

TAPE

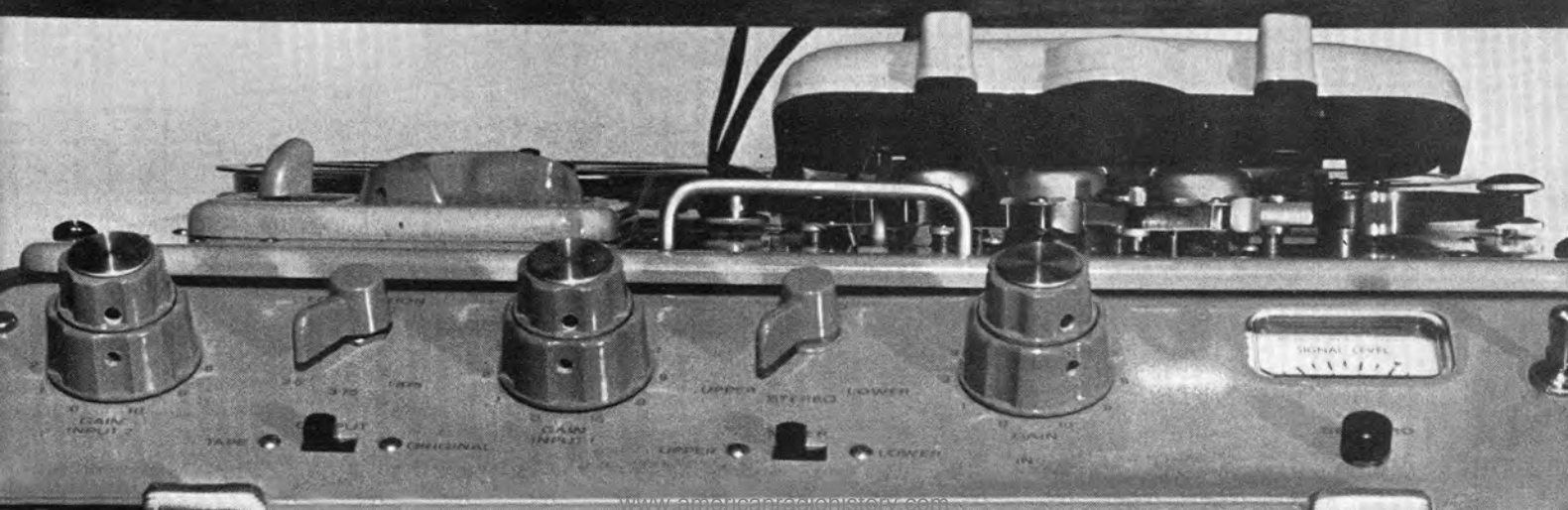
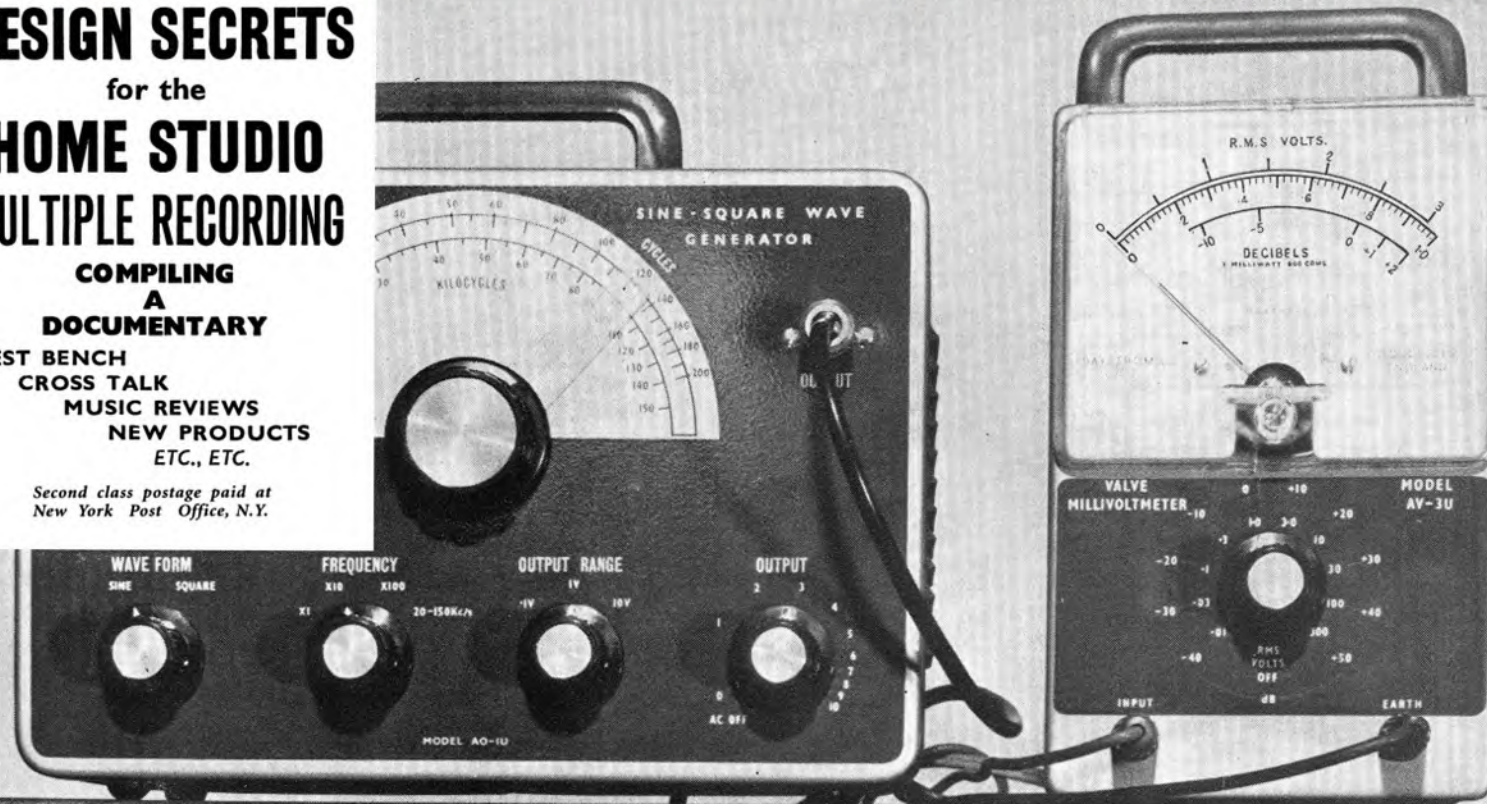
RECORDING MAGAZINE

2¹/₂

DESIGN SECRETS for the HOME STUDIO MULTIPLE RECORDING

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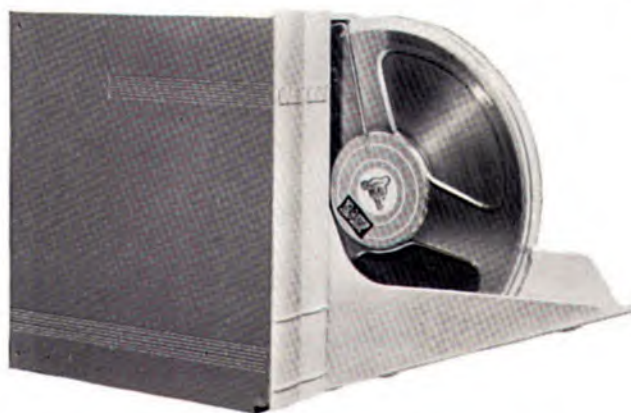
THE PERFECT TAPE LIBRARY



BASF Plastic Swivel Boxes

are available in all spool sizes from 4"-7" filled with every type of BASF Tape or are available empty with the exception of 4" Standard Play which is in a cardboard box only. This means that you can obtain BASF Tape from 450 ft. to 3600 ft. in lengths for every playing time and classify them in a separate box.

BASF Magnetic Tape is also available in the Round Pack, in spool sizes 3"-7" which means that your refills for your empty swivel compartments are less expensive and with the sealed Round Pack you are completely sure that your tape reaches you in factory fresh condition.



BASF Three-section Library

Boxes are available in 5", 5 $\frac{3}{4}$ " and 7" sizes containing one LP or DP tape and now, at a relatively low cost, without any tape. By this means you can integrate and catalogue all your tapes inexpensively.

Only BASF has all these points necessary for your perfect tape library and in addition a complete range of accessories essential for the tape enthusiast. Why not visit your local dealer today and ask him to show you the range of BASF Magnetic Tape Products.

BASF UNITED KINGDOM LIMITED

5a Gillespie Road, London, N.5. Tel: 01-226 2011



We'd like you to hear our latest number

It's the TK145. And it's quite a tape recorder

Grundig have built quality into every inch of this four-track machine. Recording level adjustment is fully automatic, by means of the unique Grundig 'Magic Ear.' This ingenious device acts with split-second precision, and retains natural loudness variations *without distortion*. And when you want it, manual operation is yours at the click of a switch!

The TK145 has a frequency response of up to 12,500 Hz, Wow and flutter below $\pm 0.2\%$, and a signal to noise ratio of 48 dB. Result? Clean, crisp, *life-size* reproduction.

What's more, you can make synchronised recordings by using the Monitoring Amplifier MA2, and the Earphones type SE3, both available as extras.



There are connecting sockets for recording/playback, monitor headphones and switchable extension loudspeaker. There's even a press-button reset for the position indicator! And—to guarantee cool operation over long periods of playing and recording, the TK145 has the exclusive Grundig single-unit combination of motor and mains transformer.

The uncrushable steel chassis is elegant in teak finish, with a charcoal and silver deck, and silver trim. The TK145 comes with 1,200 ft. of tape and a high-quality dynamic microphone . . . all that for just 47½ gns! Like to hear more? Then send off

the coupon *today* for full details of all thirteen Grundig 2 and 4 track tape recorders ranging in price from under 30 gns. to £135.9.0.

To: Grundig (G.B.) Ltd., Dept. TM2, London, S.E.26.

