
Playmaster 2T	¼-track	£26 5s. 0d.	£23 2s. 0d.
Playtime 2T	¼-track	£29 18s. 6d.	£26 5s. 0d.
Playtime 4T	¼-track	£32 11s. 0d.	£28 7s. 0d.
Studio	¼-track	£45 3s. 0d.	£36 15s. 0d.
(Fidelity Radio Ltd., Olaf Street, London W.11)			
Grundig			
TK120	¼-track mono	£39 7s. 6d.	£30 19s. 6d.
TK140	¼-track mono	£46 14s. 6d.	£40 8s. 6d.
TK145	¼-track mono	£53 11s. 0d.	£49 17s. 6d.
TK.2200	¼-track mono battery	£96 12s. 0d.	£78 15s. 0d.
TK245	¼-track stereo	£114 9s. 0d.	£87 3s. 0d.
TK247	¼-track stereo	£128 2s. 0d.	£103 19s. 0d.
TK320	¼-track stereo	£153 6s. 0d.	£124 19s. 0d.
TK341	¼-track stereo	£160 13s. 0d.	£131 5s. 0d.
TK340	¼-track stereo	£187 19s. 0d.	£152 5s. 0d.
(Grundig G.B. Ltd., London S.E.26)			
Heathkit			
STR-1	¼-track stereo (kit)	£58 2s. 10d.	£45 18s. 0d.
STR-1	(assembled)	£70 6s. 6d.	£59 15s. 0d.
(Daystrom Ltd., Gloucester)			
Kudelski Nagra *No changes anticipated*			
(Hayden Laboratories Ltd., East House, Chiltern Avenue, Amersham, Bucks.)			
Loewe Opta			
416	¼-track mono m/b	£61 19s. 0d.	£53 11s. 0d.
451	cassette m/b	£51 9s. 0d.	£40 19s. 0d.
(Highgate Acoustics Ltd., 184/188 Great Portland Street, London W.1)			
Oki			
111	¼-track mono	£47 5s. 0d.	£40 19s. 0d.
300	¼-track stereo	£89 5s. 0d.	£72 9s. 0d.
300D	¼-track stereo	£75 12s. 0d.	£61 19s. 0d.
333	¼-track stereo	£120 15s. 0d.	£93 9s. 0d.
555	¼-track stereo	£135 9s. 0d.	£110 5s. 0d.
(Denham & Morley Overseas Ltd., 173/5 Cleveland Street, London W.1)			
Perdio			
Shannon 4	¼-track mono	£37 16s. 0d.	£25 4s. 0d.
(Perdio Products Ltd., Lowther Road, Stanmore, Middlesex)			
Philips			
N4200	¼-track battery	£34 8s. 4d.	£27 6s. 0d.
N4304		£33 2s. 10d.	£27 6s. 0d.
N4305		£45 17s. 9d.	£37 16s. 0d.
N4306		£56 1s. 8d.	£46 4s. 0d.
EL3575		£101 19s. 4d.	£84 0s. 0d.
N4408		£133 16s. 8d.	£99 15s. 0d.
(Philips Electrical Ltd., Century House, Shaftesbury Avenue, London W.C.2)			
Q-Cord No change in present stocks. New prices to be decided.			
(C. Braddock Blackpool Ltd., 266 Waterloo Road, Blackpool, Lancs.)			
Reps			
M10/2	¼-track mono	£75 12s. 0d.	£61 19s. 0d.
M10/4	¼-track mono	£75 12s. 0d.	£72 9s. 0d.
(Reps Tape Recorders Ltd., 11 Colville Road, Acton, London W.3)			
Robuk			
Regal RK5	¼-track mono	£55 2s. 6d.	£46 4s. 0d.
Regal RK54	¼-track mono	£59 6s. 6d.	£49 7s. 0d.
(Robuk Electrical Industries Ltd., 559/561 Holloway Road, London N.19)			
Sharp			
RD303E	¼-track m/b	£28 17s. 6d.	£23 11s. 6d.
RD504	¼-track m/b	£36 15s. 0d.	£27 6s. 0d.
RD505	¼-track m/b	£39 18s. 0d.	£32 11s. 8d.
RD706	¼-track mono	£57 15s. 0d.	£47 3s. 3d.
RD707	¼-track stereo	£96 12s. 0d.	£78 15s. 0d.
(Sharp Sales & Service, 16/18 Worsley Road, Swinton, Manchester)			
Sony			
TC100		£47 15s. 0d.	£33 12s. 0d.
TC105		£71 0s. 0d.	£49 7s. 0d.
TC200	¼-track stereo	£95 0s. 0d.	£75 12s. 0d.
TC250	¼-track stereo	£79 10s. 0d.	£59 17s. 0d.
TC260	¼-track stereo	£116 5s. 0d.	£101 17s. 0d.

(continued on page 260)

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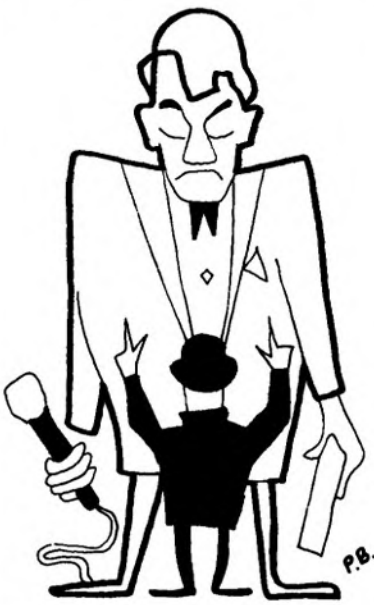
RECORDING FOR RADIO



First of four reminiscences by Peter Bastin

SOME years ago, when I was a small boy in 1835, my great delight was to 'broadcast' to the rest of the family. This was done by hooking up the speaking bit of a telephone to the back of the wireless. This resulted in a squeaky form of primitive amplitude modulation and a very bored family.

I used to sit in the kitchen, below a ceiling rack of airing laundry, and read bits out of the paper. In the early days, music was provided by making a sort of zizzing noise which I was convinced was Ambrose's band to the life. When my father once told me, tactlessly, that all that came through was a sort of splashy hiss, I abandoned the oral athletics in favour of a gramophone and electric pickup. And two records. The family never said whether they liked the records or not.

Eventually, my enthusiasm and the records wore out. On a visit to Paris, I picked up a gadget which you attached to your record player for the simple purpose of recording direct on to a disc. It was a sort of tracking device, consisting of a horizontal threaded arm which was actuated by a vertical wheel bearing on to the disc near the spindle. A conventional needled electric head fitted into something or other at the other end. Half a dozen plastic blanks were supplied. I spoiled all the blanks in the simple process of trying to record something. Each disc, when I'd finished with it, consisted of a series of light scratches going all over the place. If the thing tracked properly at all it only did it for about an eighth of an inch; then went off in all directions—frequently backwards. In course of time I had to admit that the gadget wouldn't work, clearly because it was foreign.

Very little happened in my private world of recording for several years. I was still desperately interested in radio and I always wanted to bridge or close the gap between recording and transmitting. Before I left school, one of the clever chaps built a transmitter and I picked up his broadcast one Sunday morning, dangerously close to a BBC wavelength. I wasn't the only one to pick up the broadcast and that was that. Purely as a matter of interest, this is the chappie who stole into a rather lush new Catholic church in the locality one Saturday evening. The church was so new that they didn't use the old fashioned bells; instead, they used a high power amplifier and records of chimes. Next morning at 8 a.m. prompt, Harry Roy sent Bugle Rag round the district at 100 watts.

The frontier still had to be stormed. There was radio, wanting me. By the time I had embarked on my recording era, 15 years ago, I'd never seen the inside of a radio studio. In due course, I decided to make a very deliberate attempt to do something about the matter. I got to know a very nice man who was outside broadcasts engineer for the BBC. He took me to the studios and he took me on outside broadcasts and I learned an awful lot of things about how Aunty ticks. One rather unusual thing amused me on an O.B. While waiting in the BBC van outside the canteen where Workers' Playtime was to be in full swing, my engineer friend switched on an ordinary transistor radio to keep track of the preceding programme. No arty cues from HQ; just a simple radio. My association with the O.B. engineer led me to an interview with a producer and my first steps on the greasy rungs of Aunty's ladder.

Producers are not huge, awe-inspiring brutes who tower over you, wearing bow-ties and suede shoes. They are rather ordinary people, very flustered and battling against something all the time. Mine was a nice young chap. He asked me what I had in mind. I said this, and gave him a tape with a dozen spoken items on it about odd things such as Why Ants don't like Bowlers and Don't have Uncles. That sort of thing. He played the tape and said yes, they may well fit in nicely as inserts in the so-and-so programme, would you like to come up and record them on our poor equipment? This is a thing with the BBC it seems. They like all spoken material recorded on their own equipment, which is reasonable enough. Not, said the producer, that there is anything wrong with your equipment at all, but you know how it is. So up to the studios I went. He sat me at a table with a rude-looking *STC* microphone in front of me and disappeared behind a sheet of glass. When he waved I spoke and at the end of it all I went behind the glass and he pressed a button. From the bowels of the building the result was pumped up. Sounded very good to me. Um, he said, let's do it again and smile as you talk. So I sat there talking and smiling like an imbecile, but it worked.

It's really quite strange how the smiling touch works. It gives the spoken word just that little extra bit of life and that's why BBC announcers go round with silly grins on their faces.

I went home and the producer went back to worrying. In a month or so I heard from him again. They (who?) think that the voice could be improved a little; can you come along to the studio again? I went, recording the stuff all over again, grinning like a Cheshire cat, and that is the last I ever heard of it. It would seem that the BBC have vast cellars where they keep old scripts, even older jokes, and announcers who ad lib.

It is really an odd experience the first time you do a recording or broadcast in a BBC studio. You feel desperately alone as you sit there, usually in a rotten light, and the producer disappears into his glass house with a mean grin. You look at the cold, efficient microphone and wish for your teddy bear. Eventually, he waves at you and a red light blinks. Your mouth dries up, you realise that your nose needs blowing and you want to cough. An hour and a half after the light has blinked you croak out the first word, which is the wrong one. You start again and squeak out the right one, then find you are out of breath. And so it goes on until eventually the producer waves wildly at you and a metallic voice from the control room says "OK—we finished two minutes ago". You are limp, cold, sweating and darn glad it's all over yet sorry you can't do it again.

But all this is on the other side of the fence. We are concerned with recording for radio not being recorded by radio. The essential difference is that you have to worry twice when recording for radio. You have to worry that whoever it is you are recording gets it right and you have to worry that you get *them* right. Let us therefore consider the two main aspects in this field—recording others and recording yourself or your own programme. The recording of others, be it on location or in the studio, is, to my mind, the more simple and, therefore, because I am simple-minded, I will deal with that alone.

The first recording I did in this category never got on to radio, but it may be worth reporting. It was a location recording of an exhibition at Earls Court. I did the whole thing on a battery portable and in view of the fact that battery portables were in their infancy at that time, it wasn't too bad at all. It was this recording which made me painfully aware of background noise—background noise which could not be suppressed but which, as I learned later, is the basic essence or "atmosphere" of location work. I also learned the technique of close-mike work—the technique of speaking within 3 in. of the microphone. This method gives an intimacy to the voice and cuts down on excessive background noise. It is also useful for subduing rude language from fish-porters in the background.

My first real assignment of any consequence was a recording of a Worcestershire village character, a highly-voluble man of immense memory. I recorded him on a battery-portable with an STC microphone which cost more than the recorder. I used a 3 in. reel, which proved to be a mistake, because he never drew breath, even when the tape ran out. But it was a first-rate recording. The talk/memoirs/monologue/lecture/entertainment was recorded in the living room of his 16th-century house, and because I took some care in facing him into heavy curtains and positioning the microphone

(*continued overleaf*)

on a stand so that it came within about 10 in. of his mouth, I obtained a good quality of voice —not too dead and not too reverberant. Very often a recording can be spoiled by insufficient attention to reverberation. A recording taken in a kitchen, for example, can be very boomy with many words lost in a mush of reverberation. Unless a kitchen or bathroom background is required, I never record in such places; I always record in a deader acoustic or, for best effect, in the open air. But do not do what I once did. I wanted an open-air sequence at dead of night, but in order to get a silent background, I recorded it at 6.30 a.m. I thought everything was fine until I played it back and was greeted with the noise of 300 birds singing at midnight!

One day, a splendid voice on the telephone announced that it belonged to the BBC and could it come to see me? It came in the shape of a presentable young man with a Uher battery-portable. We gave him a lot of coffee and cakes and turned down ITV in the other room which my wife and son were watching. We talked and to prove that I really did do some serious recording, I took him into my studio and played tapes to him until he started to reel. Right, he said after an hour, let's record it. What? I asked—no run-through? Nope, said the BBC, we like to do it natural like. So we did. He scrabbled about and fixed up his Uher and Beyer mike and we started. He asked me a lot of the usual sort of questions —"tell me, Mr. Bastin, what made you start on your career of recording?", etc., and ended up by taking recordings, direct on to his machine from mine. We had some more coffee and talked for a while. I broached the subject of fees when he appeared to be nice and receptive. No luck, said he, only if you are recorded in the studio. Bang went my dreams of the orgies I could have had on the BBC's 30 bob. He went even further ; he said that I would not hear the programme because it was scheduled for overseas transmission. I suddenly regretted all that coffee.

Two mornings later, at 7.25 a.m., my neighbour's wife rang up and demanded to know why I was making foul noises on radio, waking everybody up before it was dawn. She was dead right; the rotten so-and-so's had put me on without telling me! Fortunately (or unfortunately, as you see fit) it was repeated an hour later and I sat in the car in a downpour listening to myself. The funny thing about it all, although my wife does not agree, was that she never heard it. I rigged everything up to record this momentous event before I left home. All she had to do was switch on and pull a small lever. This she did, but (a) I had left the recorder on rewind, so the tape ran neatly off the reel, and (b) I'd tuned the tuner in to the wrong station!

The question of fees is rather absurd, I feel. When I won the 1967 BBC Contest I received the prize money. A few weeks later I received a contract from the BBC for the broadcast of the tape on one of their overseas services, plus a fee. It is difficult to reconcile the question of no-studio-no-fee with receiving a fee for a repeat performance not in the studio. Extraordinary, but they are nice people to deal with.

Recording for radio is, I think, one of the least worrying forms of the art. It is my experience that work from amateurs, where it is announced that it is the work of an amateur, calls for much less high-fidelity than is generally believed. The reason for this attitude is fairly obvious, but where you have to record for them on a professional basis, the standard required is understandably higher. Generally, they insist upon 38 cm/s., recorded full track if possible, but certainly, if half-track, with the other side of the tape blank. Studio replay may be on EMI, Philips, Levers-Rich or equipment according to the whim of the station. Battery-portables range from Fi-Cord to Uher and are, again, a matter of discretion. As a matter of interest, I saw in one studio, an Acos crystal microphone which, I was told, was used for sports recording. Studios and control-rooms are littered with a wide variety of equipment. I have seen Ferrograph, Sony, Brenell, Uher, Philips, Leevers-Rich, Fi-Cord and many other sorts of recorder in radio and television studios. Microphones vary, although the BBC studio microphones I have seen have nearly all been STC.

As a matter of advice, I would suggest that budding radio recordists should concentrate very heavily upon voice. Not only the quality, either. It must be fairly obvious in this direction, however, that a serious subject cannot be properly presented in a broadly-accented and badly-projected voice. If your own voice is unsuitable, get someone else to speak the lines. This is the one big fault I find with amateurs; the tendency to do the talking themselves, irrespective of the unsuitability of their voice. By the same token, a "distant" voice gives no intimacy to the dialogue and one is reminded of an army lecture in a wooden hut. A good microphone, properly used, is essential. Invest in a first-class dynamic microphone and speak fairly closely. Don't be clever and try to do it with a ribbon microphone which will only make your voice boom and buzz in the lower register. And on a final note, make sure that you have adequate 'top' on your recording; they can always cut the top but they can do nothing with a woolly recording.

MODEL	TYPE	NEW PRICE	FORMER PRICE
TC350	¼-track stereo	£109 0s. 0d.	£78 15s. 0d.
TC530	¼-track stereo	£165 5s. 0d.	£126 0s. 0d.
TC7774J	¼-track mono	£398 0s. 0d.	*new model*
TC800	¼-track m/b	£85 0s. 0d.	£61 19s. 0d.
TC900	¼-track m/b	£42 15s. 0d.	£30 9s. 0d.
(Sony U.K. Division, Eastbrook Road, Gloucester)			
Tandberg			
6X	¼- or ½-track stereo	£144 18s. 0d.	£120 15s. 0d.
12	¼- or ½-track stereo	£126 0s. 0d.	£110 5s. 0d.
1521	¼-track mono	£72 19s. 6d.	*new model*
1541	¼-track mono	£77 14s. 0d.	*new model*
11	¼-track battery	£145 19s. 0d.	*new model*
11P	full-track pilot	£208 19s. 0d.	*new model*
(Elstone Electronics Ltd., Hereford House, North Court, off Vicar Lane, Leeds 2)			
Telefunken			
M200	¼-track mono	£45 2s. 3d.	£33 12s. 0d.
M201	¼-track mono	£47 13s. 9d.	£46 4s. 0d.
M203	¼-track stereo	£88 18s. 8d.	£72 9s. 0d.
M203S2	¼-track stereo	£96 13s. 4d.	£78 15s. 0d.
M203S4	¼-track stereo	£96 13s. 4d.	£78 15s. 0d.
M204E	¼-track stereo	£136 12s. 5d.	£111 6s. 0d.
M300	¼-track battery	£63 3s. 1d.	£51 9s. 0d.
M301	¼-track battery	£69 12s. 0d.	£56 14s. 0d.
M302	¼-track battery	£69 12s. 0d.	£56 14s. 0d.
M85	¼-track mono	£117 5s. 9d.	£85 11s. 0d.
(AEG Ltd., 27 Chancery Lane, London W.C.2)			
Thorn-Ferguson			
3216	¼-track mono	£66 19s. 0d.	£51 9s. 0d.
3224	¼-track mono	£33 2s. 0d.	£26 5s. 0d.
3226	¼-track mono	£45 10s. 0d.	£35 14s. 0d.
3228	¼-track mono	£47 19s. 0d.	£37 16s. 0d.
3230	¼-track mono	£58 11s. 0d.	£46 4s. 0d.
3232	¼-track stereo	£91 13s. 0d.	£72 9s. 0d.
3236	cassette battery	£26 14s. 0d.	£22 1s. 0d.
Thorn-Ultra			
6212	¼-track mono	£58 11s. 0d.	£46 4s. 0d.
6214	¼-track mono	£35 16s. 0d.	£28 7s. 0d.
6216	¼-track mono	£46 9s. 0d.	£36 15s. 0d.
Thorn-Marconiphone			
4212	¼-track mono	£58 11s. 0d.	£46 4s. 0d.
4214	¼-track mono	£35 16s. 0d.	£28 7s. 0d.
4216	¼-track mono	£41 5s. 0d.	£32 11s. 0d.
(British Radio Corporation Ltd., 284 Southbury Road, Enfield, Middlesex)			
Uher			
4000L	¼-track battery	£127 1s. 0d.	£98 14s. 0d.
4200	¼-track stereo battery	£153 6s. 0d.	£120 15s. 0d.
4400	¼-track stereo battery	£153 6s. 0d.	£120 15s. 0d.
Royal De Luxe	¼-track stereo	£242 11s. 0d.	*new model*
724L	¼-track stereo	£101 17s. 0d.	£78 15s. 0d.
1000P	full-track battery pilot	£370 11s. 10d.	£245 15s. 0d.
(Bosch Ltd., 205 Great Portland Street, London W.1)			
Wyndsor			
Vanguard	¼-track mono	£75 12s. 0d.	£61 19s. 0d.
(Wyndsor Recording Co. Ltd., 2 Bellevue Road, London N.11)			

so you're going to buy a language tape

BY MARY ALDERTON

THE tape recorder has had an enormous effect on the business of language-teaching. But it has not stopped at revolutionising teachers' ideas; it has changed the attitude of potential learners as well, and that is a greater achievement.

Enthusiasm for the audio-lingual method, as it is called, can be too much of a good thing. "Fling away the grammar-books," the cry goes up, "let's just speak!" I am afraid I must prick this happy bubble. But do not groan; today grammar is almost effortless—with a tape recorder and a good set of taped lessons.

You see, adults cannot "just speak". Granted, at the age of two they were busily learning to "just speak" English, but since then they have gained a lot of knowledge and some inhibitions, and at the same time lost that kind of motivation and the sponge-like quality of mind.

A certain pattern of speech has been imposed on the brain, so much so that an adult can no longer truly hear a sound without superimposing what he expects to hear. He has to make a great conscious effort to analyse it. He, as opposed to the infant's almost full-time preoccupation with speech, is picking up his chosen language in a few hours a week, and he is not compelled, as the child is, to use this language as his only means of communication.

