

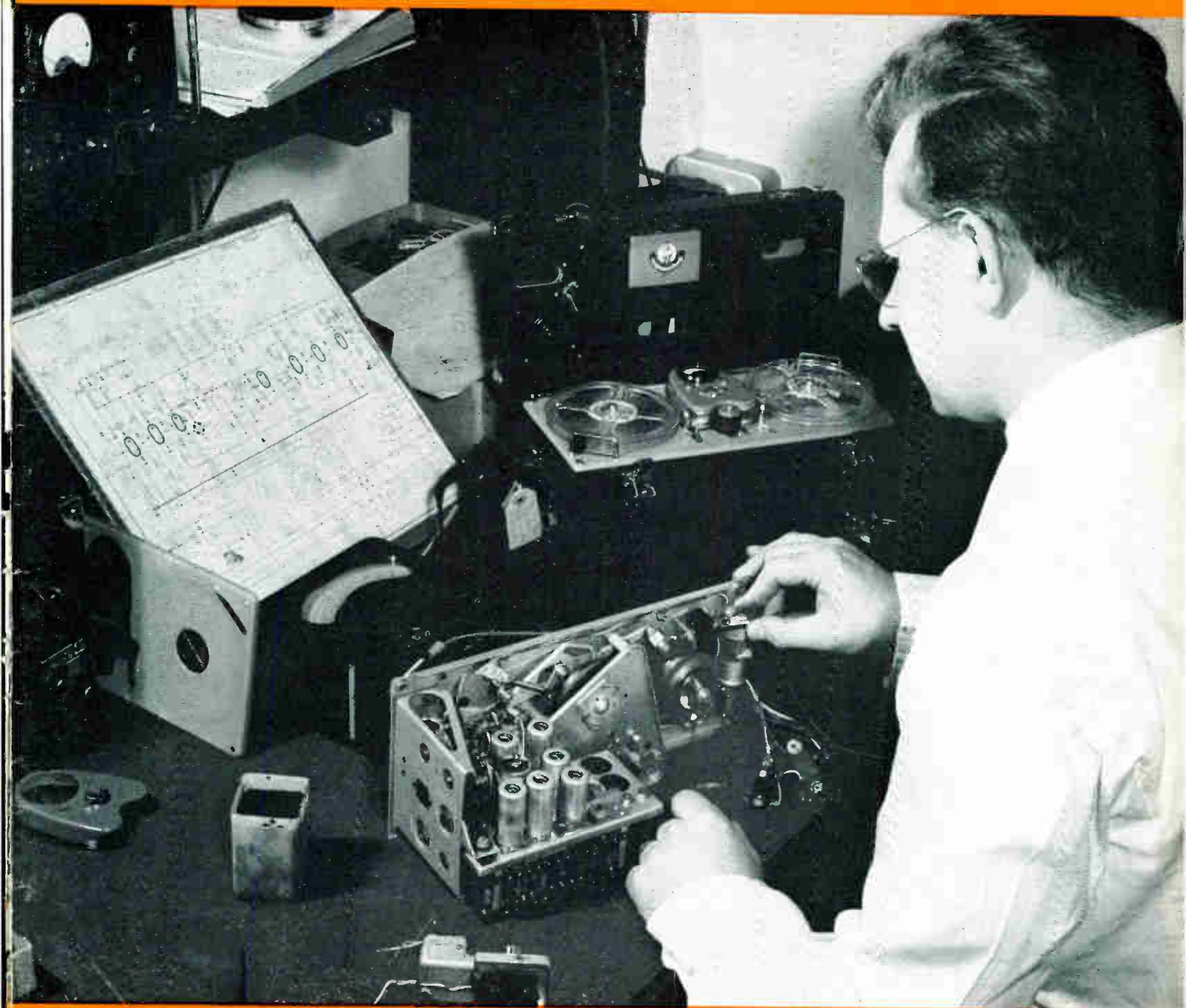
the TAPE

PRICE 1/6

OCTOBER 1962
Vol. 4 No. 9

RECORDER

INCORPORATING "SOUND AND CINE"



IN THIS NUMBER

- Tape Recorder Service
- Details of New Products
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Zonatape embodies all the professional know-how of great sound-film recordings such as *Ben Hur*, *Guns of Navarone*, *West Side Story* and *South Pacific*. It is this professional difference you will immediately recognise in your first recording on Zonatape. The various Zonatape grades are further distinguished by coloured spools: CLEAR for Diacetate, RED for PVC and GREEN for Polyester. Ask your dealer about this very different tape and send for Zonatape booklet—"The Basis of Every Good Magnetic Recording".

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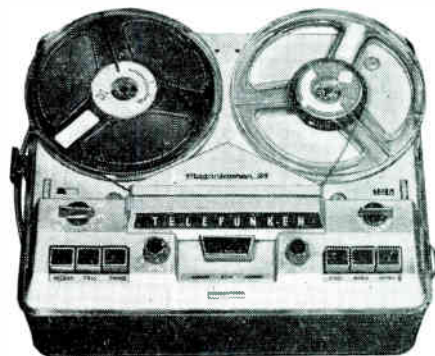
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95

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TELEFUNKEN MAGNETOPHON 95. Exceptional new design of exceptional versatility. Three speeds, twin track, facilities for trick recording and effects. Simple operation, attractive styling. 59 gns. excluding microphone.

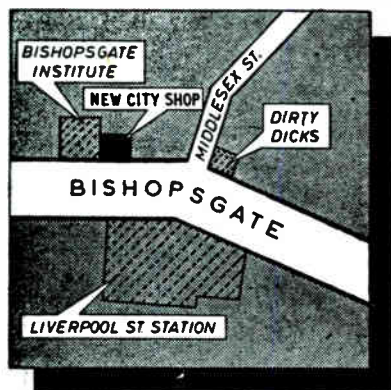
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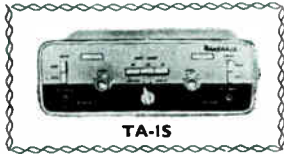
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at lowest
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No electronic or soldering experience is necessary to build any Heathkit model: our simple, well illustrated manual guides you step by step. A FREE CATALOGUE of the full range, and detailed specifications of any item, will be gladly sent without obligation on your part, on request.



TA-IS

TAPE AMPLIFIER UNITS

Models TA-IM and TA-IS

The monophonic version (TA-IM) can be modified to the stereo version (TA-IS) by modification kit (TA-IC). Special features include the provision of a bias level control; easy-to-read thermometer-type recording level indicators; large printed circuit boards. Both models have identical presentation. TA-IM £19.2.6
TA-IS £24.10.0 TA-IC £6.15.0



TRUVOX D83 AND D84 TAPE DECKS. High quality mono/stereo tape decks. D83, 2-track for highest fidelity. £31.10.0

With TA-IM, £47.2.6
With TA-IS £52.6.0
D84, 4-track, for most economical use of tape (same presentation) £29.8.0
With TA-IM £45.5.0. With TA-IS £50.9.6



COLLARO "STUDIO" TAPE DECK. Operating speeds: 1½ in., 3½ in. and 7½ in. p.s. Wow and flutter not greater than 0.15% at 7½ in. p.s. £17.10.0

With TA-IS £35.14.0 With TA-IM £30.10.0

"MOHICAN" GENERAL COVERAGE RECEIVER Model GC-1U. Fully transistorised. 4 piezo-electric transmitters. To overcome the problems of alignment, etc. the R.F. "front end" is supplied as a pre-assembled and pre-aligned unit. £39.17.6

GOLDRING-LENCO TRANSCRIPTION RECORD PLAYER Model G.L.58. Fitted with the G.60 pick-up arm, it has infinitely variable speed adjustment between 33½ and 80 r.p.m. and four fixed speeds. 3½ lb. turntable to reduce rumble, "wow" and "flutter". £19.12.6



AUDIO SIGNAL GENERATOR Model AG-9U. Delivers up to 10 volts pure sine-wave (less than 0.1% distortion, 20 c/s to 20 kc/s). Decade switch-selected frequencies from 10 to 100,000 c/s. Internal 600 Ohm N/I load, or external. £21.9.6

TRANSISTORISED TELEPHONE AMPLIFIER, Model TTA-1. Provides instant group listening and conversation. Freely portable for use with any telephone; hands-free operation; automatic switch; 9v battery operated; compact and elegant cabinet. £7.9.6

SUGDEN MOTOR UNIT "CONNOISSEUR CRAFTSMAN". Heavy duty motor operating at 33½ and 45 r.p.m. Very heavy 12 in. turntable. Virtually no rumble. £18.3.6

"COTSWOLD" SPEAKER SYSTEM

This is an acoustically designed enclosure 26" x 23" x 14" housing a 12" bass speaker with 2" speech coil, elliptical middle speaker, and a pressure unit to cover the full frequency range of 30-20,000 c/s. Capable of doing justice to the finest programme source, its polar distribution makes it ideal for really Hi-Fi Stereo. Delivered complete with speakers, cross-over unit, level control, Tygan grille cloth, etc. All parts pre-cut and drilled for easy assembly and left "in the white" veneered for finish to personal taste. Assembled weight 61 lb. £23.4.0



"COTSWOLD"

HI-FI EQUIPMENT CABINETS

A range of equipment cabinets is now available to meet the differing needs of enthusiasts. All accurately machined for ease of assembly and left "in the white" for finish to personal taste. Designed for the maximum operating convenience or for where room space is an overriding consideration, this range holds at least one model to meet your requirements. Why not send for full details? £11.12.6 to £18.10.0



"THE MALVERN"

HI-FI FM TUNER, Model FM-4U

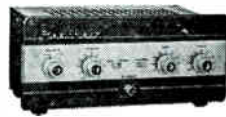
For your convenience, this model is available in two separately sold units: Tuning Unit (FMT-4U—£3.2.0, including P.T.) with 10.7 Mc/s I.F. output, and Amplifier Unit (FMA-4U—£12.6.0). Built-in power supply; 7 valves. Total £15.8.0



FM-4U

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

Also available in two units as above: Tuning heart (AFM-T1—£5.5.6, incl. P.T.) and I.F. amplifier (AFM-A1—£20.13.0). Printed circuit board; built-in power supply; 8 valves; consecutive FM limiting and ratio detector. Total £25.18.6



S33

HI-FI STEREO 6-WATT AMPLIFIER Model S-33.

Attractively styled, completely self-contained. Printed circuit makes it easy to build. Only 0.3% distortion at 2½ W/chal. 20 dB N.F.B.; sensitivity 200 mV. U/L output, ganged controls. £13.7.6

HI-FI STEREO 18 WATT AMPLIFIER Model S-99.

Within its power rating, this is the finest stereo amplifier available, regardless of price. Printed circuit board construction; ganged controls. U/L push-pull output. 0.2% distn. at 9 W/chal. £27.19.6



S-99

TRANSISTOR INTERCOM, Models XI-1U & XIR-1U

Designed for use in the business office or the home, the Master unit (XI-1U) can operate up to five Remote units (XIR-1U) which give instant service without warming-up delay. "Private" switch. 9 volt battery operated. Supplied with assembled sapele-mahogany cabinets XIR-1U £4.7.6 XI-1U £10.19.6



REMOTE XIR-1U



MASTER XI-1U



USC-1

STEREO CONTROL UNIT

Model USC-1

Push-button selection, accurately matched ganged controls to ±1 dB. Negative feedback rumble and variable low-pass filters. Printed circuit boards. Accepts inputs from most tape heads and any stereo or mono pick-up. £19.10.0

TRANSISTOR PORTABLE RADIO Model UXR-1

Presented in elegant real hide case with gold relief. Can be assembled in 4 to 6 hours. Pre-aligned I.F. transformers, printed circuit and a 7 in. x 4 in. high-flux speaker. £14.3.0



UXR-1

4-wave TRANSISTORISED PORTABLE RADIO Model RSW-1

Using 7 latest type transistors and three diodes this highly sensitive set is specially designed for Short and Medium wavebands (250-500, 90-200, 18-50 and 11-18 m.). In leather case fitted with retractable whip aerial. £22.8.0



RSW-1

HEATHKIT ELECTRONIC WORK SHOP KIT, Model EW-1.

This kit will help your boy to understand electronics, by making at least 20 exciting experiments, including Transistor Radios, Intercom Sets, Burglar Alarm, Electric Eye, etc. £7.18.0

POWER AMPLIFIER 12-WATT Model MA-12.

Single channel, ideal for stereo conversion. £11.9.6

HI-FI SPEAKER SYSTEM Model SSU-1.

This kit is easily assembled. It contains twin speakers and balance control in its ducted port reflex cabinet. It is equally suitable for stereo or mono in average room. (Legs 14/6). Less legs £11.5.0



SSU-1

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AMATEUR TRANSMITTER	...	Model DX-40U	£33.19.0
VARIABLE FREQUENCY OSCILLATOR	...	Model VF-1U	£11.17.6
TRANSISTOR RADIO for the youngsters	...	Model UJR-1	£2.13.6
RESISTANCE/CAPACITANCE BRIDGE	...	Model C-3U	£9.5.0
AUDIO VALVE MILLIVOLTMETER	...	Model AV-3U	£14.17.6
AUDIO WATTMETER	...	Model AW-1U	£15.15.0

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... the connoisseur with an eye for a bargain chooses the **SIMON SP5** because no other tape recorder in the price range gives him so much at professional standards!

Unrivalled facilities of the **SIMON SP5** include uni-directional twin track recording, two speeds, 7-inch spools, dual channel mixing, master fader, monitoring through loudspeaker and level setting, controlled echo, track to track recording, controlled bias, recording level meter.

* You can buy the **SIMON SP5** as a stereo recorder, or in a monaural version ready wired and fitted for easy conversion to stereo.



SIMON SP5
Price from 95 gns
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For overseas buyers visiting Great Britain, The Tape Recorder Centre operates the personal export system, providing equipment at UK prices, but excluding all purchase tax.

Unsurpassed Range of Equipment
The Tape Recorder Centre offers the greatest choice of all Tape Recorders and Hi-Fi equipments anywhere. Even the list here can only show a part of the complete range carried by The Tape Recorder Centre.

Specialist Know-How and Advice
The specialist experience of the Tape Recorder Centre Technical Departments is freely at your disposal to make sure you choose exactly what suits your needs and your pocket. The different units used for Hi-Fi equipment have to be carefully selected to work well together. You can rely on The Tape Recorder Centre to ensure that all units are carefully selected and matched to give you top performance and top value. Enquiries are welcome. Reliable advice and keen quotations always gladly supplied.