Please send me 'The Sound of Grundig' all-colour tape-recorder leaflet radio leaflet audio unit and stereogram leaflet *Tick which you require.*

NAME _____

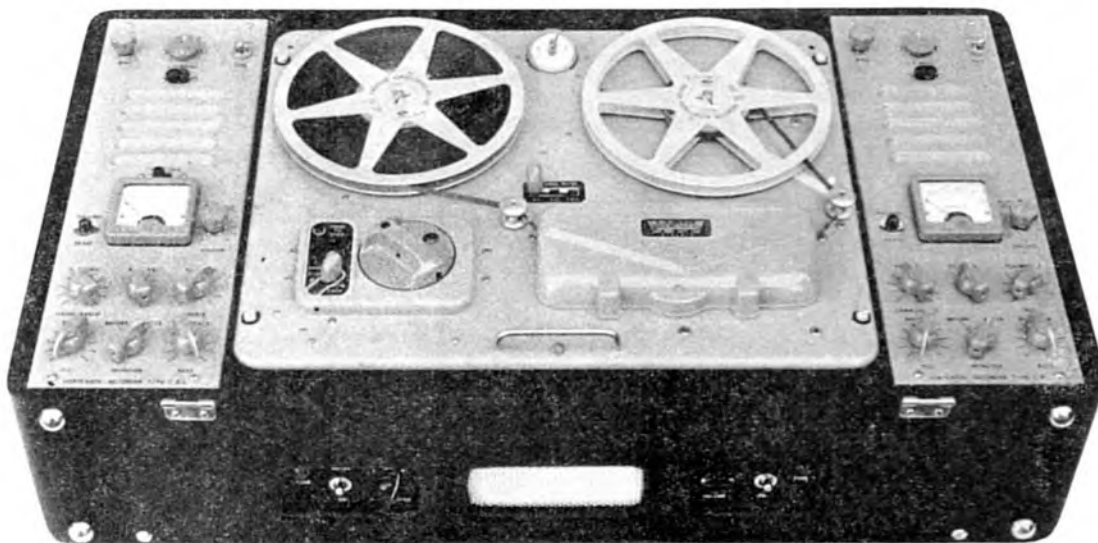
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TM2

GRUNDIG

Vortexion *quality equipment*

TYPE C.B.L. TAPE RECORDER



Here is a versatile stereophonic recorder which has no equal in its price group.

IT CAN record monaurally or stereophonically with its own mixed inputs from Gram, Radio or other sources and from high grade low impedance balanced line microphones. With good microphones, etc., the result is a suitable master for disc manufacturers. "Before and After" monitoring is provided together with adjustable metered bias for perfection.

IT CAN also make a recording on one track and then transfer it to the other track while measuring and listening to it and adding one or two more signals also metered. A special PPM type meter is now used.

IT CAN repeat the process and transfer this combined signal to the first track with one or two more signals. Composers use it for this purpose. One track may have music or commentary and the other cueing signals or commentary and either may be altered without the other.

IT CAN playback stereophonically or monaurally with its own amplifiers of $3\frac{1}{2}$ watts each.

Speeds $1\frac{7}{8}/3\frac{3}{4}/7\frac{1}{2}$ i.p.s. Price **£172 0s. 0d.**

Speeds $3\frac{3}{4}/7\frac{1}{2}/15$ i.p.s. Price **£180 0s. 0d.**

The Vortexion W.V.B. is a high quality monaural machine with "Before and After" monitoring. The recording inputs are a high sensitivity socket for moving coil or ribbon microphone and a high impedance socket for radio, etc., either of which can be selected by a switch. Superimposing and echo work can be done and the playback has reserve gain for abnormal requirements. This model cannot be converted for stereo playback, but it is a thoroughly reliable machine for the engineer specialising on monaural work.

Speeds $1\frac{7}{8}/3\frac{3}{4}/7\frac{1}{2}$ i.p.s. Price **£115 10s. 0d.**

Speeds $3\frac{3}{4}/7\frac{1}{2}/15$ i.p.s. Price **£128 0s. 0d.**

The Vortexion W.V.A. is a monaural machine which has a performance equal in sound quality to the other models. It possesses all the features of the W.V.B. except for "Before and After" monitoring, Dubbing and Echoes. The recording being made can be heard on the internal loudspeaker as in the W.V.B. and C.B.L. The controls are uncomplicated.

Speeds $1\frac{7}{8}/3\frac{3}{4}/7\frac{1}{2}$ i.p.s. Price **£96 7s. 0d.**

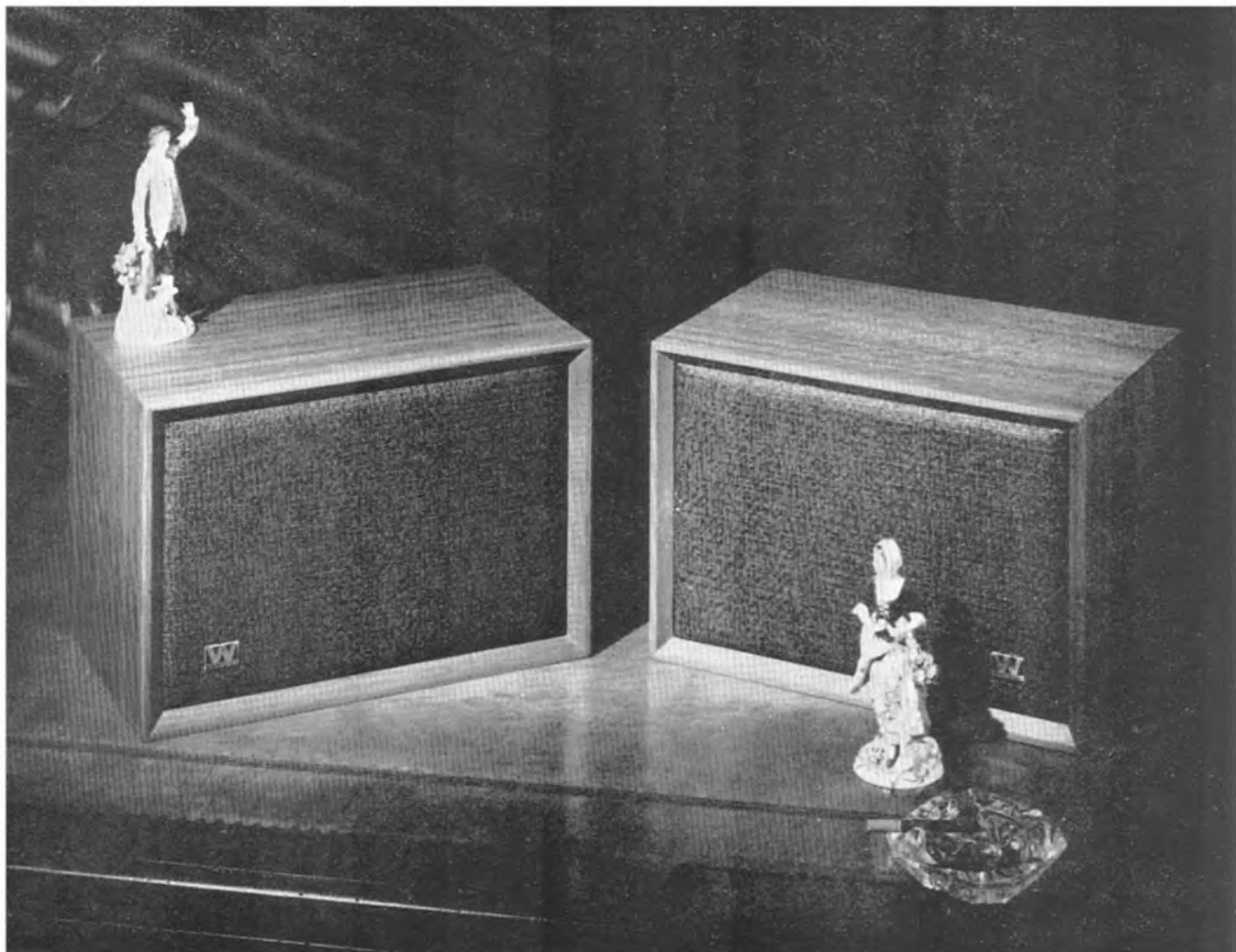
Speeds $3\frac{3}{4}/7\frac{1}{2}/15$ i.p.s. Price **£107 3s. 0d.**

All tape recorders have adjustable bias controls, low impedance mic. inputs for unlimited lengths of cable, highly accurate position indicators and meters to measure recording level and bias.

VORTEXION LIMITED, 257-263 The Broadway, Wimbledon, S.W.19

Telephone: LIBerty 2814 and 6242-3-4

Telegrams: "Vortexion London S.W.19"



High fidelity stereo starts with Wharfedale **DENTONS** at 30gns. per pair.

The new Denton speaker system brings stereo sound within the reach of everyone. Dentons are excellent operating at less than 10 watts from the existing amplifier in your record player or tape recorder. They are superb when driven by a high fidelity amplifier. Each Denton contains 2 Wharfedale speakers in a beautiful cabinet that is small enough to stand on a bookshelf or mantelpiece. Ask your dealer for a demonstration and prove its superior quality.

- The Dentons are sold in matched pairs for stereo.
- The cabinets are hand veneered and rubbed; each pair made from the same tree — perfect matching of both sound and appearance.
- Each cabinet has two speaker units with a carefully designed cross-over network.
- The dimensions are perfect for mounting on a shelf — so the Denton takes up virtually none of your precious room space.
- Size 9 $\frac{3}{4}$ " high x 14" wide x 8 $\frac{3}{4}$ " deep.
- Response: 65 Hz to 17,000 Hz.
- Finish: Oiled Teak or Polished Walnut.



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5½" 900' } Except	28/-	22/6
7" 1,200' } Agfa	35/-	28/-

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3" 210' (Not Scotch or Kodak)	9/-	7/3
3" 300' (Scotch only)	9/6	7/6
3½" 300' (Kodak only)	12/-	9/6
4" 450' (Except Kodak)	14/6	11/8
4½" 600' (BASF, Agfa only)	21/-	16/10
*5" 900'	28/-	22/6
*5½" 1,200'	35/-	28/-
*7" 1,800'	50/-	35/-
8½" 2,400' (BASF, Scotch only)	72/6	58/-
10" 3,280' (Agfa only)	85/-	68/-
10" 3,600' (BASF only)	95/-	76/-
10½" 4,200' (Agfa, BASF only)	112/-	90/-

SCOTCH DYNARANGE (L/P)	LIST PRICE	OUR PRICE
5" 900'	32/3	25/10
5½" 1,200'	40/6	32/6
7" 1,800'	57/6	46/-
8½" 2,400'	83/6	66/10

COMPACT CASSETTES	LIST PRICE	OUR PRICE
C.60	17/6	14/-
C.90	25/-	20/-
C.120	33/6	27/-

Grundig Tape available only where marked with asterisk. Postage and Packing 2/-. ORDERS OVER £3 POST FREE

FERROGRAPH TAPE—20% OFF!

Brand New. Fully guaranteed and in normal manufacturer's pack.	LIST PRICE	ONE	THREE	SIX
BN7 1,200' on 7" reel (Dynarange)	50/-	40/-	117/6	230/-
BN8 1,800' on 8½" reel (Dynarange)	71/-	57/-	168/-	330/-
BL7 1,800' on 7" reel (Dynarange)	70/-	56/-	165/-	324/-
BL8 2,400' on 8½" reel (Dynarange)	90/-	72/-	213/-	420/-

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

ILFORD TAPE NEAR HALF PRICE

A BULK PURCHASE OF PREMIUM GRADE, TOP QUALITY, POLYESTER MAGNETIC TAPE FROM ONE OF THE WORLD'S FOREMOST EXPERTS IN FILM COATING TECHNOLOGY, WITH FULL LEADER, STOP FOIL, POLYTHENE WRAPPING, AND IN ORIGINAL MANUFACTURER'S BOXES. AVAILABLE IN LONG-PLAY BASE ONLY AT THESE BARGAIN PRICES.