He has acquired also a certain amount of self-discipline in the process of growing-up. He can apply his mind more or less logically to the problems in hand, and it would be throwing out the baby with the bath-water to expect him to jettison the advantage of a mature mind.

Therefore the would-be language-learner should be prepared to use a bit of everything—memory, imagination, logic, and above all his ears. The more weapons the better, including a judicious amount of the infant's method of assimilation, which I will explain later.

In choosing the tape-course for *you*, you have first to decide what you want from it. Most people today say they would like to increase their enjoyment of holidays abroad and fewer than formerly intend to progress to the serious study of literature. Even these could do worse than to get a good grasp of the spoken tongue first.

If you define your aim like this you can eliminate what you do *not* want. In Russian, for example, many teachers would want you to master writing the script perfectly before tackling anything else. If you only want to speak you could well leave the script until much later—you will have to learn to read it of course but this is much easier than writing it. (It is also easier than it looks!) The same goes—only more so—for Chinese. Actually, most modern courses do not even bring in Chinese writing; everything is in the romanised version which has recently become standard over much of China.

Another thing you do not want is a complete and exhaustive treatment of grammar. Your chosen course will have some kind of textbook attached, so your next step is to have a good look through it.

You need some grammar because this is a handy way of remembering how the language is actually spoken. Grammar is not a set of rules to which speech conforms, it simply tabulates what the majority of educated speakers are now in the habit of saying.

Together with the bare bones of grammar you need a certain minimum of vocabulary, but no vast lists of words. This may sound odd, but remember that to speak a language you have to be able to manipulate in your mind the concepts used by native speakers.

You may know that "je" means "I", "vouloir" means "want" and "café" means "coffee", but if you cannot string them together you cannot speak the language.

It is far better to concentrate on a limited knowledge which you really know how to use. After all, the old lady in the story was supposed to have travelled Italy with only two words: "Quanto?" (How much?) and "Tanto" (Too much), but she did use them to effect.

Check the English in the book. If it is old-fashioned the chances are that the foreign phrases are equally so. Up to a few years ago there was a record course which had the word "fore-carriage" under the Motoring section.

Try to get a language-speaking friend to check that the translation, even if modern, is not too free. If it is so colloquial that you cannot sort out the original, it will not be much use until you are more proficient.

Anyway, however well you can chat up the natives, this is only secondary to what, if you think about it, is the whole object of the exercise—understanding the natives.

Here is where your tape-recorder takes you right over the biggest hurdle in learning a language. What you need is to hear what French people are liable to say in a given situation.

If you did some French at school you will remember those everlasting verb drills: "What," Miss or Sir would enquire blandly, "is the imperfect subjunctive of *faire?*". The exercise may have got you through O-level, but was virtually useless as far as conversation went.

So take your chosen tape, put it on the recorder and play it several times without looking at the text. Then play it again while you eat, bath or lie in a deckchair in the garden. This is akin to the child's position. You need not even listen most of the time, but after a while take the book and start following in earnest. As you go along, keep playing the previous lessons over in the same casual way.

If your course has both male and female voices so much the better. Their speech should not be monotonous, nor too fast, though inevitably it will seem like a gabble at first. The best arrangement is for each short phrase to be spoken *as a whole* at almost normal speed, with a pause after each. In a language laboratory, the student's repetition of the phrase can be recorded in the gap and when the whole is played through he can compare his effort with the original on the master-tape. You could simulate this effect if able to borrow a second tape recorder. In any case, even without gaps, your pause-button will allow you to repeat, except that you will spoil yourself by giving yourself too long to speak. In good courses the time lags will be of the right length to give you time to say the phrase, but short enough to prevent you lingering over it and losing the intonation or rhythm.

Intonation is the next most important factor after the ability to manipulate words. Think of those people—we all know at least one—who can convulse a roomful of friends with their perfect mimicry of a foreigner. Mostly they do not know much of the language, but it

(continued overleaf)

Producers of taped language lessons

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   Tried and tested, thorough courses.
3. **Holt, Riehart and Winston, 120 Golden Lane, Barbican, London E.C.1.**
   Excellent, but mainly for schools and colleges. Expensive for one student.
4. **Rupert Hart-Davis, 36 Soho Square, London W.1.**
   Ditto applies.
5. **Monitor Language Laboratories, 43-5 Queen's Road, Bristol 8.**
   Language drills.

is the intonation which they have, perhaps unconsciously, grasped and applied. They have also probably mastered the "er" noise—the sound you make while you are stalling for time. In French for example it is something like "eux".

But intonation is by far the biggest factor. The funny thing about it is that it switches itself on and off without your being able to do much about it. You just hear it happening. This is the point of playing your tape over and over again so that the rhythm of the sentences gets into your ears and becomes almost automatic.

Pick out one simple short sentence on your course. Go back and play that one several times until you can sing the tune without the words: "Dee-da-dee-dee-da," or whatever it is. Apply this to another sentence and see how it fits in. Then try to find out what a question sounds like.

The ear is much lazier than the eye and must be forced to do some work. If you understand every single word while following the book, try listening with closed eyes and you will be staggered at how difficult it is.

You want to absorb as much of the foreign tongue as possible, so it is really a waste of good recording time to have a spoken English translation on the tape, besides preventing you from absorbing the foreign phrase for itself alone.

Grammar examples, idioms and vocabulary are also often recorded and I feel these have limited value. The eye can concentrate in more detail than the ear and for these things exactness matters, so they should at least be in the book as well. The most important thing on the tape is the connected passage or better still, dialogue. Following the text will help to sort out the meaning, but do not be a slave to it.

It would be as well if you could have some indication—before you buy—of whether the speakers on the course have the accent you want to acquire. For example, some Spanish speakers may have a South American accent which is quite different from the Castilian norm.

Do not get the very small, cheap type of course unless you really are going the following Thursday and must pick up a few words before then. Some simply give a list of words to repeat, which is useful if you are pressed for time.

Again, the very expensive long type of course may not be what you need either unless you want to progress to higher serious study. The best general advice one can give is to get a good medium-priced set of tapes from a reputable publisher.

There are a tremendous variety of tapes which range from the academic ones designed for schools and colleges to those in alluring ads which persuade you you will be speaking like a native in a week. The first lot are expensive for the student on his own and may be difficult to track down if you are not in touch with the educational world. The claims of the second lot should be treated with extreme caution—though the contents may be indeed excellent. One of the good 'light' sets is probably what you want.

Unfortunately, there are not very many language-learning tapes specifically designed as such. There are far more tapes which have been made of courses originally planned in book form. I say unfortunately, but in fact some of these are among the best, planned on modern lines, basically conversational with good comments in the textbook on points of grammar and idioms.

One set of courses, in various common languages, consists almost entirely of conversation and masses of practise in manipulation in the shape of phrases in which appropriate words have to be substituted.

Another claims "no spoonfeeding", but I have a sneaking suspicion that it might be hard going for all but the serious who have an exam to pass, for which purpose it would be very good.

Again, there are courses between these two extremes, where a text is read, usually informative in character, then there are questions and exercises. (No, I'm afraid we haven't quite got rid of *them* yet.)

I have a personal preference for lessons with texts first and notes afterwards. When they are the other way round you get the feeling that the texts have been composed expressly to drag in as many awkward grammar points as possible.

In addition to actual courses there are various other taped aids. You will find useful little books of advanced conversation which have been taped, and when you have mastered the groundwork these will be invaluable. For those at a lower level there are lots of simple stories with accompanying text.

A few tapes of songs and of dramatised stories have been produced, and there are many of advanced lectures on literature, current events and economics. There are even tapes for teaching very young children.

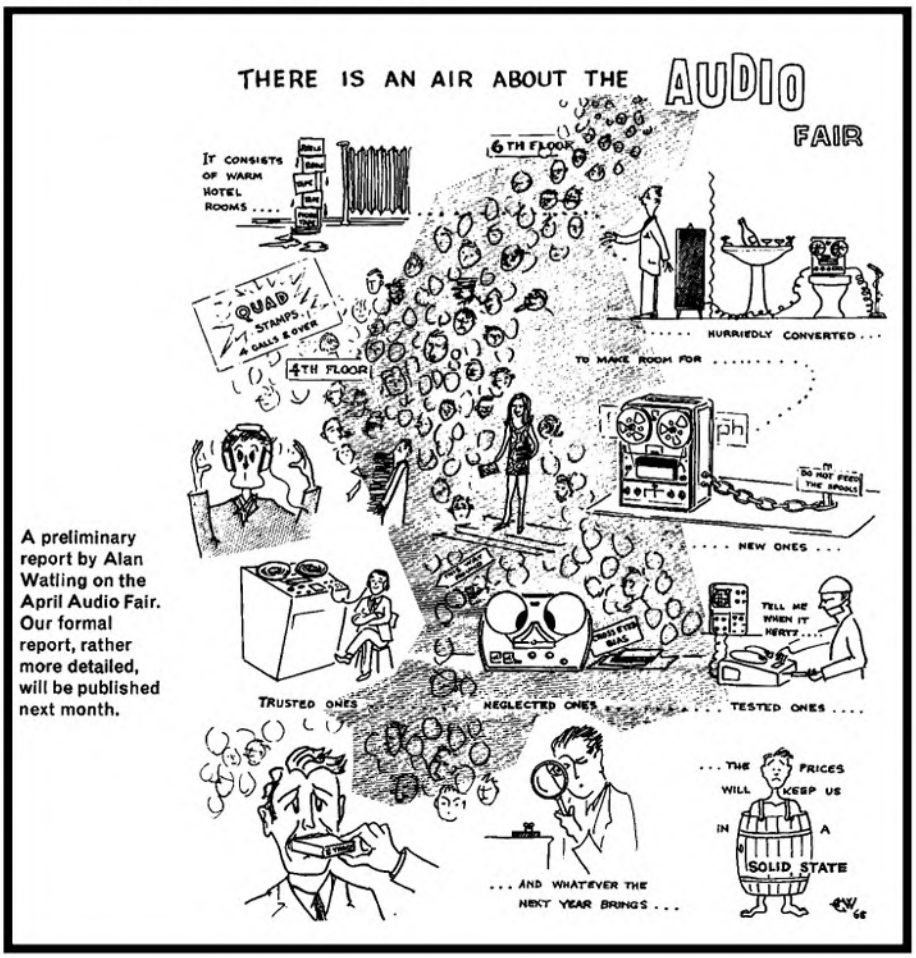
Some textbooks have very attractive pictures. These are not just to look pretty but to enable you to practise expressing yourself in the language much more directly without having a situation explained in words first. You can have background noises too, but these are simply as illustration.

You can even get language drills basically meant for a language laboratory which enable you to be absolutely proficient in the finer points, but these are rather expensive and better for those who have to pass exams.

Readers of this magazine will be far more expert than I at judging the quality of sound reproduction, but even to my ears this varies enormously, so if you have a sensitive ear liable to be irritated, test this before you buy.

I found one set of tapes with pieces of leader-tape inserted between lessons so that you could find your place very easily. Your rev-counter would serve here, or if you wished you could insert your own coloured tape.

Whichever course turns out to be the one for you, I am sure you will agree it's a far cry from those imperfect subjunctives. If ever there was a (practically!) painless way of learning, this is it.



A preliminary report by Alan Watling on the April Audio Fair. Our formal report, rather more detailed, will be published next month.

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

IMPEDANCE MATCHING

Dear Sir, I have a *Marconi 4216* tape recorder with an output impedance of 22 K. I understand that this is unsuitable for feeding into my projector which requires an input of 220 K. I would be most obliged if you could tell me the easiest way of achieving this.

Yours faithfully, **B.C., Hull**

A great number of misconceptions exist about matching, especially as regards differences in terminal impedances. Without going too deeply into the physics of the matter, we can agree with your inference: it is necessary for the impedances to be the same (the output impedance of the source and the input impedance of the driven circuit) for the maximum transfer of energy. But providing there is sufficient signal available it is quite in order to drive a medium-to-high impedance input circuit from a lower impedance source.

An example of this would be the loading of a tape recorder auxiliary input, with an impedance of 100 K or more at 50-200 mV sensitivity for full tape modulation, by the loudspeaker output of a transistor radio, or other apparatus. Here, the loading impedance may be 8 ohms, or even less, but the voltage available may be more than adequate for the recorder. The mismatch provides a 'built-in' attenuation and needs no additional matching networks or transformers.

In your case, although the Ferguson circuit of the Marconi 4216 stipulates a 22 K load, it will give a reasonably good output signal into a 220 K input. The only trouble may be that the output level might not be sufficient to drive the projector, in which case there is no remedy except to amplify it and then match the inputs. This will introduce noise unless the most stringent precautions are taken in building the intermediate amplifier. A simple one or two transistor circuit seldom gives the desired results.

We presume you have actually tried the interconnection? If so, and if the signal level is too low, you must either amplify the signal before matching or take off from the loudspeaker and, in both cases, put up with some deterioration in quality.

A HISSING TRUVOX R.44

Dear Sir, I own a *Truvox R.44* recorder, purchased in November 1965. As soon as it is switched on, a loud hiss can be heard from the loudspeaker, substantially impairing the quality of reproduction. I would be grateful if you could suggest some cure, as my dealer can offer no solution. *Yours faithfully*, **I.W., Matlock**

In tackling this task, attention should be directed to the transistor preamplifier stage, which is a 2N2613 driving an AC165. The first transistor has caused this trouble on a number of occasions and is certainly the prime suspect. Another possibility which should first be checked, however, is the 120-ohm emitter resistor.

DOUBLE-COATED TAPE

Dear Sir, I recently purchased some recording tape from a firm advertising in your columns. The tape was advertised as *Scotch* brand, double-coated. It was with some surprise that I discovered that 'double-coated' meant the tape was coated on both sides and not merely at double thickness on one. Since I understand that the oxide used could be abrasive, I wonder if I can safely use it with my *Bang & Olufsen 2000*?

Yours faithfully, **R.S.H., Stoke-on-Trent**

What you have purchased, as you may know, is the tape used by the people who rent machines for producing continuous background music. It is normally loaded in cassettes with an endless loop with a half-twist at the join (Mobius loop) so that both sides are used in two revolutions of the loop, without turning over.

Subject to your finding otherwise after a time, the tape is not likely to be unduly abrasive since the nature of endless-loop cassettes demands very low abrasion and friction. This may be the reason for its being available anyway but it is much more likely to be merely surplus to requirements in a rather limited market. On the other hand it may very well sound as though it is abrasive but this is because the pressure pads and other paraphernalia at the back of the tape are now being rubbed with something rather rougher than they normally meet. The coatings may be impregnated with graphite (check whether it leaves a pencil-like smear on your finger when rubbed), in which case abrasion will not be a problem.

As to recording on double-coated tape, stick to 4.75 cm/s (1⅞ i/s) if you want to use both sides or you will get audible breakthrough at lowish frequencies. Be prepared also for audible print-through at the higher speeds unless you can store the tape at temperatures below 10°C. Given care, you should find this tape comparable in performance to ordinary domestic types.

CIRCUIT FOR A GARRARD DECK

Dear Sir, I am trying to obtain a tried and tested transistor tape amplifier circuit of reputable design for use with a *Garrard* battery tape deck. If you know of any circuitry that you feel would be of any use to me, I would be grateful for details of where it may be obtained.

The circuit that exactly matches your deck is that of the Dansette Cadet tape recorder, which actually uses the same deck. H. W. Hellyer's 'Tape Recorder Servicing Manual' (Newnes, 63s.) contains this circuit plus general data on the Garrard deck.

EXPLOSIONS BY REMOTE CONTROL

Dear Sir, When using the remote control switch on my *Sony TC-900* microphone a loud bang and sometimes a squeal accompany the switching action. The switch is fairly stiff but is nevertheless potentially useful when recording on the move. I would appreciate any advice you can supply.

Yours faithfully, **B.T., London N.3**

There should certainly not be such noises as you describe, and neither should the switch be very stiff. It may be that the contacts are not quite touching, or, more likely, that the plastic part is sliding on a rough channel. These plastic halves are heat-moulded in large quantities and the odd article with 'flash' on the break-away edge is bound to get through. We have had this several times with British Radio Corporation, HMV and Ferguson microphones, which use the same type of switch. Fortunately, the trouble is easy to cure.

One other possibility is that the pin on the remote control socket is not cleanly operating the isolating blade. This double-part plug has a rather thin remote pin with a very fine insulating washer between the two parts, and we have had one or two making bad contact. Check also that the knurled outer clamp ring is tight on the socket.

MATCHING TAPE AND RECORDER

Dear Sir, I have always been led to believe that certain makes of tape suit certain recorders, according to the bias setting. Some time ago, I noticed a fall-off of hiss after splicing two brands of tape. Consequently I tried an experiment by joining a yard each of *BASF*, *Grundig*, *Ilford*, *Scotch* and *Electronic World* tapes. However, I could detect no differences between these, either when blank or recorded with piano music.

What is the simplest way (without special instruments) to find the ideal tape for my machine. My recorder is, incidentally, a ¼-track *Reps R.10* and I have always used LP tape. *Yours faithfully*, **G.G.H., Belfast**

You are in general correct in saying that certain makes of tape suit certain recorders according to the bias setting; only now it would be fairer to say that most *makes of tape suit* most *tape recorders. There is now very little domestic tape on the market which differs appreciably in bias requirements from the average, so consequently there are very few machines which are not biased to the average tape. The Reps R.10 is; thus most tapes sound alike on it, especially if they are compared using something fairly impulsive and restricted in frequency range like piano music. You may hear more difference in respect of dropouts and treble response if you test with smoother or more brilliant music, respectively, and this will make*

(*continued on page 269*)

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TAPE TRANSPORT MECHANISMS

PART 3 MOTORS

BY G. T. ROGERS

IN previous articles in this series I have stressed the importance of constant tape speed which can only be achieved if the capstan and flywheel are accurately machined and assembled. I have also shown why it is desirable for the tape to be at the correct tension, the pull from the reel motors being important here.

The power required to maintain the speed of the flywheel, and so drive the capstan spindle, is supplied by the capstan motor and it is essential that this motor should have a very constant speed characteristic. By this I mean that its speed should be both steady—short term speed stability—and not vary appreciably in r.p.m. when run for a long period of time—long term speed stability. In view of this, most capstan motors are more complex and costly than the spooling motors where, as we have seen, long term speed variation does not affect performance since the speed will depend on the amount of tape on the reel. The capstan motor must also be silent and cool in operation, without radiating unduly powerful stray magnetic fields.

In practically all mains-powered tape recorders, the capstan and reel motors are of the induction type where there is an air gap between the moving part (the rotor) and the fixed part (the stator). These motors are very efficient, giving a lot of power for their size, and their method of construction and operation enables a high degree of reliability to be obtained. To understand how an ordinary induction motor works let us first consider some basic principles of electromagnetic induction.

The phenomenon was discovered in 1831 by Michael Faraday when, after many unsuccessful experiments, he was able "to convert magnetism into electricity". In other words he was able to obtain an electric current using only magnetic flux. This can be shown (**fig. 1**) by suddenly moving a magnet from **X** to **Y** close to a coil to which is connected a sensitive galvanometer **G** to measure the current. The type of current observed which can be obtained without the use of a battery is known as *induced* current and the force or EMF (which is really like voltage) giving rise to it is termed an induced EMF. Further experiments show that (a) the induced EMF is increased by the presence of a soft iron core inside the coil and (b) that no induced current is produced when the magnet is stationary, however near the latter may be to the coil. If the magnet is kept stationary and the *coil* moved, an induced EMF is again produced, so it is the *relative motion* between the coil and the magnetic field or flux that is necessary for electromagnetic induction.

Instead of using a magnet to obtain the flux, another coil can be used (the *primary coil*) which is connected to a battery as in **fig. 2.** When the switch **S** is connected current flows in the primary coil and, owing to the magnetic effect of the current, a magnetic flux is obtained inside and outside the coil. From what we have said above it is therefore possible to obtain an induced EMF in a *secondary coil;* however, the current flow is momentary as it only occurs while the flux in the primary coil is changing, i.e., while the current in it is rising towards a steady level. Having established a steady current in the primary coil, a change of flux in the secondary can only be obtained by a relative movement between the two coils.

In the induction motor the equivalent of the primary coil is fixed in position and is known as the *stator.* This closely surrounds the secondary coil (or *rotor*) which is mounted in bearings so that it is free to rotate. A changing flux is set up around the stator by applying an *alternating* current to the winding which sets up an induced current in the rotor windings. It is the interaction of this induced current and the field set up in the stator that makes the motor begin to rotate. To understand this let us look at the sequence of events in a little more detail.