HIRE PURCHASE TERMS PART EXCHANGES RANGE OF CABINETS

SPEAKERS	£	s.	d.	§
Goodmans ARU172 or 180...	3	5	6	9.15
Goodmans Axiote 8	5	10	0	11.40
Goodmans Axiom 300 12"	11	5	9	31.80
Goodmans Axiom 10	29	10	6	12.65
Goodmans AL/120	7	0	0	82.90
Goodmans Trebas 5K/20XL	25	0	0	19.70
Goodmans Triaxiom 12/20	10	10	0	70.25
Kelly Ribbon HF Mk. II	39	18	0	29.50
Leak "Sandwich" Speaker	38	17	0	112.15
Lowther Acousta	72	16	0	111.00
Lowther Acousta/Twin	95	0	0	208.00
Lowther Acousta/Super	98	0	0	273.00
Lowther Audiovector	98	0	0	280.00
Lowther TPI	18	18	0	53.10
Lowther PM6	42	0	0	120.00
Mordaunt "Arundel" Speaker	52	0	0	146.10
Quad Electrostatic Speaker	30	15	0	88.00
Tannoy 12" Monitor	37	10	0	108.00
Tannoy 15" Monitor	1	18	7	4.00
T.S.L. Tweeter LPH465	15	1	6	41.25
W.B. Stentorian "Clumber" 912C	4	5	6	8.78
W.B. Stentorian 8" HF812	7	0	9	14.42
W.B. Stentorian 8" HF816	4	10	6	9.27
W.B. Stentorian HF912	5	2	6	10.50
W.B. Stentorian 10" HF1012	8	4	0	16.85
W.B. Stentorian 10" HF1016	4	8	3	12.40
W.B. Tweeter T10	1	15	9	3.70
W.B. Tweeter T359	7	3	5	14.75
Wharfedale 8/145	5	3	3	11.40
Wharfedale Bronze 10FSB	25	0	0	70.25
Wharfedale Coaxial 12	8	15	5	19.30
Wharfedale Golden 10FSB	12	10	0	33.00
Wharfedale RS12DD	39	10	0	111.00
Wharfedale SFB/3 3-speaker	22	10	0	63.20
Wharfedale Slimline 2	17	10	0	49.20
Wharfedale Super 12 RS/DD	7	3	5	14.75
Wharfedale Super 8FS/AL	6	9	11	14.30
Wharfedale Super 3	29	10	0	82.90
Wharfedale V2 Speaker System	39	10	0	111.00
Wharfedale V3 Speaker System	17	10	0	50.00

Most Makes of Cross-Over Units in Stock

CABINETS (Speaker and Equipment)	£	s.	d.	§
A.D. Equipment Cabinets from	17	10	0	50.00
A.D. Speaker Enclosures from	10	10	0	30.00
Record Grieg Equipment Cabinet	25	4	0	72.00
Record Liszt Equipment Cabinet	11	19	6	34.00
Record Nordyk Equipment Cabinet	6	19	6	20.00
Record Viking Corner Enclosure	10	10	0	30.00

TUNERS	£	s.	d.	§
Armstrong ST3 Mark II AM/FM	27	16	0	58.20
Armstrong T4B Tuner	21	18	0	47.80
Chapman FM91 Unpowered	22	15	10	50.00
Chapman FM95 (AM/FM)	26	8	3	58.00
Chapman FM91 Powered	26	13	4	57.00

	£	s.	d.	§
Chapman FM95 Powered	30	6	2	66.00
Leak Mark II Troughline	33	15	0	70.25
Quad FM	28	1	9	59.00
Quad AM Tuner L/M/S	32	2	0	67.44
Rogers Variable FM (S/P) in case	30	17	6	62.75
Rogers Variable FM (S/P) chassis	26	9	6	57.20
Rogers Switched FM Unit	15	11	1	34.00

AM/FM RADIOGRAM CHASSIS	£	s.	d.	§
Armstrong AF208	22	18	0	49.20
Armstrong Jubilee Mk. II Tun/Amp.	30	12	0	65.95
Armstrong Radio 12 Mk. II Tun/Amp.	43	10	0	93.00
Armstrong Stereo 55 Tun/Amp.	32	15	0	70.15

AMPLIFIERS	£	s.	d.	§
Leak TL12 Plus and 'Point One' Pre-Amplifier	31	10	0	88.50
Leak TL12 Plus and 'Varislope' Mk. III Pre-Amplifier	34	13	0	97.35
Quad II Control Unit and Quad II Amplifier	42	0	0	118.00
Quad II Amp. and 22 Pre-Amp.	47	10	0	133.45
Rogers Cadet MK2	12	0	0	35.00
Rogers RG Cadet MK2 Control Unit	11	0	0	32.00

All Non-Integrated and Pre-Amplifiers Available Separately

STEREO AMPLIFIERS	£	s.	d.	§
Archon	49	19	6	143.00
Armstrong PCU27 Control Unit	28	10	0	82.00
Armstrong A20 Amp. and PCU25 Pre-Amplifier	44	12	6	127.50
Chapman 305 Stereo	39	18	0	114.00
HMV Integrated Stereo	72	9	0	207.00
Leak Stereo 50 Amp. with Varislope Stereo Pre-Amplifier	67	0	0	188.30
Leak Stereo 20 Amp. with Varislope Stereo Pre-Amplifier	55	9	0	155.80
Leak Stereo 20 Amp. with Point One Stereo Pre-Amplifier	51	9	0	144.60
Lowther Stereo	87	0	0	249.00
Quad 22 Control Unit with two Mk. II Amplifiers	70	0	0	196.70
Rogers Cadet MK2 Complete	2	10	0	73.00
Rogers HG88 Mk. II Integrated Stereo Amplifier (in case £43 10 0)	40	0	0	113.50
Rogers Junior III Stereo Control	22	10	0	63.20
Rogers Master Stereo Control	35	0	0	98.35
Rogers 'Junior' Stereo Amp.	27	5	0	78.00
Walgain Stereo Pre-Amplifier	7	10	0	21.20

TAPE RECORDERS AND DECKS	£	s.	d.	§
Ampex—Prices on Application				
Armstrong PAB03 Tape Osc. Pre-Amp. (Power Unit £2 19 6)	16	16	0	47.20
Brenell Mark V	67	4	0	188.80
Brenell Mark V, Type M	92	8	0	259.60
Brenell 3 Star (2 or 4 track)	60	18	0	171.20
Brenell Mark V, deck	29	8	0	82.65
Brenell Play/Record Amp.	24	0	0	67.45
Butoba MT5 (Battery)	66	gns.		198.00
Coscor 1601 1/2T	59	gns.		177.00
Coscor 1602 1/2T	37	gns.		117.00
Coscor 1603 1/2T	28	gns.		84.00
Elizabethan FT3 1/2T	45	gns.		135.00
Elizabethan TT3 1/2T	39	gns.		111.00
Elizabethan FT1 1/2T	34	gns.		102.00
Ferroglyph Series 420	115	10	0	324.00
Ferroglyph 4 A/N	85	1	0	239.00
Ficord 202 (Battery)	66	gns.		198.00
Grundig TK40 1/2T	75	gns.		225.00
Loewe Optacord 403 1/2T	43	gns.		129.00
Loewe Optacord 404 1/2T	53	gns.		159.00
Loewe Optacord 412 1/2T (Battery)	45	gns.		135.00
Philips EL 3585 (Battery)	24	gns.		72.00
Philips EL 3514	27	gns.		81.00
Philips EL3541	36	gns.		108.00
Philips EL3542	59	gns.		177.00
Reflectograph Mod. A 1/2T	105	gns.		315.00
Reflectograph Mod. B 1/2T	115	gns.		345.00
Simon SP5 1/2T	93	gns.		279.00
Sony 521 (Stereo)	124	gns.		372.00
Sony 777 (Professional Mono)	190	gns.		570.00
Stella ST455 1/2T	59	gns.		177.00
Stella ST454 1/2T	37	gns.		111.00
Stella ST470 (Battery)	25	gns.		75.00

	£	s.	d.	§
Stella ST456 1/2T	28	gns.		84.00
Stuzzi Magnet (Battery)	59	gns.		177.00
Tandberg Model 3B	76	gns.		228.00
Tandberg Series 6	110	gns.		330.00
Telefunken 75-15 1/2T	47	gns.		141.00
Telefunken 85KL 1/2T	79	gns.		237.00
Telefunken 95 1/2T	59	gns.		177.00
Telefunken 96 1/2T	59	gns.		207.00
Telefunken 97 1/2T	95	gns.		285.00
Truvox R7 1/2T	82	gns.		246.00
Truvox PD86 1/2T	63	0	0	180.00
Truvox PD87 1/2T	63	0	0	180.00
Veritone 16 1/2T	91	gns.		273.00
Vortexion WVA	93	13	0	263.15
Vortexion WVB	110	3	0	309.25
Wearite 4A deck (other available)	42	0	0	117.00

MOTORS	£	s.	d.	§
Connoisseur 'Craftsman' 2-speed	18	5	0	39.35
Connoisseur 3-speed	24	8	8	53.00
Garrard Autolim	8	14	6	20.00
Garrard Deluxe Complete	12	14	8	28.00
Garrard LAB/A/Auto unit/GC8	21	18	11	62.00
Garrard Lab/A/Auto unit/EV26A	22	17	0	64.00
Garrard 301	23	5	0	50.00
Garrard 301 with Strobe	24	10	3	54.00
Garrard 4HF/GC8 on base	22	0	2	49.00
Garrard 4HF/EV26A Stereo-Mono	22	18	4	44.25
Lenco GL58 (Cartridge extra)	17	15	5	44.25
Lenco GL70 (Cartridge extra)	29	1	8	63.20
Philips AG1016 Motor and P.U.	14	3	6	30.40

PICK-UPS AND CARTRIDGES	£	s.	d.	§
Auril Pick-up Control	3	9	9	7.70
Acos Hi-Light Stereo pick-up	18	5	8	39.00
Bank & Olufsen ST/L Stereo pick-up	17	11	6	38.00
Decca ffs Stereo pick-up	21	0	4	44.85
Decca Deram cartridge	4	4	0	8.70
Decca L.P. head	10	10	0	23.25
EMI EPU/100 Stereo pick-up	22	12	3	47.80
Garrard EV26A Stereo/Mono cartridge	2	5	11	5.00
Garrard GC8 Mono t/o cartridge	1	7	10	3.00
Garrard SP3 Stylus press gauge	1	19	9	2.20
Garrard TPA12 pick-up arm shell	4	11	10	9.00
Goldring G60 pick-up arm only	3	17	7	8.45
Goldring L70 pick-up arm	8	2	10	18.00
Goldring MX1/D mono cartridge	2	8	6	5.30
Goldring SX10/D stereo cartridge	2	18	2	6.36
Goldring 580 t/o cartridge	5	8	7	12.00
Goldring 600 t/o cartridge	10	17	2	24.00
Goldring 700 Mk. II Stereo cartridge	9	10	0	21.00
Leak L.P. Pick-up complete	12	18	7	29.00
Ortofon CG Mono Head	18	0	11	40.00
Ortofon Pick-up arm SMG212 (inc. trans.)	6	2	6	12.50
Ortofon Pick-up arm SMG212	12	17	9	28.75
Ortofon Pick-up arm RKG309	21	18	2	48.50
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★
EDITORIAL



MEMBER OF THE
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LOOKING backward over the past ten years, it is both interesting and revealing to see how many "impossibles" have become everyday fact, and how many heads have had to bow before the winds of demand. It is also significant to note that, in the tape field, a large number of the most successful products have come from sources which regard—and make—a recorder as a complete instrument, and not as an assembly job.

Most of those which have succeeded in gaining and holding the confidence of the buying public stem either from the "complete job" factory, or from the workshop in which the various components are regarded, and treated in such a way that (but for the absence of the vast production plant) they could have been made on the spot and tailored to suit one another.

This is the way in which the tape recorder industry is settling down, and this is the direction in which we forecast that it will develop. Count the brands of recorder that you can remember during the past five years, and note those which still enjoy popularity today, and there you will find the basis for this statement. Ten years is a short time for any new device to be born and become a household item; and, as we have reminded our readers several times before, that is the approximate span of time in which the tape recorder has established itself. And it is within this short period, too, that so many impossibles have become practicable. Tape speeds were, of course, among the first to be altered. Track widths and numbers were tackled next. The biggest impossibility—if such a word can be qualified—was the increased frequency response obtainable from tape which enabled television signals to be recorded. Ampex use a band of about 4,000,000 cycles per second.

There are many people in the tape industry today who were quite firm in their beliefs and statements that $7\frac{1}{2}$ i/s was not good enough for music. A few said that this speed never would be good enough. The idea of using $3\frac{3}{4}$ i/s for music was ridiculous. It is still not good enough for the quality of reproduction that many demand: but it probably will be. It is already more than

SUBSCRIPTION RATES

The subscription rate to *The Tape Recorder* is 21/- per annum (U.S.A. \$3.00) from The Tape Recorder, 99 Mortimer Street, London, W.1. Subscription + Index, 24/- (U.S.A. \$3.25).

The subscription rate to *Hi-Fi News* is 27/6 per annum (U.S.A. \$4.00) from Hi-Fi News, 99 Mortimer Street, London, W.1. Subscription + Index, 30/- (U.S.A. \$4.25).

OCTOBER - - - - - 1962

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adequate for average domestic use. Half that tape speed is already used by many people for music. Music from tape at that speed will obviously improve in quality as materials and techniques are developed and improved.

Any published letter on the advantages and disadvantages of quarter-track recording is bound to provoke a fierce argument. We all know that four-track recorders have caused a lot of trouble; but we also know that some of the more advanced instruments employ this system with very great success—indeed it is quite true to say that some of the best four-track recorders produce better results than some of the inferior two-track machines. There seems little doubt that quarter track recording will establish itself in the near future, it will have to, if stereo tapes are to succeed in terms of economy and quality. And why should four tracks be the limit? Today, using modern techniques and materials, four are often more than the limit—but we are progressing. Who is bold enough to say, definitely, that eight tracks at $1\frac{1}{4}$ i/s will not be with us, providing good quality domestic stereo, within the next ten years. We would most certainly not make such a statement. Nor would we say that recorders of reasonable price will be incapable of recording and replaying TV signals of good quality within the same time span. We *did* say, in one of our publications, that TV recorders should be quite possible, commercially, about six months before the news arrived of the first Ampex "Video" machine.

At this time we are fortunate to have reached the stage at which *all* tape recorders are reasonably good, and at which the better ones are very good indeed. We have also reached the stage at which these instruments are being accepted in the home as musical instruments, with a growing catalogue of tape records for use with them. We may now look forward to a period of steady improvement all round—decks, heads, electronics, tapes. And it will not be long before a few new ideas come along to surprise us, as one or two more "impossibles" become fact.

COVER PICTURE

REGULAR servicing is essential for most machines, and for tape recorders that have to deliver "B.B.C. quality" for broadcasting it is a vital routine. Our photo shows an EMI L2 in the B.B.C. Maintenance Unit, at Maida Vale, and will be of particular interest to those of our readers who have never had a sight of "the works" of this popular model. The L2 has, of course, been superseded by the EMI RE 321—a transistorised model, with in-built monitor speaker. Nevertheless, the older models are still in use in their hundreds, and are likely to give good service for many years to come.

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NEWS FROM THE WORLD OF TAPE

Grundig Open Permanent London Showroom

GRUNDIG (GREAT BRITAIN) LIMITED who reopened their showrooms at 39 New Oxford Street, London, W.C.1. for the period of the Radio Show, announce that in response to popular demand the showrooms will now remain open permanently. Their full range of tape recorders, radios, radiograms, dictating machines and typewriters will be on show and members of the Grundig staff will be available during normal business hours to answer queries and give demonstrations.

Planet Tape Decks for Export

KENNETH WILLIMAN, managing director of K. H. Williman & Co. Ltd., Blackford House, Sutton, Surrey, announces that an Agreement has been signed between his company and Planet Projects, Ltd., of London, under which the firm will handle all export sales to Europe of the new Planet range of high performance tape decks.

Experience gained over a number of years in the export of British made audio equipment indicates that a good market for high-quality units of this kind can be developed, provided, as the production plans ensure, they are backed by good delivery and service.

Mr. Williman expresses the view that whether or not Great Britain enters the Common Market, there is great potential for the development of British sales to E.E.C. Countries.

A New Tape Recorder Shop



A NEW shop, specialising in the sale of tape recorders has been opened by Lovell and Brand Ltd., 94 Stokes Croft, Bristol. Over 60 different models are on show, together with microphones, mixers, speakers, tuners and other equipment suitable for use with recorders. The showroom is specially wired to demonstrate any of these items immediately.

The manager is Mr. Gazzard, a keen tape recording enthusiast, with a wide range of experience in all aspects of high fidelity equipment.

To enable enthusiasts to see the equipment, the showroom is open every night, except Wednesday, until 8 p.m. and on Saturdays from 9 a.m. to 6 p.m.

New "Scotch" Tape Accessories

A NEW range of magnetic tape accessory items has been introduced by the makers of "Scotch" magnetic tape. Items include leader and timing tape, sensing tape, tape clips and an accessory kit.

No. 24 Leader and Timing Tape is made in five colours—red, green, white, blue and yellow. Each $\frac{1}{4}$ in. x 100 ft. roll is



carded and sealed inside a transparent dispenser pack complete with cutter. The price is 6s. per roll, and the tape, with plaid sections accurately spaced, can be used for timing, tape "lead-ins" and labelling.

"Scotch" Tape Clips, for holding the tape end secure on the spool, are now available in packets of ten, price 2s. 6d. The clips prevent tape spilling and tangling in storage, handling and shipment.

New in the accessory field is No. 51 Sensing Tape—a thin, flexible, strong conductive foil with a pressure-sensitive adhesive. No. 51 Tape has been developed to work in conjunction with recorders having electronic sensing controls. Each $\frac{7}{32}$ in. x 150 in. roll is carded in a unique bubble pack, complete with tape guide, automatic separator for the discardable liner and cutter for easy tape removal. Price of each roll is 14s. Apart from the advantage of this tape as an effective stop foil, it can be used as a sensing medium in certain tape recorder-slide projector systems.

A new pocket size Accessory Kit is introduced. It contains the basic accessories needed for better, more professional recording: one splicer, one roll of No. 41 Splicing Tape, one roll of No. 24 Leader and Timing Tape and ten Tape Clips. Price is 29s. 6d., complete in an attractive pack with instruction leaflet. The No. 41 Splicing Tape is still available separately and the easy-to-use $\frac{1}{4}$ in. x 150 in. roll on the dispenser is now available in a modern style pack.

A leaflet describing the new "Scotch" accessories is available from the makers, Minnesota Mining and Manufacturing Co. Ltd., 3M House, Wigmore Street, London, W.1.

International Radio Communications Exhibition

OVER seventy-five per cent. of the space has now been booked for the International Radio Communications Exhibition to be held at the Seymour Hall, Seymour Place, Marble Arch, London, W.1., from October 31st to November 3rd. A special communication satellite-display will be one of the features also a new communication receiver will be on show. Technical bookshops will again be another large part of the exhibition. For the first time Japanese equipment showing the latest amplifiers, wide range of microphones and transistors also Hi-Fi and loudspeaker components will be on view.

Silver Plaque Awards to be won outright will again be presented for outstanding new products and home constructors' equipment and many cash prizes will be given.