	One	Three	Six
900' on 5" reel	List Price 28/-	16/6	48/-
1800' on 7" reel	List Price 50/-	32/6	95/-

Please add 2/- P. & P. ORDERS OVER £3 POST FREE

SENSATIONAL NEW HALF-PRICE OFFER!

A bulk purchase of top quality Recording Tape manufactured by one of the country's leading makers. A polyester based tape with superlife black coating. Polythene wrapped boxed and fully guaranteed. Available while stocks last in one size only.

1800' on 7" reel Long Play	Normal Value	ONE	THREE	SIX
	50/-	26/-	72/-	150/-

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

AMPEX TAPE 25% OFF

BRAND NEW, FULLY GUARANTEED & IN NORMAL MANUFACTURER'S PACK '500' SERIES AUDIO TAPE (MYLAR BASE)

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

'600' SERIES PROFESSIONAL AUDIO TAPE (MYLAR BASE)

	DESCRIPTION	LIST PRICE	ONE	THREE	SIX
641-9	900' L/P 5" reel	30/6	23/-	66/6	127/6
641-18	1,800' L/P 7" reel	52/6	39/6	116/-	226/-
651-12	1,200' D/P 5" reel	46/-	34/6	101/-	197/-
651-24	2,400' D/P 7" reel	80/-	60/-	177/-	348/-

Post & Packing 2/-. Orders over £3 Post Free

N.B.—OTHER TYPES & SIZES AVAILABLE INCLUDING THE INEXPENSIVE "WHITE BOX" SERIES

SPECIAL OFFER COMPACT CASSETTES

"MC 60"



Compact Cassettes with 60 mins. playing time. Brand new and packed in normal plastic library box—available at this exceptional price.

NORMALLY 17/6 OUR PRICE 13/-

Standard pattern to fit Philips, Stella, Elizabethan, Dansette, Sanyo, etc.

3 for 38/3 6 for 75/- 12 for 144/-
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BASF TAPE—30% Reduction

A SPECIAL OFFER OF THIS FAMOUS PREMIUM GRADE TAPE Brand new, boxed, with full leader, stop foil and polythene sealed. Multiples of three 4" size can be supplied in the BASF 3 compartment plastic library cassettes at no extra cost.

Type	Description	List Price	One	Three	Six
LGS 26	600' D/P 4" reel	25/-	17/-	49/-	93/-
LGS 26	1200' D/P 5" reel	42/-	29/6	86/-	166/-
LGS 26	1800' D/P 5½" reel	55/-	38/6	112/6	219/-
LGS 26	2400' D/P 7" reel	77/6	49/6	145/6	285/-

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

TRIPLE PLAY TAPE—40% OFF!

A large purchase from TWO world renowned manufacturers enables us to make this unique half-price offer. Brand new, fully guaranteed, premium grade Polyester Base Tape with FULL LEADER and stop foil. In original maker's boxes and polythene wrapped at these EXCEPTIONALLY LOW PRICES.

	List Price	One	Three	Six
450' on 3" reel Gevasonor	22/-	14/-	40/6	78/-
600' on 3" reel Gevasonor	27/6	17/6	51/-	99/-
900' on 4" reel Gevasonor	39/-	24/6	72/-	140/-
2400' on 5½" reel Zonal	90/-	55/6	165/-	324/-

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

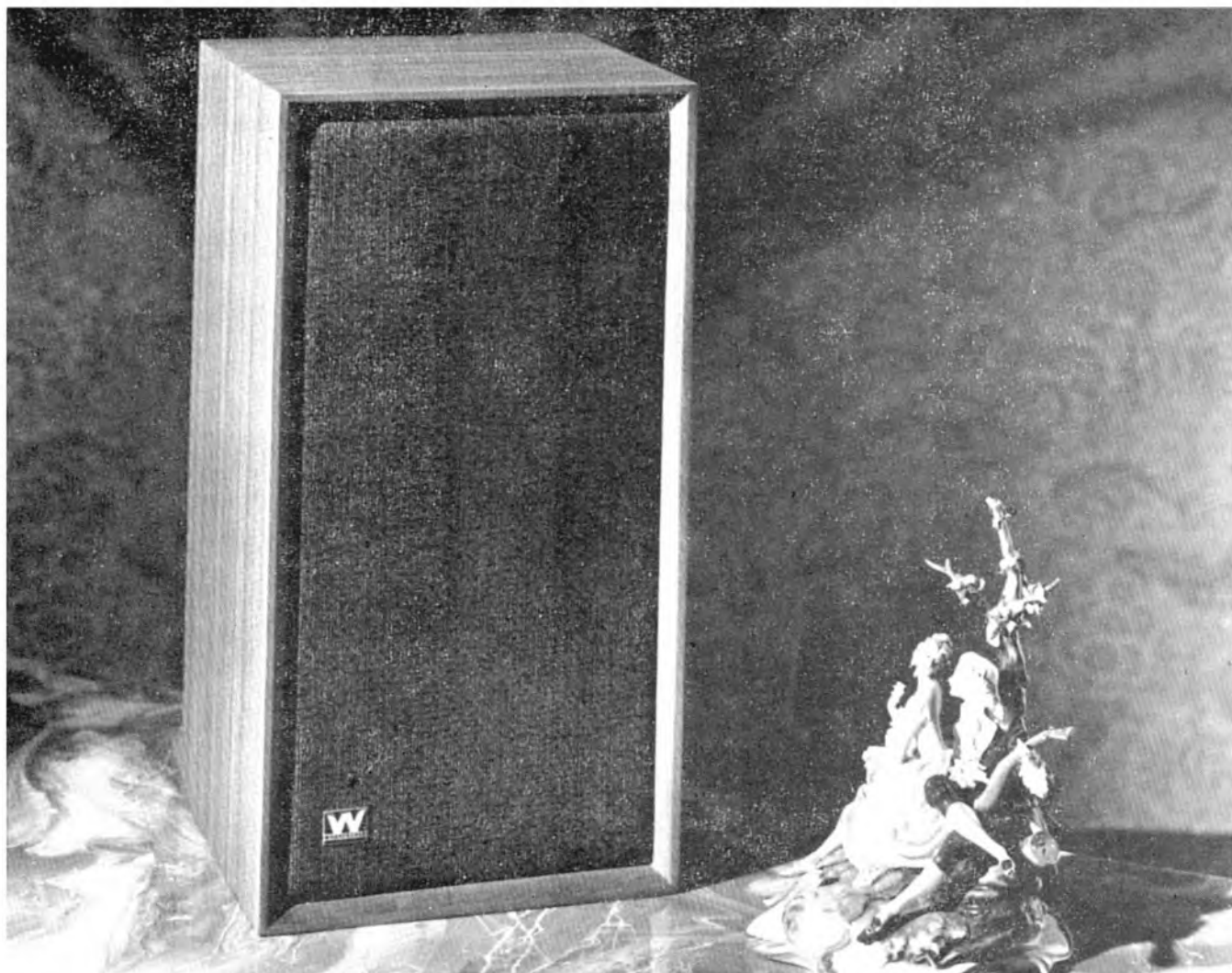
20% off all Grundig and Philips equipment.

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How can Wharfedale get so much pure sound from the **SUPER LINTON?**

Because they put so much into it.

Yet it costs only 19 gns. Compare it with any other compact high fidelity speaker costing up to £30. It sounds just as rich as it looks because it is built around a new powerful 8" bass unit linked with the Wharfedale cross-over to a new pressure unit. These speakers are mounted in a hand-laid veneered cabinet and give you a rich full blooded high fidelity sound right up to 17,000 Hz and down to 40 Hz.

You get such a lot out of the Super Linton for such a modest outlay.

- Deep full blooded bass response from the .75 cu.ft. capacity cabinet.
- Powerful 8" bass unit with a 3½ lb. 12,000 Oersted magnet.
- 8" Bass and pressure unit carefully controlled through the cross-over network.
- Smooth response throughout the whole frequency range.
- Hand-laid veneer on each cabinet, hand rubbed.
- 19 gns. (inc. Purchase Tax).
- Compare it with any speaker unit costing up to £30.



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High quality 4-speed, 4-track stereo/mono recorder featuring Crossfield head. Frequency range 30-25,000 c.p.s. at 7½ i.p.s. Vertical or horizontal operation. 4 hours stereo recording on 1,200ft. standard tape. 2 stereo fill-in speakers. Sound-on-Sound. 6 watts per channel.

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Philips

SAVE 6½ GUINEAS
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Model EL3302 Philips latest Portable Cassette Recorder

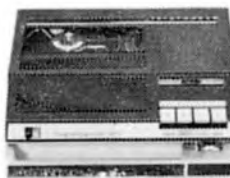
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ONLY 20½ GNS.



This new recorder from the compact Cassette range offers all the advantages of Instant Cassette Loading, with bigger, better performance than before! Wide freq. range, max. playing time 1½ hours. Interest free terms, £5.7.6 deposit and 12 monthly payments of £1.6.11. Carr. pkg. ins. 10/6.

301 Telefunken 302



These are the machines which stand up to the hard life you expect from a portable, and they're also the ones that really stand out from the rest for performance. Model 301: 5 in. spool, four track, 40-14,000 c/s, 3½ i.p.s. Sockets for radio, microphone, pickup, headphones, tape recorder and additional loudspeaker, A.C. power supply/battery charger. Operates on five flashlight cells, car battery or rechargeable storage battery. Save 6 gns. on pre-devaluation price of 54 gns. REW's price or on interest free only 48 gns. terms 12 gns. deposit and 12 monthly payments of 3 gns. Model 302: four-track, 3½ and 1½ i.p.s. Save 8 gns. on pre-devaluation price of 59 gns. REW's price only 51 gns., or on interest free terms £13.8.0 deposit and 12 monthly payments of £3.6.11.

Please note: these Telefunken machines are slightly shop-soiled but are in immaculate condition and fully guaranteed.