In practice the stator coils are wound on soft iron *pole pieces,* the faces of which project inwards and partially surround the rotor. The polarity of these pole faces depends on the direction of the current flowing in the stator coils. In one direction the pole will be *north* and when the current is reversed the pole will be *south.* Now, when an alternating voltage is applied to the stator, current in the winding will change, being in one direction in the positive half cycle and in the opposite direction in the negative half cycle. This means that the pole faces in the stator will change in polarity with a frequency equal to that of the alternating voltage applied; 3,000 times a minute for a 50 Hz supply.

The number of poles in the stator of an induction motor is important since it determines the speed of the rotor. In the two pole motor (**fig. 3**), with the polarity of the poles reversing 3,000 times a minute, the field produced can be looked upon as rotating at 3,000 times a minute. This can be seen if we follow a north pole from **A** during the course of one cycle of supply voltage. After half a cycle it will have moved half a revolution to **B** (when the polarity is reversed) and in the remaining half of the cycle it will have returned to **A.** In a four pole motor the polarity of the poles is still changing 3,000 times a minute for a 50 Hz supply, but the arrangement is such that the field only rotates half a revolution for every cycle of the mains supply and so its speed will be 1,500 revolutions per minute. Again, if we follow a north pole starting at **A** (**fig. 4a**) we reach the position **B** (a quarter of a revolution) when the supply voltage goes through half a cycle (**fig. 4b**) and position **C** (only half a revolution) when the supply voltage goes through a complete cycle (**fig. 4c**).

An alternative way of looking at the rotating field in a four pole motor is shown in **fig. 5,** where the magnitude and direction of the current is plotted against time. In this diagram the capital letters refer to the positions (shown in **fig. 4**) of a north pole as the field rotates round the stator. The speeds of field rotation for a six- and eight-pole motor are 1,000 and 750 revolutions per minute respectively. Since it depends on the supply frequency, the speed of the rotating field is extremely constant; it is known as the *synchronous* speed.

So far we have assumed that the field rotates immediately the alternating supply is switched on. This is not so in practice so it is necessary to place additional poles in the motor structure which become energised at a slightly different time, or out of phase with the applied voltage to the regular poles. In most tape recorders this phase shift is accomplished by means of *pole shading.*

The effect of this is to provide a movement of magnetic flux across the pole faces. This is done by having a groove in each pole face through which passes a copper ring (the shading coil) which encircles about a third of the pole face. This ring opposes the change of the magnetic field and so when the main pole moves towards north, the secondary pole, created by the shading coil, becomes south. Consequently, when the main pole begins to reverse towards south the secondary becomes north, giving a rotational field which starts the motor.

Let us now examine the effect of this rotating field on the rotor. Essentially, the rotor consists of a cylindrical laminated iron core carrying lengthwise conductors in slots in the surface, the conductors being shorted by a ring at each end of the core. As soon as the stator supply is switched on an induced voltage is generated in the rotor coil—due to lines of force cutting the coil as the field rotates. This causes a current to flow in the rotor which tries to oppose the effect of the rotating field. This results in the rotor coil rotating in an attempt to follow the field round.

From our earlier discussion on electromagnetic induction, we can see that the speed of the rotor can never actually catch up with that of the field, since at 'synchronism' there would be no relative movement between the coil and the field axis. This would mean no induced voltage to produce the driving current.

This constant difference in rotation between the rotor and the field is known as the 'slip', which is just enough to create the necessary driving current. The speed of the induction motor is not greatly influenced by the supply voltage but it is affected by the load. With an increase in load the slip will be increased, more flux lines are cut, more current will flow in the rotor and a greater torque develops, depending on the speed-torque characteristic of the motor (**fig. 6**). This is particularly advantageous where the motor is used to drive the tape reels.

Reducing the supply voltage has the effect of lowering the full load torque or rotational force available at full load speed. This means that the full load power of the motor can, within certain limits, be controlled by varying the supply voltage. In tape recorders where separate motors are used to drive the reels a resistor is switched into the motor circuit during record and playback—this reduces the voltage and hence pulling power of the motors. Under these conditions, and if the motor is carefully designed, the relationship between

(*continued on page* 267)

We'd like you to say a few words...

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CONTINUED

torque and load is such that a torque can be developed which enables the correct tape tension to be maintained irrespective of the amount of tape on the reels.

The induction motor is able to withstand relatively long periods of stalled operation without serious overheating, and in the case of the supply reel motor it can even be pulled in a direction opposite to its normal rotation so that the back tension is set up.

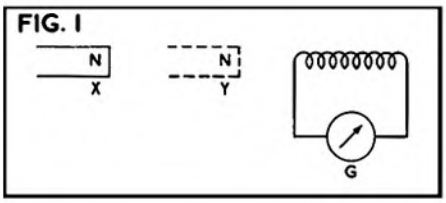
In domestic recorders an ordinary induction motor can be used to drive the capstan. The rotating field of the motor is never the same in all directions and there is an inherent tendency for the speed of the rotor to vary intermittently during every revolution. However, this form of vibration can be minimised considerably by employing suitably designed pole faces and sufficient shading rings properly positioned. This type of motor then has the advantage of a very good instantaneous speed characteristic, introducing little wow and flutter into the drive system. Its long term speed stability is poor, however, on account of the variation which can occur when the voltage or load changes.

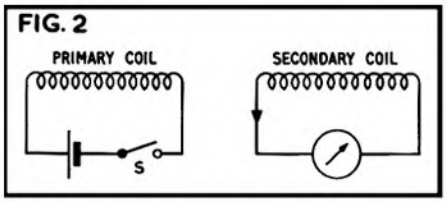
It is equally important to prevent excessive mechanical vibration which can exist if the rotor is not correctly balanced and precisely centred between the pole faces. Furthermore, the bearings and spindle ends must be very well made. Even so the motor will produce some vibration and this will be transmitted to other parts of the deck mechanism unless adequate provision is made to suspend the motor and cushion the effect of its movement. This is usually done by employing resilient supports such as small rubber grommets.

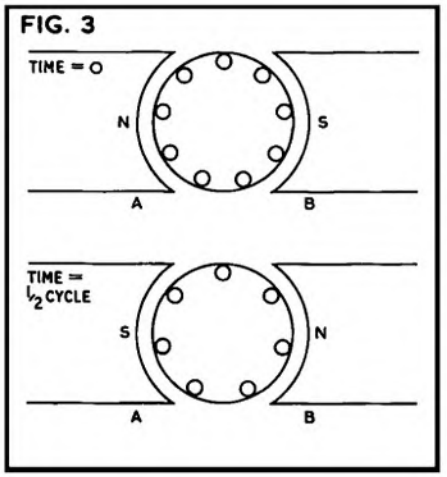
Four-pole induction motors have several advantages over two-pole motors. The more important of these is a much lower external magnetic field, a slower speed requiring a smaller reduction to drive the capstan, the use of a larger rotor which can be balanced more accurately, giving quieter operation, reduced motor vibration and an improved instantaneous speed stability.

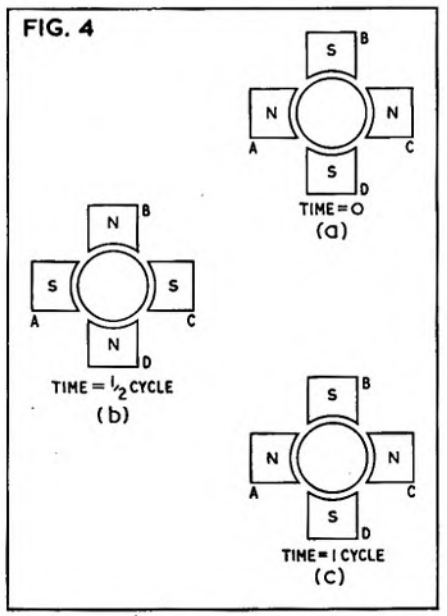
Whereas the ordinary induction motor is adequate for driving the capstan spindle of a domestic tape recorder, the poor long term speed stability rules out its use in professional and semi-professional equipment. In these recorders another type of motor is used—the synchronous motor—where the rotor travels at *exactly* the same rate of speed as the magnetic field. These motors therefore run at an exactly synchronous speed. If the stator has four poles, the rotor will run at 1,500 r.p.m. when connected to a 50 Hz mains supply. The synchronous motor therefore has the advantage that its speed will never vary; it will be as constant as the frequency of the line voltage and the recording will last exactly the right length of time provided all other parts of the drive are functioning without slippage.

A synchronous motor, however, has a poorer instantaneous speed regulation. On account of its design it cannot slip behind the speed of the rotating field. The motor instead tends to 'hunt' or vibrate about the synchronous speed, and this introduces flutter into the recorder. As we have seen in the first two parts of this series, various methods can be employed to minimise small variations in instantaneous speed and so bring the flutter to an acceptable level. In professional equipment preference is therefore given to the synchronous motor to drive the capstan.









One type of synchronous motor, the hysteresis motor, employs a specially designed rotor which has an outer covering of magnetically 'hard' material. This material has a high *remanence* which means that it has a residual flux density when the magnetic field is removed. It is therefore the sort of material which is used to make permanent magnets and can be contrasted to magnetically 'soft' material which conducts lines of force easily and loses its magnetism quickly. Now as the rotor approaches synchronism the flux of the pole faces in the stator during the last cycle will highly magnetise this outer casing of the rotor, and since this is magnetically 'hard' the induced poles will be attracted by, and lock in with, the rotating field and the rotor will run at synchronous speed.

In another type of synchronous motor, the salient pole motor, the rotor is milled with flat spots on it. The air gap between the flattened part of the rotor and the stator pole faces is therefore enlarged. The rotor laminations are made of 'soft' iron and so they conduct lines of force more easily than does air. The rotating field in consequence has an easier path on one side of the rotor than the other and the rotor tends to follow the synchronous speed rather than slip behind it. The phase shift necessary to start synchronous motors is usually accomplished by means of a series capacitor or by making one pole winding with more inductance than the other.

In battery driven portable recorders a small DC motor is employed. This type of motor cannot rely on the mains frequency for speed regulation and so some other means of control is necessary. We shall look at this shortly, but first it will be useful to explain briefly the working of a typical DC motor. The rotor or armature consists of a spindle around which are attached three pole pieces, each with its own winding. The armature is mounted in bearings so that it is free to rotate within a tubular permanent magnet. Unlike the induction motor, the power is supplied to the armature windings by a *commutator*—brush system. The commutator is made from three electrically insulated metal segments, each being electrically connected to one of the pole windings. The brushes, shaped to match the radius of the commutator, are situated diametrically opposite each other and, being spring-loaded to press against the metal segments, convey battery power to each pole winding in turn as the motor revolves. The commutator-brush system thus acts as a switching device and passes current through the pole windings in such a way that a continuous turning moment is developed relative to the field of the permanent magnet, which is at right angles to the axis of rotation.

To achieve the turning moment the commutator is positioned on the armature spindle and wired so that the current from the brushes passes through the winding of one pole *directly* and in the opposite direction through the windings of the other two poles *in series*. This means that the polarity of one pole will be opposite to the polarity of the other two. As

(*continued on page 269*)

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the armature rotates, of course, the brushes will make contact with different segments in the commutator and the current conditions through the windings will change. The magnetic polarity of the poles will then change in turn, since the current will always be in an opposite direction through one winding. It is essential for the operation of the motor that the commutator reverses the current in the pole winding as its face passes the poles of the permanent magnetic field. Reference to **fig. 7** will then reveal that the turning moment is always maintained. In **fig. 7a** the south pole **A** will be attracted by and the north pole **B** will be repelled by the north pole of the permanent field. At the same time the north pole **C** will be attracted by the south pole of the field. It is clear from **fig. 7b** that when the south pole of **A** changes as it passes the north pole of the field it will then be repelled by it and the turning moment will be continued.

The simplest way of controlling the speed of a DC motor is to vary the input voltage by means of a governor which itself is controlled by the output of the motor. A simple example of output control with which many of us will be familiar is the flyball governor used in a steam engine. As the speed increases the flyballs are forced further apart from the axis of rotation by centrifugal force, and this movement in turn controls a valve which decreases the steam pressure to the cylinder. This is an example of feedback control.

In the DC motor (**fig. 8**) a centrifugal switch is used which opens a pair of contacts as the speed of the motor increases above a certain preset level. When this happens power is supplied to the motor through the resistor R and the reduced voltage or current slows the speed of the motor below the controlled rate. The switch then closes, the resistor is bypassed, and full power is applied to the motor, when the speed is again increased. The governor is therefore a make-and-break device and by careful design it can be made to act within a very narrow range of speed variation and at a very high frequency, so that the motor is in effect being energised by a pulsed unidirectional current from the battery. The main disadvantage of this method of control is that of sparking between the contacts which results in rapid wear of the governor and also interference which may be picked up by the amplifiers. Next month we shall look at a simple way of combating this and then discuss the various ways in which motor power can be transmitted to the capstan and flywheel.

FIG. 8

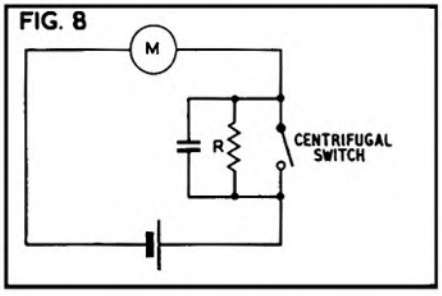


FIG. 7

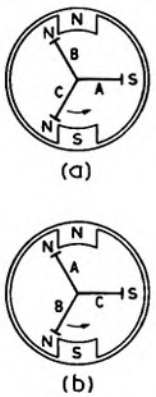


FIG. 5

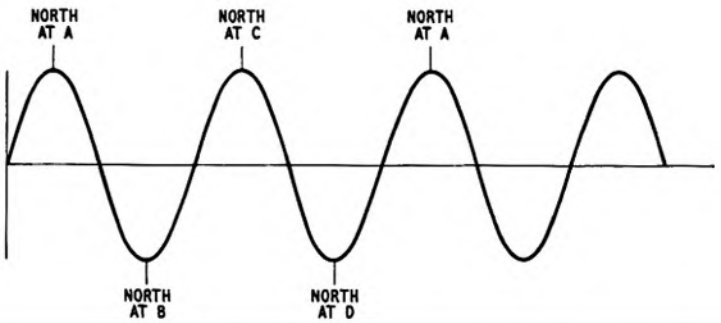
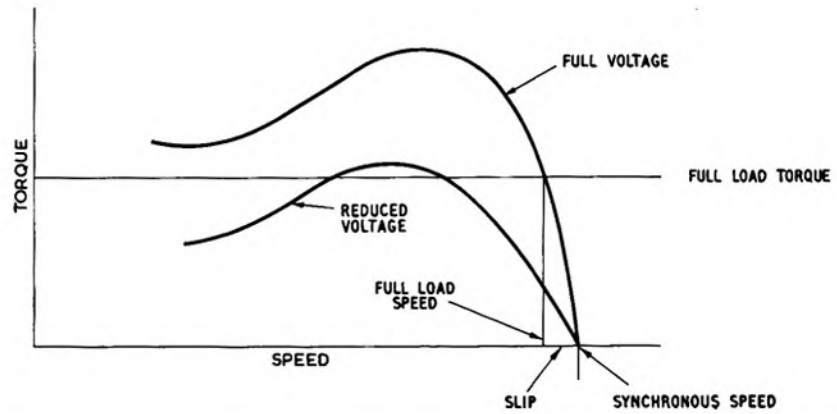


FIG. 6



your choice easier. We shall be surprised if you hear any appreciable difference in background noise between tapes, however, unless your machine happens to have, or develops, a fault in the erase or recording circuits.

EQUALISATION ANOMALIES

Dear Sir, Articles that one reads, variously published, give tape replay characteristics as: 100 μS for 19 cm/s (7½ i/s) and 50 μS for 9.5 cm/s (3¾ i/s). Likewise, applicable recording curves are given, presumably to the same CCIR standards.

I have, however, a considerable number of American stereo tapes which are stated to be of "standard NARTB characteristics" and a *Sony* stereo recorder for which the following is stated: "Generally NARTB is employed for stereophonic recording and reproducing while CCIR is for mono recording and reproducing".

Since CCIR seems generally adopted in the country, can you tell me what the NARTB recording and replay characteristics are or give your observations on this apparent anomaly?

Yours faithfully, **L.F.L., Crowborough**

The current NARTB characteristics are (for domestic use) 50 μS for 19 cm/s and 90 μS for 9.5 cm/s, both with a bass modification of 3180 μS. These curves are also now practically standard in Europe and the UK; the CCIR curves for these speeds went out of use some years ago as far as new equipment is concerned.

We understand that Sony use the newer curves for stereo, because stereo tape records are generally more modern than mono ones, which were mostly recorded to CCIR standards. We assume this was done with the US market in mind, since the argument does not hold here—mono tape records are being made here in fair quantities to the newer curves, whereas none are being made in the US. In your shoes, we would have the machine modified to the new standards, since there seem to be only disadvantages in having it as it is.

A PROFESSIONAL APPROACH TO INTERVIEWING

SPEAKING as a professional broadcaster, I am going to say straight away that I am appalled by most of the amateur recordings I hear. Let me make it clear that I am not talking about the entries to competitions—such work is often up to the best professional standard and sometimes exceeds it in terms of imagination and experiment. No, I am talking about the stuff that goes on to tape every day. You probably bought a tape recorder in the full flush of enthusiasm and then did the usual things with it: let Mum hear her own voice ("That's not me! I don't speak that way. I know my own voice!"), have some fun at a party and probably hide a mike somewhere and giggle at what comes through; what you can hear, that is. Then what happened? You took a few bits off the radio, probably by propping a mike in front of the 'transistor' and then telling everyone to keep quiet. Then a chat with a friend, technically an interview, and perhaps a tape letter or two. And what were the results like? Honestly now, how did it compare with what you hear on the radio?

Now why were they all so bad? Why were they not as good as the BBC? Here is where you start to rationalise, you say: "I haven't got the equipment that the BBC has. My machine cost £30, theirs cost £100 and up." Now this is a half truth. Yes, we do use better - than - average recorders for various reasons that I will go into in a moment, but almost any recorder is better than the cheap transistor radio that many people listen to—yet even over that the BBC material is much better. The truth is that more expensive equipment helps, but the top photographer can still do better with a cheap box camera than most people can with a *Rolleicord*. No, it just is not the equipment, it is the user who is to blame.

What can be done about it? The truth is that making acceptable recordings under ordinary conditions is easy. Professionals do it every day. All you have to do is to *understand* the problems, then you can solve them simply. And broadly the problems are these:

(a) Getting rid of local noise (maintaining a satisfactory signal-to-noise ratio).
(b) Recording at the right level.
(c) Balancing the levels between voices, music or effects.
(d) Eliminating unwanted noises due to the recording (microphone noises, noise of recorder motor, etc.).
(e) Choosing the best place from the acoustic point of view, in particular keeping down unnecessary reverberation.
(f) Using the microphone correctly (e.g., getting rid of plops and splutters and not over-emphasising bass).

Let us have a look at all these by considering what a professional does when he goes out on a job. We shall take an easy job first, interviewing Professor Pumpshaft about his new invention. We go to see him at his college. This is a job that really needs a battery portable recorder, you *can* use a mains machine, but it is usually heavy and you make a nuisance of yourself finding a power point and a plug to fit it. The techniques get between you and the story and this must never happen.

Personally I use one of two machines for outside work, a *Fi-cord 1A* or a *Uher 4000 S Report*. We use 7½ i/s (19 cm/s) because we always expect to edit the tape afterwards and the higher the speed the easier the editing. Obviously we use clean tape—not necessarily new tape—and we employ only one track. One little warning here. Professional playback equipment in studios is always full-track. So if there is anything on the other track, disaster will stalk! Of course if you are going to play back on a ½-track machine, or a ¼-track for that matter, there is no problem. But I still must emphasise that you must expect to edit the tape, if only to clean up the beginning and end. If you are miserly about tape, use the other track or tracks *after editing* to record something that does not need editing, like a radio programme.

So you turn up with a machine, a couple of clean tapes and a fully charged battery, or a spare set of dry cells as the case may be. The way the interview is conducted depends on the man doing the job. Professionals all have their own ideas. Some like to record much more than they need and then edit the final tape down fairly drastically. Others work out questions in advance and record as though it were a live broadcast. Some like spontaneity, nothing worked out in advance, just throwing questions as they come to mind. Each method has its merits and to some extent which you use must depend on your own style and inclination. I will tell you what I do, merely because it suits me, but this is not a method that I would necessarily recommend to others.