NEWS AND PICTURES FROM

NEWS has been received by the **Rugby Amateur Tape Recording Society** within the past few days from one of the vice-presidents, John Brown, who is the resident tutor at the College of the University, West Indies. After leaving Rugby in 1959 he has spent his time in the West Indies and in December next he will be returning to England with his wife and family and will spend a little time in the Rugby area before taking up a new appointment. Of late he has been host to Alan Lomax, singer of the blues and folklore in the States, and it is probable that he will have some very interesting recordings with which to make a programme long promised to the Society, upon his return to this country.

Two visitors in the town recently from our French twin town of Evreux, were M. and Mme. Jacques Maupas, and whilst here they were given the opportunity to present slides about Evreux to the local people at a free meeting organised jointly by the Twinning Committee and this Society. The couple speak only an odd word or two of English and the tape-recorded commentary which accompanied the slides was made in Evreux by an English-speaking friend. With the equivalent speech in French and the aid of a stop-watch M. and Mme. Maupas were able to present a very good programme, slickly operated. The quality of both slide and tape was excellent.

Further details can be obtained from *M. Brown, 219 Clifton Road, Rugby.*

MAIN events of the last month have been the recording of the annual Whitstable carnival, and a sound report on the newly-instituted Whitstable Industries Fair. Both these events have now been made into feature programmes, and copies have been offered to local societies and associations free of charge.

Members of the **Whitstable and District Tape Recording Club** also visited the Medway Club for a demonstration of tape recorders and microphones, etc., by Highgate Acoustics, and are looking forward to a return visit by these clubs to the forthcoming visit by Lustraphone and BASF.

Club meetings recently have been concerned with listening to the final entries in the 5 minute feature competition, and the eventual winner turned out to be Ken Pearce, with a brilliant and ingenious entry employing the differing speeds technique.

Some samples of pre-recorded commercial tapes were also heard, but members were not very impressed by the quality of these, and felt the production could have been much better. There was far too much distortion present, to say nothing of drop-outs, and one dreadful passage in an organ recital where, as one member remarked, it sounded just as though the organ was changing gear, and not very smoothly at that!

Future plans are going to include a local talent competition, which it is hoped will not only encourage young musicians and other performers, but will also allow members to try out their skill at live performance recording. Details of these and other club activities from *T. Robinson, 17a St. Anne's Road, Whitstable, Kent.*

RESUMING their regular fortnightly meetings after the semi-recess of the summer months, members of the **Cotswold Tape Recording Society (Cheltenham)** met on September 6th for a novices' evening, at which several members submitted a five-minute tape in a competition judged by the chairman, Ernest Morris. These were of a very varied character, ranging from musique concrete by Ray Tingley, to the singing of handicapped children round a camp-fire by June Turner. The winner was Harry Foleder, who had created an imaginary interview between doctor and patient somewhere in the future. All the diagnosis was done by electronic means.

In the second half, Peter Turner presented a sound record of the Stroud Jubilee Show, which had been specially commissioned by the Show Society. Beginning with recordings of the carnival

procession, the tape went on to give snapshots of activities and personalities on the ground, with special emphasis on the annual brick-throwing contest between the four Strouds of England, Australia, Canada and Oklahoma. This tape will be circulated to the Strouds of other lands.

Colin Woods recently designed a tape-editing machine, which renders the operation of editing a great deal more simple than the scissors-and-paste method. Members hope to learn more of the actual design later; but the final item on the programme was a brief heart-breaker entitled "Making a Girl go Wrong". This was a recording of TIM, the speaking clock, chopped about to make the golden voice, with its obedient pips, say some most astonishing things.

Details are available from *P. D. Turner, Pike Cottage, Frampton Mansell, Stroud, Glos.*

THE inaugural meeting of the **Britwell Amateur Tape Recording Society** was called by Syd Hall and Ron Chambers, on Wednesday, April 25th in the local Methodist Church Hall. In his speech outlining the possibilities and advantages of forming a club, Syd Hall stressed very strongly that members would never get more out of a club than they were prepared to put into it, and it seems to have had its effect, because since then the club has gone from strength to strength, fourteen members attended the first meeting, now they have thirty. Meetings are held on alternate Wednesdays at the Methodist Church Hall, Wentworth Avenue, Britwell, at 8 p.m., but it is hoped very shortly to move to new premises in the Britwell Community Centre now undergoing adaptations and alterations in Long Furlong Drive.

The first outing was to the Audio Festival and Fair, twelve members spent the whole of the final day at the Russell Hotel and thoroughly enjoyed themselves.

Activities being organised in the near future include: a visit to a studio; a demonstration of splicing and editing by Ron Chambers; a puppet-tape show by Bob Tessman and an outing to Farnborough Air Display.

Further details can be obtained from *S. Hall, 46 Whittaker Road, Britwell Estate, Slough, Bucks.*

A club newsletter round-robin on tape started by the **North London Tape and Hi-Fi Club** has been returned with recordings of programmes from three other clubs. The tape, which will take between three and four months to complete its round of half-a-dozen clubs, allows for each programme to last about 10 minutes. Those who took part in the first round of the tape are the Whitstable, Bournemouth and Poole, and Nelson clubs. Other groups will be invited to participate when the tape is next in circulation.

The round-robin started when the North London club recorded its first newsletter. The tape, with this newsletter at the beginning, was sent to another club, who, having added their programme, passed it on to the next on the list. The tape, which the North London group played back at a recent meeting, includes brief surveys of each club's formation, as well as excerpts from a play, a wartime speech by Sir Winston Churchill, a sound quiz, snippets from commentaries at a local gala and circus and an interview with a sports personality.

The North London club has now added its second newsletter, giving extracts from competition entries and recordings made at churches in Cheshunt by chairman Sinclair Scott.

Club meetings recently have offered a wide variety of subjects, including a demonstration of the Veritone 16 by Messrs. Alan Wakeford and Don Hawkins. Members' tapes were played as well as tapes brought with the machine and a lively discussion during the meeting covered several topics of tape-recording interest, including after-sales service and guarantees.

THE CLUBS

A competition in July called for "Crazy Tapes". And the humour offered on the entries made it a very difficult job for the judges, but a tape produced by member Ray Maslin was chosen as the winner of the club's 10th competition. This is the sixth time Ray has won a club contest.

Unable to hold one recent meeting as planned in a church, members satisfied themselves with Bush Hill Park School and enjoyed an informative talk on recording in churches by chairman Sinclair Scott, who has made many such recordings. An August meeting was devoted to a quiz.

The North London club has now joined forces with two other Enfield organisations to form a fund to enable more old folk to hear a local newstape, which for the past 15 months has been issued weekly for old and blind people. The tape club has been given this opportunity to compile the regular programme because of the extra facilities for recording; the result every fortnight will include interviews with local people in the news, feature programmes, as well as readings from the newspaper.

Further details can be obtained from R. Collinson, 30 Ridler Road, Forty Hill, Enfield, Middlesex.

* * *

WITHIN ten minutes of the end of the Carnival Procession through Queens Road, Hastings, a recording was being played back to the residents of Old Hastings House.

This meant that the old folk were listening to the recording before the procession was over; in fact, they heard it before those people watching on the sea front even saw the beginning of it.

John Aitchison, the secretary of the **Hastings and District Tape Recording Club**, made the recording, complete with commentary from a vantage point overlooking the route, where he was helped by Tony Jackson, manipulating the controls of the recorders. Before the actual procession passed, a message from the Carnival Queen recorded on the night she was chosen and the commentator's impression of the Crowning Ceremony which took place earlier the same afternoon, were dubbed on to the tape which was taking the main recording. The tape was rushed to Old Hastings House, where about thirty residents were waiting to listen to the recording.

Much in evidence at the recent opening of a new Primary School in Hastings were two members of the club, Bill Mackey and Tony Jackson. With over £200 worth of equipment, including a Ferrograph and Vortexion, they made recordings of speeches by Sir Adrian Boulton, the Bishop of Chichester and the Mayor of Hastings and of choral music, including a special item specially composed by the Headmaster. Excellent recordings were made and played back at a concert the same evening.

Further details of the club can be obtained from J. Aitchison, 62 Vicarage Road, Hastings.

* * *

THE Cambridge Amateur Tape Recording Society must surely be unique in that within two years it is staging its second Audio Exhibition telling the public of its activities. The society was founded in January 1961, and in October of the same year held a small exhibition at which five manufacturers and local dealers exhibited.

This year, arrangements are being made for a much larger exhibition with 14 exhibitors participating in addition to the society, and visitors are assured of a first-class display and demonstration of all that is best in tape recording and high fidelity equipment.

Several competitions are being organised, with prizes including a portable tape recorder, record tokens, spot cash and a mystery prize. Each catalogue, on sale from October 1st, will be numbered, and the bearer of the winning catalogue will receive a portable tape recorder as a prize. Record tokens and spot cash will be given away daily in the "Spot the Tune" competi-



The above photograph shows part of the stand of the Pietermaritzburg Tape Club at a recent "Do-it-Yourself" exhibition held in the city hall, Pietermaritzburg.

tion, and Cosmocord, Ltd. of Waltham Cross are donating a mystery prize to the contestant who wins the title "The Voice of Cambridge, 1962".

Throughout the exhibition, programmes will be relayed on sound and closed-circuit television from the society's studio and control room equipped with professional equipment. It is hoped that the attendance this year will exceed last year's estimated figure of 2,000.

For further information contact M. E. Renshaw, 6 St. Vincent's Close, Girton, Cambridge.

* * *

DURING the last month the **Thornton Heath Tape Recording Club** have been trying out some of the new ideas that were put forward at the last A.G.M. by the members, and so far they have found that they have picked some very interesting items for themselves to do.

Members had a very interesting meeting when a blind member of the club, gave a talk on how tape recording has helped him during the six years that he has been blind. He illustrated his talk with recordings that he has made during his holidays.

The club held an "Open Discussion Meeting" at which members could ask the panel questions on tape matters with which they were having trouble. They got through quite a large amount of questions and the idea is to be carried on every few months when it is thought that members need such a meeting.

Members were asked to bring their portable recorders and the club held an outside meeting at which the small groups had to interview the public on the latest Russian space trips and the space twins. Among the places the groups visited were the local police station and the bus garage at which some very good recordings were obtained.

Anyone wishing to join the club should apply to E. J. Bashford, 4 Duneved Road North, Thornton Heath.

* * *

THE South Birmingham Tape Club having now settled in new premises at the Breeden Cross Hotel, Pershore Road, held an equipment night and entertained visitors from Kidderminster Club.

Over a dozen different types of recorders were demonstrated, including a Ferrograph, Simon with stereo attachment, a stereo machine built by a member and an ingenious clockwork machine built by a visitor.

Members recently visited the Midland Gliding club where the chairman, Mr. Gordon Skippen, was able to take his portable up in a glider. A film of club activities complete with soundtrack is now being prepared for presentation in October.

Details of future activities can be obtained from J. T. Gilbert, "Woodcote", Box Trees Road, Dorridge, Solihull, Warwickshire.

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MODEL 69 'DE-LUXE'

Wide Frequency Range: Equipped with a record/play head which consists of specially treated core-materials being imported from West Germany.
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Level meter: with pilot lamp for easier determination of correct volume control setting when recording.
Index (Revolution) Counter.
Instant Stop Control: Spot editing and momentary stops are easily accomplished by use of the Instant Stop Lever.
Monitoring and better reproduction: Monitoring of your recording may be accomplished by plugging a crystal earphone into the recorder's Output Jack. Superb reproduction can be obtained by operating a large Hi-Fi speaker direct from the Output Jack. Also your existing power-amplifier that does not have a pre-amplifier of its own may be driven from the same Jack.
Head Output and three position Power Switch: If desired, the tape transport mechanism (tape deck) of the recorder can be operated independently of the built-in amplifier and speaker. The Head Output Jack and the three-position Power Switch are provided to make this special function possible.
Retail at 79 GNS.

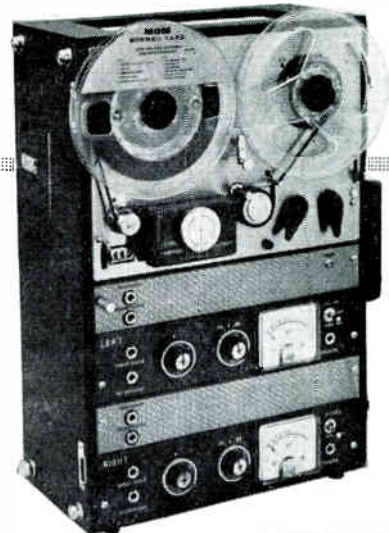
HI-FI WIDE RANGE STEREO SPEAKER SYSTEM MODEL SS-50

Matched with the Model M-6 in styling and size, complete with connecting cables. Speakers: Two 8-inch mechanical 2-way (with built-in coaxial tweeter) speakers in a dividable carrying case.

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MODEL M6

Records and plays back either 4-track stereophonically or 4-track monophonically and also plays back 2-track prerecorded stereo tapes. Hysteresis Synchronous Motor always ensures constant tape speed. Designed for vertical or horizontal operation. Two inline and accurate VU-Meters reads recording and playback levels.
A precision index Counter. Recording/play head consists of specially treated core-materials which are being imported from West Germany. Maximum output power of the built-in amplifier is 6 watt on each channel (total 12 watt) which can drive up to 12 in. extension speaker system. Dual Head and Preamp Outlets are provided for connection direct to any other pre-amplifiers or stereophonic amplifier.
Instant Stop Lever. All operating controls are interlocked.
Automatic stop device.
The pinch wheel is always automatically released from capstan which protects it against a "spot" on the soft rubber surface causing uneven running.
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Akai's new modern factory in Japan where the finest equipment is produced under the most up-to-date conditions.

Akai* is the most important contribution that has been made to first-class tape recording equipment for years. In a comparatively short time, they have established themselves in a leading position in the American Tape Recording Field.

Now they have come to Britain and one has only to examine them to see why they are going to prove serious competition to those European manufacturers, who have led the field for so long. You find this hard to believe? Then see the Akai Terecorders for yourself, contact your usual dealer or the sole importers.

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TAPE RECORDER SERVICE

GRUNDIG MODELS, PART 3

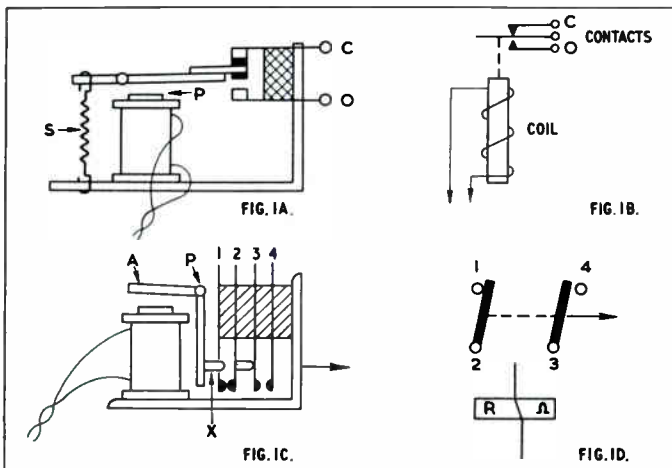
By H. W. HELLYER

BEFORE passing on to the servicing details of one or two of the more elaborate *Grundig* machines, a few words on the subject of relays may not come amiss. Mention of relay switching sequences was made in articles Nos. 8 and 9 of this series, and a few general hints given on maintenance. Discussion of the *Grundig* range provides an excellent opportunity to digress in this manner, for these machines employ relays in a number of different ways.

We have already seen the advantage of a relay for autostop and head-switching operation; but a number of queries have been received on the subject of relay sequences, which can be confusing, even to the experienced reader of diagrams.

Basic Details

First, a few basic details. A relay is simply a switch: but a switch that is electrically rather than mechanically "thrown". Current is made to pass through the coil of the relay, energising it and producing a magnetic field that attracts (or repels) an armature. Spring loading ensures the return of the armature when the relay is de-energised. To the armature is attached an



actuating arm or lever, which causes contacts to open or close. Fig. 1a shows the basic construction of such a device. In this simple illustration, it will be noted that the "common" pole of the switch is attached to the armature itself. Its contact connects to C when the relay is not energised, the pressure being maintained by tension spring S. When current flows, the armature is attracted to polepiece P and the contact closes to O. The electrical circuit of such an arrangement is shown in fig. 1b.

Relays

A more general form of relay is that shown in fig. 1c. This has a hinged armature A, pivoted at P. A small block of insulated material X is fixed to the lower arm of the armature so that when the coil is energised this moves in the direction shown by the arrow. Four contact "leaves" are illustrated, the second having a similar insulated block. Note that the block X passes through a hole in leaf No. 1 and presses 2 away, open-circuiting 1-2. At the same time, the block on 2 presses 3 into contact with 4. This is shown electrically in fig. 1d, with the relay coil illustrated as will be found on many circuit diagrams.

The number of contacts and the arrangement of opening or closing may now be multiplied, and careful reference to the diagram will be necessary to identify individual switch sequences.