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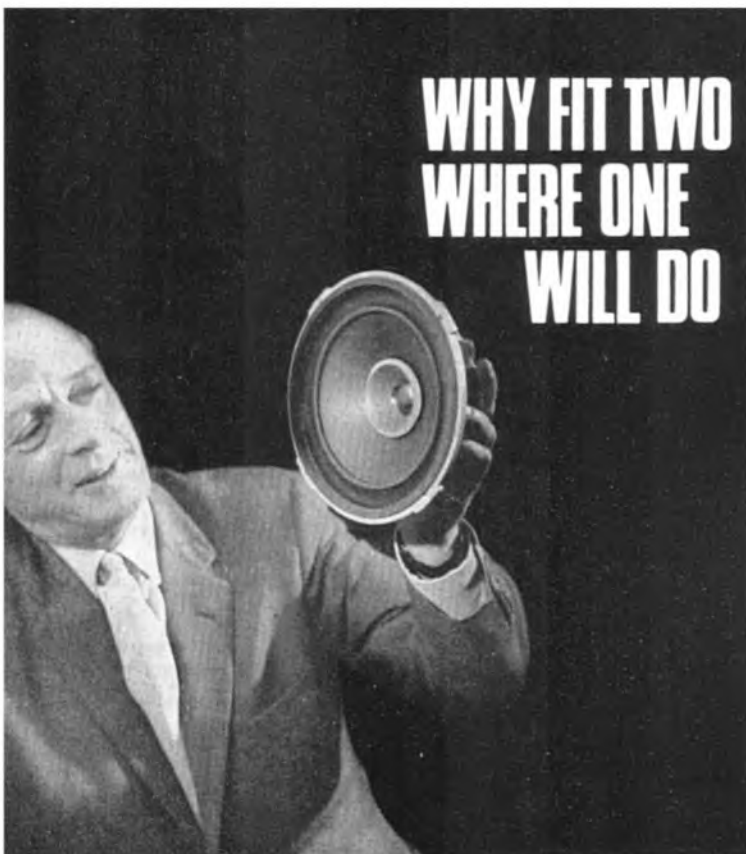
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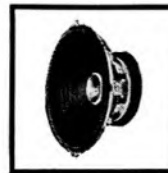
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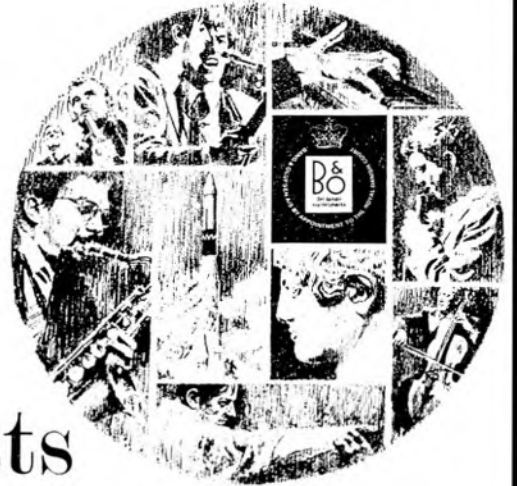


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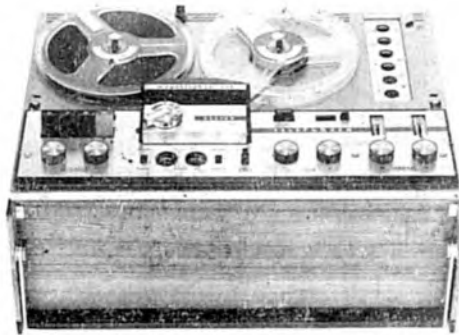
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Tandberg 74	24	8	3	6	2	1	93
Sony TC260	25	9	3	6	7	4	97
Tandberg Series 12	27	11	3	6	17	10	105
Revox 736 2- or 4-T.	31	4	9	7	16	3	119
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Akai M8	32	16	3	8	4	1	125
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Akai X355	62	14	9	15	3	9	239

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Fidelity Playmatic 4	8	2	9	2	0	9	31
Elizabethan LZ34	8	18	6	2	4	8	34
Ferguson 3218	8	18	6	2	4	8	34
Telefunken 201	8	18	6	2	4	8	34
Ferguson 3222	9	3	9	2	6	0	35
Philips EL4305	9	9	0	2	7	3	36
Grundig TK140	10	2	2	2	10	7	38½
Philips EL4306	11	0	6	2	15	2	42
Ferguson 3214	11	11	0	2	17	9	44
Truvox 44	12	6	9	3	1	9	47
Ferguson 3216	12	17	3	3	4	4	49
Tandberg 843	15	9	9	3	17	6	59
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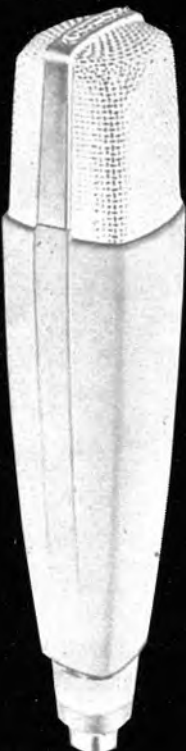
Fidelity Playtime 2...	6	11	3	1	12	10	25
Grundig TK120	7	14	11	1	18	9	29½
Philips EL3310	9	3	9	2	6	0	35
Grundig TK18L	9	3	9	2	6	0	35
Grundig TK125	10	7	6	2	11	10	39½
Truvox 42	12	6	9	3	1	9	47
Tandberg 823	14	3	6	3	10	11	54
Tandberg 92	18	2	3	4	10	7	69
Brenell Mk. V3	19	8	6	4	17	2	74
Brenell Mk. V3 (Meter)	20	14	9	5	3	9	79
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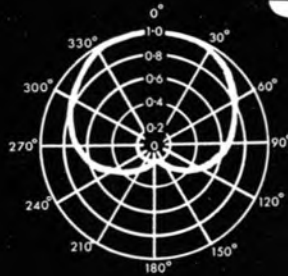
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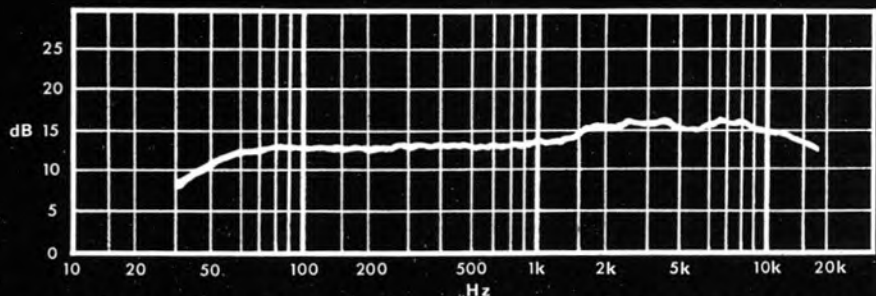


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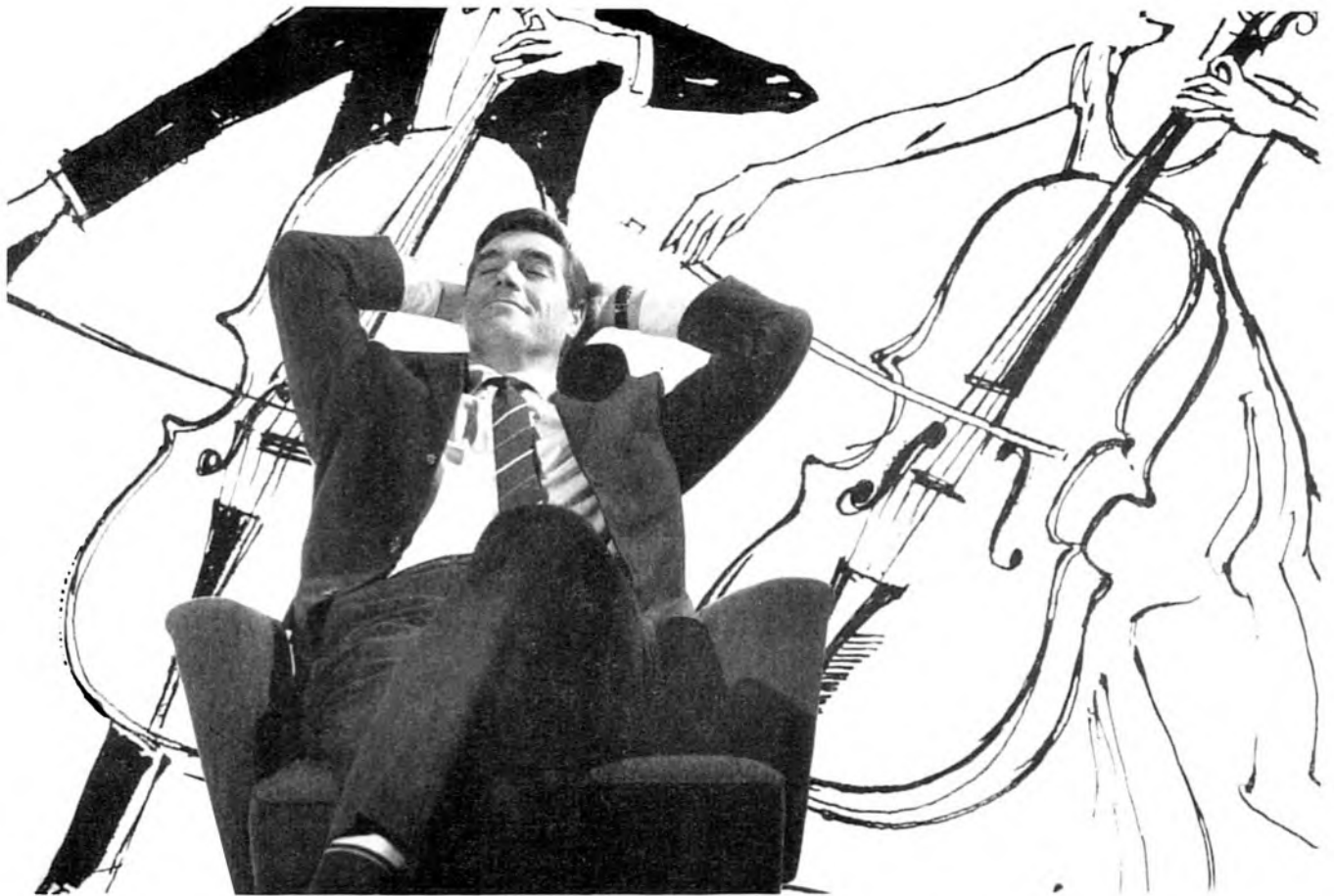
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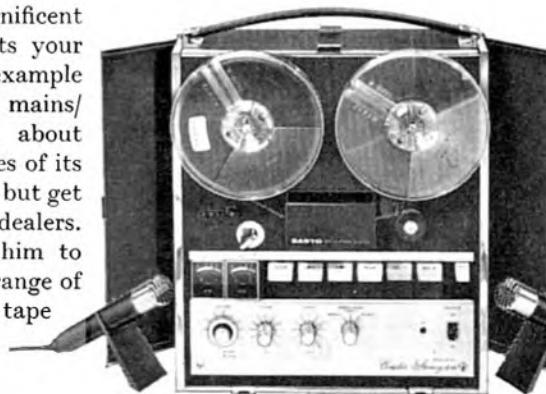


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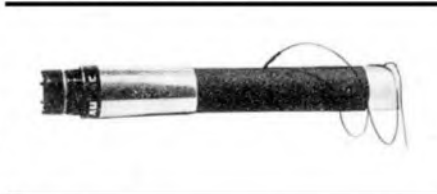
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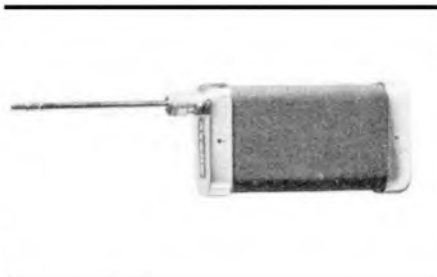
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TAPE

RECORDING
MAGAZINE

Vol. 12 No. 2 February 1968

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COVER PHOTOGRAPH: More and more amateurs are acquiring their own test equipment so that they can check performance against specification. The test gear used in our "Test Bench" Reviews is extremely expensive and sophisticated, but our cover picture shows the actual machine reviewed this month with a pair of simple but effective instruments that are proving popular amongst enthusiasts. On the left is the Heathkit Sine-Square Wave Generator and on the right the Valve Millivoltmeter, Model AV-3U, by the same manufacturer. Both appliances can be purchased either ready built or in kit form.