Most of my work is of a technical or scientific nature and I want good, concise answers to searching questions. I am not out to catch someone unawares and extract a confession from him. This may or may not be fair game in current affairs, we all have our own views on this, but in science it clearly does not apply. So the first thing is to learn what the story is all about. I just do not believe that you can do a good interview if you do not understand the story and its implications *before you start*. There are several reasons for this. One is that it should be put into a logical form; there has to be a pattern or the listener will get lost. Another reason is that the wrongly phrased question can be unanswerable, and this does neither side any good. I will give you an example: suppose a doctor has developed a new drug which lowers blood pressure in mice. If you say: "Doctor, does this mean that sufferers from high blood pressure need have no further worries?", you put him in an impossible position. He does not know and cannot know the answer at this stage of the work. All he knows is that under certain conditions, using certain mice, the drug lowers the blood pressure. But if you put the question like this: "Can this work be applied to human beings who suffer from high blood pressure?", it becomes answerable. He can elucidate the difficulties of transferring work on healthy mice to human sufferers and then, perhaps, make what he will admit is a guess about the future.

So what I do is this. I talk to Professor Pumpshaft and find out all the details. I have previously done some homework, so that I know something about the device before I get there. Then I jot down a few questions and ask him if these will draw out the story—I do not let him answer them at this point; this usually spoils the effect as most people answer better the first time than the second. But I do discuss with him any difficult points and how he can make his account graphic. I believe that in radio one must draw a picture, the listener should *see* what you are talking about. So you do not say "20 feet high"; you say "as high as a telegraph pole" and create a mental picture. You use analogies if they help, but not if they get in the way. A cyclotron can be described as a race track with electrons instead of horses. Each time they go round there is a man with a whip to flick their behinds as they go by and so speed them up. And he must flick at just the right time or they may slow down, just as the magnetic field has to be synchronised with the electron motion. Here is a picture, something the listener can get hold of. And such pictures do not always come to the interviewer during an interview; another good reason for some forward planning.

Yet another reason for the advance plan is that the man being interviewed, who is usually a bit ill at ease in an unfamiliar situation, gets confidence that you are not going to slip in a dirty one. Of course, as an interview progresses points usually come up which need supplementary questions, but the basic pattern can still be followed.

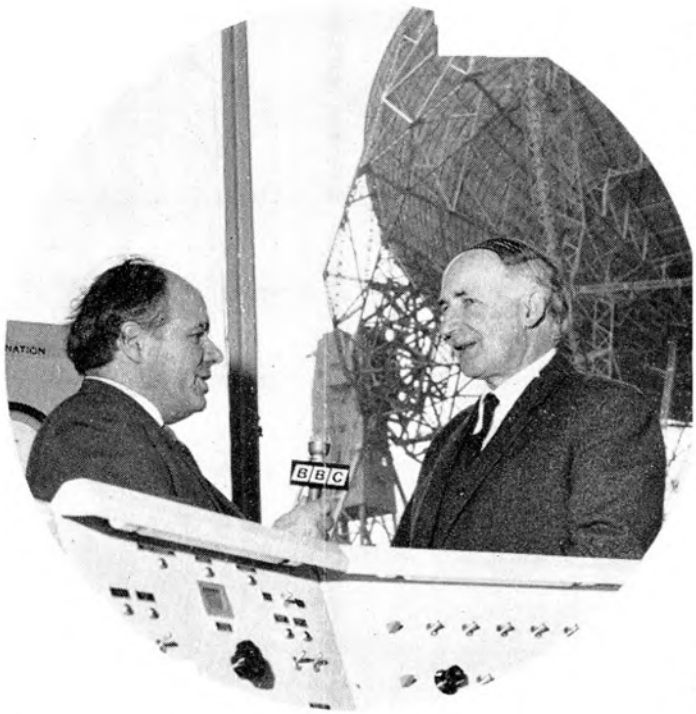
So much for the interview, now what about the mechanics? The first thing to decide is where to do the interview. In general, the quieter the place the better. I say "in general" because there may be a case for having some effects behind. If the device is a machine which does something, it may be better to start the machine at an appropriate moment and then describe what it is doing as the listener hears it doing it. Often this can best be done by doing the main interview somewhere quiet and then saying: "Well now Professor, let's go and have a look at the machine itself". Then fade down the recording gain to zero, move to the new place, and fade up to a pre-determined spot. With a neat edit the two will then match together very convincingly. Do not be tempted to record footsteps as you go across—it seldom works!

Suppose then we start in his room. Almost always university rooms are far too lively; company directors are much better off with carpets and curtains! There are two possibilities if there is far too much reverberation. One is to go somewhere else; there is often an acoustically treated conference room nearby. The other is to record as close to the mike as possible so that the voices are much stronger than the reverberation. This means sitting really close —try and avoid moving the microphone about and *never let the other man get hold of it*. Recordings should always be made with the speaker within 18 in. of the mike if you want an acceptable acoustic. If you *have* to work closer, speak *across* the mike to stop the sibilants from splashing.

A PROFESSIONAL APPROACH TO INTERVIEWING

BY ARTHUR GARRATT

Now those extraneous noises. Some are an advantage; if the room is as quiet as a studio, why not use a studio? So traces of atmosphere —a piece of apparatus running quietly in the distance or the faint sound of traffic can actually help. But there are some familiar sounds that are highly distracting. For example, get rid of anyone whistling, stop his secretary typing, and avoid the twitter of birds. And don't forget the fridge and the ticking clock—we get so used to such sounds that we do not realise they are there.



Sir Bernard Lovell being interviewed by the author at Jodrell Bank. The microphone is placed to balance the two voices. Each speaker is talking across it to ensure there is no splashing of the sibilants. *(BBC Photograph.)*

Then comes the most important technical point in an interview: getting the levels right. There are two things to remember. One is that good recordings will peak up to maximum but not beyond. If they go over the maximum modulation level ('mod' in the business) there can be serious distortion. If the mod is too low you get tape hiss and in cheap recorders stacks of hum on playback when you wind the gain up, so try and get it right. And, second, both voices should be at the same level; this is essential—an interview is useless if the voices do not balance.

Having got the levels right you now take the recorder off the table and place it on the floor or another chair. All recorders make some noise and you do not want this on the tape, so keep the recorder away from the microphone and close the lid. Then, you are ready to go. Start the machine—say "Recording with Professor Pumpshaft on his new proton microscope, going ahead in five seconds". Then let the tape run for five seconds before putting the first question. This will give the machine time to settle down in case the tape jumps as the slack is taken up and it also gives you 'atmosphere' which is often useful if you want to edit in a pause later.

Satisfying these two requirements is not as difficult as it sounds. First of all you do a test; usually you can try the level without the tape running. If not, use a bit of tape and wind it back when the test is over. Ask one or two questions not related to the subject, such as "Who's going to win the Cup Final". Do this with the recorder on the table and watch the level indicator. See where the microphone has to be in relation to you and the man you are interviewing. If he has a soft voice, he will have to be closer than you and vice versa. A word of warning—many people talk louder as soon as recording starts. If this happens and you overshoot badly, stop and start again. Overmodulation distortion cannot be eliminated afterwards.

There are some 'noiseless noises' that you should be on guard against. These are caused by electric fields picked up direct on the microphone, the microphone lead or the recorder itself. One of these is hum—I once recorded a Nobel Prizewinner near a mains transformer (under the floor; I had no way of knowing it was there) with disastrous results. The only check here is a playback and even this is not a complete check as often the small speaker in a portable recorder has too poor a bass response to hear 50 Hz. Another source of hum is in diesel-electric trains when there is sometimes electric heating run off the alternator. Here you are inside the loop and there isn't much you can do except try the mike in different

(continued on page 273)

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- 4 track
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Tape speeds
7½ in/sec (19cm/sec)
3¾ in/sec (9.5cm/sec)
1⅞ in/sec (4.8cm/sec)

Playing time
96 min x 2 at 7½ ips
(stereo 7″ 1,200 ft. tape)
192 min x 2 at 3¾ ips
(stereo 7″ 1,200 ft. tape)
384 min at 1⅞ ips
(stereo 7″ 1,200 ft. tape)

Frequency response
7½ ips : 20–21,000 c/s
(–3db 30–16,000 c/s)
3¾ ips : 30–13,000 c/s
1⅞ ips : 30–9,000 c/s

Wow & Flutter
7½ ips : 0.15% R.M.S.
3¾ ips : 0.20% R.M.S.
1⅞ ips : 0.30% R.M.S.

Output Power
Music: 10W x 2
Undistorted : 5W x 2

Erase rate
Less than 65db

Weight
35.2 lbs (17 kg)

Accessories
Microphone x 2,
Recording tape 7″,
Empty reel 7″,
Patch cord x 2,
Reel stopper x 2,
Splicing tape,
Capstan sleeve,
Microphone stand x 2.

SANYO

RELIABILITY IS BUILT IN

positions to see if you can get a null-point. A third source of electrical interference is the paging systems used in some places, particularly hospitals. Because these are not continuous they are extremely difficult to find and you discover loud bleeps on the best bit of the tape. If you own one of those low voltage table lamps with a built-in transformer, do not use it anywhere near your microphone. These lamps, when they are alight, have a powerful magnetic field that will cause hum. Another thing to do is to stop your wife ironing while you are recording; you often get clicks and splutters from the iron thermostat getting on to the tape. And do not go to a physics laboratory as one of my friends did, make some excellent recordings, and then stand the machine down alongside one of the most powerful magnets in the country. As this was after he had checked the tapes, it took some time to realise how he managed to get home with nothing on the tapes at all!

Sometimes you need to talk to two people. In this case there is a lot to be said, if one follows the other, for stopping after the first and lining up the second for level before going on. This makes sure the levels match and only takes a moment. If you are talking to two people at once, take care that both of them are 'on mike' and also make sure the listener can identify which is which. A man and a woman is easy, but two men or women with similar voices need the occasional identification from the interviewer, like: "What do you think, Mr. Hammerblock?".

So much for the straight interview. Remembering the rules, and the most important are keep noise down, get the levels right, and balance the voices, this is technically easy, but I do not think the art of interviewing is easy. This needs practice and I do suggest that you listen to professional interviews and note the way the questions are developed and how a logical thread is built in throughout—or rather should be, because I certainly would not say that all professional interviews are artistically good.

But what about the interview in tricky circumstances—where there is a lot of noise, for instance? Here it is just a case of getting the right balance between the noise and the voices. Noise can help, but must not intrude. If you want the noise for effect only, you can often get the right balance by taking the man you are interviewing some way away from the noise to where it is just loud enough to be heard. It is then a 'fair cheat' to imply that you are beside the machine or whatever it is. But this isn't always possible. A good example is the flight deck of an aircraft; this is often much noisier than the passengers' cabin and recording there is always difficult. For one thing, if you want to interview the captain it's usually impossible to sit by him; all you can do is lurk behind him and lean over him with the mike. Then you have to wind the gain right down, speak fairly loud and close to the mike. If possible speak *across* it; this reduces plops on consonants and splashing sibilants. With precautions it is possible to get good recordings in such circumstances, but it is a challenge. One word of warning—never use a recorder in a plane without permission, it is possible for the bias oscillator to interfere with the navigation equipment on the plane.

Now a word about equipment. I have implied that this is sound stuff capable of good results. If you buy a fairly expensive machine this is true, but what about the cheaper machines? What are the minimum requirements? First I think it is a waste of time using a machine for interviewing which has not got a constant tape speed. The dictation machines which drive the tape by the take-up spool are just not on because you cannot edit the tape; and as I keep saying, this is absolutely essential. So you need a machine with a capstan drive.

A portable machine should work equally well in any position. If the tape speed varies as you swing round with it hanging from your shoulder, you cannot do serious work with it, and this is something to try when you are buying a recorder. The machine must run quietly and it must have a level indicator that you can see in daylight; best is a meter, but a light indicator can be used if it is really visible in bright sunshine. As for tape speeds, the faster the better. It just is not worthwhile to travel somewhere, take a lot of time and then be niggardly with tape. And remember, you can edit easily at 19 cm/s but it is almost impossible at 9.5. Make sure the gain control is free of noise; a dirty pot can ruin a recording.

Probably the main difference between the cheap machines and the better quality recorders is the microphone. I would recommend this as the part you spend a bit more on. I am not suggesting you buy a microphone out of all proportion to the machine, but I do think that the cheap crystal is a waste of time. The response is peaky and rough and the microphones are noisy when held in the hand. Professionally we use more expensive microphones. I have an *AKG D.19C* with a windshield and a *Grampian DP.4* for outside work. But in the studio I use a *Reslo* ribbon. I think that, at a medium price, the ribbon gives the best response *in a stationary position*, but it is quite useless held in the hand or in the open air where there is wind. The D.19C has two excellent features. One is a cardioid response; in other words it rejects sounds coming from behind. The other is a built-in speech/music switch. This means that set to 'speech' it introduces bass cut, so helping a lot in a lively room. By the way it is not really a switch; it opens and closes ports to change the acoustic labyrinth system.

The windshield is invaluable—and expensive! In the open air it is usual to have enough wind to produce unpleasant roars on the tape. If you do not have a windshield, improvise one with a thin handkerchief wrapped over the mike. The windshield has another useful function—it prevents those horrible noises as you rub your fingers along the case—and it is not easy to avoid this if you have to move the mike about. Again a handkerchief wrapped round the case helps a bit, but do not cover any ports or you will affect the operation of the mike. Of course, if you are recording one person in a room, the mike should be on a stand of some kind, preferably not on the table that carries the script or it will almost certainly pick up nasty rocking noises. One little point here; the table acts as an acoustic reflector which can spoil the speech balance. This is why BBC studios use a gauze table-top—you can get much the same effect by buying a piece of plastic foam, the sort of thing used to put on sink tops, and putting this on the table. If a script is used it must be on rustle-free paper —try typing on blotting paper, this is very good. Otherwise fix the pages separately to pieces of card with paper clips; this is a standard trick in film dubbing suites. If you can hold the script up alongside the mike—not in front of it—do so as this prevents a change of level and acoustic as your head moves down with the lines. Most amateurs are so bad at reading scripts that it is almost always better to use notes and improvise round them. It does not matter if you make a mistake, you can always edit or start again. And you need not be ashamed, all professionals fluff at one time or another!

If you want to do a lot of recording in a room, it is worth having a look at the acoustics. For speech most rooms are too lively, for music most are too dead! So put down extra carpets for speech, roll them up for music. It is not possible to get rid of all extraneous noise unless you are prepared to build a special studio; the odd lorry or plane will get through, even with double-glazing and acoustic treatment. And mind those birds, you get so used to them you do not notice them until you play the tape back. Personally I do a lot of recording of straight speech for radio stations in different parts of the world, and I make it a rule to do it late at night when the birds have gone to bed and the drivers of the heavy lorries are in the all-night cafes. The recorder should be in a different room, then its noise is not important and someone can monitor the recording on a loudspeaker—which is really the only satisfactory way because this is how the listener will eventually hear it. If you have a recorder with a separate replay head and amplifier, always monitor off tape—but this is unusual in amateur equipment. If you are taking recording seriously, fit up a cue light so that the 'recording engineer' can tell you when to start or, better still, use one of those loudspeaking phones as a 'talk-back' system—fade the recorder gain when you use it or you will get howl-round.

I am not going to talk about editing, this is a subject in itself. But I am going to say that without editing you may as well give up any hope of doing good work. If professionals doing the job all the time need editing, it is obvious that you can profit from it.

So there you are. With relatively inexpensive equipment you can do a professional job. Just remember the rules and what they are for and you are in business. And if you still have the occasional calamity, don't give up. It happens to all of us. And a final word; listen to radio interviews with a critical ear, you can learn a lot from them.

IF serviceability were among the top ten requirements of tape recorder purchasers, the *Van Der Molen* range would be well up among the market leaders. Remove a few screws, a cover plate or two, and the electrical and mechanical mysteries lie revealed. No cluttered layout with odd levers and switches; no overlaying the deck system with printed circuit boards until the simple act of removing a spool carrier needs the serial care of an archaeological dig. Just as we have seen with the two previous models discussed, the *Sonic-Eight* follows this trend toward 'get-at-ability'.

Trendy, too, is the overall design concept, for the whole idea of this cassette machine is to obtain the best possible stereo conditions in a bookshelf unit, and yet retain the apparently contradicting virtues of compactness and adjustable speaker separation.

If this is beginning to read like a copywriter's exercise, regular readers will have to forgive me. There has been no review of this machine in these pages, so a few remarks on the general design are needed to set the scene, before we can talk about repairing the Sonic-Eight. Although I must add a comment that the simplicity already mentioned has resulted in a remarkably small proportion of those we have sold returning for repairs. There was, it is true, one 'rogue' machine, but more of that some other time.

The deck employed in the Sonic-Eight is the basic *Philips* cassette mechanism, as used in the *EL3301* and *EL3302* models. (Actually, the latter is a better reference, for this machine employs the motor regulation circuit reproduced in **fig. 2** and which is an important part of the improved design.) For readers needing some mechanical guidance around the basic Philips deck, the servicing article in November 1965 should give a few clues. There have been small changes in design since then, allied to numerous circuits under the Philips flag and a few unusual bedfellows. It is hoped to be able to collect a few of these examples together for a future servicing article, when time and space allows. We cannot use this article for a dissertation on the cassette or its driving mechanism, except for those odd points relevant to the Van Der Molen method of employing it.

VAN DER MOLEN SONIC-EIGHT

BY H. W. HELLYER

In the central section of the low cabinet, behind the deck, the regulator circuit and the oscillator section are housed with the record/play switch. More correctly, we should say the record interlock switch, for this machine has electrical functions on the interlock as well as the press-button record switch on the side panel. In this way, the amplifier circuits can be switched to record without the mechanism being engaged and without the oscillator in action, giving the useful facility of a straight-through amplifier. As the circuit is completely stereo, on both record and playback, this is handy. It justifies the maker's claim for its suitability as the heart of a stereo hi-fi system for pickup and radio signals alike. If any criticism is to be levelled, it is that some pilot tone filtering should be included where stereo radio broadcasts are to be recorded. This might be a useful modification, and will need only three components per channel for effective 19 kHz filtering.

The control panel is to the right of the machine, and in this section of the Sonic-Eight we find the principal circuitry as well as the right-hand 13 cm. loudspeaker. The left-hand speaker is housed in a matching compartment that fits within the left side of the cabinet, secured by a swivel clip at the rear. It has a 6ft. extension lead that allows removal and placement of the speaker unit for the required stereo separation. Despite the fact that there is no evidence of particular attention to acoustic design, the quality of the sound available from these high-flux speakers in their small enclosures—*not* of the infinite baffle-type, it must be stressed—has to be heard to be believed. We have often surprised customers who sneered at the 'pint-pot' approach without having heard the results that could be produced from a pre-recorded tape or an amplified signal from disc.

To get even better results, a pair of 15-ohm loudspeakers in heavier enclosures can be substituted; external DIN J21 loudspeaker sockets are fitted, switched to isolate the internal units. Audio output from a fully modulated tape is 4 W per channel.

Other specified statistics are: overall frequency response 100 Hz-10 kHz±3 dB; playback frequency response 60 Hz to 10 kHz± 3 dB; signal-to-noise ratio better than 40 dB; microphone inputs 70 μV at 2 K; gram inputs 70 mV at 2 M; line outputs (for stereo pre-amplifiers) 100 mV at 10 K. Mains operation from 110, 205, 225, 245 V AC at 50 or 60 Hz and DC operation at 20-25 V from an external source. Total consumption 15 W. Size 53.5 x 19 x 12.5 cm. Weight, 15 lb., approximately. Cabinet finish, teak veneer. Type of cassette, Philips *Compact*.

So much for the scene-setting. What about the circuit? As **fig. 1** shows, the machine is fully transistorised and some of the features are similar to the *VR4* and *VR7* designs we have already considered. The differences arise from the fact that this is a stereo machine. **Fig. 1** shows one channel only of the amplifier section, but the oscillator and power pack are common to both channels. The amplifier sections within the dotted line are small printed circuit modules, but for the rest, the Van Der Molen technique of simple tag-board mounting has again been used to good effect.

Good, because the layout enables immediate access to any required test point. Indeed, despite the compactness of the layout in the right-hand 'box', it is rarely necessary to do any dismantling for test and repair to the main circuitry. Even the printed circuit modules, which are mounted beside the loudspeaker and next to the deck section, can be removed after 4 BA nuts are slackened.

The sockets on the side panel are perhaps the most awkward connections to reach, but this is a comparative statement, and we are pleased to note an improvement in socket mounting over the previous models which should eliminate the need for much work in this area. The front socket is a three-pin DIN, for stereo microphone input; the centre socket, a five-pin DIN, input for gram or radio and output at high impedance to drive an external amplifier or for dubbing to another tape recorder. The rearmost of the three sockets is a J21 type DIN loudspeaker socket, of the non-reversible variety, but with switched 'live' pole, cutting out the internal loudspeaker when the plug is inserted.

At this point, it may be auspicious to mention some of the test and operational procedures for transistor amplifiers, because this is a subject that quite evidently gives some readers a few qualms. Scarifying tales of ruined transistors have done much to make enthusiasts reluctant to change from their tried and trusted valved equipment. But really, working with transistors can be very much easier than with valves, and all that is needed is a modicum of common sense. For example, reverting to the last paragraph: the loudspeaker socket is switched, so we take good care that the amplifier is either 'off' or turned to low gain before inserting the plug.