Circuits

An important advantage of the open and close arrangement is the "hold" device. An excellent example of this is the auto-stop. When the metal foil of the tape leader short-circuits the split, insulated tape guide, a relay is energised and the contacts on this relay cause the machine to stop running. Now, if there were no way of causing the relay to hold, removal of the tape from the guide would allow the machine to start. So a contact on the relay is used to by-pass the switching circuit, maintaining the relay in the energised condition until the current is cut off by manual switching, and the machine is ready for restarting by normal control.

A basic circuit to carry this out has been drawn (fig. 2), derived from the common *Grundig* circuit. R1 is the relay, energised by closure of the circuit from the 22.5 volt line to chassis. C is a contact on the Stop switch, G the guide and R1x the holding contact on the relay, providing a parallel circuit to the foil F. Several instances of this "hold" arrangement will be found in tape recorder relay sequences. When tracing circuits, always begin at the neutral condition, and follow the normal switching sequence step by step.

A slightly different arrangement is that of fig. 3, which is a skeleton circuit of the auto-stop, start and pressure solenoid circuit of the TK55 tape recorder. Here, the relay R is energised by the closure of the mains switch, via three switch contacts. Two contacts on the relay close: one completes the motor circuit and starts things moving, the second Ra closes and holds the relay energised. This contact also completes the energising path of the pressure solenoid P which comes into action when the Start key is pressed. So, if R de-energises, the motor stops and the pressure roller is disengaged by the pressure solenoid reverting to neutral.

Short Circuiting Contacts

When the metal foil short-circuits the guide G an alternative path to chassis via the resistor A and contact Ra by-passes the relay R, which opens. The motor and pressure solenoid become dead and R cannot be re-energised until the alternative current path is made. Now, of the three contacts mentioned above, the upper one F is opened by the pressing of the Start key, so the only other current route will be via switch contact C, which closes when the Stop button is pressed. Thus we have the paradox that pressing the Stop button restarts the motor; but as mechanical linkage has reverted the other buttons to neutral, the machine is now ready to resume operations.

One point worth noting with this arrangement is that there are a pair of short-circuiting contacts in the remote control socket in the Pressure Solenoid circuit. When tracing, these can easily be overlooked.

Auto-Stop

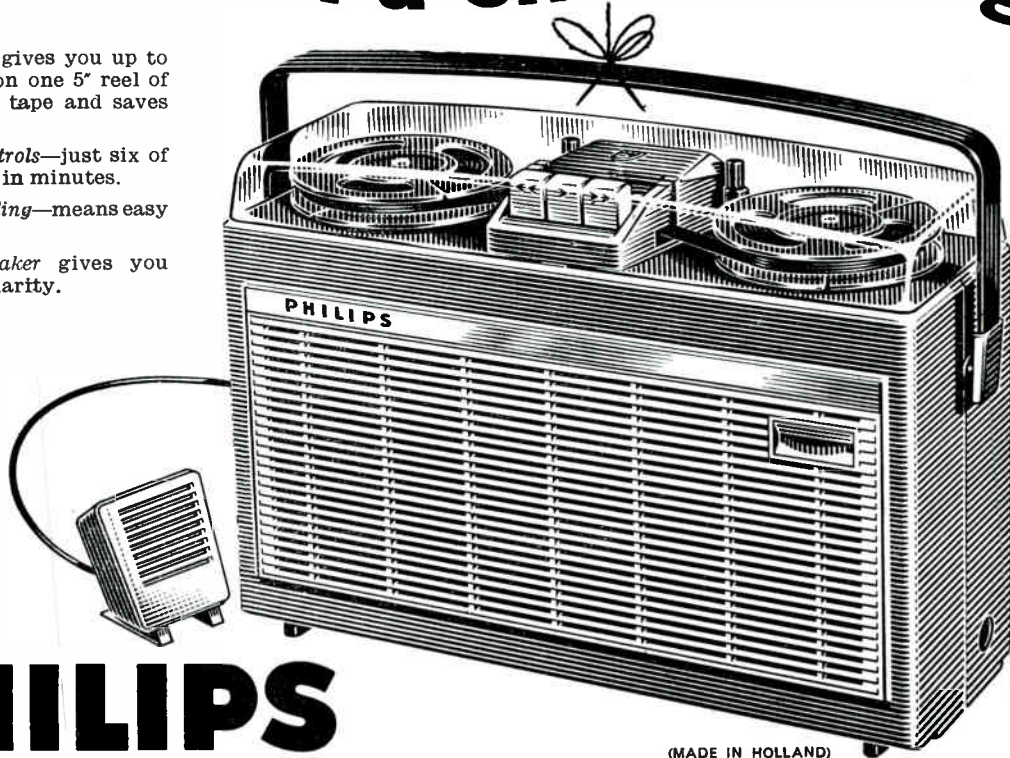
Mention of solenoids brings us to the auto-stop arrangement of the popular 4-track machine, the TK40. First, it should be mentioned that a solenoid is an electro-mechanical switch. A current flows through a coil, producing a strong magnetic field which moves a pole-piece, mechanically operating levers or cams. In this case, the solenoid is simply fed via a 68,000 ohm, 1 watt resistor. Short-circuiting the auto-stop to chassis com-

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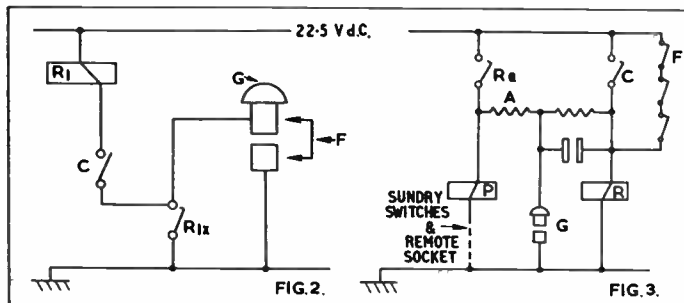
TAPE RECORDER SERVICE—(continued)

pletes the solenoid circuit and mechanically switches the machine off. An 18,000 ohm resistor and 100 microfarad electrolytic capacitor are shunted across the solenoid to provide a discharge path.

TK40 Drive and Braking System

The main drive and braking system of the TK40 is worthy of mention here. As can be seen from fig. 4, there is only one main drive belt *D*. Belts *B* and *C* are used to drive the tape position indicator, which is mounted just behind the track selection buttons. Drive is from the upper right-hand clutch.

The motor pulley *M* drives the flywheel via an idler pulley which engages the appropriate step for each speed. Belt *D*



couples the left-hand fast wind pulley *A* which engages the upper left-hand clutch for *Fast Rewind*, couples with the idler *G* which drives the lower right-hand clutch for take-up and with the right-hand fast wind pulley and the upper right-hand clutch for *Fast Forward*.

Fast Forward winding of a full 5½ in. spool of Grundig Double Play Tape (TDP8), 1,800 ft. is 3 min. 35 sec. Fast Rewind is quicker—2 min. 36 sec.

The clutches are rather different from the ones we have discussed in previous articles. Operating on the friction principle, they have an adjustable set of four discs in each upper half. Tension is altered by the position of a flat spring-steel strip in each lower half. The standard position for this strip is indicated by a paint mark on the fixing spigot, and the tension may be increased by turning the strip anti-clockwise from this position. Friction is decreased by clockwise rotation.

The purpose of this type of clutch is to reduce the tug on the tape when the machine is started. For this reason, it will be noted that speed of rotation is initially slow, but rapidly assumes required movement. This is quite in order, and not a defect of the machine.

Belt Changing

Changing the drive belt of the TK40 is not a difficult task, provided that one takes care to lift right-hand idler pulley and fast wind pulley carefully together, to remove the idler. Prior to this, it is only necessary to remove the brake arm spring and the arm itself, then the right-hand clutch idler bracket, which is fixed with two screws. The belt may then be replaced, taking care not to twist it.

Brake operating, too, differs from previous models. There are two main brakes, *X-X*, applied partially during record and playback, via the brake arm and common lever. Stop operation applies further pressure by the same brakes, and *Temporary Stop* uses a separate brake, *Y*, which impedes the left-hand clutch only. The double spring action is quite definite, but care must be taken that tension on both sides of the main bracket is even, and the slide action of the subsidiary bracket is unimpeded. A high viscosity vaseline grease is recommended for all slide rod and lever lubrication.

A further feature of this machine, and of the TK14, is the use of a pressure tape in place of the conventional pressure pad. This gives an efficient wrapping action with the minimum of head wear, and is largely self-adjusting. A spring at the

left-hand end allows for variations in tension, and the tape-to-head pressure should be uniform.

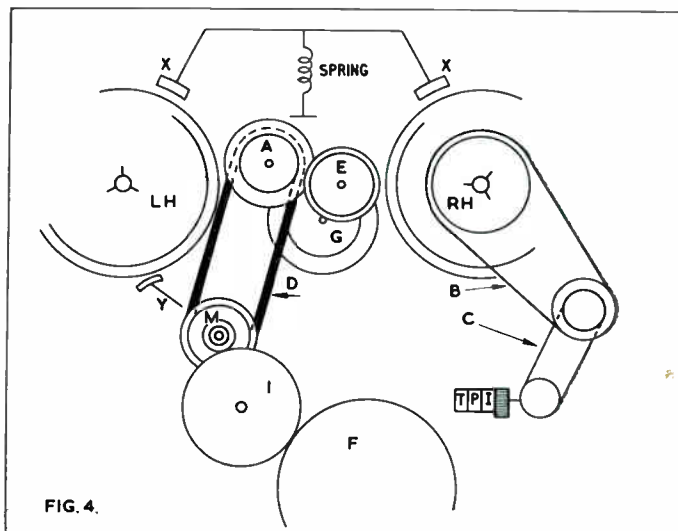
The TK40 has several refinements that may complicate servicing—including the *Cine Socket*, which permits the connection of external heads. When both track buttons are at neutral, the inbuilt heads are disconnected and signal, bias and erase currents are fed to the cine socket. The external erase head should have an impedance of 30 ohms at 75 Kc/s. Erase current is 40 mA. The external record/playback head should have an impedance of 280,000 ohms at 75 Kc/s. Bias is approximately 0.25 mA, adjustable by variable capacitor. Signal current for full recording level at 1 Kc/s is 0.03 mA, and on playback, a minimum signal of 1.8 mV at 1 Kc/s from a fully modulated recording is required.

Superimposition is obtained by simultaneous pressing of *Trick* and *Start* buttons. This is performed by normal switch operation via the *Start* button, plus disconnection of the erase head and shunting of a dummy load (470 ohms) by the *Trick* button.

Pressing both track buttons simultaneously allows tracks 1 and 3 or 2 and 4 to be replayed together. A further facility permits the monitoring of one track while the other is being recorded, with the addition of a separate head amplifier. The *Grundig Monitor Amplifier*, MA2, employing three transistors and feeding headphone output is suitable for this operation.

The obvious development from this stage is the fully stereophonic tape recorder. The TK55 has already been mentioned and, with the later, more opulent model TK60, should provide a fitting conclusion to our review of the servicing features of *Grundig* machines. Here, again, the use of relays is important; the TK55 has four relays, Auto-stop, Brake, Recording and Recording Switch, and the Pressure solenoid; the TK60 uses three relays and solenoid.

The speed change arrangements on these machines are mechanical, but with a different system again, and the drive method is worthy of study at greater length than is possible here. We shall therefore devote the next article in this series to these two machines and finish our *Grundig* study by considering a few of the more important accessories.

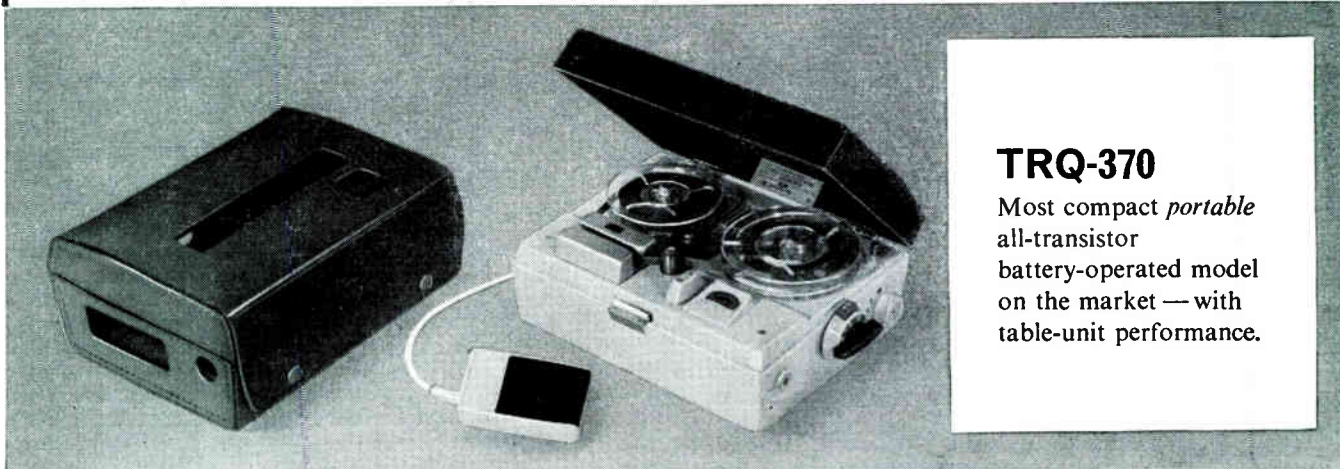


As a further note on Grundig belts, we should perhaps deal briefly with some aspects of the TK14. (It is hoped to go into greater detail on this popular machine at a later date.) At present, we are concerned mainly with the query received from some readers about the adjustment of the motor pulley and the fitting of a different belt.

It may be appropriate to observe here that the material of which belts are made has undergone some modification in latter years. The plastic of the old belts tended to stiffen with disuse, and the rubber easily perished, or went brittle. But modern plastics are likely to be longer lasting, and the rubber belts are made of a more durable and constantly elastic material—although in appearance they may be the same.

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... tape recorder workbench

No. 39. MEASURING A.C. SIGNALS

by A. Bartlett Still

ONE of the big problems besetting an enthusiastic tape recorder owner who has the desire to service or modify his machine, and who also has the necessary knowledge, is usually lack of the test equipment required. This is often available at quite reasonable cost, but may well be the alternative to another microphone, a mixer unit, several reels of tape, or some other accessory. This is, perhaps, the reason that so much equipment in the Amateur Workshop is home-built.

An item that I made for myself quite a number of years ago has proved extremely useful and reliable, the latter being most important. On the basis that "What one fool can do another can", I hope that the details will be useful to some of my more energetic readers. The unit in question represents a valve volt-

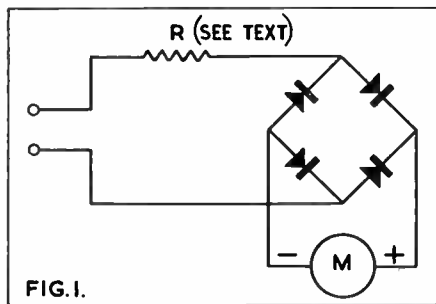


Fig. 1.

Meter Circuit

meter capable of measuring A.C. signals from 10 mV to 10 V at frequencies from 25 c/s to 100 Kc/s. Calibration is simplicity itself, and can be checked at any time. The amplifier can be used separately as a linear pre-amplifier, or for comparison purposes as it has known gain, adjustable in 10 dB steps.

The meter itself should be made up as shown in fig. 1. It needs to be 1 mA full scale or better—the one I used was 100 microamps—but the lower the current the more expensive, and fragile, the meter is likely to be. Germanium diodes are used to form a bridge rectifier. These tend to be better than the more conventional meter rectifier at the higher frequencies. The series resistor will have to be found by experiment to produce an A.C. voltmeter of 10 V F.S.D. In the case of a 1 mA movement it will be about 10 K ohm, 500 μ A. 20 K ohm, and so on.

We are assuming that the meter has an original scale of 1, 10, or 100. Should it be 5 or 50 we could calibrate to 5 V F.S.D. and alter the other ranges accordingly, as will be seen later on.

How is this calibration to be done? Any A.C. sine wave signal of appropriate value can be used, I suggest the 6.3 V heater supply from an amplifier or tape recorder. This should be connected to our meter (which should indicate a little over half scale) and to a check meter. Here, of course, is the problem. We need a meter which will give us a reasonably accurate measurement, on 50 c/s only, of our calibrating voltage. The accuracy of our finished meter, throughout all its ranges, can be no better than the check meter. However, it should not be too difficult to get the use of such a meter for long enough to obtain the right value of resistor. Perhaps I should explain that "resistor", in this context, may well mean several resistors in series or parallel. In my case the 100 K nominal resistor is actually a 100 K 1% high stability in parallel with 1 M ohm to reduce its value slightly.

Once the meter has been set to read correctly on some voltage between $\frac{1}{2}$ and full scale it can itself be used for all further checks.