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DENYS G. KILLICK**

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Tape trends and tape talk

By Douglas Brown

I HAVE tended to think that the tape recorder in the classroom is mainly of use to teachers of junior and senior pupils, and that the infants are too young to be aided mechanically. I was particularly interested, therefore, to see *Child Education*, in its last issue, featuring the use of tape with the youngest classes.

The author, Keith Gardner, certainly hit the nail on the head with an introductory comment that the tape recorder's potential in teaching "has hardly been touched."

One of the secrets of success with a recorder in the infants school is, apparently, to use earphones or ear-plugs, so that children can be individually guided. This, of course, is a familiar technique in the language laboratory, but the possibilities in the wider field of education are still being explored.

My private adviser on infant teaching methods received some of the specific suggestions in the *Child Education* article sceptically; there is always a danger, of course, that the enthusiast may push his case too far. But the bigger danger is that education opportunities will be lost because too many teachers are conservative in their approach to new audio/visual aids.

Incidentally, I pass on a suggestion made by Mr. Gardner which I have not encountered, in just this form, elsewhere. If you want to make a recording at home and avoid extraneous noise and excessive reverberation, make yourself a mini-studio, he suggests. Line an ordinary tea-chest with suitable absorbent material, place the microphone inside and talk into the open end of the box. It is, of course, simply the principle of the sound-damping hoods often found around telephones in public places.

DID YOU find any novel party uses for your recorder over Christmas? For years I have had it in mind to get on to tape the boisterous banter of a friend who is the raciest raconteur I know. His greeting when we meet after an interval is a dramatic performance of high quality, but over the years I have never been able to get a microphone rigged up suitably to pick it up.

Christmas enabled me to remedy this omission. And so set me thinking about the attractions of a Visitors' Book in Sound. This was an idea I first found in BASF's "Tape Manual," from which I quote:

"The voice is just as personal as handwriting, where you can't even tell whether it was a male or female guest. The spoken greetings of your guests on tape with the pleasant atmosphere of your party will always remain a source of enjoyment at later gatherings."

Actually, I doubt whether a conscious recording session at a party, or a deliberate playback session at a later party, will produce very satisfactory results.

I go for the spontaneous expression of personality that comes when old friends meet. It does mean, of course, recording without the knowledge of the subject, which is a practice I normally deplore; but perhaps in these circumstances it is permissible to make an exception to the rule?

* * *
MY RESOLUTION for 1968? To get around the village in which I now live and to record the memories of the oldest inhabitants, who can recall a way of life which has completely disappeared. I have lived in the village for three years now and have been putting off this task because of pressure of other work. But it is the one job which cannot be too long postponed, for the material can be lost for ever by undue delay.

My discovery of 1967? That customs officers everywhere no longer show curiosity about recording equipment in the hands of tourists. I passed through customs in eight countries during last year and never was I asked a question about the portable recorder I was carrying. Even when I slipped into East Berlin the frontier men were more interested in my camera than my recorder.

* * *
THE BOROUGH of Slough, in Buckinghamshire, is organising a Slough Festival this Spring and there is a special tape recording section, with three classes, open to all comers.

If you have a recording on any subject made on equipment not exceeding a total value of £40 (not more than five minutes), or a sound snapshot, interview, interesting or historic sound, or on-the-spot report (not more than eight minutes), or a musical, live vocal or instrumental recording (not more than ten minutes), why not have a go?

Details from Slough Festival, Slough Community Centre, Farnham Road, Slough, Bucks.

Other areas, please copy!

* * *
IF I WAS a better linguist, I would have reported latest tape developments in Italy rather differently to my comments last month.

Georgio Grassi writes to tell me, most graciously, that the Italian amateurs do *not* concentrate, as I suggested, on tapes for the blind. Their main activity is in making "round robin" tapes in order to build up contact between members scattered from Sicily to the Alps, in producing sound magazines in order to stimulate interest in creative recording, and in publicising CIMES and endeavouring to form an Italian committee to organise a tape recording contest there.

"The lack of a tape recording magazine is a great handicap," says Signor Grassi of his task. How I wish I could start an Italian edition of this publication. If only I were a better linguist . . . !



The village church—an excellent starting point for a documentary

TECHNIQUES

By DENYS KILLICK

COMPILING A DOCUMENTARY

THE medium of recorded sound lends itself naturally to the production of documentary type features. In programmes requiring both vision and sound—such as television or cinema—documentary work presents formidable difficulties to the amateur. As soon as we move into the realm of pure sound the task becomes far less complex. But one must not run away with the idea that sound documentaries are easy; far from it. As much dedication to the task in hand is required whatever the medium. Final results might be so good as to constitute works of art in themselves, or alternatively they might be so bad as to be completely worthless. Success or failure depends entirely upon the perception and skill of the production team.

I have used the word “team” deliberately, because the production of a good documentary is really beyond the capabilities of any single individual. Assistance is essential—usually the more the better. I would regard the minimum requirement to be two people. These might be a couple of equally enthusiastic friends or, as in my own case, a husband and wife team.

It is convenient to divide documentaries into two classes. Firstly we have the “straight” documentary involving direct live reportage. By contrast we have the “dramatic” documentary where some of the parts are actually read by actors who purport to be representing characters in the action. This latter technique is

obviously one that must be resorted to if it is intended to include the voices of persons to whom one does not have access, either because they are no longer alive or perhaps they might live on the other side of the world. As soon as we introduce this dramatic element to the documentary we are on very dangerous ground indeed. Not only do we have to prepare a script which will accurately simulate the kind of statements that this character might have made, but this script has to be read convincingly by the person playing the part. We will have taken that short decisive step which effectively separates actuality from drama, and if we are not very careful we shall find ourselves producing a glorified play instead of a documentary.

So I am going to recommend the straight documentary where voices heard are the actual voices of the characters represented. Acceptance of this principle is of the greatest importance because so many amateurs attempt to work on documentary features but completely ignore what I regard to be one of the cardinal precepts of such an enterprise. Surely the purpose of documentary is to convey to the listener an impression, or information, of a particular slice of life. When we talk about life we mean *people*, and the life of any place—town, village or city—is expressed only through the lives of its inhabitants.

An obvious and convenient subject for a documentary might be “My Village” (or town or city). I have heard so-called

documentaries on this theme where the producers merely offered a guided tour of buildings and monuments. This is *not* a documentary. The official guide at places of public interest has always been a figure of fun. As he conducts his party of tourists around he mouths an endless stream of dates and facts about the building or whatever it is he is showing the visitors. Even when one can see the fabric of the structure he is referring to such a talk is usually pretty dull and boring. When translated directly into sound it becomes utterly meaningless.

Let us suppose we are producing a documentary about a village. In this country the word village immediately indicates three very important focal points: The church, the pub and the school. Take the church as an example. Much of the work involved is research—a job which can be quite exciting because one never knows what odd or surprising facts one might turn up. So we will read all we can about our church finding out when it was built, what alterations if any have been undertaken and the name of the present vicar and other officers. Very often all this information is available on a single pamphlet available to visitors within the church itself. The temptation to merely read this information and to regard it as having dealt adequately with the church is the trap into which too many people fall. If we do this our documentary is utterly lifeless.

Continued on page 66

Experiment for yourself by following expert advice on

THE FINE ART OF MULTI-TRACK

By an anonymous contributor

NOT knowing the kind of equipment that readers of this series of articles may be using makes it a little difficult to prescribe a given formula for multi-music recording. I will, therefore, supply details of basic methods, as well as various ideas which should be adaptable to a variety of recording systems.

Initially the best plan is to experiment as much as possible. Find out which method is most suited to one's own equipment, and exploit its flexibility. Once a *modus operandi* has been established the production of multi-track music recording becomes both more simple and interesting; one can soon acquire a style of musical presentation that actually originates from the techniques employed. For instance, recordings by the American guitarist, Les Paul, are distinctive because of his combination of playing style and personal recording techniques.

Those who have little or no musical ability will be wondering how they can best experiment in multi-track. If you can't play a musical instrument a gramophone record of the appropriate music might enable you to sing a vocal and even build up the recording to a double vocal providing reasonable quality can be maintained through two or three dubbings. Remember the record will be copied twice over. One vocal plus the music can be accomplished by a mono-only tape recorder without an extra replay head, but of course it must have provision for mixing the signals from the record-player and from the microphone. (Fig. 1.) For double vocals a recorder with track-to-track facilities, or two tape recorders, are necessary and here one can embark on real multi-track musical work.

Most of the techniques I will be covering can be applied equally well to either single recorders with track to track facilities or to recording from one tape recorder to another. First, then, some general principles and examples of multi-music making. It follows that the order in which the various parts are recorded all depend largely on the musical instru-

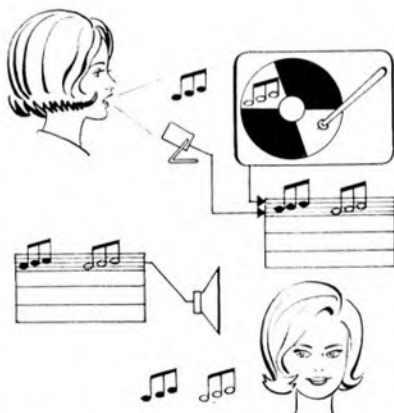


Fig. 1. Simple multi-tracking in diagrammatic form, showing the combination of signals from a voice and a disc giving composite playback

ment concerned and on the music itself. When more than one kind of instrument is to be played the order in which they are recorded also needs very careful thought. When re-recording some distortion is inevitable, and this should be confined as much as possible to parts which are of secondary importance and therefore usually at lower signal level. These might be drum rhythm, chord accompaniment, bass part and counterpoint, etc.

The predominate melody parts are almost always recorded last, in the final one or two recordings. As an example let's take a fourpart recording using a piano and an acoustic (non-electric) guitar. To begin with a microphone has to be used and monitoring must be carried out via headphones to prevent acoustic pick-up of the completed recording and acoustic feedback (howling between microphone and loudspeakers).

Let us now assume the following musical arrangement—guitar chord accompaniment, bass part (from low register guitar strings), piano (taking first chorus), guitar (taking the introduction and second chorus). Now the basic accompaniment of chords and bass will go

through the whole of the music, in this case a fourbar introduction and two choruses. As these parts are the "background" to the melody they should appear on the final tracks at an appropriate level which will be lower than that for the melody. Try to imagine that you are recording these parts all at once as a group of instrumentalists would play them—and consider how they would be balanced one against the other in terms of loudness. Balance of this nature is just as important in multi-track but has to be done with the volume control, not by arranging the instrumentalists relative to the microphone. And yet, in order to preserve quality of reproduction and keep tape and amplifier noise to a minimum, it is essential to make all primary recordings at full level.