This is no more than one would do with valved equipment if one has respect for one's speakers. Nothing is more harmful than the sudden blast of sound. With the transistor amplifier, the danger is rather different, but the proviso is the same—switch off before altering outputs, and make sure connections are correct before switching on again. Complementary push-pull stages dislike short-circuits, and transistors will over-run too quickly for any margin of control, so make sure that all is well before applying the power. Equally, push-pull output stages of the alternative varieties that designers of transistorised equipment have dreamed up may dislike the open circuit, though the danger is not so great, and overload protection devices are sometimes fitted. Therefore, make it standard practice (a) to switch off before altering outputs, (b) turn down the gain before re-applying the power, advancing to the required level smoothly, and (c) never blast the input stages with an overload signal—by the time you have leapt to the control, if any, it may be too late.

Remember that the input stages of transistorised equipment are seldom controlled. This is

(*continued on page 276*)

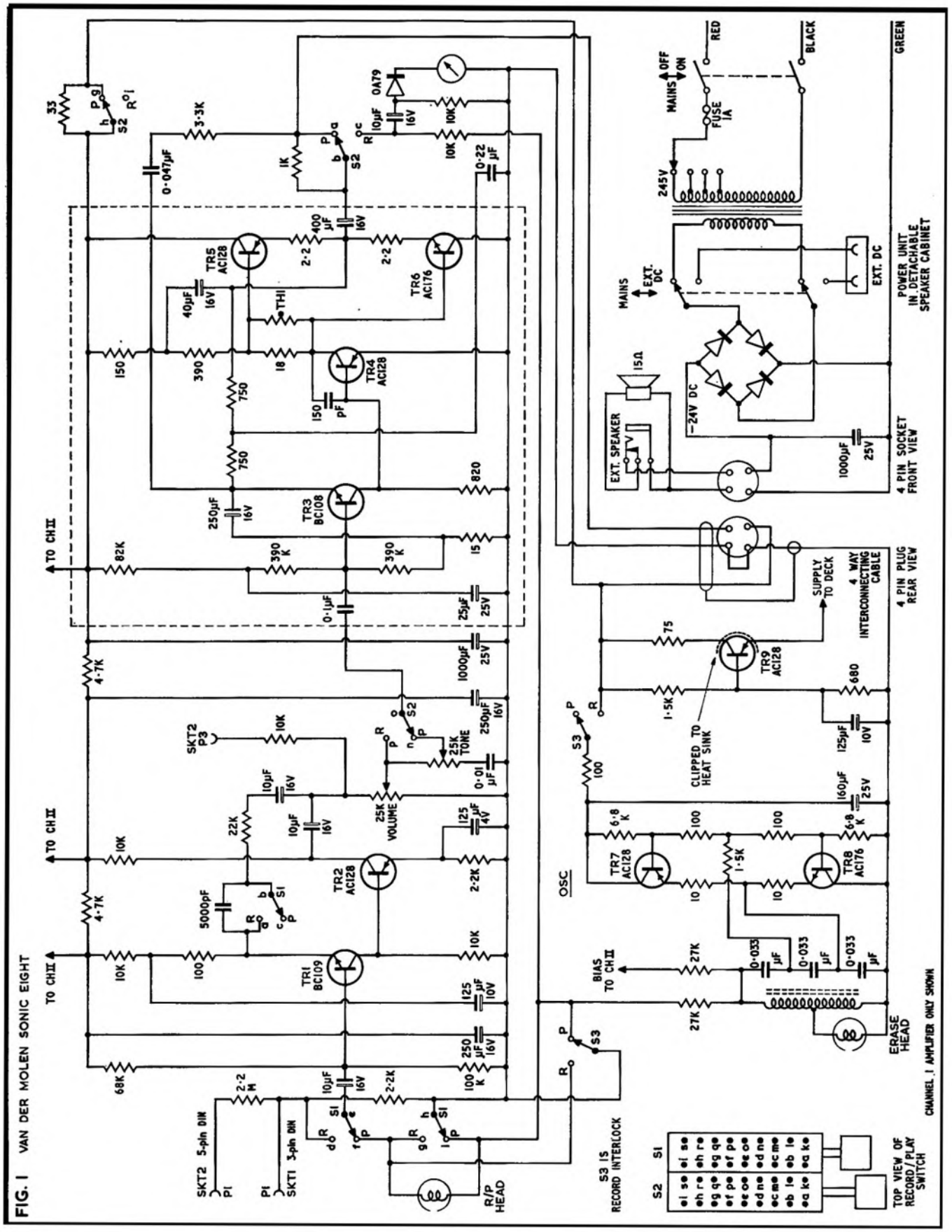


FIG. 1 VAN DER MOLEN SONIC EIGHT

to obtain the best signal-to-noise ratio, the stage being designed to operate at its optimum performance rating. Therefore, to offer it too large a signal is to invite the transistor to overwork. Whereas a valve will simply block off and suffer no lasting harm, a transistor is a willing workhorse and will turn itself inside out in an effort to accommodate all the voltage you can give it, but cannot recover from an excess of current. All that is needed is a revised set of operational rules, including the three we have already mentioned.

To go on with this diversion—while we are mounted on our hobby-horse—the practice of fitting an anti-surge fuse where a plain one is used should be deprecated. It is one of the tricks of the trade on valved equipment where an overheat fault is suspected, giving that little extra time to locate fault sources. On transistor gear the time limits are shorter and waiting for the smoke to rise will usually result in a frightening toll of failures, often with no clue to their origin.

A regular workshop practice, in fact, is to employ the opposite approach. That is, to fit a fuse that will blow a little sooner, then run the equipment on a lower than normal supply, gradually increasing this while making voltage tests to pinpoint the fault source. Often, voltage tests alone will give the necessary clue, but this needs a good meter, capable of accurate readings of low voltages, and not likely to impose a load on the circuit. A valve voltmeter is perhaps the most trustworthy instrument for these tests. For signal tests through a transistor amplifier, there is little to beat a good oscilloscope.

Coming back to the machine we are inspecting, its aid to easy servicing is the fact that it is completely stereo. Comparisons can be made between the channels, even with a simple signal tracer. *In extremis*, sections of the two channels can be transposed, and even supply lines to the individual sections swopped over to note current drain, which is a good clue to fault origins.

Which brings us to the power pack, and a further point. **Fig. 1** shows the main part of the circuit, which is located on a plate behind the removable left-hand loudspeaker. The transformer is not large, and the rectifier is of the selenium type. Provision is made for operating the Sonic-Eight from an external 20 to 25 V DC supply, when the rectifier becomes a low resistance path and forms, in fact, a portion of an input filter. The transformer is completely isolated in this mode.

To remove the power pack plate for testing requires only the extraction of the three plain screws. The painted black screws should not be slackened: these secure the transformer. Similarly, although it looks as if it needs to be taken off, the on/off switch can be left in place for most service operations. Two screws at the bottom of the cabinet rear will allow complete access.

The rear of the deck is accessible when the small panel is taken off. The bottom screws that go through the support of this panel also locate through the plastic front cover of the deck, which becomes clear after the removal of one more screw. But taking off this rather flimsy cover can be a bit ticklish. It needs easing from the top, to clear the record lock lever, and when refitting some care is needed to locate in its slot the spring blade that helps secure the cassette. With these front and rear covers removed it is possible to get at any portion of the deck for servicing.

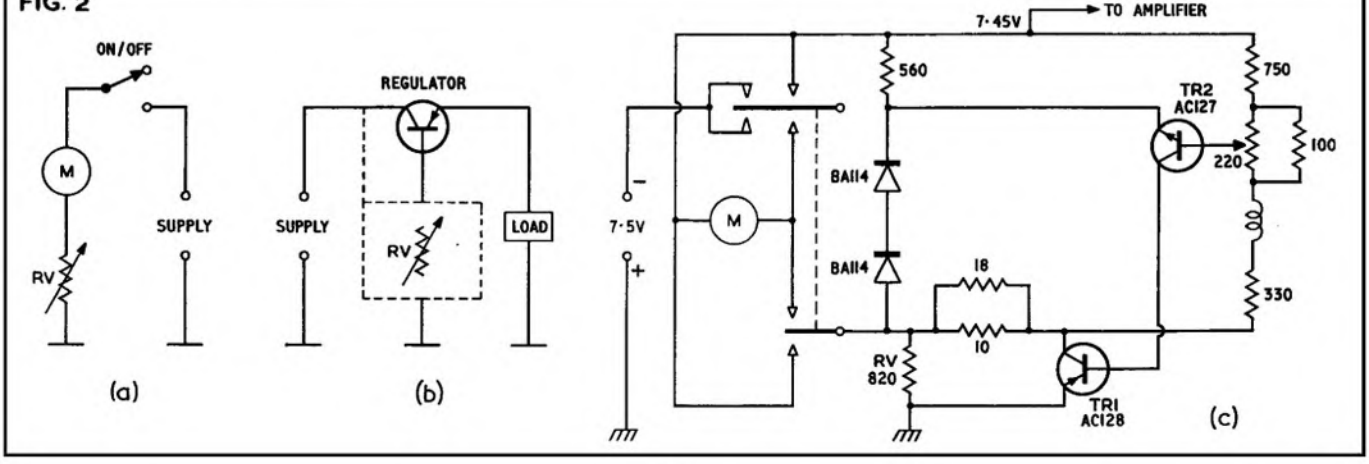
At the bottom corner of the rear of the deck can be seen the regulator panel, the circuit of which is given in **fig. 2.** This was a modification to the original cassette mechanism design by Philips and is well worth studying. Physically, it is a postage-stamp sized printed board with only a couple of connections to it. For test purposes, it is the work of a moment to remove it from the circuit altogether. My experience of regulators is that they seldom give trouble themselves; more often, the motor develops a fault and damage to the regulator can result. In these cases, it is wise to look for mechanical troubles that may have strained the motor—having just had a very dodgy job on a *Uher 4000L* (which employs a complicated regulator circuit), I am sore on the subject of DC motors. Briefly, the trouble on this new machine was that a knock developed when fast rewinding. We suspected a 'flash' on the rubber-tyred drive wheel to the left-hand spool carrier, but closer inspection proved that the fault was a deformed belt which drives the rocker bar on which this roller is mounted. However, on changing the belt and re-testing, we discovered a pronounced wow at 9.5cm/s, apparently at pinch wheel revolution timing. It was not until a lot of head scratching and frustrated mechanical testing time had been spent that we thought to check the motor drive current under running conditions in the various functions. Believe it or not, this led us immediately to the fault—one high resistance cell in the pack of five U2's. The regulator was striving to compensate for this, and just failing—but the symptom did not show up until we had fitted the new belt. Life is interesting, don't you agree?

But to return to cases. **Fig. 2a** shows the basic idea behind motor regulation. The current through the motor also passes through a variable resistance, and by making the variation keep in time with a changing current demand, imposed by a changing mechanical stress, the motor can be kept within certain limits of steady torque and runs at a constant speed. Remember that a DC motor depends on the applied voltage for its revolution rate.

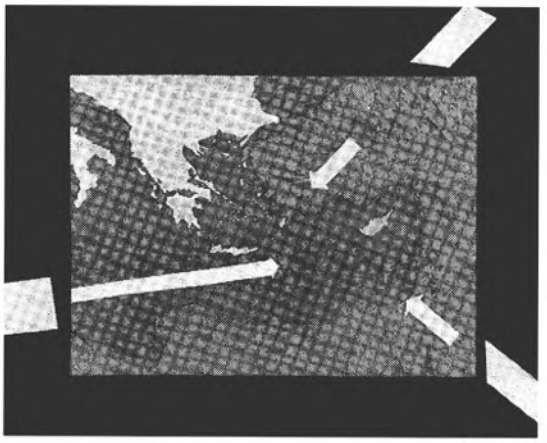
Obviously, we cannot sit with our hand on a variable control and must make something more sensitive than the human reaction rate do the adjusting for us. So a method basically like that of **fig. 2b** can be employed. Here, a transistor acts as the variable resistance, in that it passes a current that changes with the base voltage, and isolates the load from the supply. If the base voltage can be arranged to vary with the supply voltage, some control is possible, but such a primitive method would not do for motor regulation, although it is common when amplifier supply lines are held within limits to allow for the falling battery power. I understand from Mr. Kirk that an article on regulation is being prepared, so shall not waste more time in going into the whys and wherefores.

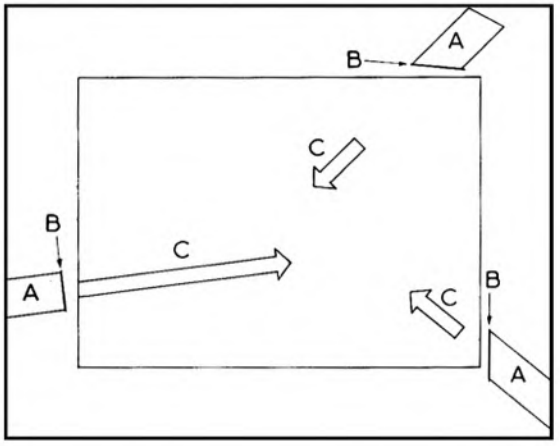
Fig. 2c shows the actual circuit of the regulator as fitted in the Sonic-Eight, and here we see that two transistors are employed, with the actual variable resistor in the positive return line, marked **Rv.** Variation is achieved by the shunting effect of Tr.1 and the varying impedance of the shunt controlled by Tr.2, in conjunction with the silicon diodes that stabilise the emitter voltage and rectify the AC variations due to the EMF in the motor windings. A preset resistor at the base of Tr.2 allows a spot setting, and the motor rotation is reversed by the changeover action of the switch.

FIG. 2



special effects for video





Left: Typical animated diagram to display routes. Pointers **C** are controlled off-screen by arms **A** through slots **B.**

CLOSED CIRCUIT

BY RICHARD GOLDING

TRICKS and effects are a vital part of TV network productions and add immeasurably to the programme content. In a live transmission they may be staged live in front of a second camera, produced electronically inside a camera, generated electronically (in the case of a simple wipe effect), or taken from film via a Telecine process. Where the effects are on film, 16 or 35 mm., they are known as Opticals and will have been printed in the laboratory to the editor's orders after he has cut together the final takes and viewed them in their correct order.

More control can be exercised when the effects are produced by an Optical Printer but it can work out very expensive and can take a long time to do. It is nice to be able to produce effects this way, but even those effects produced live in very limited CCTV conditions can be successful if the overall planning and timing is good.

Caption effects are the first to consider for they are most important of all. You can get by without wipes, fades, mixes and trick effects but you must have suitable lettering, adequately photographed, to provide head and end titling, explanatory captioning and sub-titling. These may be produced by any one of a number of mechanical devices: a slotted box holding pull-out titling on stiff card; a strap-easel where the title cards are kept in place by webbing straps weighted at both ends; an adjustable shelf rather like a music stand; a revolving drum—mounted horizontally or vertically and either hand-operated or motor driven; rollers mounted horizontally or vertically for travelling captions; a flip-over device with provision for holding two or more titles; or the live TV equivalent to the 'scrapeback' technique used in film animation where titles are prepared with tear-off ribbon which can be progressively removed to reveal the stencilled lettering underneath.

For a CCTV system using only two cameras the slotted box device can save time and trouble, for all the necessary title cards can be fitted in the box together in the right order and the off-air cameraman can swing round to the pre-set position on his tripod or pedestal and set up the next caption quite easily himself. All the other devices will probably need an assistant to work them so this one is worth considering.

The slotted box can be placed on top of a larger box and inside this you could have a slide projector already set up with the necessary slides in order of continuity, and the pre-set position for the captions will do to televise the slides as well with just a slight adjustment to the height of the camera.

Where space is limited and equipment and staff are in short supply, this sort of planning is vital.

For reasons of economy and speed in their production title cards need not be very large. 12 x 9 in. is a workable size and instant lettering sheets can be bought in a variety of fonts and letter heights. The maximum height of lettering on a card this size should not be much more than 1 in. and, for good legibility, the minimum height not much less than 0.5 in. 0.25 in. lettering will be readable but will not make good impact on the viewer. Simple rules to bear in mind when making up a title card: leave ample margins around the title to compensate for inaccurate framing in the camera, try to avoid too great a contrast between card and lettering—use dark-grey card with white lettering or off-white letters on black card to minimise a streaking effect across the lettering.

The time that a title should be held on screen depends on its importance and its length —a working rule to start with is to read the title aloud twice and then cut. Of course if a picture is to be seen behind the title then this rule does not carry.

Film animation is expensive and takes a long time to produce. Animated titles can be effected by the tear-off ribbon process but there are other ways of writing on lettering live under the camera. One of these has the artist dressed in black gloves and sleeves painting the title in white on a glass table top. There is a black background above the table top and under the table is a 45° angled mirror. To correct the mirror-image, circuits are switched in the camera so changing line-direction for mirroring and, as the title will be upside-down, changing field-scanning direction for inversion. When there is no facility for circuit switching, reversing prisms will have to be used. It's a tricky business whichever way you tackle it, but if you have the time and are prepared to take the trouble this technique should give you quite some pleasure.

Apart from writing on lettering, circuit switching (phase reversal) can be used effectively to transmit negative film (saving time and expense in having a print made); to reverse the caption image to make it stand out more when superimposing; or to give a special dramatic effect to rain and clouds. This pre-supposes that you have some form of Telecine within the system.

One of the basic needs of CCTV is the animated diagram that can be worked easily under the camera by an assistant standing behind or below the diagram. There are simple ways of doing this. With a map, for instance, where you want to show a route being taken, the route can be cut out from the map and a pull-out strip of card placed behind the slot. If the first portion of the card is toned to match the map above it and the second portion is white, then immediately the card is pulled along, the route will start to show up. If arrows are needed to appear on the map then the same technique can be used. The arrows will be cut out from the map and each arrow will have a two-toned card behind it ready to be pulled over.

This technique can be extended to show a continuous movement in a piece of machinery, a flow of liquid along a pipe, the rise or fall of liquid in a container, or even the rise or fall in a graph. The basic requirements being areas cut out in the artwork backed by two-toned cards to show movement that has a distinct beginning, and backed by rotating discs to show continuous flow or repeat cycles. You can simulate the flow of a tap quite easily by this last method by painting dots on the disc and, if you change the density or the tone of the dots over the disc or change the speed at which the disc turns, you can introduce variations in flow. *(continued on page 279)*

TELEFUNKEN

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5"	600'	9/-	6/6
5½"	900'	11/6	8/-
7"	1200'	16/-	10/-
Long Play			
3"	220'	3/-	2/6
4"	450'	6/-	5/-
5"	900'	11/6	9/-
5½"	1200'	16/-	10/6
7"	1800'	23/-	14/-
Double Play			
3"	400'	6/-	4/-
4"	600'	8/6	7/-
5"	1200'	21/-	13/-
5½"	1800'	24/-	17/-
7"	2400'	39/-	22/-

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A POWER PACK FOR THE Fi-Cord 202

BY K. MELLOR

THE writer purchased his first *Fi-Cord 202* in 1963, when the first models were supplied with mercury cells in cassette form, one set each for motor and electronics. As an alternative to these, rechargeable lead-acid cells were introduced, using a specially designed charger and cassettes.

Having sampled both these methods of power supply, plus 'penlight' dry cells, it was decided to construct a power pack that could be used with the recorder and which would give sufficient power for long periods on location. More important, it was to use batteries which were readily available in areas where the mercury cell would not be stocked by even the largest of tape recorder and radio dealers.

For suitable power capacity and voltage, the *U2* dry cell was chosen. These can be obtained in the remotest districts at a cost which is fractional compared with mercury batteries.

The 202 requires a voltage supply of between 7 V and 12 V, which means that an ideal voltage can be obtained using six 1½ V U2's (fresh cells actually total 10 V). The dimensions of the U2 are 6 x 3.8 cm., thus two separate power supplies, using 12 cells, can easily be accommodated below the recorder (see **fig. 1**).

The box used in the prototype was made from three-ply and hardboard, the size being roughly that of the 202. The depth, however, was made 5.8 cm. This enables the recorder to sit inside the box when fitted with two empty battery cassettes. This method does add to the depth of the recorder, but it has not been found cumbersome, even when used with a shoulder strap.

It will be noticed from the sketch that three U2 cells placed end-to-end do not take up the full length of the box. Advantage was taken of this to fit a 3 V cell across the end to provide illumination of the VU-meter. This was also useful when changing tapes at night. The battery contacts inside the box were salvaged from old 'flashlight' batteries, though other types could be used. The external connections were made with press-stud terminals on the end of the power pack; from these, flying leads made connection with each cassette, being soldered in place (great care must be taken when doing this to ensure correct battery polarity). This may seem a little unorthodox, but it retains the original means of contact, which has always been found reliable, and normal cassette operation can be resumed quickly and simply.