The Amplifier Unit

Now let us have a look at the amplifier, which I suggest should be made up as a separate unit to increase its versatility. The first stage is a cathode follower, giving the unit an input impedance of about 10 M ohms. This very high value will ensure that the meter itself can have no effect on any voltage being measured, but will require careful screening as suggested by the dotted line in fig. 2. The Cathode load is formed by the attenuator, the most important part of the whole unit, each step introducing 10 dB reduction of gain. Here lies the principle of easy calibration—with the attenuator all in our test voltage is applied to the input, its value having been checked on the meter. The gain of the amplifier is now adjusted until a similar voltage appears at the output, exactly compensating the loss of the attenuator. If we now take all the attenuation out, full scale will be attained by a voltage 50 dB below 10 V, or a little over 30 mV. (Continued on page 388)

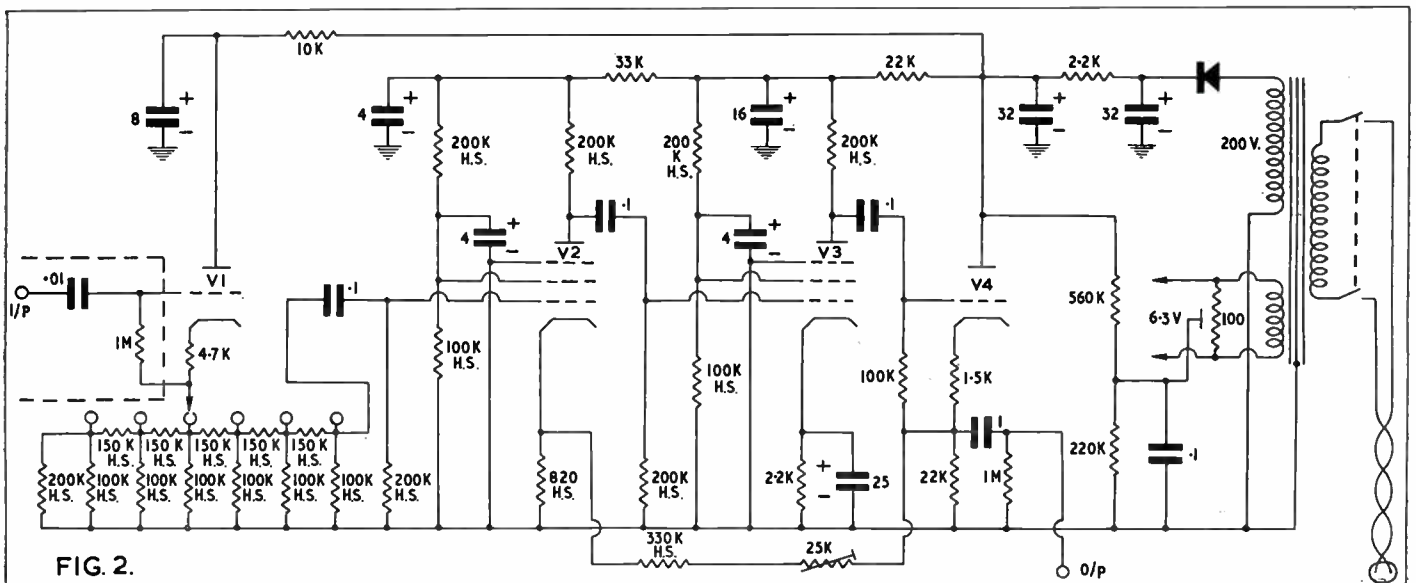


FIG. 2.

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TAPE RECORDER WORKBENCH—(continued)

We are therefore going to need a second scale on the meter—two more in fact, because a decibel scale will be almost indispensable. The exact relationship of these scales is shown in fig. 3. It will perhaps have been realised that we are relying on the attenuator to be a reasonably accurate 50 dB, but provided the components are chosen with some care, this is not too much to ask.

The two amplifier stages can perhaps be described as conventional. Feedback is applied to the cathode of the first stage, and the total gain is controlled in this way. In the interest of stability the screens of the valves are potentiometer fed, and the grid resistors are kept low to counter "Miller Effect" and improve the high frequency performance.

The use of a cathode follower output stage keeps the output impedance low, of the order of 1 K ohm, and ensures that any load impedance greater than that about 10 K will have negligible

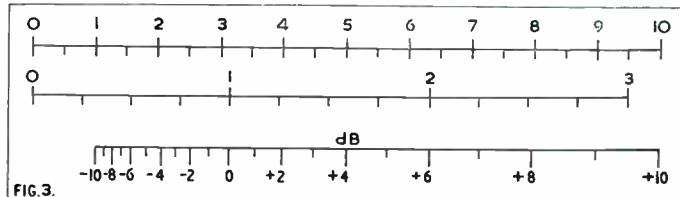


FIG. 3.

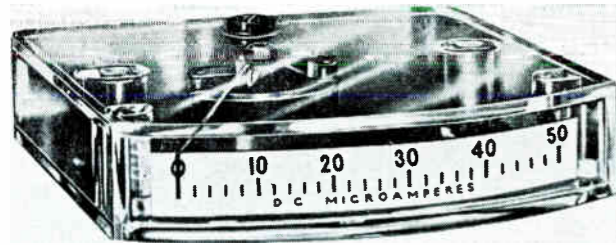
Fig. 3. Meter Scaling

effect on the output voltage. The power supplies are quite simple, the high degree of negative feedback will, in fact, keep the amplifier gain stable over wide mains variations. It will be noted that a D.C. voltage is applied to the heater supplies, via a humdinger potentiometer. This is because the cathode of the first valve is at an unusually high voltage and would, if the heaters were earthed, pick up a hum signal by virtue of emission from the heater. Ensuring that the heaters are positive with respect to the cathode keeps the hum level down to an equivalent input signal of only $5 \mu\text{V}$.

Next Month

Next month I shall give a list with details of the components to be used, and one or two are rather critical, and give some hints on construction. However, I shall not give complete, step by step, instructions, that would be contrary to my normal practice. I believe that, provided all the *essential* information is given, little is likely to go wrong and much more is learnt by the tyro.





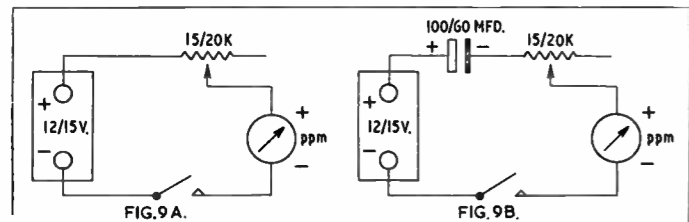
PEAK PROGRAMME METERS

PART THREE

by GRAHAM BALMAIN

BEFORE we proceed, I must deal with three queries of general interest from readers. The first raised points not covered in pt. 2 last month. His question was this: "The manufacturer I approached was a bit vague about the response time of his 'medium' meter (see pt. 1, August 1962). In any case I may decide to buy a cheaper surplus meter which seems suitable, and of course no response time is quoted for it. How do I know, in either case, when the fall time-constant of the circuit is long enough to give reasonably true readings?"

It should go without saying now that the rapid meter should be used wherever possible, as it will give the best results. However, this is a good question for those unable to do so, and it can be answered fairly simply. After the initial tests and low setting described last month, postpone the check on fall-time (which is pointless in the circumstances at this stage) and proceed with the check on rise-time. If R9 in fig. 4 has been chosen too low in value, the ppm pointer will not kick to "5" and the resistor must be increased until this deflection can be obtained. Should the value apparently needed be impracticably



large, say greater than 20 megohms, it will be better to stop at this value than to create trouble by exceeding it; provided the pointer kicks to within 1 or 2 dB of "5", results will be as good as one can expect using that kind of meter. If even this cannot be achieved, the meter is really not up to the job.

On the other hand, there is no sense in making the fall time-constant longer than necessary. If the pointer already kicks to "5", ensure that it is not by reducing R9 until the kick is just appreciably reduced, and use the next higher preferred value for R9.

To set up the circuit of fig. 1 in this way with a "medium" meter, it is necessary first to establish a setting for RV2 by making R4 temporarily very high (20 megohms or more), so that the full value of the pulse peak must be registered. Then, after adjusting RV2 so that the pulse causes a kick to "5", reduce R4 as above (for R9 in fig. 4).

Testing Meter Movements

The first reader's question also prompts me to give a warning. It is not generally advisable to buy unknown surplus meters for this job unless you have the opportunity to perform two simple tests on them. For a 1.5 mA movement, you will need a 12 V. or 15 V. dry cell (a hearing-aid type, for instance) a 15 or 20 K ohm potentiometer and a 100 or 60 mF capacitor of at least 12 V working. The cell and potentiometer should be connected in series with the meter (fig. 9a) and the potentiometer adjusted to produce 1.35 mA meter deflection. When the circuit is broken and suddenly remade, the pointer should not swing to more than full-scale—the less the better—and should not oscillate about the 1.35 mA point before settling down there. Now readjust the potentiometer for full-scale deflection and connect the capacitor into the circuit (the right way round, of course) leaving it connected for a minute or two to allow it to polarise satisfactorily (fig. 9b). Break the circuit, discharge the capacitor and then remake the circuit suddenly, whereupon the meter

pointer should kick to a point between 1.2 mA and full-scale—the higher the better—before returning to zero. Repeat the break-discharge-make cycle once or twice to get a consistent reading.

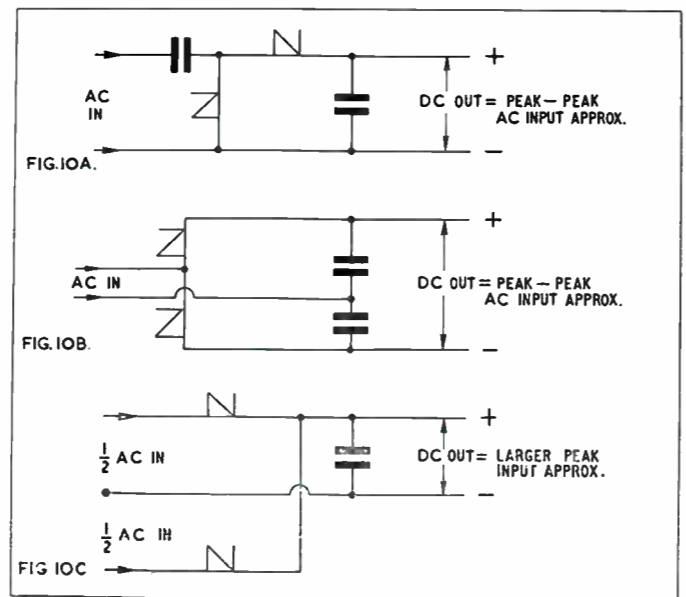
If, as is likely, you can find 1 mA movements in your shop but not 1.5 mA, these tests should be made with a resistor of twice the movement resistance connected across the meter terminals. Then perform the tests as before, but reading "0.9 mA" where 1.35 mA has been quoted for the other and "0.8" for 1.2 mA. I should in fairness add that very few "common or garden" milliammeters will pass these dynamic tests, especially shunted 1 mA movements.

Readers who are buying special instruments may be interested to test them also in this way. Treat "medium" movements as for 1.5 mA types above; they should respond well within the limits stated. For "rapid" movements, adjust the potentiometer to give a deflection to "1" then check that the overshoot does not extend over more than half of the remaining distance to the unnumbered left-hand mark (see photograph in parts 1 and 2). Now readjust to deflect to this latter mark, connect the capacitor as before and check that the pointer kicks to within a third of the same distance short of that mark. These tests can also be made—as they are by professionals—using 150 V, 100 K ohm and 10 mF capacitor, but the results on "rapid" meters will be much the same. The official specification quotes a maximum overshoot of 5% and a pulse deflection within 3% below f.s.d., which correspond roughly to the limits given just above.

Why Not Voltage Doublers?

A second reader put the other two queries. In one, he asks: "Regarding the desirability of full-wave rectification, is there any objection to using a cascade voltage-doubler? This would eliminate the phase inverter and give more voltage. . . ." (A "cascade" voltage doubler, by the way, is a type having a common input and output terminal, unlike the better-known push-pull doubler whose input and output are independent—see fig 10.)

This is an attractive and simple idea which unfortunately has two snags in our application. One is that the charging time-constants for the two $\frac{1}{2}$ -cycles cannot be made equal under practical conditions. The other is that the output of this doubler



(and indeed the other also) depends on the sum of the two $\frac{1}{2}$ -cycle voltage peaks, whereas we want an output proportional to the larger peak only. It would work so long as only symmetrical input waveforms were present, but as I pointed out in part 1 (and as the photograph at the head of "Soft For Art's Sake" in the March, 1962 *Tape Recorder* showed) programme waveforms can show differences of up to 8 dB between positive and negative peaks.

Thus it is possible to read only a "maximum" deflection derived from a signal which is in fact quietly overloading the tape by some 4 dB on alternate $\frac{1}{2}$ -cycles. To be sure, this is not as bad as a $\frac{1}{2}$ -wave rectifier which can similarly allow 8 dB overloading, but it still represents the difference between 2% and 5% distortion, or between 5% and 10% (according to where "maximum modulation" is), which is too much.

This reader's other question was, in short: "I have tried substituting silicon diodes for the thermionic type and find I cannot get the meter current/signal input voltage relationship to fit the meter scale. Why?"

The answer lies in the forward current/voltage characteristic of the diodes themselves. Silicon diodes would have to be used in this circuit because of their high back-resistance; the lower back-resistance of germanium diodes would shunt R9 and alter the fall time-constant, and not even consistently over the scale or from diode to diode. But those silicon diodes which are currently available have to be used with a higher forward current than exists in our circuits in order to reduce the effect of the curvature in the turnover region. Tapping the grid of V4 some way down R9 would achieve this by requiring a higher signal input for a given meter deflection, and the reduced sensitivity would be tolerable in most cases.

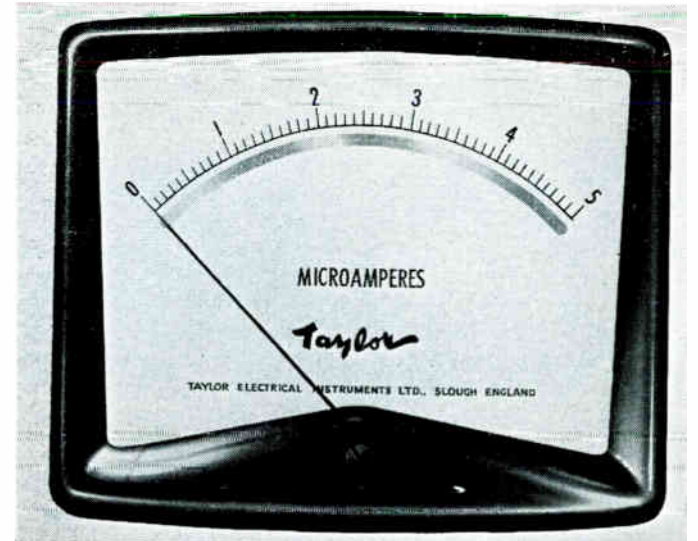
However, I prefer to use the thermionic diodes because their small standing current (see part 1) makes for a more comfortable pointer action during the fall to zero. With silicon diodes the pointer dawdles annoyingly in the "2"- "0" region, whereas otherwise it falls fairly steadily from "3" and then stops in a most satisfying way.

Connecting to the Recorder

The best place in a recorder to monitor the audio signal will usually be where the existing modulation indicator is connected, where the signal level should be more than enough to drive the ppm circuit. You will remember from part 1 that the minimum safe design input for a deflection of "7" is about 0.8 r.m.s. sinusoidal, so make sure that at least this level is available on maximum steady modulation. Do get in touch with the recorder manufacturer if you strike snags—you may be able to monitor satisfactorily at other points: a loudspeaker output, for example.

For those who build their own recorders, the best monitoring point is generally direct at the output of the recording amplifier, preceding series resistors, bias traps and so on, although the measurement should take account of all recording pre-emphasis, part of which is sometimes incorporated in the head circuit.