So first the guitar chord accompaniment will be recorded at full recording level. The bass part is next recorded, again at full level. The chord accompaniment level will be re-recorded at 3 to 4 dB below maximum so as to strike a balance between itself and the bass part. When these two parts have been completed the recording should be played over a loudspeaker to assess the balance. If the recording can be reproduced "life size" the next part could be rehearsed with it if so desired. Part three, in this case the guitar solo, can be recorded at full level but with the level of the accompaniment recording balanced accordingly. Finally the piano solo part is recorded. The reason for doing this last is because the tonal quality of the piano would suffer more than that of the guitar had it been twice recorded. Just one final comment which applies to all multi-recordings when a microphone is used. Try to keep room echo and unwanted noises to a minimum by using the microphone close up to the instrument or voice. Remember that the natural reverberation of the room in which the microphone is placed will appear on every recording and could emerge as a confused background on the final tape.

Experiment for yourself by following expert advice on

THE FINE ART OF MULTI-TRACK

Most of the multi-track records which one hears on the radio are of popular tunes played by virtuoso instrumentalists like Wout Steenhuis and Les Paul, and there are also multi-track productions in which several instrumentalists are employed, such as those by Tommy Garrett. The electric guitar and the electric organ lend themselves more than any other musical instrument to multiple recording since their electrical output can be coupled directly to the tape recorder. This does away with the attendant losses of the microphone as well as unwanted acoustic effects and those odd sounds which always seem to get through unless one is blessed with a soundproofed studio. My own multi-tracking activity is concerned mainly with the electric guitar and electronic organ so that most of the musical examples which follow in this and further articles will apply to these instruments. There is no reason why the actual recording techniques and electronic treatments of sound with which I will be dealing should not apply to other musical instruments. I can't imagine for instance what a multi-track trombone recording would sound like, but then there's no accounting for the aesthetic tastes prevalent in the contemporary "let's be different" way of life, particularly in music.

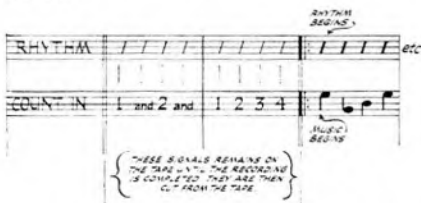


Fig. 2. The "count-in" is essential in multi-tracking techniques. Here we see the relationship between the counting and the start of the music

"One man band" recordings, with electric guitar and/or organ, can sound very pleasing, and like some of those by Wout Steenhuis, seem almost as though they had been played by a group of musicians. To achieve this effect is not

technically difficult but does require most careful attention to musical arrangement and timing. It is difficult, if not impossible, to produce tasteful multi-track music by haphazard arrangements "played by ear" or made up as you go along. Those who do "play by ear" will soon discover how essential precision timing is in multi-track music. Coming in half a beat too soon, or too late, will throw the whole thing out completely.

This leads now to background rhythm, such as percussion, and to "starting" or "counting in" signals that enable the instrumentalist to start playing exactly on the first beat. For those who would like a good rhythm foundation there are now available various records of drum rhythms complete with count-in signals, usually tapped on a wood block. If no rhythm of this kind is used the count-in could be done by voice, but this means using a microphone which might have to remain live unless someone can turn it off after the count. Alternatively the counting can be done by playing the requisite number of single notes to mark the time. Without a count-in signal it is practically impossible to come in on the first beat of the music. When the whole recording is finished the count-in is simply cut from the tape. Fig. 2 illustrates the relationship between the count-in signal and the beginning of the music.

At least three records of popular drum rhythms are now available and can be obtained from Ad-Rhythm Records, Broadwalk, Pinner Road, North Harrow, Middlesex. These are 45 rpm EP discs, each containing four rhythm tracks as follows:—

A.R.1. *Dance Time*. Quickstep, Fox-trot, Waltz and Cha Cha.

A.R.2. *Latin American*. Bossa Nova, Samba, Rhumba and Tango.

A.R.3. *Pop Time*. Twist, Slow Ballad, Rock-a-Latin and Two Beat.

Each rhythm runs for two standard 32-bar choruses, a total of 64 bars with a preceding count-in signal. The quality of reproduction is excellent and will stand

up to further copying on to tape. I have verified with Ad-Rhythm that there is no copyright problem so long as the sound tracks are used for private purposes only.

Next month I will explain how rhythm tracks from such records can be extended to cover more than the 32+32 bars to provide, say, a four-bar intro, two 32-bar choruses and a two- or four-bar ending. The possibilities of rhythm from taped sounds such as rhythm loops will also be dealt with.

add
rhythm

to your
own
melody

volume 2
latin american

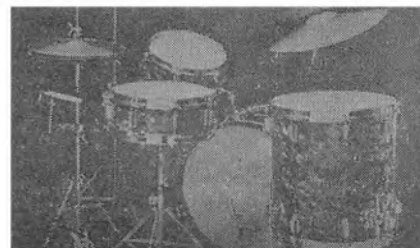


Fig. 3. The sleeve of the second record in the series recommended for adding rhythm by multi-tracking. These discs are published by Ad-Rhythm Records, The Broadwalk, North Harrow, Middlesex

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TECHNIQUES

Continued from page 63

Having carried out our basic research we must now concentrate exclusively on *the people*. We shall visit the vicar, the organist, the choirmaster, the verger—yes even the grave-digger. We shall record what they have to tell us about the church and we shall conduct our interviews in such a way as to attempt to draw out from them the basic historical information revealed by our research. If renovations had been carried out within the last ten or twenty years we could even go and see the contractor employed and perhaps even talk to craftsmen who were on the job. They will be able to comment expertly on the stonework and woodwork and will be able to relate time past to time present.

We can look around the churchyard at the names on the gravestones. One will certainly find at least a few names constantly reappearing. These will be local families who have lived in the parish for generations. Are any members of these families still resident? If so we must go and see them. Perhaps people with important village connections have moved far away to the other side of the country. If possible we should go to see them as well. We shall look for elderly inhabitants so that we can take advantage of their memories of the turn of the century or perhaps even earlier. We shall look for children so that through their eyes we can get a youthful impression of the contemporary scene. Does the church have a bell tower? If so, who rings the bell? We must both talk to him and record his bells.

So our investigations proceed. Gradually, piece by piece, like a fascinating jigsaw puzzle the church is being represented in our documentary as a living institution, not as a piece of dead history.

No two documentaries are alike and so it is impossible to lay down hard and fast rules. In the initial stages the production team will be concerned solely with research and recording. Gradually a great mass of material will be assembled on tape. The more we accumulate the greater freedom of choice we shall have in assembling our finished programme but the greater will be the complexity of the job.

You will note that I have as yet said nothing about preparing a "shooting script." There is a very good reason for this. Unless the production team has a basic and thorough knowledge of the subject to be undertaken then this knowledge will have to be acquired by the kind of painstaking research I have already referred to. Now until this research is done it is impossible to even visualise what the final programme will be like. Similarly, when we once start interview-

ing we may uncover all kinds of interesting facts which are important enough to warrant development into our programme. The professional approach is to spend a great deal of time talking to people as part of the research endeavour without recording. By so doing all relevant facts are uncovered and the producer can sketch out the framework of his programme on paper before an inch of tape is used. As a rule the amateur is in a rather different position. He has not the time available to go about the job in this way. Many of his interviews will be the result of a single visit which cannot be repeated later. Working in this way one deals with actual recordings which have to be edited and fitted into the programme structure rather than deciding on a programme structure and then taking recordings to suit. It's a case of which comes first, the chicken or the egg.

We have already dealt with the principles of editing and we referred last month to movement as one of the basic concepts evaluation. Movement in that sense meant actual movement of characters within the context of an action. We can now give movement another meaning—the movement or pace of a programme through its duration in time from the beginning to the end.

A fast-moving programme is said to have pace, or to be racy. The listener is moved from scene to scene, from episode to episode, without any single item being laboured or long drawn-out. Research has established that the mind of the general listener moves very much more quickly today than it did in the past. The time it takes for the listener to absorb any given point has become progressively shorter and shorter and now stands at around ten or fifteen seconds. If we stay on one point or one subject (or one detail of one subject) for more than about fifteen or twenty seconds we are in grave danger of creating boredom.

Does that surprise you? Fifteen or twenty seconds may seem to be a very short span of time. So it is, but to the bored listener it can be interminable. Obviously, drastic editing and pruning is called for. I will repeat one general principle which applies in ninety-nine cases out of a hundred. The more that is cut out the better the finished programme will be. Ruthlessly we cut, cut, cut, paring away all superfluous material. If we do this conscientiously we will find that miraculously our programme is beginning to take shape.

There are many other problems to be considered. In a previous article I have discussed the need to regard such a programme as having three distinct parts: A beginning, an end and a middle. Our material must be arranged in logical sequences so that it tells an intelligible story and conveys specific pieces of infor-

mation. Continuity is always a vexatious subject. It can be provided by a "studio voice" linking one episode to the next. Far better, the subject-matter can be arranged in such a way that one comment introduces the next itself (by direct reference or by inference) giving a natural, continuative, fade between sequences.

This may sound complicated but in practice it often works very simply. For instance, the vicar might conceivably refer in his interview to Mr. Jones, the very elderly verger who is on the point of retirement. We proceed to rearrange the sequence of the vicar's remarks so that he concludes with this reference and then cross fade to the verger when we hear him talking about how long he has been working in the church. In interviewing him we induce him to refer to, say, the renovation of the organ which gives us a natural cross fade into an organ recording and perhaps a short excerpt from a service. And so it goes on, piece by piece, each fitting neatly together. We, as the production team, do not belong to this village and our own voices should ideally be removed entirely. This again calls for skill, not only in editing but also in drawing the correct phrasing of answers so that they will still make sense when the original questions have been deleted.

I hope I have said enough to indicate what I consider to be the right way to go about producing a documentary programme. It's not a job to be undertaken lightly. It involves a great deal of hard work and perseverance. But when carried out properly and conscientiously it becomes an all-absorbing occupation. To simplify matters I have only referred to places as subjects. But the whole world is open to treatment in this way. The person who fails to think of a subject for a documentary is not seeing the wood for the trees. Suitable subjects are around us all day and every day. However exciting and interesting it might be to do a documentary on life in the upper Amazon our chances of success are slight. In my own case, at least, I should never get there! The right subjects to choose are those on your doorstep. Avoid apparently exotic subjects. The very dullest or most mundane of subjects soon take on an interesting aspect as soon as one begins to properly investigate them. It is so much better to present new and interesting aspects of an apparently dull subject that other people would not dream of looking at twice. The contrast at once gives the added advantage of impact and the programme is far more likely to be finally successful.