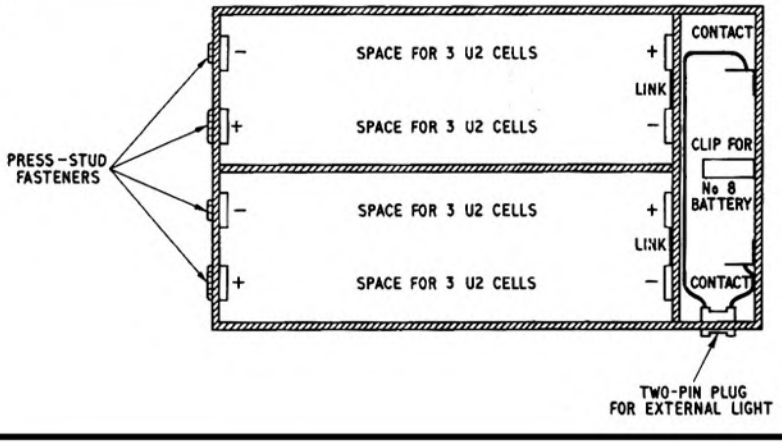
Allowing the recorder to rest inside the box on the original cassettes prevented any movement between the two, and it was found that the most practicable way of holding the power pack beneath the recorder was by means of two large rubber bands. These can be purchased from most commercial stationers.

In practice the average life for the motor batteries is 20 hours; this is taken as a safety factor rather than the full life of the cells. Those who have experienced battery failure in the middle of a 'once in a lifetime recording' will agree with this.

Here then is a cheap and simple way to overcome the 202's only drawback, namely heavy battery consumption, and as already mentioned, limited availability of the mercury cell.

Production of the Fi-Cord 202 has of course now ceased. Having owned five of these machines, I feel that this might not have been the case if design had centred around the U2 cell, as with the *Uher 4000* and most other European battery models.

FIG. 1



CLOSED CIRCUIT CONTINUED

An even simpler method of moving arrows over a map is to use magnets behind the map. The arrows can be controlled quite well if the outline of the map is traced on the back of the artwork for the operator to follow.

Most of the spectacular effects like train collisions and explosions, and weather effects like snow and pouring rain, will have to be taken from film inserts but there are minor effects worth experimenting with in front of the camera.

Carbon dioxide in solid form (dry ice) will produce a white swirling ground mist when hot water is poured over it. If the mist is required to roll down steps then perhaps the liquid form stored in thermos flasks until needed is best to use. The mist soon rolls away and disappears and you need to act quickly and to have plenty of hot water at hand otherwise the effect may misfire. Another use for the solid form is to have small pieces in the bottom of a drinking cup. When the warm water is poured in the water will bubble and send up wisps of white vapour like a magic potion. To make liquid steam you can use titanium tetrachloride, but be careful—it's poisonous. There are several small suppliers who specialise in effects of this kind and it would be useful to send off for a catalogue.

There are theatrical effects suppliers for all sorts of small stage machines—blow-torches for creating smoke, wind machines, and ghostly effects machines. The other day I hired a cobweb machine for a film insert I was making in a cellar and it worked extremely well. I stretched some black thread out as a framework first and the machine sprayed out a fine rubber solution over this framework. The finished result was then dusted with talcum powder to make the cobwebs shine. Before this I had been using strands of fine hemp dusted with powder but the result was not as realistic as that obtained by the machine.

The *Writer's Guild of Great Britain* has put forward a proposed fee structure for programmes written by teachers for CCTV operated by local authorities.

Under this scheme, payment will be based on a rate of two guineas per minute of transmission time which is restricted to the CCTV system of the contracting local authority only. All copyright on a work will revert to the author after five years and any programme repeats will earn the author 50% of the original fee.

Sale of a programme to another local education authority, either as a recording or as a licensed production, will bring the author 100% of his original fee. All other rights, including the sale of the work to networks, or any recording on cassettes, should be reserved to the author.

The Guild is currently organising a recruiting campaign for all teacher-writers throughout the country so that it may implement the proposed fee structure from a position of strength. The address of the Writers' Guild is *430 Edgware Road, London, W.2.*

ONE MAN'S MIXER

THE FIRST OF TWO CONSTRUCTIONAL ARTICLES
BY M. G. SKEET

THE keel of the mixer to be described was first laid down a couple of years ago. Having previously used two *Grundig* mixers bolted together, initially unmodified but later with additional improvised facilities, I recognised the need for a new chassis on which to bolt, hang or glue the circuits. A local engineer's offer to "improve upon that overdrilled shell" was taken up and plans prepared for a cabinet that would accept all the bits and pieces likely to be needed in the next five years. This involved provision for some 40 potentiometers, 20 sockets, 30 slide switches, 12 toggle switches, 20 valves, some transistor circuits, and two level indicators. The extent to which the mixer has grown in the last two years can be gauged from the photographs.

I doubt that much demand exists for a mixer identical to my design, since requirements will vary from one user to another. No mechanical construction details will therefore be found here, other than recommendations concerning circuit layout and similar problems. Readers are invited to plunder those circuits likely to suit their needs, these in turn having been plundered from various sources.

My own mixer was required to serve four main functions: to simplify home mono and stereo recordings from disc, tape and radio; for live recording, public music and sound reproduction (before a social club audience) and finally for sound re-inforcement—away from home!

Figs. 6, 7 and **8** should show, with the following description, the way in which the basic layout functions. Each input has four potentiometers connected in parallel, allowing any input to be fed four ways—mixed feeds A, B, C and D.

A word or two at this point on the inputs themselves. Microphones require amplification; ceramic pickups require 2 M input impedance and some amplification; radio tuners usually offer sufficient signal to feed straight into the potentiometer. Tape-head signals are best amplified and equalised in the tape machine and then fed to the potentiometer. Magnetic pickups are probably best dealt with by amplification and equalisation using a circuit such as that described by Reginald Williamson and Alan Watling in April 1966 *Hi-Fi News*. With the preamplifier in the turntable unit, the signal could feed straight into the potentiometer.

Mixed feeds A and B pass to main amplifiers

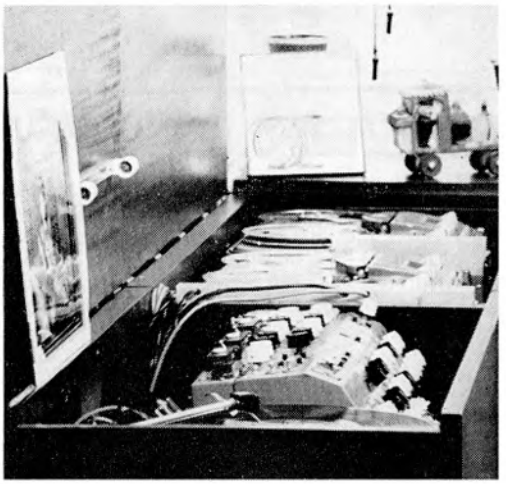


Fig. 1—The mixer nestles amongst disc and tape equipment as part of a domestic audio system.

Fig. 2—Potentiometers for mixed feeds A and B are on top, C and D being to the right of the bass and treble controls.

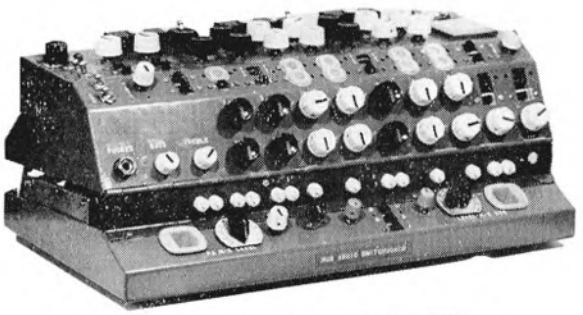


Fig. 3—The top section hinges to give access to the circuits.

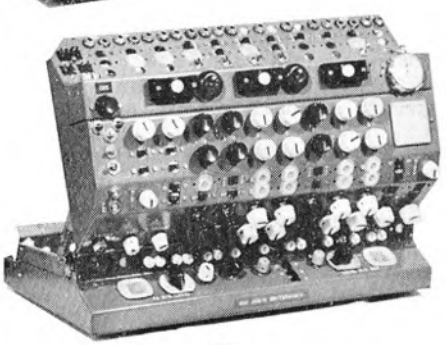


Fig. 4—The detachable valve cover has studio cueing facilities. The top section is screened from the bottom.

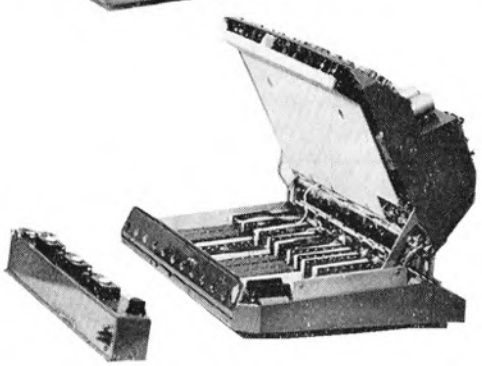
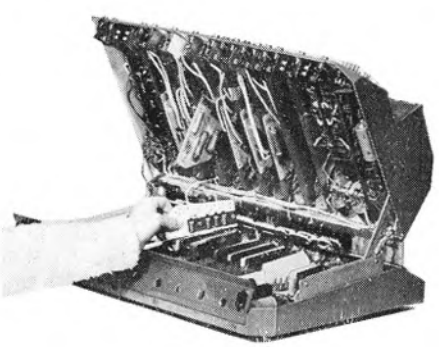


Fig. 5—Preamp circuits are accessible behind the screen and are built on hinged *Formica* cards. Similar cards in the plinth section plug in via *Bulgin* connectors.



via the post-mixing preamplifier, passive bass and treble controls (hence the post-mixing preamp), master gain controls, and out via cathode-followers.

Mixed feeds A and B can pass simultaneously to a tape recorder, ready to record, via a ganged master fader and again cathode-followers.

For reasons that will be explained, the tape recorder can also receive mixed feeds C and D in a similar manner if the A and B master fader is also operated, appearing at the main amplifier output—but at a very low level. Professional circuits incorporate hybrid transformers to avoid this condition.

Used at home, two suitable input channels may be employed for the left and right outputs of a ceramic pickup. With the aid of the appropriate potentiometer, the left signal can be sent over mixed feed A and the right signal over mixed feed B. One can listen to a stereo record via the main amplifiers and loudspeakers. With the same settings, a mono record should produce a central image. Recording as you listen is very simple—operate the master fader to send the A and B feeds to the tape recorder.

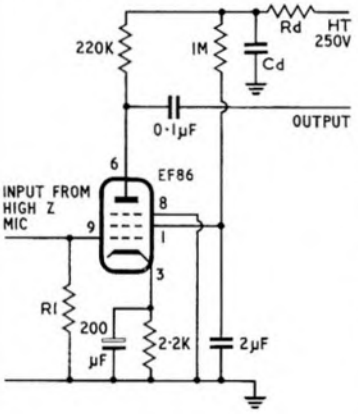
Suppose a mono recording is required while you listen in stereo. Feed both the left and right signals along mixed feed C and operate its master fader only (ganged with D but without effect in this case) and the combined left and right signals find their way to the recorder's upper track. It is also possible to monitor one signal while recording another, assuming good layout preventing inter-channel crosstalk. The mixer thus behaves as a useful preamplifier in the home with the advantage that one knows it is functioning satisfactorily when taken out for one of its other uses.

Enough microphone channels have been provided for, say, one stereo microphone pair and a narrator's mono microphone. This arrangement has been used for recording stereo plays, allowing the narrator to be removed from the acoustic in which the play is being performed. Bringing him close to the stereo pair to achieve the same end would merely create a 'wide voice' effect. By using the appropriate potentiometers, his voice can feed through the single microphone to appear at the centre, extreme left, extreme right, or anywhere in between—in its own acoustic. Now mixed feeds C and D are used to take the microphone outputs to the tape recorder, since using A and B would cause them to reach the loudspeakers with consequent howl-round.

Why have loudspeakers installed? A stereo play requires some sound-effects and it is easiest to pre-record these and to play them

(continued overleaf)

FIG. 9a MIC PRE-AMP



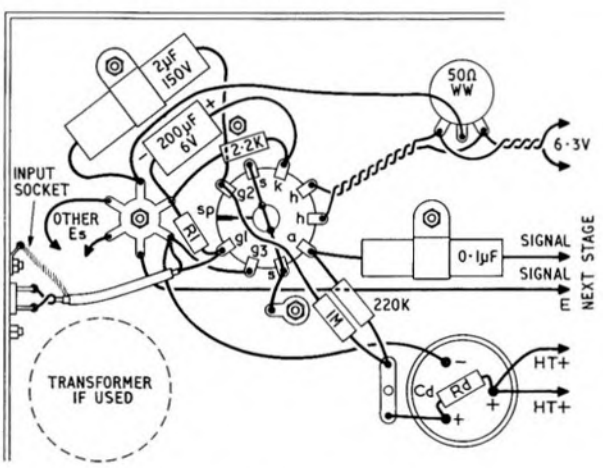
NOTE 1) HIGH STABILITY RESISTORS PREFERABLE

2) HEATER 6·3V AC ON PINS 4 AND 5

3) EARTH ON PINS 2 AND 7

4) RI IS 100K − IM. SEE TEXT

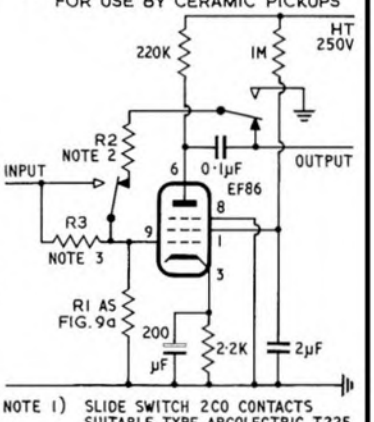
FIG. 9b LOW NOISE LAYOUT



NOTE 1) ABOVE LAYOUT DUE TO GRAHAM BALMAIN AS DESCRIBED IN TAPE RECORDER DEC. 63

2) THE DECOUPLING COMPONENTS Rd AND Cd VALUES DEPEND ON OVERALL CIRCUIT ARRANGEMENTS

FIG. 9c CONVERSION OF FIG. 9a FOR USE BY CERAMIC PICKUPS

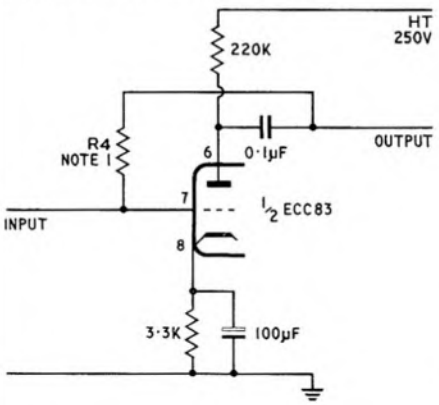


NOTE 1) SLIDE SWITCH 2CO CONTACTS SUITABLE TYPE ARCOLECTRIC T225

2) R2 CAN BE 470K − 4·7M TO GIVE A DEGREE OF CONTROL OVER THE GAIN

3) DEPENDING ON THE IMPEDANCE AT THE GRID PRODUCED BY RI AND R2 THEN R3 SHOULD BE OF SUCH VALUE TO RAISE THIS TO 2M

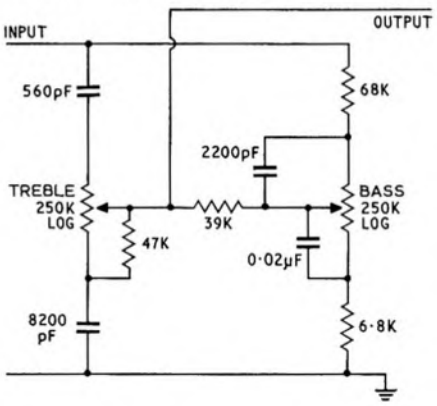
FIG. 10 POST MIXING PRE-AMP



NOTE 1) DEPENDING ON THE SENSITIVITY OF THE MAIN AMPLIFIERS THE FEEDBACK RESISTOR R4 MAY BE BETWEEN 470K TO 4·7M

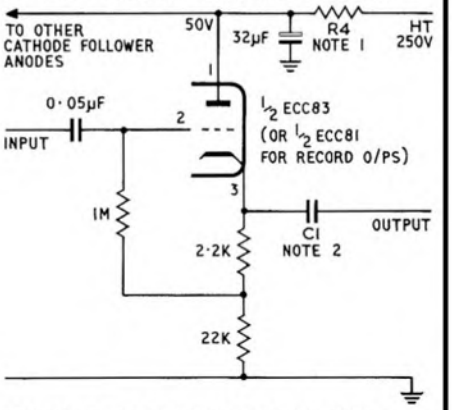
2) HEATER 6·3V ON PINS 4 AND 5 STRAPPED AND PIN 9

FIG. 11 TONE CONTROL



NOTE 1) THE ABOVE CIRCUIT IS FROM MULLARDS "CIRCUITS FOR AUDIO AMPLIFIERS" AND PERMISSION TO PUBLISH IS ACKNOWLEDGED

FIG. 12 CATHODE FOLLOWER OUTPUTS



NOTE 1) R4 TO BE DECIDED BY EXPERIMENT SO THAT HT IS REDUCED TO 50V

2) RECORD O/PS. C1 TO BE 2μF MAIN AMP O/PS. C1 MAY BE 0·1μF IF FEEDING INTO 100K OR MORE

3) RECORD O/PS. HEATERS WIRED AT HALF VOLTS BY CONNECTING 6·3V TO PINS 4,5

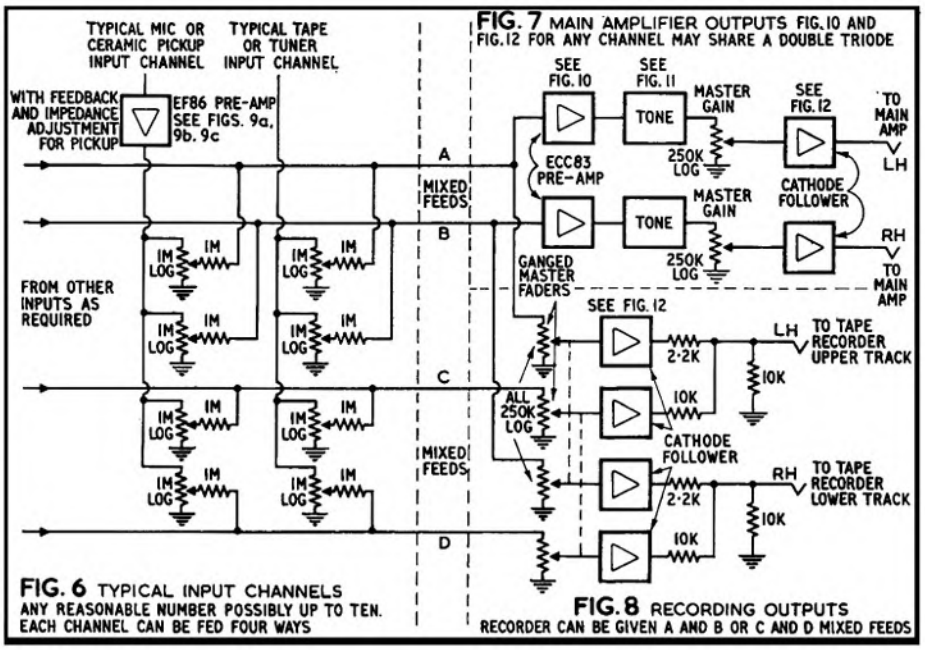


FIG. 7 MAIN AMPLIFIER OUTPUTS FIG. 10 AND FIG. 12 FOR ANY CHANNEL MAY SHARE A DOUBLE TRIODE

FIG. 6 TYPICAL INPUT CHANNELS
ANY REASONABLE NUMBER POSSIBLY UP TO TEN. EACH CHANNEL CAN BE FED FOUR WAYS

FIG. 8 RECORDING OUTPUTS
RECORDER CAN BE GIVEN A AND B OR C AND D MIXED FEEDS

on a tape recorder feeding the mixer. To allow the actors to react appropriately to the sound-effect and to allow the sound-effect to acquire some of the acoustic of the room being used, this recorder's output is sent over mixed feeds A and B to the main amps and loudspeakers. If these produce good enough quality, then the sound-effect reaches the actual recording machine via the stereo microphone. In practice, however, it is necessary to send it electronically to the recorder, as well, by operation of the mixed feeds A and B master fader. Variations on the theme are possible, depending on the number of channels provided and on the use to which each channel can be put, be they for microphone, pickup or tape, etc.

Use at a social club to provide stereo entertainment before an audience makes great use of the facilities already discussed. Mixed feeds C and D allow a stereo pair to supply audience reaction to a machine recording the show as it goes out. Hence the microphone can operate in the room with the loudspeakers without a howl-round.