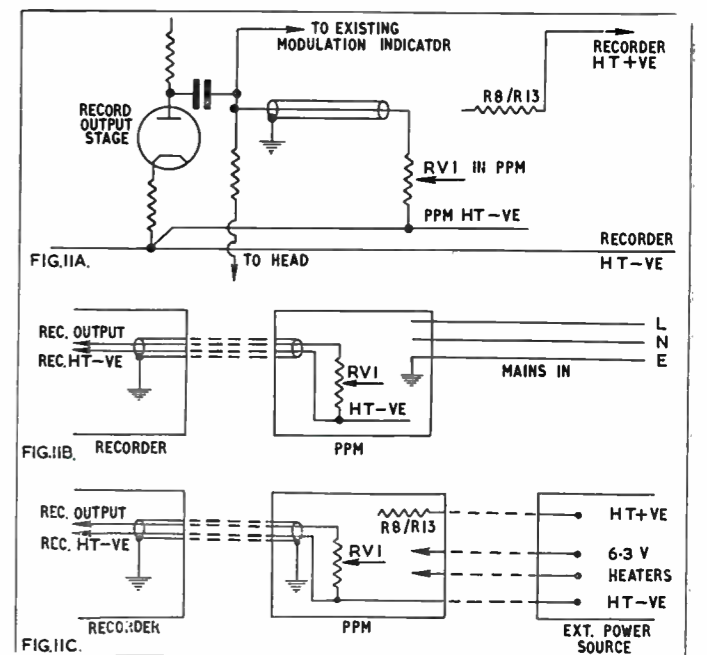
When you are arranging the signal link itself, make the connection as short as possible consistent with avoiding sensitive parts of the recorder circuitry. Use twin-core screened cable (with the screen connected only at the recorder end) if the ppm circuit is outside the recorder case as in a separate unit; single-screened (with a separate ht-ve lead and with the screen similarly connected) if it is inside the recorder and supplied by it. Here again, ask the recorder manufacturer how much capacitance can be put across the output to be used, and choose the cable accordingly. In either case the ht-ve lead should be connected to the recorder ht-ve wiring at or near the cathode of the stage



from which the meter input is taken. Whenever the meter is an external unit, leave its ht-ve wiring connected only through the links; do not connect it to the unit chassis, but do connect the latter separately to mains earth either directly or via a screen. Wiring schematics for the three most likely cases are shown in fig. 11.

Since the modulation indicator already incorporated in the recorder is presumably accurate enough on steady signal inputs, it can be used in setting the gain of the ppm. First consult the specification of the recorder under the heading "Distortion", and note whether it says "5%" or "2-3%". Feed a steady tone into the Radio input, either from an a.f. oscillator or from one side of the heater supply, and adjust the recorder gain to give full modulation on the indicator. Now adjust RV1 in the ppm circuit for a deflection of "7" if the specification says "5%" and "6" if it says "2%" or "3%". And that, at last, is that.

In use, the recorder gain will normally be adjusted so that peak levels normally deflect the ppm to between "5" and "6", but only very occasionally exceeding "6". Average levels will generally lie between "2" and "4" depending on the nature of the programme. Those who record from the BBC—and can get up early enough—will find that adjusting the recorder gain to give "4" on the tuning signal which precedes the opening of programmes will suffice for the day; barring engineering accidents, peak transmission level will not seriously exceed "6".





Every tape recorder, no matter how good, needs repairing and servicing at some time or other. For this you need a dealer who is ready and able to give a delicate machine the specialised attention it needs. Here is the solution to your problem. Study the list to see who is the nearest dealer who can help with a top line repair service for top line machines, at reasonable cost*.

Birmingham Area

REG. WARD & CO. LTD.,
229 Heath Road, Bournville, Birmingham, 30.
5 Alvechurch Road, West Heath, Birmingham, 31.
21c Alcester Road, Studley, Warwicks.
21 The Square, Alvechurch, Worcester.

Glasgow Area

CLYDE ELECTRONICS,
4 Maule Drive, Glasgow, W.1.

J. JOHNSTON & SON (ELECTRONICS) LTD.,
61 Kilbowie Road, Clydebank, Dunbartonshire.

Liverpool Area

WM. E. POTTER LTD.,
64 Dale Street, Liverpool, 2.

E. A. STEVENSON (ELECTRICAL) LTD.,

178 Oakfield Road, Liverpool, 4.
122 Widnes Road, Widnes, Lancs.
La Scala Building, High Street, Runcorn, Cheshire.

SIDON (G. F. & E. Sims),

10 Greenway Road, Higher Tranmere, Birkenhead,
Cheshire.
Electric House, Market Hall, Birkenhead, Cheshire.

London (North-West) Area

SIGNAL SERVICE (WEMBLEY) LTD.,
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454 High Road, Wembley, Middlesex.
2 Station Approach, Carpenders Park, South Oxhey,
Herts.

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worry about—Telesurance takes care of them. Ask your local Telesurance Agent for details or write to

**Telesurance Limited, 14 Windmill Street,
London, W.1. (Telephone: MUSEum 8584).**

our readers write

. . . about good service

From:—D. Herkes, 5 Hamilton Rd., Long Eaton, Nr. Nottingham.

Dear Sir:—In these days, when one encounters such an "air" of general apathy, it is refreshing to be able to write bringing to light the sound and helpful service given by a particular manufacturer.

Some two years ago I purchased a Repts R20 tape recorder. This machine has given me yeoman service both mechanically and electronically. The machine has been used on an average of *thirty hours weekly* and has not deteriorated in any way. When the very few queries that have arisen needed more technical knowledge than I have available, a letter to the makers, Messrs. Repts (Tape Recorders) Ltd., has brought, by return of post, a courteous, helpful reply, couched in layman's terms—on one occasion replacement parts "gratis". Such service gives one confidence in the manufacturer's desire to implement the guarantees of reliability (in the case of this particular maker, it is *two years*).

I say, for carefree tape recording, selecting a machine assembled with understanding skill by an all-British manufacturer who is prepared to fulfil his guarantees of "After Sales Service!"

Yours faithfully,

. . . about instruction manuals

From:—J. S. Chapple, 34 Hadham Rd., Bishop's Stortford, Herts.

Dear Sir:—I feel that my experience with a new, fairly expensive British-made tape recorder may be of assistance to some of your readers in view of remarks in the technical press about scanty details in some instruction books.

The first trial recording and playback at home was quite up to my expectations but after three days the quality of recording began to deteriorate rapidly and after using 15,000 feet of tape was quite appalling, although the playback of a commercially recorded tape was still pretty good.

I suspected the bias oscillator and telephoned the service department of the makers who most courteously enquired whether I had cleaned the tape heads after 5,000 feet. I had to admit I had not done so as the instruction book mentioned "occasional cleaning with methylated spirit" which I fondly imagined meant two or three times a year.

However I immediately cleaned the heads with a proprietary cleaning tape fluid and the trouble completely disappeared, but why, oh why, was this not clearly stated in the maker's instructions.

Yours faithfully,

. . . about bagpipes

From:—V. Gilbert, 46 Douglas Road, Tonbridge, Kent.

Dear Sir:—I wonder if there is a reader, owning bagpipes, who would be willing to help me in completing a tape for one of my films. I need about two minutes of the tune "Over the Sea to Skye", and have been unable to obtain a recording of this anywhere.

Yours faithfully,

. . . about dialects on tape

From:—M. Newsome, Flat 2, 92 Kings Road, Harrogate.

Dear Sir:—My hobby, apart from constructing and building all my own tape recording equipment, is recording and collecting country and rural dialects from all over England. Pure dialect I find is rapidly dying out, or becoming so intermingled with other alien accents, that the purer forms are practically extinct. I am anxious to collect as many of the purer examples as possible, before they are lost for all time.

I am always interested in any and all new dialects I can get on tape, whether personally recorded or not, but am particularly anxious to obtain additions to my collection from the following

counties and wonder whether anybody can offer help—Cornwall, Durham, Dorsetshire, Herefordshire, Huntingdonshire, Norfolk, Oxfordshire, Rutland, Shropshire, Somerset, Suffolk and Westmorland. My collection, so far, includes over 70 items from over 25 counties in England. Each item takes the form of local verse, legend or reading that typifies the character of the area to which the particular accent belongs.

If any recording enthusiast cares to reply to this letter, either by letter or tape offering help, I will reply by return. Any tapes sent can be copied and returned within 48 hours.

Yours sincerely,

* * *

. . . about standardisation

From:—S. Ford, 6 Scarth Road, London, S.W.13.

Dear Sir:—Referring to your editorial in the August issue regarding the problem of standardisation. May I say that I am in full agreement with your views on this subject. At the present time I possess two English recorders and one Continental machine and the trouble of connecting these recorders together is prematurely making my hair turn grey.

First of all there are three different input plugs and sockets, calling for a multitude of interconnecting leads. This is followed by such things as varying spool sizes, microphone inputs and impedances, speeds, and last, but not by any means least, the mains plug into the recorders.

Manufacturers of tape spools are also guilty of non-standardisation. Hub centre diameters vary from one 7-in. reel to another and anchoring the tape quite often presents a problem.

Therefore the sooner the manufacturers realise the urgency of this problem the better it will be for tape recorder owners throughout the world.

Yours faithfully,

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SOUND and CINE

IN last month's "Sound and Cine" I posed some questions regarding the quality reproduction of 8 mm optical sound film. These questions have been answered in part for me now, for the other day I was privileged to be present while the *Toie Talkie* 8 mm optical sound projector was being put through its paces. At the moment there are but two of these machines in this country and both of them are in the offices of the importers—Marubeni-Iida Co. Ltd.—in the City of London. The importers, however, are faced with a number of problems which will have to be solved before even a distributor is appointed and the machines are marketed.

Inadequate Supply of Films

The first problem is how to sell the projector without an adequate supply of optical films being available in this country. In Japan, of course, where the projectors are made, the *Toie Motion Picture Company*, producers of the machine, already have over 200 8 mm optical films in their catalogue and this figure is increasing every month as 8 to 10 new films are added to the titles.

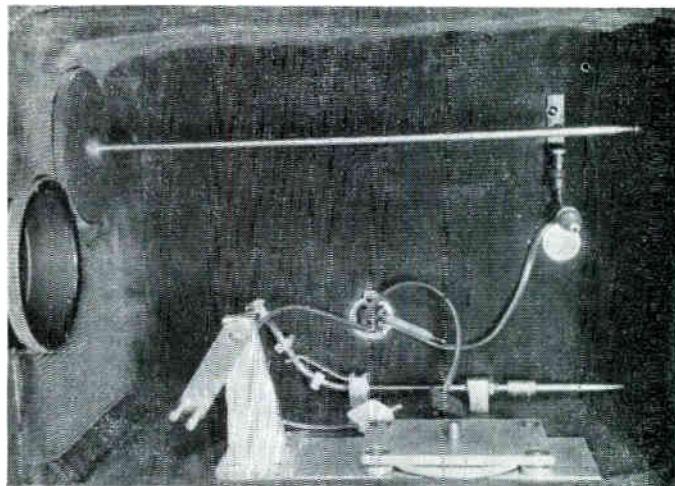
These films are quite cheap to produce and a 200 ft. reel of black-and-white 8 mm optical film sells at £3 retail in Japan—a fifth of the price of 16 mm optical. Although it is assumed by Mr. Sadao Nukina, the Marubeni representative, that the price difference between the two gauges should be relative in this country also, our laboratories have no means of trying this out. There is no 8 mm optical reduction printer available at the moment although it has been said that *Bell & Howell*, in the United States of America, are ready to supply their own printer anywhere in the world. The Japanese, too, could ship out a printer as soon as the need was felt, but the circle has to be broken first, *i.e.* the position where no laboratory will invest in expensive optical printing equipment without an outlet for the films so reduced, and where the machine cannot be marketed without an adequate supply of these films.

Marubeni have plans to beat this but are treading carefully. They propose to introduce a modification to the *Toie Talkie*, making it a mag/opt machine, selling for under £170. The theory is that the magnetic stripe record/replay facilities will sell the machine on its own merits but with the attractive addition of being able to project 8 mm optical as well once the optical films were available. If this plan is to succeed then Marubeni must act quickly for a problem of standards is involved.

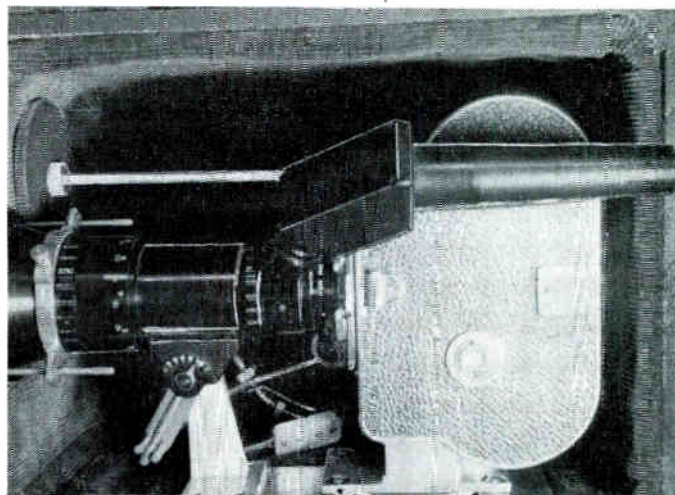
Standards

There are no specifications available at the moment but it seems extremely unlikely that the Japanese printer will conform exactly to that of the proposed *Bell & Howell* printer. If the Americans ignore the Japanese optical machine and go ahead to produce one to their own design then we may well have two types of optical film and two types of optical projector and with them, resulting confusion where playback of the non-standard film is concerned. We all know that standards are set, more or less, by the first successful machine in its particular field. Economic production, thereafter, depends on embodying technical principles compatible with this first successful machine, whether or not this machine is the most efficiently designed for the job it has to do.

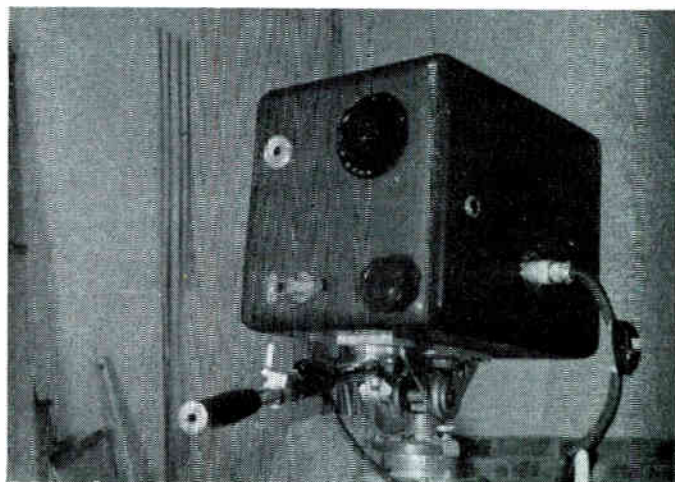
This brings me back to the actual performance of the *Toie Talkie* 8, for it is quite evident that the designers had been at great pains to produce a most efficient machine. It is very neatly styled and a smooth drive (one of my last month's queries) has been effected by the introduction of two pressure rollers before



Interior view of the blimp



Interior view showing Bolex and zoom in position



The blimp mounted on a tripod

Series 5 — an addition to the range

Those to whom tape recording is a serious business will be interested to know that September 1st will mark the release of the Series 5 Ferrograph (Model 5A/N). In appearance it follows very closely what has become known over the years as the standard Ferrograph format, but it has been designed to give — at a slightly increased cost — an improved performance in the essential features of wow and flutter and frequency response.

These advances are such that the slower speed of $3\frac{3}{4}$ i.p.s.

becomes a useful speed for musical performances, whilst $7\frac{1}{2}$ i.p.s. offers results very close to those of much more expensive professional instruments.

Thus does the Ferrograph policy of continuous research and development justify itself.

It is not intended that model 5A/N should replace the series 4 currently available.

It augments the range and provides yet again evidence of the truth of our advertising slogan of 1951 — Ferrograph, the recorder by which others are judged.



Series 4A

For conventional Monaural Recording and Playback.
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As above but in addition fitted with stereo head to permit playback of pre-recorded stereo tapes through external hi-fi amplifiers and loudspeakers.

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SOUND AND CINE — cont.

and one after the sound drum which is connected to a heavy flywheel inside the projector. The optical track placement on the 8 mm film is quite different to that which I supposed; it is only a fifth of the width of 16 mm optical and is situated on the other edge of the film—and not between the perforations and the film outer edge. The picture dimensions on the reduced film are thus smaller than with the normal silent print but varying size masks can be fitted to the projector gate to allow the showing of normal 8 mm prints.

The Most Important Factor

The sound reproduction—and this is the most important factor—was quite good, and with no obvious distortion; but in all fairness I must admit that the commentary was in Japanese and so gave no fair test of the machine's capabilities. With the mag/opt model, Marubeni are arranging for some prints with English commentaries to be sent over from Japan. The reduction prints available at the moment seem to be mainly educational with a strong scientific basis.

The whole situation is extremely interesting and we could be witnessing the start of a minor revolution in cine. Once taken up by education and industry, and with thousands of excellent sponsored films on 35 mm and 16 mm available for reduction in this country, 8 mm optical could prove a vital force in teaching, training and, of course, in advertising. We must wait and see.

16 mm Blimp for Zoom Camera

The very smart and professional-looking 16 mm zoom camera blimp in the picture was made for experimental film maker Alan Cohen, by Burgess Lane, of Chiswick, to their own specifications for a cost of just under £150. The outer casing is of cast aluminium with wooden side-panels inserted for overall lightness. The interior sound-proofing follows the normal pattern of thick absorbent materials, covered with corduroy felt. The top control wheel at the blimp rear rotates an internal shaft, turning a gear train at the front of the blimp, thus revolving the glass window and its frame. This last rotation is transmitted to the lens focus ring via two brass rods loosely fitting into two bushed holes in a clamped ring on the lens.