Don't worry about equipment. Again choose subjects that can be adequately dealt with on the limited equipment available. A good many years ago I wrote an article under the title "Features Start at Home." So could documentaries.

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THE INCOMPARABLE TAPE RECORDER

At last the secret is out . . . our author reveals basic facts about "studio" requirements

THE HOME STUDIO

By JOHN BORWICK

THERE are two distinct species of acoustic problems in the home studio. The first is room ambience or reverberation—by which all rooms impart their own characteristic quality to the sound (during recording, and again during playback). The second is extraneous noise and the need for sound-proofing.

A complete solution to both these types of problem is complicated and expensive. Professional studios are lined with special acoustic absorbers to give controlled amounts of reverberation and are heavily insulated against outside noises. The home studio cannot go to these lengths, but it will help if the nature of the problem is understood. Then some of the troubles can be side-stepped, if not eliminated.

REVERBERATION

If we set up a microphone in a room and play a long, sustained note, the sound will rapidly build up to its final volume (see the leading edge and plateau in Fig. 1). If we now cut off the note, the sound does not instantly disappear; it dies away more or less slowly. The time taken for sounds to fall by a certain amount (actually taken as 60 dB) is called the Reverberation Time of the room or concert hall, etc.

This phenomenon of reverberation comes about due to the finite, and indeed relatively slow, speed with which sound waves travel. Sound travels out from the source at about 765 miles per hour (1,120 feet per second). Therefore, if our microphone is 11.2 ft. from the source, it will take one hundredth of a second for the direct wave to reach the microphone. This first wave will then be succeeded by innumerable reflected waves as the sound bounces off walls and obstacles. The further each wave has travelled in its criss-crossing of the room between source and microphone, the longer it takes for the journey and the greater will be the time lag. It is like giving a distance handicap to lots of runners who all run at the same speed.

Besides arriving after different time intervals, the reflected waves are also weaker than the direct wave. This dissipation of the energy of the waves is due to several factors. First, because the wavefront is continually expanding as it travels outwards, the given amount of energy is spread more and more thinly over a wider area, like ripples on a pond. Also, if obstacles break up the wavefront, the scattering process is accelerated.

Finally, the sound waves actually give up a fraction of their energy at each reflection. This fraction is known as the absorption coefficient of the material. It varies enormously with the type of material or structure and also depends on frequency. Table I gives a few typical examples and I would strongly recommend anyone wishing to study this aspect to get a copy of "Sound Absorbing Materials" by Evans and Bazley (H.M.S.O. price 3s.), from which these values are quoted.

CONTROLLING REVERBERATION

So, the secret is out. The reverberation time, or "echo," in a room depends on the wall, ceiling and floor structures and the kind and amount of coverings and furniture. (Clearly it also depends on the actual room dimensions; in a large room there is a longer time lapse between each reflection.) A bare, empty room might have a reverberation time of 2 seconds and sound very echoic. Put down a thick carpet and bring in curtains, sofa, etc., and the more usual living-room figure of 0.3 to 0.5 seconds will be achieved.

TABLE I—Absorption Co-efficients

Material	Thick-ness (in.)	Frequency (Hz)			
		125	500	1,000	4,000
Brickwork (plain or painted).	3	0.05	0.02	0.04	0.05
Glass-wool	2	0.2	0.65	0.75	0.8
Perforated Fibre-board (tiles on 2in. battens)	1	0.3	0.5	0.55	0.8
Axminster carpet (on needle-loom underfelt)	0.6	—	0.4	0.6	0.75
Cork tiles	0.6	—	0.15	0.25	—

Table 1. The Absorption of Coefficients of common materials

This will be the kind of acoustic environment of the home studio and it approximates to the effect strived for in the small studios used by the BBC for talks and discussion programmes. The professionals actually try, by incorporating several sorts of sound absorber, to get the reverberation time consistently down to about 0.4 seconds over the whole frequency band—but your living-room will normally have an acceptably flat reverberation time/frequency curve for all types of speech recording. Music generally requires more reverberation but this is such a big subject that I shall defer a fuller discussion for a later chapter.

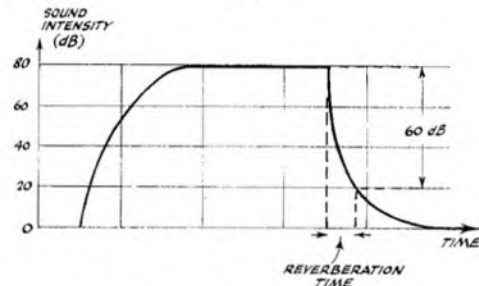


Fig. 1. In an enclosed space sounds take some time to build up to their equilibrium intensity (when energy is being supplied and absorbed at the same rate) and then die away

Getting to know how your chosen room measures up as a home studio requires experiment and more experiment. You can do this by long series of trial recordings; but you will speed up the whole process if you follow my advice and install your tape recorder and/or monitoring amplifier/loudspeaker in a separate room from the "studio." Then, with an assistant acting as combined speaker and scene-shifter, you can simply listen to the effect of each change in position, furniture, etc.—making, and replaying a recording only when necessary to double-check some feature.

Tackle these experiments as scientifically as possible, changing just one thing at a time. You will be surprised at the number of variables at your disposal. Drawing back the curtains, to reveal the hard, reflecting expanse of glass, will increase reverberation. Opening the door into a hall will couple in a whole additional lump of

At last the secret is out . . . our author reveals basic facts about "studio" requirements

THE HOME STUDIO

By JOHN BORWICK

reverberation—in changing degree, according to how close to the door you place the microphone. Speaking towards a corner of the room gives a deader effect than standing with your back to the corner and speaking out into the room. And so on. . . .

Almost any room will ultimately yield, from such experiments, a choice of microphone and speaker positions to give a nice neutral acoustic for talks, interviews, poetry reading, slide commentaries, etc. You should also take note of any odd acoustic effects which will come in useful for recording plays or dramatised inserts to build into documentary or magazine programmes.

I have implied that the acoustic "character" of a room is fixed by its reverberation time. Well, so it is from the point of view of direct listening in the room or—equally important—using the room for listening to sounds reproduced from one or more loudspeakers.

But, when we are recording through a microphone, we introduce something that I have called the "apparent reverberation." This allows us to alter the amount of acoustic ambience on our recordings by varying the microphone distance.

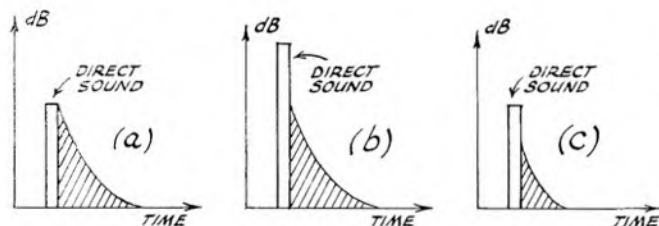


Fig. 2. Showing how a closer microphone position will reduce the "apparent reverberation" in a recording

Figure 2a shows the typical wedge of sound reproduced by the microphone for a short note of music or syllabus of speech in a room, with the direct sound giving the peak level and followed by a "tail" of reflected waves. Now in Fig. 2b the microphone has been moved closer to the source, so that the peak of direct sound is at a higher level. Notice, however, that the general wedge of reverberant sound is pretty evenly distributed throughout the room and has not changed. Therefore, when we reduce the gain control on our recorder to give the same peak level as in Fig. 2a, the recording will appear to have been made in a less reverberant room (see Fig. 2c).

This control of the apparent reverberation by adjusting the microphone distance is a large part of the technique of microphone balance. It influences the apparent depth or perspective of musical ensembles and it helps to wrap drama recordings in a kind of sonic ambience in which the relative positions of actors is suggested by acoustic means—even in mono, as opposed to stereo. I shall return to this subject more than once in later chapters.

STANDING WAVES

I said, a few lines back, that the reverberant sound energy is evenly distributed throughout a room. In fact, particularly in small rooms, we have to contend with an acoustic nuisance in the shape of standing waves.

In just the same way as a violin string or organ pipe will resonate, that is vibrate in sympathy with, sounds at specific frequencies, the air in a room is tuned to resonate at selected low frequencies for

which the room dimensions (length, breadth and height) correspond to multiples of half a wavelength. Frequency and wavelength for any type of wave motion are related by the expression frequency \times wavelength = velocity. Therefore, taking the velocity of sound as 1,120 ft./sec., a room measuring 11.2 \times 10 \times 7 ft. would have three series of harmonically related resonant frequencies 50, 100, 150 . . . Hz; 56, 112, 168 . . . Hz; and 80, 160, 240 . . . Hz. (See sketch in Fig. 3).

The effect of these room resonances (sometimes called eigentones) is to give a peaky emphasis to low frequencies (making the room sound boxy) and complicate microphone placing because the pattern of standing waves sets up peaks and troughs in sound energy at the dead centre of the room, one-third of the distance between walls, etc.

Standing waves are most troublesome in small, square rooms of course. They are less of a nuisance in odd-shaped rooms (since they can only build up between parallel surfaces) and in large enclosures. When the dimensions are more than about 56 feet, for which there is a harmonic frequency every 10 Hz, the resonances are so close together as to be ignored.

If the home studio is forced to use a small room with marked eigentones, it may be necessary to build a bass filter into the microphone circuit (a series capacitor of about 0.1 microfarads might do). As shown by Fig. 4, this will reduce the bass rise to give acceptable recordings. Note, however, that the acoustics of the room itself are unaltered so that anyone speaking in the room or listening to the radio, etc., will still experience the boomy kind of quality which eigentones always produce.

Standing waves can also be set up in the vicinity of an obstacle such as a table top or even a script. There is also selective reflection, due to the fact that any object will reflect only sounds whose wavelengths are smaller than the object: lower frequency (longer wavelength) sounds simply bend round the object. So, just to take one example, if a speaker holds the script *between* his mouth and the microphone, he will filter out high frequencies. If the script is held *behind* the microphone or at such an angle that sounds can bounce from script to microphone, some erratic boosting of treble frequencies may occur. For the same reasons, the talks tables in BBC studios have perforated tops instead of solid wood.

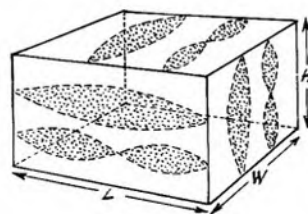
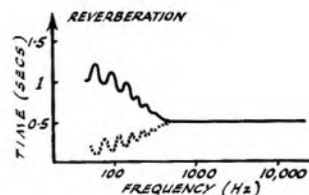


Fig. 3. Standing waves are set up in a room at frequencies which make each dimension equal to half a wavelength, and multiples

Fig. 4. The bass rise due to room resonance can be cured by filtering in the microphone circuit



Continued on page 75

OUR STAFF LOOK ENVIOUSLY AT A COSTLY AND EXCLUSIVE TAPE RECORDER
WHAT SHOULD WE GET FOR OUR MONEY IF WE HAD OVER £500 TO SPEND?