The programme from all the sources mentioned plus a channel used by the announcer is fed to the tape recorder by way of the master fader on mixed feeds A and B.

Sound reinforcement work in stage entertainment has required up to five directional microphones to be placed along the footlights, feeding line-source loudspeakers each side of the stage. By the use of the potentiometers feeding mixed feeds A and B, it is possible to send the centre microphone on to both speakers. The left microphone, as the audience sees it, to the left speaker only and the right-hand microphone to the right-hand speaker only. Completing what could be a nice stereophonic feed to those sitting in the centre of the audience, the two microphones, either side of the centre, have their potentiometers so adjusted that, heard from the centre seats, the 'image' coincides with the singers' positions on the stage. As with all two-channel stereo, the effect is not so good if seated on either side of the hall. However, one good point if you are seated, for instance, near the left-hand speaker, is that a singer over the other side of the stage does not have his or her voice coming from the speaker nearest you. The competent use of sound reinforcement is at least aided by the facilities, but at all times one must remember that it is reinforcement and not a take-over bid. No doubt the greatest compliment you can be paid in the foyer afterwards would be to overhear: "I heard every word, darling. Was there any amplification?"

WHY VALVES?

Enough digression into imaginary conversations! The promised circuitry to accompany the semi-block schematic of **figs. 6, 7 and 8.** First, a question: why valves? Old fashioned? The author had a supply of valves, that's one reason. The other is that he, and he suspects others also, cannot make transistors do the same job without hiss or greater cost.

The microphone channel preamplifiers can be served by an EF86—well what's wrong with these, to the author's mind, genuine low-noise high-gain pentodes? Reference to **fig. 9a** shows the arrangement and readers are referred to Graham Balmain's article on 'Hum and Noise in Tape Recorders' in *Tape Recorder* (December 1963). Layout is important to avoid lowering the possible standards and **fig. 9b** shows the arrangement suggested by Mr. Balmain. F1 should be of a value suitable for the secondary impedance of the microphone transformer being used. High stability resistors are always worthwhile.

For ceramic pickups a microphone channel can be used with a slide switch to convert the **fig. 9a** arrangement to that shown in **fig. 9c.** It is unlikely that all the channels that can be used for microphones will be required at the same time, as two of them are needed for the pickup.

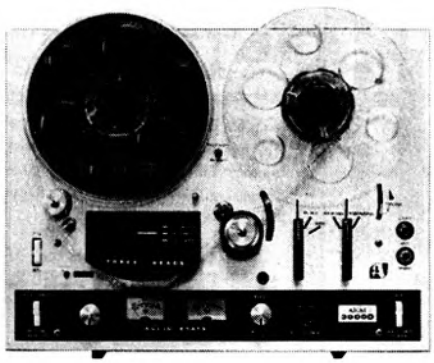
A suitable post-mixing preamplifier and tone controls are shown in **figs. 10** and **11.** Some measure of control over the output level is possible by varying the feedback resistor R4. The sensitivity for full output of the main amps is the deciding factor here. The tone control circuit comes from the *Mullard* book 'Circuits for Audio Amplifiers'.

Any reader unsure of the value of low impedance outputs when feeding out via a screened lead should try the experiment. Without cathode-followers early on, a loss of 12 dB at 10 kHz with respect to 1 kHz was suffered by the author for a number of years. The equipment was made to sound right by full treble boost. One foot of good quality coaxial cable can measure 25 pF, but at the other extreme a screened microphone cable used to couple to main amplifiers was measured at 130 pF per foot. **Fig. 12** cathode-follower can share a valve with **fig. 10** for that channel. A special HT of 50 V is used for all cathode-followers to keep down hum and noise generated in the stage.

Special arrangements for heater wiring of the record output cathode-followers has been found to assist in keeping down hum and hiss (see **fig. 12**). The record outputs are at low level—can be as low as 3-5 mV due to losses incurred in the mixing stages, this depending on the number of channels provided. The author's mixer is used to feed a *Revox 736* and is plugged into the microphone sockets. Why not amplify more in the mixer? Not in the case of the Revox, as any higher level would be fed into the same preamplifier. Other recorders may not have such good microphone preamplifiers and thus would benefit from a higher level into their radio inputs which by-pass the first stage—you pays your money and takes your choice! The 2.2 K and 10 K resistors in **fig. 8** avoid distortion produced when you parallel cathode-followers at their outputs.

The 1 M padding resistors from the wipers of all the channel potentiometers must be placed as near to the grids of the following stages as possible. At least they must be in the same screened compartment as the output stages they belong to. As shown for clarity, they are very close to the wiper of the potentiometer they belong to, and it is tempting to mount them in this position. Doing so produces very bad crosstalk as the grid circuits of the next stages are virtually extended throughout the mixer. It is not necessary for the connection from the wiper of each potentiometer to its padding resistor to be screened. When channels are not feeding, these wipers are at earth potential and cannot cause overhearing problems. Being used at high impedance screening these wires would probably cause treble losses. More next month on this topic.

Noisy potentiometers are bad enough if your equipment has just two or three. The author's mixer has some 40 potentiometers. None of them has ever become noisy. Once or twice, though, leaky capacitors in the cathode-follower outputs have produced the same symptoms. Trouble can be avoided by the use of moulded track types, originally discovered by accident and obtained from *Radio Clearance.* Now they have appeared in the *Radio Spares* Catalogue and it seems are made by *Plessey Ltd.* of Cheney Manor, Swindon, Wilts. The latter, however, do not execute small direct orders.



AKAI 3000D STEREO TAPE UNIT

BY DAVID KIRK

MANUFACTURER'S SPECIFICATION. Quarter-track stereo tape unit with silicon transistor preamplifiers. **Tape speeds:** 7½ and 3¾ i/s (19 and 9.5 cm/s). **Wow and flutter (playback only):** less than 0.15% RMS at 19 cm/s; 0.25% RMS at 9.5 cm/s. **Frequency response:** 30 Hz-22 kHz at 19 cm/s; 30 Hz-14 kHz at 9.5 cm/s; ±3dB. **Distortion:** 2% at 1kHz, 0 VU. **Signal-to-noise ratio:** 50dB. **Equalisation:** NAB. **Inputs:** 0.5mV (microphone), 50 mV (line). **Power supply:** 100-240 V AC, 50/60 Hz. **Power consumption:** 30 VA. **Dimensions:** 40 x 30 x 14 cm. **Manufacturer:** Akai Electric Co. Ltd., 12, 2-chome, Higashi-Kojiya, Ohta-ku, Tokyo, Japan. **Distributor:** Pullin Photographic Ltd., 11 Aintree Road, Perivale, Greenford, Middlesex. **Price:** £105 11s. 4d. including £16 6s. 4d. purchase tax.

THE Akai 3000D was comparatively inexpensive for what it offers, at its original £86 price, and at its post-Budget price probably still is. One must remember that most tape recorder prices are being increased by practically the same percentage, and that relative values will remain similar.

The 3000D is a three-head silicon transistor stereo tape unit employing a similar mechanism to the *X-150D*, *1710W* and *M9*. The tape channel follows a radial path, free of pressure pads or pins, record and play heads being sufficiently close together to make A-B comparison meaningful at both tape speeds.

A recessed plate at the side of the wooden plinth holds left and right inputs and outputs—a total of four phono sockets duplicated by a single five-pin DIN. The DIN pins correspond to the signals entering or leaving the adjacent phono sockets, thus the lower left pin duplicates the lower left socket, and so on, at the same time following the relevant DIN standard.

This recorder is evidently intended to join an existing domestic disc and radio reproduction system, working through an external stereo amplifier and speakers. A stereo headphone outlet is provided for private listening or location recording—an essential facility when working in the field. When replaying tapes through headphones or external equipment, the record gain controls govern the signal level, the level meters remaining in circuit.

The two rotary mode selectors are mounted in front of the take-up spool. The right-hand selector may be turned through some 20° to locate the play mode and through a further 20° to record, when the red interlock button is pressed. Any movement of the left-hand selector forces a metal ball into the right-hand control mechanism, locking the fast forward/rewind control in its neutral position. When the tape is stopped and rewound with the right-hand control, the ball is thrust back into the play selector mechanism. A glance below the deck face shows that the mechanical controls have a great deal of ironmongery to move, acting against some very substantial springs. Nevertheless, the selectors have a positive feel about them which induces greater confidence than the more common plastic tab.

To the right of the fast forward/rewind control is a lockable pause lever. This is rather stiff in action but is very useful for rocking a tape about its splicing point, since it withdraws the pinch wheel without applying additional brake tension. Since the motor remains running continually once the recorder is powered, the main play selector provides instant starting. Were the motor switched off in the neutral position, the pause control would have been more important as a means of eliminating the starting wow caused when a heavy flywheel is slowly accelerated. A slight flutter was audible when start or pause controls were used on the 3000D, which could probably be cured by accommodating a damping spring on the autostop arm just right of the capstan.

A felt tape cleaner is mounted to the left of the erase head to remove dust and oxide from the tape surface. The 3000D is particularly sensitive to dirt on the head faces and all three heads should be cleaned with a moist handkerchief after each playing. A *Bib* cleaning kit or moist clean rag are good alternatives—the handkerchieves appear to become permanently oxide-stained! Failure to keep the heads meticulously clean quickly results in attenuated treble. Fortunately the heads are easily reached, both for cleaning and editing.

Akai have fairly consistently kept the equalisation circuitry independent of the speed control, and this unit is no exception. I prefer this arrangement, since the occasional 19 cm/s tape is improved with 9.5 cm/s replay equalisation—when made, for example, on equipment with worn or dirty heads. Similarly, as a very last resort, a hissing 9.5 cm/s recording can sometimes be improved by cutting the treble in the 19 cm/s equalising position.

The 3000D was employed with a *Brenell 5M* during the course of its field test, to prepare and reproduce sound-effects for an amateur stage production of the play *Someone's Waiting*. This involved four performances, two of which were at an Essex prison (I was a visitor, not an inmate). Under the circumstances, I particularly did not wish to risk jammed controls or tangled tapes. The 3000D proved entirely reliable from both viewpoints and also allowed one to see the precise starting point of each item, where a coloured leader trailed across the play head.

The input and output wiring is rather unusual for a stereo recorder. Playing a stereo tape, the track selector either permitted normal monitoring of left signal through left speaker and right signal through right speaker or cut out the unwanted channel *and speaker* altogether. It is normal practice to feed a single track to both speakers when mono replay is selected with the track switch.

Similarly, on the input side one would expect to be able to mix the left and right channels on to a single mono track. Considering the two input and two output preamplifiers as four independent 'bricks', it is wasteful to leave half the circuitry in an unusable passive state. Rewiring the track selector would permit simultaneous replay of one channel and recording on the other without any material effect on cost.

When included in a domestic audio reproduction system, the 3000D proved a good medium for storing FM broadcasts and other people's discs. With such programme material, classical and light music, wow and flutter were at a comfortably low level. Open guitar strings—more testing, even, than a piano—did show a coarseness at both speeds due to fast flutter. The effect was lost on chords and melody in normal playing and might not trouble the average owner. It nevertheless represents a significant design fault on the Akai deck, namely, capstan sleeve speed change. Both from the quality and convenience points of view, I would much rather see a switched-pole motor (of the type used on the 1710W) to give two speeds—19 and 9.5 cm/s, without any form of capstan sleeve. Even if the sleeves were perfectly machined to fit the capstans, the technique would cause difficulties since dust and oxide on the capstan would score the inner part of the sleeve after prolonged slow-speed operation. Detachable sleeves are found on recording machines varying from £10,000 to £20 and in all cases are capable of causing speed instability.

The 3000D is among the better recorders now available in the £100 price region and certainly one of the most rugged. With detailed attention to capstan and tape transport, it could become the best.

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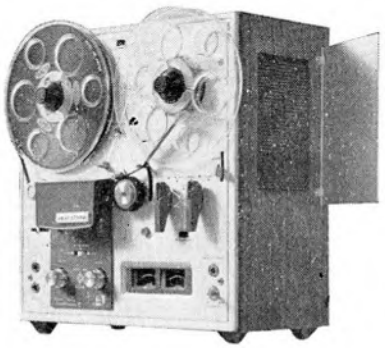

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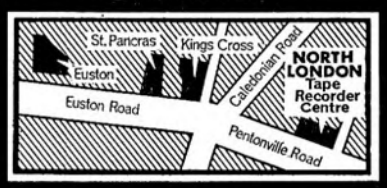

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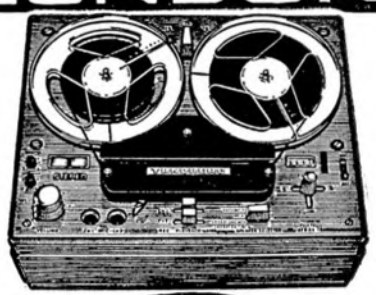

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REVOX A77

THE Revox 736 set such a high standard that it was difficult to envisage any worthwhile improvements in frequency response, signal-to-noise ratio and speed stability, although after six years the packaging and styling needed a face lift. The *A77*, however, shows significant improvement in all these features.

The absolute tape speed no longer depends on the mains voltage or frequency; instead, the outer rotor of the direct-drive capstan motor is grooved to act as a phonic wheel to generate a tone in an adjacent pick-up coil which is exactly proportional to the motor speed. This signal is amplified and fed to a tuned circuit discriminator to produce an error voltage which increases or decreases the power fed to the capstan motor so that the error is reduced to zero. Thus a change of tape tension or bearing friction, or a change of mains voltage or frequency, is automatically compensated within a small fraction of a second and the tape speed is ultimately dependent only on the frequency of the discriminator tuned circuit (800 Hz for 19 cm/s and 400 Hz for 9.5 cm/s).

The short-term speed stability is also controlled by this 'electronic flywheel' to a degree which is not possible with the orthodox heavy flywheel and compliant coupling to the motor drive. The feedback in the servo control circuit damps the effect of transient load changes so that the tape speed is maintained constant under all conditions. The machine can be moved while playing a constant tone tape from a horizontal to a vertical position, or even turned upside down, with no audible change of pitch.

The pen recordings of **fig. 1** show the cumulative record-play wobble at each speed. Three traces are given for each speed to illustrate the extreme consistency of the readings. Mean RMS readings at the full 200 Hz bandwidth of the WHM fluttermeter are 0.03% at 19 cm/s and 0.065% at 9.5 cm/s.

PLAY ONLY WOW AND FLUTTER FROM TEST TAPE		
19 cm/s	Wow	0.02%
	W+F	0.035%
9.5 cm/s	Wow	0.035%
	W+F	0.07%

Play-only readings from low wobble test-tapes are shown in the panel above. It will be seen that the filtered wow-only (bandwidth limited to 10 Hz) is exceptionally low at 0.02% and 0.035% respectively.

The play-only responses from standard 70 and 140 μS test tapes are shown in **fig. 2**. A choice of playback equalisation is provided labelled IEC and NAB. It will be seen that the IEC equalisation is similar to the CCIR and DIN 70 μS response and is level within 1 dB from 60 to 10 kHz.

The NAB response shows the usual 3 dB step at high frequencies which indicates a playback time-constant of 50 μS.

The equalisation switch does not affect the 9.5 cm/s response, which remains fixed at the NAB 90 μS time-constant, hence the deviation from flat for the response on play only in **fig. 2**. (*continued on page 287*)

MANUFACTURER'S SPECIFICATION. Half-track stereo recorder with self-contained silicon transistor power amplifiers and side-facing speakers. **Tape speeds:** 19 and 9.5 cm/s ±0.2%. **Wow and flutter** (CCIR weighted): 0.08% at 19 cm/s, 0.1% at 9.5 cm/s maximum. **Spool capacity:** 26.5 cm. (10.5 in.). **Frequency response:** 50 Hz - 15 kHz ±1.5 dB, 30 Hz - 20 kHz +2 —3dB, at 19 cm/s. 50 Hz - 10 kHz ±1.5 dB, 30 Hz - 16 kHz +2 —3 dB, at 9.5 cm/s. **Signal-to-noise ratio** (CCIF weighted): 58 dB at 19 cm/s, 56 dB at 9.5 cm/s. **Crosstalk:** 60 dB (mono), 45 dB (stereo) at 1 kHz. **Distortion:** 2% at 19 cm/s, 3% at 9.5 cm/s, full modulation at 1 kHz. **Oscillator:** 120 kHz, push-pull. **Inputs:** 0.15 mV at 50 ohms—6 K or 2 mV at 100 K (*microphone*—switchable); 2 mV at 33 K (*radio*); 40 mV at 1 M (*auxiliary*). **Outputs:** 2.5 V at 600 ohms; 1.2 V at 2.5 K. **Output power:** 8 W per channel continuous at 1% distortion, 4—16 ohms. **Remote control:** electro-mechanical, for all operating functions. **Components:** 54 transistors, 32 diodes, 4 silicon rectifiers, 1 photo resistor (autostop) and four relays. **Power supply:** electronically stabilised to accept 110, 130, 150, 220, 240, 250 V at 50 or 60 Hz. **Weight:** 34 lb. **Manufacturer:** Willi Studer GmbH, CH-8105 Regensdorf, Zurich, Switzerland. **Distributor: C. E. Hammond & Co. Ltd., 90 High Street, Eton, Windsor, Berkshire. Price:** *See page 255.*

FIG. 1 REVOX A77 CUMULATIVE RECORD/PLAY WOBBLE

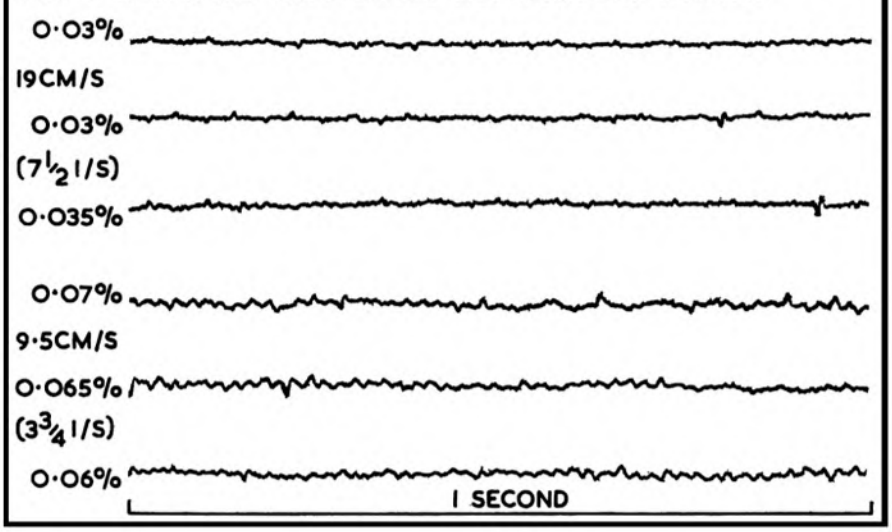
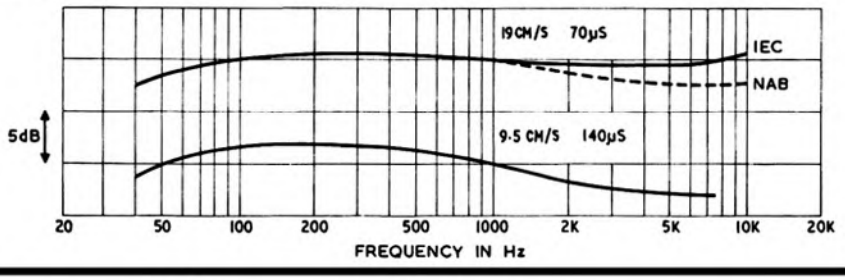


FIG. 2 REVOX A77 PLAY/ONLY RESPONSE (TEST TAPE TO LINE OUTPUT)



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System noise (unweighted) was 46 dB below test-tape level with no tape passing the heads.

Fig. 3 shows the overall record play responses using BASF *LGS35* LP tape. Other tapes showed only small changes in response above 10 kHz at each speed. Extra bass lift in recording has extended the low frequency response to 20 Hz at each speed. The new large radius heads show no contour or 'wavelength wobble' effects even at these very low frequencies.

Overload recording tests were made on the same tape at 500 Hz, 1 kHz and 3 kHz from a very low distortion tone source at 12 dB above test-tape level, using a full-track reference tape to obviate track placement errors on normal test-tapes. Third harmonic distortion levels were: 1.5%, 1.3% and 1.2% at 19 cm/s and recording level could be increased to 15 dB above test-tape level before distortion at 500 Hz reached 3%. Distortion at 1 kHz and 3 kHz were then 2.8% and 2.5% respectively.

Test-tape level was recorded at —6 dB on the VU recording level meter.