The bottom control wheel at the rear of the blimp rotates a flexible cable which, in turn, controls the movement of the forks holding the zoom lever. The six-point plug at the side of the blimp connects to (1) the motor switch—the battery consists of four 6 volt *Vesper* batteries in series giving 24 v.; (2) bell-push to a small window light over the footage counter window; (3) pulse contacts. Alan uses a synchropulse system for his lip-sync recordings, and his outfit consists of a modified *Ferrograph* with twin-track recording and erase, a pulse signal generator, two *Gramdecks*, two pre-amps, gain control and a high quality microphone and boom.

Used with a *Ferrograph* and *Gramdeck*

The 9 volt supply from the *Waltrack* transistorised signal generator is fed through the camera contacts, and the resulting pulse signal is fed direct to the *Ferrograph* bottom track via a cable to the auxiliary socket at the rear of the recorder. The *Gramdeck* is normally used for playback of the pulse track, or for checking purposes, and has a bottom track head fitted. With the *Gramdeck* system, of course, he has to be careful to use pre-erased tape and not to windback or playback top track without switching the generator off. In the case of the *Ferrograph*, the bias on the bottom track is supplied by the machine itself and the multi-point switch cuts the erase when winding or playing.

The once-per-frame contacts consist of an eight point commutator fitted to the 8 frames-per-turn shaft of the *Bolex*. As this is between the motor and the camera, the motor had to be spaced away on a special bracket. This modification cost Alan another £40 and was carried out by B. J. Lynes.

The microphone he favours is an A.K.G. D.19.B. cardioid mov-

ing coil of 50 ohms impedance. It works through a matching transformer to the *Ferrograph* but without a transformer to the *Gramdeck*. Microphone results are extremely good and there is hardly anything to choose from the *Ferrograph* or *Gramdeck* recording when the tone has been equalised.

Level Frequency Tests

Alan records a level frequency test at the start of each tape, keeping one tape for the portable recorder and one for the *Ferrograph*. Eventually the bottom track is used to strobe the speech on to 16 mm perforated *Cine-tape*, driven by projector sprocket shaft. The tape can be levelled at the same time but only the *Gramdeck* needs this. With the dubbing system, two *Gramdecks* can be driven vertically by sprocket wheels, using perforated tape in sync with the projector, for assembly of a synchronised speech track with a music and effects track. His mag/opt projector is then run double-headed with the cutting copy to mix both tracks on to fully coated 16 mm magnetic film.

Coupled with this sound system is an exceedingly efficient lighting set-up modelled on the *Color-Tran* method of increased light output from relatively small light units and, in his latest film which Alan screened for me, this lighting system works very well indeed.

Award Winning Film

The films he makes can be labelled as experimental, I suppose, but there is much more to them than just this tag. His films, generally, express the feeling of intense mystery and dramatic significance that he feels everywhere around him. He says that he cannot explain with mere words how non-material and how exciting he believes reality to be so his films must do it for him. His last amateur film—*Integral*—won an award at this year's Vancouver International Film Festival but he feels the urge for greater things than amateur awards. His plan at the moment, for he is limited by lack of financial support, is to make films on 16 mm Ektachrome and to have them blown up to 35 mm for specialist cinema screening. The subsequent loss in picture quality, he says, will be no disadvantage as specialist audiences are quite happy to dispense with Hollywood gloss provided that the film content is interesting and effective.

Equipment for Hire

He is quite willing to hire out some of his equipment to responsible film makers (I do receive many queries about hire of equipment and this might ease the situation somewhat) and his charges are moderate: *Bolex* 16 mm camera with zoom lens, motor and battery (silent), at £5 per day; the same with blimp, *Ferrograph*, pulse generator, microphone and boom, etc. (sound sync), at £10 per day. In each case, one week's hire charge is at the rate of three days only, i.e. £30 per week for full lip-sync. His address: Alan and Ena Cohen Art Films, The Elms, Station Road, Ashwell, Herts.

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for beginners

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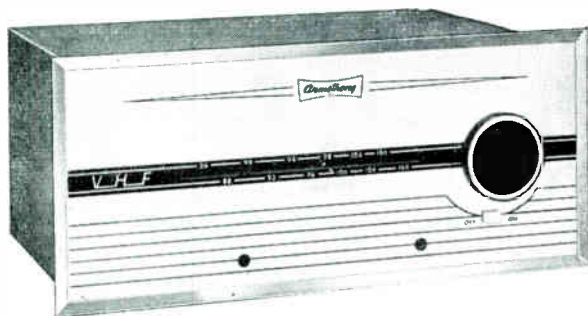
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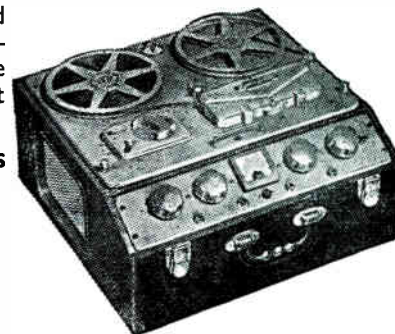
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Sony 521 Stereo	... 124 gns.
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FIRST DETAILS OF NEW PRODUCTS

● We remind our readers that notices of equipment listed and illustrated in this monthly feature are in no sense reviews. When figures, specifications and diagrams are published, these data are extractions from manufacturers' lists. When samples of this equipment are submitted for test, they are passed to our technical contributors, whose reports are published in a separate section.



★
**PHILIPS
 MODEL EL 3534
 FOUR-TRACK
 FOUR-SPEED
 STEREO
 RECORDER**
 ★

PHILIPS are releasing a new stereophonic 4-speed 4-track tape recorder, model EL 3534. This replaces the EL 3536 with a completely new design, both inside and out. Apart from full stereo record and playback facilities, many new interesting features are added, making this the most comprehensive recorder ever offered by the company.

The most interesting new feature is Multiplay—a technique which enables a recording to be transferred from one track to the other, while at the same time adding a new recording synchronous with the first. This is also the first Philips mains machine to feature all-transistor amplifiers.

The new tape speed is 15/16 i/s which enables 4 hours of mono-recording to be made on a 3-inch reel of double-play tape or 32 hours mono on a 7-inch D.P. This feature will prove particularly attractive to owners who correspond by tape letter.

Recording level is now indicated by a meter (moving coil movement). Push buttons are provided for record, pause, play, multiplay, stop, fast wind and rewind operation, rotary controls for volume, tone, microphone and radio/gram connections, and switches for track selection and speeds, with off marks between each speed indicator.

In addition to the loudspeaker in the cabinet, a separate speaker is housed in the detachable lid, to enable true stereo playback with complete control over speaker spacing. A £10 stereo moving coil microphone, a 7-inch reel of LP tape, a take-up spool and screened connecting leads are all included with the machine.

The specification supplied gives the following information: **Recording Sense:** 4-track recording, left to right. **Power Consumption:** 65 watts approx. **Transistors and Crystal Diodes:** 4 x AC107, 6 x OC75, 2 x OC44, 2 x OC74, 2 x OC 26, OC79, 2 x OA70, plus Selenium Rectifier. **Frequency Response:** 15/16 i/s 60-4,500 c/s, 1 7/8 i/s 60-10,000 c/s, 3 1/2 i/s 60-16,000 c/s, 7 1/2 i/s 60-16,000 c/s, all ± 3 dB. **Programme Indicator:** Built in with zero reset. **Maximum Reel Size Diameter:** 7 in. **Modulation Level Indicator:** Moving-Coil Meter. **Output Power:** 3 watts per channel. **Loudspeakers:** Two. One in main cabinet, one in detachable lid. **Signal to Noise Ratio:** Better than 40 dB. **Wow and Flutter:** Less than 0.6% peak to peak at 3 1/2 i/s. **Playing Time:** Maximum playing time 7-in. reel double-play tape 4 x 8 hours = 32 hours on monophonic operation. **Weight:** 35 lb. The price is £96 12s. **Manufacturers:** Philips Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

★ ★ ★ Ferrograph Announce a Series 5 Machine

The Ferrograph Company Ltd. announce the introduction of the series 5 Ferrograph model. The differences between series 5 and the series 4 (which have been on sale for nearly 3 years) are

centred mainly on the capstan and flywheel assembly, whereby the capstan motor speed has been doubled and the diameter of the capstan reduced in accordance therewith.

The effect of this change is further to improve the wow and flutter figures and frequency response. All other features of the Ferrograph remain as before with a few minor changes in the placing of controls, switches, etc.

The main reason for the change and the introduction of series 5 is that in the natural process of development it was found that the speed of 3 1/2 i/s could be extended beyond good speech and could be made useful for musical performance thus contributing to economy of tape. Consequent on the modifications to the capstan and flywheel assembly there is an increase in price so that model 5A/N is £89 5s. as compared with £85 1s. in respect of model 4A/N. **Manufacturers:** The Ferrograph Company Ltd., 84 Blackfriars Road, London, S.E.1.



★
**COSSOR
 MODEL CR 1620
 BATTERY
 TAPE
 RECORDER**
 ★

A PORTABLE battery-operated tape recorder styled to provide ease of operation while being carried, costing £26 5s., has been added to Cossor's range of recorders. The new twin track, single speed machine, model CR 1620, has operating controls and tape deck on top of the vertically-styled case with a volume control and combined recording level meter and battery level indicator on playback operation on the front of the machine.

The simple operation is by means of three push buttons with a safety interlock to prevent accidental erasure of the tape. The plastic cover over the recording heads and reels leaves spaces for the control push buttons to be operated without removing the cover.

Weighing only 8 lb. complete with the six U2-type batteries, the machine is supplied with a 3 in. reel of double-play tape and empty take-up spool giving 2 x 30 minutes' play. When the transparent plastic cover is removed 4 in. reels can be used, giving 2 x 60 minutes' playing time. The recorder is also supplied with a moving coil microphone and screened connecting lead.

One socket in the side of the machine can be used for recording from a microphone, radio receiver or gramophone. The same socket can be used also for output by connecting to another tape recorder or amplifier. The socket is inside the microphone stowage compartment and is not visible when not in use.

The turquoise polystyrene cabinet has a removable carrying handle which can be replaced by a shoulder strap. The shoulder strap, together with a carrying case, can be supplied as an optional extra. Another optional extra is a main supply unit, model EL 3766, which allows the recorder to be operated from the mains.

Manufacturers: Cossor Radio & Television Limited, 233 Tottenham Court Road, London, W.1.

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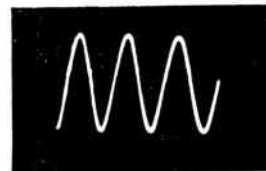
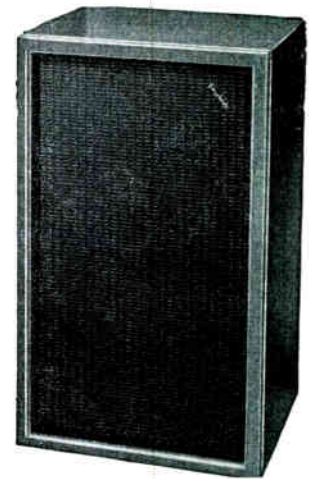
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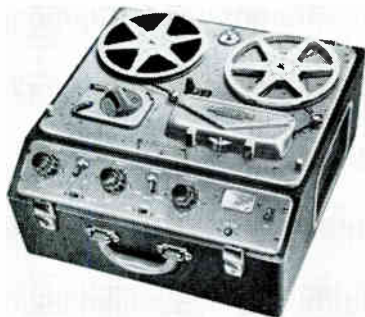
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EQUIPMENT REVIEWED

★
**FERROGRAPH
 SERIES 422
 STEREO
 RECORDER**
 ★



Manufacturer's Specification:—Recording medium: Standard or Extra Play $\frac{1}{4}$ in. plastic coated tape. Reels up to a maximum of $8\frac{1}{4}$ in. dia. (coating inside). Recorded track width: 0.83 in. (Head is 0.093 in. but overlaps tape 0.010 in.). Number of recorded tracks: 2. Playing time per track: Large reel 1,750 ft. Standard tape. 45 mins at $7\frac{1}{2}$ i/s. 90 mins at $3\frac{3}{4}$ i/s. Fast winding times: Less than one minute for 1,200 ft. standard tape (either direction). Frequency response: $7\frac{1}{2}$ i/s. 40-15,000 c/s ± 3 dB, $3\frac{3}{4}$ i/s. 50-10,000 c/s ± 3 dB. Wow and flutter: Less than 0.2% at $7\frac{1}{2}$ i/s. Erase and bias frequency: Approx. 68 Kc/s. Input levels (for full depth recording): Input 1. min signal 2 millivolts rms. Input 2. min signal 350 millivolts rms. Impedances 1 meg. and 0.5 meg. respectively. Output arrangements: Two terminal jacks (one terminal o chassis). Output each track: 1.0 volts rms max. (output impedance 5,000 ohms approx.). Signal noise ratio: 52 dB unweighted including hum. Track separation (stereo): Approx. 40 dB. Lower track rejection: On mono application, equal to, or greater than 60 dB at 400 c/s. Power consumption: 115 watts. Overall dimensions: $18\frac{1}{2} \times 17\frac{1}{2} \times 9\frac{1}{4}$ in. with lid. Weight: 48 lbs. Price £115 10s. Manufacturers: The Ferrograph Company Ltd., 84 Blackfriars Road, London, S.E.1.

THE Ferrograph recorder needs no introduction; it has a well-earned reputation for reliability and consistent performance under all kinds of conditions. The 422 is a stereo recorder with two channel recording facilities and simultaneous playback for monitoring at line level. An A-B switch allows the recorded signal to be compared with the incoming signal for critical assessment of the recorded quality.

The controls for the two channels are mounted coaxially so that they may be turned together for mixing or fading stereo signals, or they may be moved independently for balance or for separate track recording.

The speed change switch is mechanically linked to the equali-

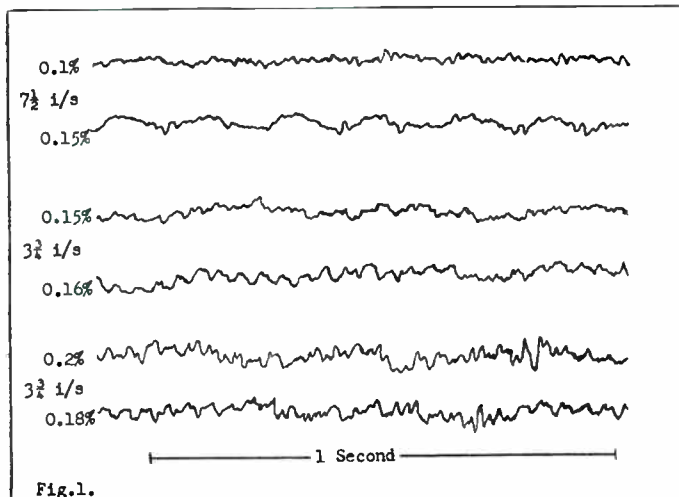


Fig.1.

sation switch on the front panel so that the starting button will not lock unless the speed and equalisation are matched. Alternative C.C.I.R. and N.A.R.T.B. playback equalisations are provided, but the recording is to N.A.R.T.B. characteristics.

Cross recording from one channel to the other is possible by interconnecting the input and output jacks by a patch cord.

Speed Wow and Flutter

Tape speeds were checked and found to be within 1% of the nominal speeds from beginning to end of the $8\frac{1}{4}$ in. reels. Wow and flutter were within the specification limit of 0.2% at $7\frac{1}{2}$ i/s with the worst reading at 0.16% r.m.s. when the five cycle capstan wow coincided on record and play; the best reading, during cancellation, was 0.1%. At the lower speed of $3\frac{3}{4}$ i/s, the combined wow and flutter remained below 0.2% with a contribution from the motor shaft at 25 c/s and a capstan wow at $2\frac{1}{2}$ c/s.

A number of readers have written to ask why several fluttergrams are shown for each speed. The answer is that a one second sample is sufficient if the wow or flutter remains constant from instant to instant: this only occurs if the speed disturbance is fairly random and at a very low amplitude. If several sources of wow or flutter are present, the various cyclical components come in and out of phase from second to second to give a variety of meter readings and an even wider variety of pen recordings. When this happens I usually select a few representative samples

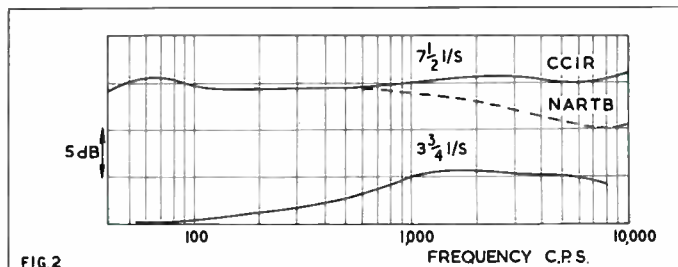


FIG.2.