Peak level (+12 dB) 500 Hz recording erased on the machine gave an unweighted signal-to-noise ratio of 54 dB; this can be extended to 57 dB if a peak level distortion of 3% is accepted (+15 dB). Filtering low frequency hum and noise with a 250 Hz high-pass filter showed that transistor hiss was 65 dB below peak recording level. Bulk erased tape noise was —62 dB and tape erased on the machine was —61 dB. Mono cross talk at peak recording level was at approximately the same level as the machine erased tape noise, i.e. better than —60 dB.

Record/play crosstalk on stereo was —45 dB; this is because the record head crosstalk is added when both tracks are biased.

Wind and rewind time for 1,800ft of LP tape was 1 minute 45 seconds. The tape position indicator is driven from the right-hand take up reel and 10 revolutions clock up 11 digits on the counter.

Straight-through amplifier distortion was less than 0.2% at all levels up to 6.5 V across an 8-ohm speaker load (5 W). Distortion at 8 W was just under 1% but increased very quickly beyond this point with the onset of peak clipping in the output stages.

The acoustic response of the machine was measured by playing a 25 one-third octave band white-noise test-tape at the IEC equalisation and measuring the sound output at a distance of 1ft. on the speaker axis of one channel with the balance control set to reduce the sound from the other speaker to a low level. The resultant response is shown in **fig. 4.**

COMMENT

The poor acoustic response of **fig. 4** was confirmed by careful listening tests. A lot more high frequency response is required for the off-axis listening that is inevitable with this 'all in' type of machine. A couple of good quality bookshelf type speakers transformed the stereo performance and a pair of larger wide-range speakers confirmed the extended frequency response and low distortion measurements of this review. I understand that the basic chassis is available in a teak surround with full recording facilities, with or without power amplifiers, but *without* the internal speakers, and for home use I would certainly recommend one of these alternatives.

A. Tutchings.

FIG. 3 REVOX A77 RECORD/PLAY RESPONSE (AUX INPUT TO LINE OUTPUT)

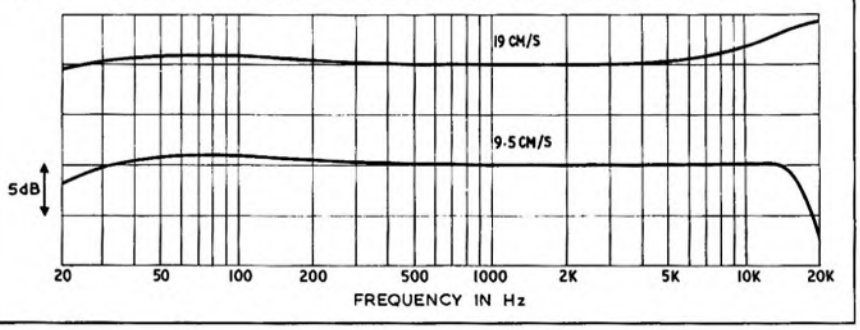
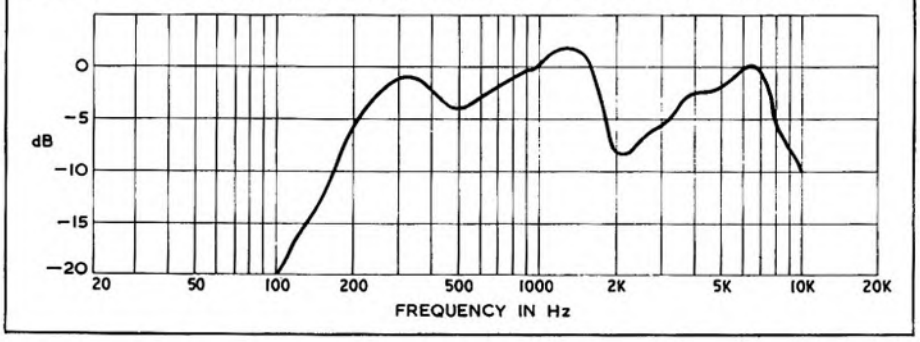
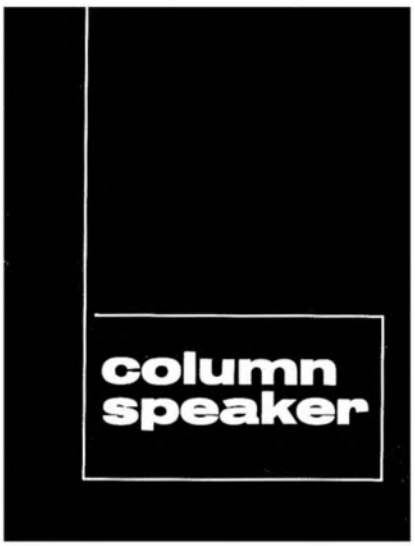


FIG. 4 REVOX A77 ACOUSTIC RESPONSE (WHITE NOISE TAPE TO SOUND OUTPUT)



AN OCCASIONAL COMMENTARY

BY DROPOUT



So it's hit us, brothers: after a really quite incredible run for our money, we are lumbered with purchase tax on tape records and tape-recorders. I suppose most of us were expecting it: the trade certainly was (I know of one dealer who was assuring everybody that after Black Tuesday everything would be up by 60%, which made it essential to get the stuff while it was still "cheap", of course); and I think most of us have been gasping with relief after every budget of recent years.

Some consolation can be drawn from the fact that our camera-toting colleagues have been stuck up to 50%. I know that after that I felt positively virtuous because of what had until then seemed inexcusable extravagances like a *Leitz* projector and a 25 mm. *Flektogon* lens; but there is really a more serious point to this, you know.

A few months ago a friend played me some of his early recordings. They were, in fact, recordings of himself playing various keyboard instruments, and they had been made on a *Ferrograph* of venerable age—a *Series 2AN* or something like that. We listened in proper silence until the tape was finished. He switched off and looked at me. I glanced at the range of ritzy stuff in the room and remarked: Why on earth do we bother with it? For those recordings were astonishingly good although they were 10 years old, and made with equipment which, by present standards, was really not quite . . . you know.

We are so inclined to believe that if only we had a better recorder, better microphones, more mixers, booms, pan-pots and acoustic screens we could make better recordings. There is no doubt about it: if we ever mastered the extra complications introduced by such wonders, we *could* make better recordings. But should we? I take leave to doubt it. It is just the same with cameras: encouraged by well-written advertising copy and attractive illustrations, we get that niggling conviction

that a *Slopcon* would give us better results than our present *Praxakta*. All very good for trade, of course; but the horrid truth is that the man behind the camera, like the man behind the recorder-knobs, counts for far more than the equipment he is driving. A first-rate professional, using sophisticated equipment up to its limits, is justified in having his costly tools; but we ought to recognise that most of us have never got near the potential offered by our more modest rigs. Our homes are full of gear capable of first-class results; and it is not the fault of the gear if our results are not first-class, nor would they be even if we gave way to the urge to sell our heritage of antique silver and buy Leevers-Rich. Oh yes, the Leevers-Rich is better than our despised mono veteran, but we ought to ask ourselves the simple question: If I had professional equipment, could I make recordings of professional standard? And anybody who has seen inside a BBC recording studio at work knows the answer to that one.

Therefore, brothers, if the Westminster Vampire has drained our pockets to the point where we have to abandon indefinitely our ambition to own the new Revox or the new Ferrograph or the new Whathaveyou, let us indulge in a secret pleasure: the satisfaction of being compelled to keep what we have. If we were to try to make our existing gear do what it is capable of, we should not only make better recordings, we should have justified our earlier choices and shown ourselves what good stuff we already have. We should, in fact, have become more expert *recordists;* and that is what it is all about. And having done that, we can save our threepenny bits in the empty bottle of that whisky we were once able to afford, until we can pay for that Revox or that Ferrograph. And when we can, we may be able to make the best of that one, too.

Every time I go to my gramophone to play a record (now at 50% tax, in case you did not know) I regret the need to do it. I am about as far as man can be from what is called a scientist: when I wanted to matriculate into the University of London, it took me two goes to convince the examiners that two and two may add up to three or five, but never four; but the idea of dragging a plastic groove past a sharp diamond in order to make music strikes even my uneducated mind as a monstrosity. I could put up with that, since modern pickups seem to do little audible violence to discs; but what gets my goat is the need to mop, preen, dust and generally treat the record as though it were a patient in the operating-theatre, and even then to have to put up with pops, crackles, scrunches and thumpings even on a new disc.

All right: so I can send the thing back to the manufacturer if it is faulty; but who the blazes wants all that bother and delay? No: the answer is to have the stuff on tape instead. And how I wish we could! But a recent article in *Tape Recorder* (*What's Wrong with Tape Records?*—February) gives all the reasons why, in general, we can't; and the Vampire has made things more difficult still by whacking on the tax. But I have yet to meet anybody who is habituated to the use of tape who does not wish that he could standardise on it and forget his discs, and I shall go on hoping. One day recorded tapes may be as cheap (?) as discs, with a comparable repertory and equal fi. Until then—back to the operating theatre.

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For young men between eighteen and twenty-eight, who are interested in imaginative, high quality tape-recording and are dedicated enthusiasts in the art of sound recording, there is a comprehensive training scheme which leads to a challenging and worthwhile career. Conditions of employment are generous and congenial and there are opportunities for travel at home and abroad.

For further details and application form, write to Head of Appointments Department, P.O. Box IAA, London W.1 (quoting reference 68.G.662T.R.).

Radio and Tape Recorder Testers and Trouble Shooters required. Canteen, excellent rates of pay, 8.00 a.m. to 5.00 p.m. 5-day week. Elizabethan Electronics Ltd., Crow Lane, Romford, Essex. Phone Romford 64101.

FOR SALE—PRIVATE

Cardioid Microphones, S.T.C. 4105, immaculate, boxed, list £29.10s., sell £14.10s. each. Details Box 536 (London).

B & O Beocord 1500 4 track stereo deck £70. Rogers HG88 Mk. II Stereo amp, teak case, £25. L. Mullender, South Marston House, Swindon, Wilts.

Revox F36, very good condition, remote switch and Reslo ribbon microphone £75. Camberley 24348.

FOR SALE—TRADE

Always be careful (and money-wise) before buying quality equipment. Send your requirement list to Audio Supply Association for evaluation and quotation. See below . . .

Your sole U.K. agent for spares/service of the Saja recorder. C. Braddock Ltd. (Blackpool 45049).

Blackburn has Lancashire's leading Hi-Fidelity/Tape Recorder stockists and Electronic Engineers at Holdings Audio Centre, Mincing Lane/Darwent Street, Blackburn (Tel. 59595).

30% off BASF tape, L.P. 7in. reel 1,800ft. 33/-, D.P. 7in. reel 2,400ft. 52/6. P. & P. 5/- per order. W.S.L., 104 Norwood High Street, S.E.27.

If quality matters consult first our 70-page, photographically illustrated catalogue (5/6) and equipment housing guide (1/6). Members enjoy unbiased advisory service, preferential terms. Membership 7/6. Our associates also manufacture records from your own tapes, or record the Master at our studios (Steinway Grand). Bulk terms for choirs, fund-raising. Please specify requirements. Audio Supply Association, 18 Blenheim Road, London W.4.

Turn your Tape Recorder into a powerful learning machine. Send now for Catalogue of Accessories such as Time Switches, Pillow Speakers, Special Induction Tapes for Learning and Therapy. Endless Tape Cassette Repeaters, Language Courses, G.C.E. Courses, etc. If you do not already have a tape recorder we can supply an all-British 3-speed model for only 28 gns. Credit terms available. Get with it ! Take advantage of these new, simpler, faster educational techniques. Send postcard to :—Institute of Tape Learning (TR), 153 Fellows Road, London, N.W.3. 01-722 3314.

STUDIO FACILITIES

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

Your tapes to disc. 7in. 45—18/-, 10in. L.P. —48/-, 12in. L.P.—55/-. 4-day postal service. Masters and Vinylite pressings. Top professional quality. S.A.E. photo leaflet : Deroy Studios, High Bank, Hawk Street, Carnforth, Lancs.

J & B Recordings. Tape to disc—latest high level disc cutting, all speeds. Mastering pressings, studio, mobile. 14 Willows Avenue, Morden, Surrey. MITcham 9952.

TAPE EXCHANGE

Tapespondents. Free sound magazines. Far and Wide Recording Club, Eccles, Maidstone. Details free (S.A.E. please).

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MISCELLANEOUS

Repairs. Our modern service department equipped with the latest test equipment (including a wow and flutter meter and multiplex Stereo Signal Generator) is able to repair Hi-Fi and Tape Recording equipment to manufacturers standards. Telesonic Ltd., 92 Tottenham Court Road, London W.1. 01-636-8177.

Skilled tape recorder repairs carried out by expert personnel of many years' experience backed by extensive test equipment: Wow and flutter meter, audio valve voltmeter, audio generator, oscilloscope, etc., with final test performance figures quoted if required—Ferrograph specialists. Tape Recorder Centre, Tel-Lee-Radio, 220 The Broadway, Wimbledon, S.W.19. 01-542-4946.

Free with **Do It Yourself Gardening Annual** 1968—a packet of guaranteed-to-grow Crackerjack African Marigold seeds. These magnificent plants have superb golden and yellow blooms 3in. to 4in. across. Other top features include : 20 ways to a better garden ; Complete guide to lawns ; How to cope with pests and diseases ; Labelling garden plants ; Easy-to-build lily pool ; The rose—Queen of flowers ; Gardening without soil—beginners guide to hydroponics ; What's new in vegetables for 1968 ; Caring for house plants. ; 3/- from newsagents or 3/11 (pp) from Link House, Dingwall Avenue, Croydon CR9 2TA.

WANTED

Goon Show connoisseur wishes to contact other collectors with view to exchanging recordings. Lipscombe, Gorse Farm House, Bradford Road, Corsham, Wilts.

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

Highest prices offered for good quality Tape Recorders and Hi-Fi. R.E.W., 266 Upper Tooting Road, London, S.W.17.

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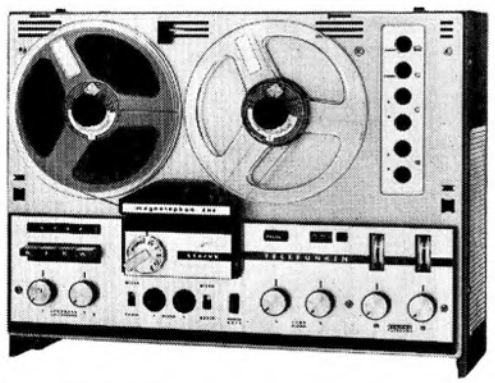
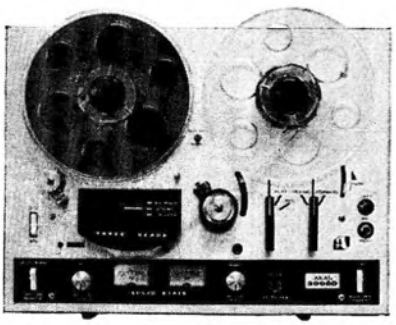


TELEFUNKEN 204E Stereo. Special multiple-function switch controls six different functions, gives greater operating convenience and flexibility of control. Mono and stereo—four track recording/playback, frequency response at 7½ i.p.s., 40-18,000 c.p.s. Two built-in speakers, 6 watts per channel output. Save 20 gns! List price 106 gns., our price 86 gns. or on interest free terms **£22.12.0 deposit and 12 monthly payments of £5.12.10.**



THE SENSATIONAL AKAI 3000D. Superbly engineered, four track, two speed Stereo Tape Deck. High quality, three-head system incorporates all-silicon transistor amplifier.

£1 gns. cash, or on interest-free terms, £21.6.0 deposit and 12 monthly payments of £5.6.3.

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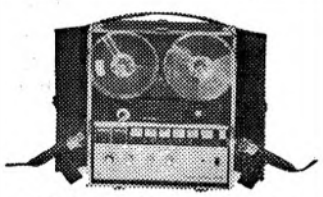
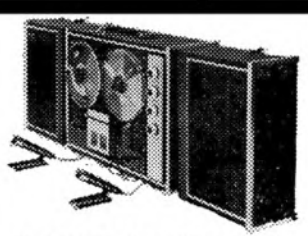
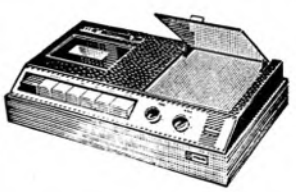


SANYO MR151 Solid State Stereo Tape Recorder. Powered either by batteries or mains, this exciting newly developed Sanyo Model combines all the advantages of a lightweight portable recorder with the performance capability of a large stereo set. Elegant and compact, with three speeds, sound-on-sound facilities. Four track recording and playback, two VU meters. **65gns., or on interest-free terms £17.2.0 deposit and 12 monthly payments of £4.5.3.**



SANYO MR939 Solid State 4-Track 3-speed Tape Recorder. Engineered for superb studio performance and offers professional standard facilities at a sensible price. 4-track mono or stereo recording. Sound-on-Sound and Sound-with-Sound. Two VU meters. Two detachable speakers. Built-in amplifier can be used for P.A. **89 gns. or on interest-free terms £23.8.0 deposit and 12 monthly payments of £5.16.9.**

SANYO MR999 Solid State 4-Track 3-Speed Stereo/Mono Tape Recorder. A really magnificent instrument impeccably styled and finished with 20 watts output power at an incredibly low distortion rate of less than 0.9% at 3 watts. Sound-on-Sound, Sound-with-Sound, two hi-fi speakers. **97 gns. or on interest free terms £25.10.0 deposit and 12 monthly payments of £6.7.3.**



SAVE 10 GNS. Model EL3310 Home Cassette Recorder. List Price 35 gns. ONLY 25 gns. High quality, slim line, 2-track Cassette mains recorder with wide freq. range. Tape speed 1⅞ i.p.s. Housed in teak finished cabinet. **Interest free terms, £6 15s. deposit and 12 monthly payments of £1.2.6. Carr., pkg., ins. 15/-.**

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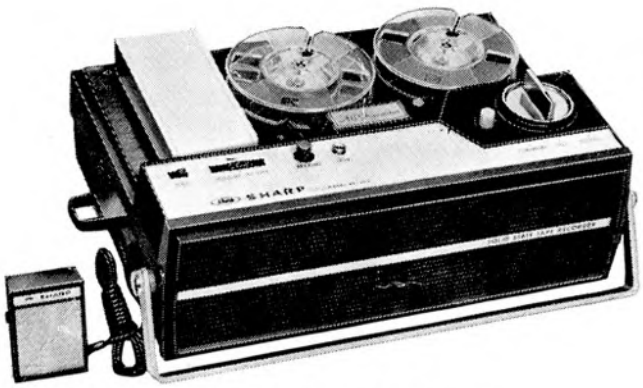
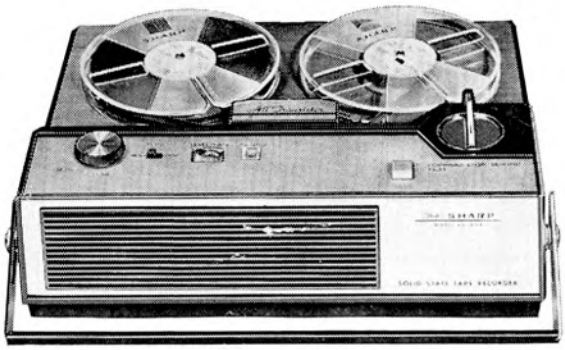


Model RD 303E. An all transistor solid state Tape Recorder. Two speeds, twin track. Fully portable with operation from internal batteries or AC Mains. Automatic or manual recording level control. Remote control switch on microphone for instant start/stop. Uses 3″ reels. Utmost simplicity of control with brilliant performance—truly a miniature marvel Dimensions: 11⅝″ x 3¾″ x 7½″. Complete with dynamic microphone, recording lead, earphone, batteries (4 x Ever Ready LP U2 or equivalent) 3″ reel of tape and empty spool. R.R.P. **£28 17 6.**

RD 504. An all transistor solid state Tape Recorder, twin track, two speeds. Superb recording and reproduction. Entirely portable, will operate anywhere. Automatic change over from batteries to its own built-in A.C. power unit. Designed to play or record in any position. Remote control switch on microphone allows full flexibility in use. Dimensions: 12″ x 3¾″ x 9¼″. Complete with dynamic microphone, recording lead, earphone, batteries (6 x Ever Ready LP U2 or equivalent) 5″ reel of tape and empty spool. A.C. mains 240 V. R.R.P. **£36 15 0.**



Model RD 505. Solid state all transistor tape recorder, twin track, two speeds. Superb recording reproduction with outstanding simplicity of control. Entirely portable will operate anywhere from internal batteries or AC mains. Designed to play or record in any position. Remote control switch on microphone allows full flexibility in use. Dimensions 12″ x 10″ x 4″. Additional features include 3 digit tape counter, fully variable tone control, large internal speaker, automatic or manual level control and level/battery meter. Comes complete with dynamic microphone recording lead, earphone, batteries (6 x Ever Ready LP U2 or equivalent). 5″ reel of tape and empty spool. R.R.P. **£39 18 0.**

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