Fig. 2. Replay only response 100 and 200 μ sec Test Tapes

to include in the review. Fig. 1 shows just a few of the samples obtained from this machine where 50 c/s pulsating torque from the motor, 25 c/s motor pulley eccentricity and slight capstan eccentricity are present in roughly equal proportions and combine in many different ways.

The high frequency flutters can be disregarded as the ear is insensitive to such speed fluctuations, but the $2\frac{1}{2}$ to 5 c/s capstan wow is within the ear's most sensitive range and can be clearly heard on a steady tone. Nevertheless the level on this recorder is well below that which can be detected on normal programme content.

I hope to deal with this in more detail in a future article.

Play Only Responses

Fig. 2 shows the responses obtained when playing standard 100 and 200 microsecond C.C.I.R. test tapes. The dotted curve is for the N.A.R.T.B. equalisation. The $7\frac{1}{2}$ i/s response is satisfactory for both standards, but the $3\frac{3}{4}$ i/s response has a bass fall of 5 dB at 100 c/s which indicates that the equalisation time constant should be decreased at this speed. Noise and hum was 40 dB below test tape level at either speed.

Record Replay Tests

An overload test showed that plus 13 dB on test tape level could be recorded with negligible waveform distortion at either speed and that recorded noise due to bias and erase was within 1 dB of bulk erased noise.

The overall record/play response at $7\frac{1}{2}$ i/s (N.A.R.T.B. equalisation) is shown by the top curve of fig. 3 and is obviously very

(Continued on page 401)

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EQUIPMENT REVIEWED—(continued)

satisfactory. The lower curve shows the response at $3\frac{3}{4}$ i/s, and this again shows the bass loss found in the playback tests, and confirms that the playback time constant is too high.

Signal Noise Ratio

A reading of 8 on the peak reading record level meter corresponded to a level 12 dB above test tape level, and measured hum and noise was exactly 52 dB below this signal level as demanded by the specification.

Comment

This is a well engineered and time tested tape transport mechanism combined with relatively new electronics, which feature a push pull oscillator and very elegant and simple record

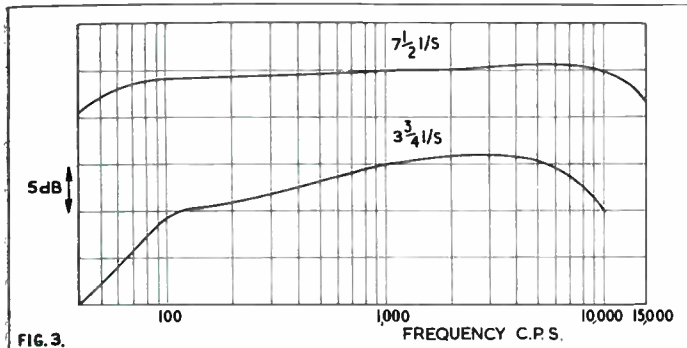


Fig. 3. Record/Play Response

and replay amplifiers using double triode valves throughout for reliability and ease of servicing. D.C. is used on the heaters of all the early stages.

The wow and flutter performance, although adequate, is not up to the highest modern standards. Like a horse's teeth it tends to give away the age of the beast! The basic design of the Ferrograph deck has not been changed in nearly ten years of production.

The slight fault in the $3\frac{3}{4}$ i/s playback equalisation can be corrected by a slight touch of an internal pre-set control—it is not known whether this is a common trouble or whether it is peculiar to this review sample.

The styling, finish, and general engineering is of course superb, and the prestige value of owning such a machine must be considered if you are in the market for a semi-professional recorder which will not be out of date in another ten years. **A. Tutchings.**

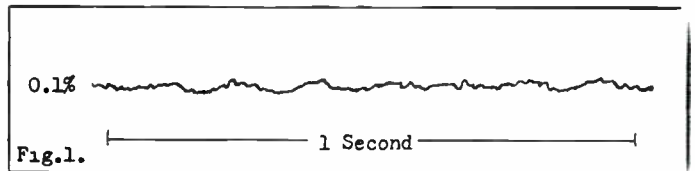


★
**GRUNDIG
TK 23
FOUR-TRACK
RECORDER**
★

Manufacturer's Specification:—Mains Voltage: A.C. only, 200-220, 220-240 volts 50 c/s. Current consumption: 55 watts max. Valves: EF86, ECC81, EL95, EM84, EF86 plus two metal rectifiers. Recording level indicator: Magic eye. Frequency response: 60 c/s to 12 Kc/s \pm 3 dB. Signal/noise ratio: 47 dB. Wow and flutter: \pm 0.2%. Tape speed: $3\frac{3}{4}$ i/s. Max. spool size: $5\frac{1}{2}$ in. Fast rewind time. Approx. 2 mins. for full spool TLP2. Running time per tape (using 1,200 ft. L.P. type TLP2): 1 hour each track. Selector keys and buttons for: Fast rewind, fast forward, start, stop, temp. stop, microphone. Controls for:

Loudspeaker and microphone level combined with on-off mains switch, and tone and radio input. **Inputs:** Microphone, 2 millivolts, 0.5 meg. Radio/gram 80 millivolts, 1 meg. **Output power:** 2.5 watts. **Dimensions:** $14\frac{1}{2}$ x $11\frac{1}{2}$ x $6\frac{1}{2}$ in. **Weight:** approx. 20 lb. **Price:** £47 5s. **Manufactured by Grundig (Gt. Britain) Ltd., 40 Newlands Park, Sydenham, London, S.E.26.**

THIS is a four-track version of the T.K.14 recorder which was reviewed in the December 1961 issue of this magazine. The controls have been rearranged slightly to provide mixing facilities



between microphone and radio or gramophone inputs, and a track selector switch added between the reels at the rear of the deck. Superimposition of one recording on another can now also be achieved by depressing and rotating the record button while playing a recorded tape.

Speed Wow and Flutter

On the T.K. 14 we had some trouble with the tape speed due to a twisted belt. A round cross-section belt is now fitted, and the speed was found to be within 1% of the nominal $3\frac{3}{4}$ i/s. Wow and flutter were extremely low at 0.1% rms. with only a slight trace of capstan wow at 7 c/s. See fig. 1. High frequency flutter is noticeably absent due presumably to the use of the Grundig pressure "sling" instead of the usual pressure pad.

Play Only Tests

The machine was loaded with a 200 microsecond test tape and the response measured at the extension loudspeaker socket.

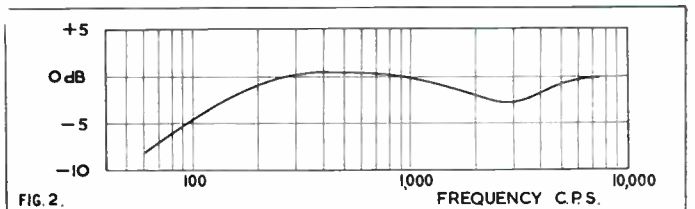


Fig. 2. Play only Response 200 μ sec Test Tape

This is shown in fig. 2. System noise and hum was 37 dB below test tape level with no tape running.

The response on the lower track was checked and found to be identical with that of the top track—but only after the head had been readjusted for azimuth—with the head position fixed there was a difference of 7 dB between the tracks at 5 Kc/s. It was noted that the head azimuth had been set to a compromise position to equalise the outputs at high frequencies. Note that this fault will only affect the playing of pre-recorded tapes or tapes recorded on other machines.

Record Play Responses

Fig. 3 shows the overall record replay responses with the tone control at either extreme. These responses were identical on the top and bottom tracks as the alignment error is cancelled by playing back with the same head and azimuth misalignment.

Overload tests showed that a level 12 dB above test tape level

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could be recorded with negligible waveform distortion and that this peak recording level was correctly shown by beams of the magic eye just meeting.

Recorded noise with the gain control at zero was only 1 dB above bulk erased tape noise; this shows that the bias waveform is pure and free of second harmonic distortion.

Signal Noise Ratio

The signal noise ratio obtained by adding the system noise of -37 dB below test tape level to the overload of 12 dB above test tape level, and subtracting the 1 dB of recorded noise, gives

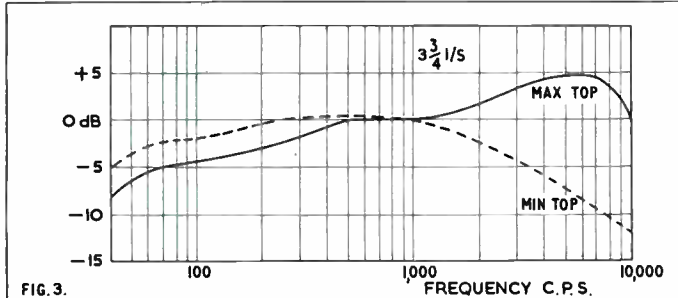


Fig. 3. Record/Play Response

48 dB. This was checked directly by recording a 500 c/s tone at peak level, as indicated by the magic eye, and then erasing on the machine. This time the ratio came out at 47 dB which exactly agrees with the specification.

Acoustic Response

Twenty one-third octave bands of filtered white noise were recorded and the sound level on replay measured on a calibrated microphone at a distance of 12 inches on the axis of the internal loudspeaker. The resultant response is given by fig. 4 for the extreme settings of the tone control. It shows the usual bass cut due to inadequate baffle area and small cabinet volume, but the high note response is smooth and level to 8 Kc/s. Distortion is low enough to encourage the use of a larger

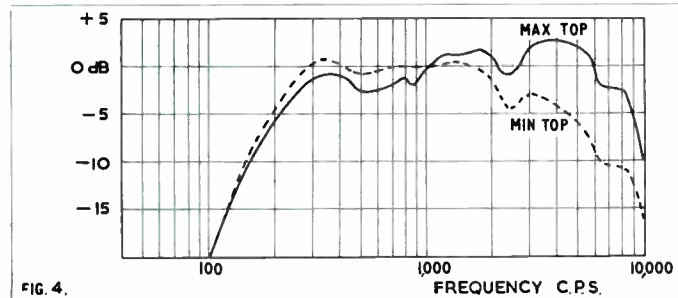


Fig. 4. Acoustic Response

external speaker, but a really wide range speaker should be fed from a hi-fi amplifier connected to the line output of the recorder, as the output stage is not quite good enough to feed such a unit directly.

Comment

Plus points for the T.K.23 are: Excellent frequency response and signal noise ratio together with very low wow and flutter. Minus points are: Azimuth difference between top and bottom tracks—as noted above this only affects the playing of tapes not recorded on this machine—and a slightly inadequate output stage for feeding a hi-fi speaker directly.

Styling and operation are up to the usual Grundig standard, which is very good indeed.

A. Tutchings



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READERS' PROBLEMS

★ Readers who encounter snags, or who run into trouble with their tape recording equipment, are invited to write to this editorial office for advice, marking the envelopes "Readers' Problems—Tape". Replies will either be sent direct by post, or published in this column if the subject is of general interest. However, we must emphasise that this advisory service cannot include requests for information about manufacturers' products when such information is obviously obtainable from the makers themselves. It is also essential to keep the queries reasonably short and to the point, and to limit them to one specific subject if at all possible. And, please, in no circumstances confuse such letters with references to other matters which may have to be dealt with by other departments in our office.

Lubricating Recorders

Dear Sir:—Regarding your articles on the Philips tape recorders in *The Tape Recorder* recently. I was hoping you would give some hints on lubricating etc. My recorder has been in use for 18 months now and I often wonder regarding grease or oil etc. Could you give me a hint re the following. I get a good wind-up on recording and playback but if I use the fast forward or rewind the tape rises about 1/16th on both spools and makes things look untidy.

Yours faithfully, W.J.W., Cardiff.

The reason I did not mention lubrication in my Service articles in *The Tape Recorder* was, quite simply, the need to get as much useful information into the space available. If you refer back to earlier articles in this series you may note that I have more than once stressed the importance of keeping lubrication to a minimum. Modern bearings have several thousands hours of useful life without the necessity of lubrication. Motor bearings, particularly, seldom need more than a drop of light oil after, say, 2,000 hours operation. As a general rule, light machine oil should be applied to rotating parts, spindles, bearings, pivots, and a light grease (graphite grease if available) to sliding surfaces. No lubricants should be applied near friction surfaces or rubber or plastic belts, wheels, or felt pads. Neither should surplus oil be "spun off" rotating parts to the harm of adjacent drive materials.

On your machine, the Philips EL3541/15B, a drop of motor oil could be applied to upper and lower motor bearings, the lower bearings of pinch wheel and pressure wheel (the one on the swivel that takes up belt tension) and the pivots of the shaft on which the keys are mounted. Light grease should be used for flywheel bearings, and renewed in the tension wheel grease container. It can also be smeared on brake levers and brackets, and the pressure assembly (top deck) at pivot points. But keep this to a minimum.

Your next point, loose spooling, is part of the price we pay for fast rewind. If you can cut down the speed by applying manual tension to the feed spool (in either direction) the 1/16th in. rise you mention should not occur. A further possibility is that of spools rising due to the centrifugal force. Check their fit on the spindles, look for worn splines, and if possible, fit some sort of makeshift hub-cap to prevent this. I would doubt the guides being out of true if playback is accurate.

* * *

Harmonics

Dear Sir:—On attempting to make a frequency test tape on my 3A/N Ferrograph I was surprised to find a descending beat note from 8 Kc/s upwards. By pre-biasing the tape and then recording

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M11

READERS PROBLEMS — (continued)

with the bias oscillator inoperative I eliminated the beat, proving that it was a product of input and bias oscillator.

The output of my Grayshaw Audio oscillator looks sinusoidal on my Heathkit 0-124 'scope, as does the bias waveform on the Ferrograph. Since the bias frequency is 56 Kc/s. I assume that harmonics of the input must produce the beat. Could you please explain how this effect is taking place? Is it normally to be expected and can it be eliminated?
Yours faithfully,
S.D.H., Leicester.

The phenomenon you observe is very common in tape recording, although—since not many recorder users deal with steady tones at all, let alone try to make their own test tapes—it is not often appreciated for its true nature. It is indeed harmonics of the input which produce the beat-tones you hear, but they are produced generally during the actual magnetic process of recording on to the coating because of the latter's non-linear response at high recording levels. This produces several harmonics of the audio signal, one of which will beat with the frequency of the bias field from the head. The beat-tone is then also recorded on the tape.

When you pre-bias the tape as you describe, the bias flux remaining in the tape is insufficient of itself to cause appreciable intermodulation products with the subsequently applied audio. (However, I doubt whether under normal conditions the tape would then retain sufficient field to ensure proper registration of the audio either.) It is also possible that the recording amplifier is distorting the input signal and that the beating is thus occurring electrically in the head circuit itself, but this is unlikely as it would undoubtedly lead to audible distortion of normal programme inputs also.

There are only two practicable remedies for this trouble. One is to reduce your audio recording level; the other to increase the frequency of the bias oscillator, which should really be at least five times the highest required audio frequency. When the trouble appears on normal programme inputs, it does so as a vague sort of twittering or shrillness in the upper registers. If it doesn't it is probably because the treble content of your input signal is fairly low compared to the rest.

Personally, I would be disinclined to assume that your pre-biasing is a satisfactory substitute for the normal process, although you do not give enough details for me to be sure of this. If you can spare the time I would be interested to hear more of this and your experiences, generally in making test tapes.

* * *

Power Supply Circuits

Dear Sir:—I have a power supply problem. I want to build a 12 V. power unit for two stereo tape head pre-amplifiers I built a few months ago. I am at present using a 9 V. dry battery but voltage fluctuations are causing output fluctuations greater than the normal output, with 8 mV. input from the tape head. This is audible as low thumping and swishing sounds. Previous attempts to build a power unit met with little success as the hum overloaded the pre-amplifier.

A general description of the pre-amplifiers—3 transistors with overall Negative Feedback for C.C.I.R. specification, gain approximately, times 15, highly successful but for power supply problems.
Yours faithfully, **D.C., Upton Park.**

Details were given of a power supply circuit suitable for the purpose you have in mind in the August 1961 issue of The Tape Recorder.

You can obtain a 9 V. supply very easily by using a 6.3 V. heater winding. This when fed into a full-wave bridge rectifier, using a large enough capacitor, should suit your particular need. I would recommend Westinghouse rectifier type 4A1019. The capacitor, which can be of about 12 or 15 V. working, merely needs to be large enough to ensure a stable voltage. A good rule for this is to allow 1½ mfd for every milliamp of load current.

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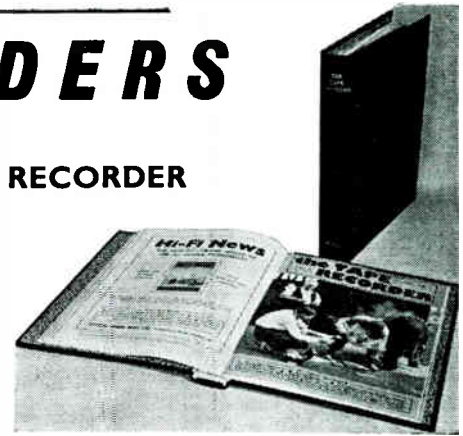
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