THE TELEFUNKEN M28A

A TRM Report

THANKS to the courtesy of AEG (Great Britain) Limited we have recently been privileged to examine a prototype of the new Telefunken Magnetophon M28A. Superseding the M24, which was designed to fill the gap between the best of the high fidelity domestic recorders and the top quality studio machines, the new Magnetophon M28A possesses a number of interesting features—such as solid state equaliser switching—and offers a professional specification. What we might call the “specification/weight factor” is particularly outstanding. The chassis measures no more than six inches high by 18 inches wide by 16½ inches deep and weighs only 37½ lbs. The substantial carrying case naturally increases the size and adds another 12¼ lbs. to the weight. Nevertheless we are able to consider a truly professional machine at a total weight of approximately 50 lbs. which is rather less than the weight of certain other so-called “semi-professional” equipments whose performance facilities do not in any way compare with the M28A.

We were most grateful for the opportunity to examine the M28A because we felt sure that readers would be interested in relating the facilities and features offered in this thoroughly professional piece of equipment to the more modest specifications of domestic recorders, whilst bearing in mind what is probably the most important difference of all—that of cost. To own a Telefunken M28A you would have to part with some £500. This is a great deal of money but in our opinion not too much for the very real benefits that could be derived from the acquisition of such a piece of equipment, *provided one can afford it*. When the M28 series was evolved the designers' brief was to produce a machine that would not only be suitable for professional use in broadcasting stations and recording studios but also to create an ideal instrument for the advanced or discerning amateur recordist or music lover.

The machine consists basically of a three-motor tape transport system running at 3½ and 7½ ips giving wow and flutter evaluated



The Telefunken M28A. Other versions, designated 28B and 28C will have speeds of 15 and 7½ ips but will have no mixing facilities, monitoring or VU meter. Model 28B has full-track heads, 28C half-track with track selector switch. Details are available from AEG (Great Britain) Ltd., 27, Chancery Lane, London, W.C.2

to DIN 45507 of 0.1 per cent at 7½ and 0.15 per cent at 3½ ips. The head assembly, comprising half-track stereo, erase, record and play-back heads is interchangeable and the heads themselves are manufactured by an entirely new process. The manufacturers claim that due to the extremely low wear it is not normally necessary to replace or adjust heads during the working life of the machine.

On the electronic side we have four inputs coupled to a 2 x 2 channel stereo mixer. The microphone sockets are balanced for moving coil or condenser microphones of 200 ohm nominal impedance and the other two inputs are suitable for other sources such as radio tuner, record player or tape recorder. Standard DIN connections are used throughout. The mixing control panel on the deck comprises four slide controls operating against numeric scales and each control has its own overall sensitivity adjustment permitting the matching of input levels varying by as much as 100-1.

Record level indicators are a pair of VU meters and the two channel monitoring and VU meter amplifier can be switched either to before or after record by push button controls. Modulation level can be monitored aurally by means of sockets provided for high grade moving coil headphones or visually via the meters. All amplifier inputs and outputs are brought out to DIN type sockets in a recessed panel at the rear.

The speed change switch in the centre of the deck panel is unusual in that it is also

linked to the mains on/off switch by means of a neutral central position. Power is applied only when the switch is turned positively to either one of the two speeds and is off when the switch is returned to centre. The tape path is one of the simplest we have ever seen, dispensing entirely with pressure pads. A dual function tape lifter is located between the heads so that the tape is automatically lifted clear for spooling but for monitoring a spring loaded slide lever can be operated to bring the tape back into contact with the playback head. Similarly when recording the lifter can be employed to move the tape away from the erase and record heads for fade-in and fade-out effects.

Thanks to a special tension control the required mechanical characteristics of the tape transport system are maintained for spooled tape diameters between 1¼ and 10¼ inches. A typical professional refinement is the provision of a three-digit numeric counter which indicates linearly the expended length of tape. This counter measures in minutes and tenths of minutes (at 7½ ips) the actual playing time and is independent of spool size, valid for all grades of tape and is operative during fast forward or rewind.

As soon as one begins to operate the equipment it becomes immediately obvious where at least some of the purchase price has gone. The tape transport is electrically controlled by means of illuminated buttons requiring the very lightest fingertip operation. The selected functions are stored by relays which switch the motors and solenoids. A touch on the fast wind control illuminates that particular lozenge-shaped transparent button and immediately sets the tape in motion. A touch on the stop control brings the tape to an effortless tension-free halt and again illuminates the button operated. Fascinated by the unerring and simple efficiency of this system we could not resist the temptation to send the tape hither and thither as we played for a few moments with these controls. It is no exaggeration to claim that there is as much difference between the mechanical design and functioning of this machine as there is between a mini car and a Bentley with automatic gearbox.

Frequency response is quoted as from 25 to 17,000 Hertz at 7½ ips and 25 to 15,000 Hertz at 3½ ips; tolerances to DIN 45511. Signal-to-noise is given as 53 dB for the faster speed, 51 dB for the slower. There is no final audio output stage or loudspeaker incorporated, the output level being 0.7 volts to 2 volts adjustable by concealed preset controls.

Removal of the carrying case revealed a chassis that must be a serviceman's dream. The various amplifier modules are mounted

Continued on page 76

don't buy any tape buy **EMITAPE**

Buy the new, improved range of Emitape. It makes everything sound so real—it's unbelievable! Insist on it for your tape recorder and enjoy the difference. And don't forget the new C60 Compact Cassette—a whole hour of playing time (30 mins per side) and the new C90 Compact Cassette—an hour and a half playing time (45 minutes per side). Ideally matched for all Compact Cassette Recorders. Packs of 6 include free rack for library storage.

88 STANDARD PLAY	100 DOUBLE PLAY
99 LONG PLAY	300 TRIPLE PLAY



EMI TAPE LIMITED HAYES MIDDLESEX ENGLAND

CROSS TALK

By Audios

THE scene was set. At the Steinway grand piano the distinguished pianist; two violinists of international reputation stood in front of their music stands with bows poised. Two pairs of condenser microphones, delicately held in their resilient shock-mounts, were linked to a tangle of cables leading out of the music room in this pleasant Hampstead house, across the hallway and into the lounge which served as a control room. There we engineers awaited our cue as the voice from continuity came over the monitoring speaker.

"Take 24. Third movement bars 86 to 128. 1 . . . 2 . . . 3 . . ."

At that moment came a pounding on the front door fit to awaken the dead. The monitoring speaker nearly dissolved in a shower of explosive expletives. As the door was wrenched open we could hear the plaintive childish treble voices—

"Away in a manger . . .!"

Those poor youngsters must surely have imagined that their tuneless melody had invoked the very devil himself. As they beat a hasty retreat down the garden path the last I heard from them was a shrill, incredulous "Cor blimey!"

At that same session an unusual spot of bother occurred when we were taking preliminary sound tests immediately after setting up equipment. Certain chords on the piano produced an obvious mechanical rattle which was bad enough to be picked up by the microphones and clearly heard on the monitoring speaker. The pianist swore that the pictures on the wall of the music room were rattling. I swore it was the music stand on the piano itself. Both were wrong. The cause of the trouble? An ordinary, common-or-garden paperclip. Somehow it had fallen between the strings of the piano and lay on the sounding board. If we hadn't spotted it we might have pulled the entire room apart and still have been left with the offensive rattle. Such a recording as we were about to undertake, employing professional musicians and technicians, could represent an investment of many hundreds of pounds—and it could so easily have all been spoilt by an insignificant little paperclip.

DURING the last few days I have been playing around with an interesting piece of brand new equipment—the Akai 3000 D. Unlike many of the recent Akai machines it does not include the famous Akai Crossfield Head system. Neither does it use pressure pads of any kind. The manufacturers claim a response of up to 22,000 Hertz plus or minus 3 dB at 7½ ips. I have not had a laboratory check on these figures but from subjective listening it certainly appears to perform outstandingly well. The 3000 D comprises a tape transport system with preamplifiers only and so must be used with an existing hi-fi set-up. It will be interesting to compare it with other competitive models because the manufacturers appear to have developed a new line of thought. They have dispensed with all frills and have evolved a mechanism which is essentially record/playback only, but they have been careful to include the one feature that I regard as absolutely essential, separate heads and amplifiers giving "after record" monitoring. At a price of around £86 I feel it is a machine that warrants an early review.

* * *

TALKING of "after record" monitoring I am delighted to note that the new Quad transistorised amplifier equipment (referred to in New Products, page 86) includes this facility. I like to think that we at "TAPE Recording Magazine" played no small part in influencing the manufacturer to include the necessary circuitry in his design. Your Editor spent a full day in Huntingdon several months ago when he forcibly expressed his own opinions on the importance of providing for monitoring directly off the tape in any modern amplifier design.

The Acoustical Manufacturing Company Limited can hardly be accused of "rushing" into the transistor field. But from the quoted specification—which if it errs is likely to be on the conservative side—the time spent in research and development has certainly not been wasted. The Quad amplifier has always been a piece of equipment that we could proudly claim to be British. Such is the manufacturer's reputation that I would stake my life on the certainty that the new model will precisely follow in the old tradition. And having lavished such praise may I plaintively add what a pity it is we didn't see this new equipment twelve, or indeed twenty-four, months ago.

* * *

TECHNOLOGY moves at such a pace that some of us can't keep up with it. At one time electronics meant valves and wires. Next came transistors and printed circuit boards. Now we have integrated circuits and a new breed of technocrat whose speciality is "electronic packaging."

The term electronic packaging has nothing whatsoever to do with parcelling up components for transit. The technique relates to the translation of schematic circuit diagrams into production products where the components are so chosen and arranged that they may be mass-produced in the form of an electronic package. Not only is there a magazine devoted to their interest, *The Electronic Packaging and Production Magazine*, but in October this year they will have a special trade exhibition in Brighton called INTER/NEPCON. This exhibition will also include an extensive technical seminar where more than one hundred senior level engineers will present papers on various aspects of equipment construction and production. The organising genius behind this venture is Milton S. Kiver, President of Industrial and Scientific Conference Manage-

ment Incorporated. Mr. Kiver has devoted much of his life to advanced electronic techniques and he feels strongly that our production lines in this country could benefit from an exchange of ideas between specialists. If we are to make more efficient electronic equipment more cheaply this is precisely the kind of venture that our technicians should be eager to support.

* * *

HAVE you heard of the Welte Legacy of Piano Treasures? This is a famous collection of music by early twentieth century piano masters recorded by the composers themselves, and it will soon be available on stereo tape. First released on discs in 1963, this repertoire is the subject of an agreement by Ampex who hope to have their tapes ready in the near future. The impressive list of composer-performers includes Ravel, Debussy, Mahler, Richard Strauss and Saint-Saëns. To make the recordings a special piano was fitted with carbon rods extending downwards from each key. As the keys were struck the rods dipped into a tray of mercury completing an electric circuit. The circuit controlled the pressure of rubber wheels inked with colloidal graphite turning against a roll of tissue-thin paper.

The wheel marked the paper faintly if the key was struck softly, fortissimos produced a wide mark because the force of the pianist's finger sank the carbon rod deeper into the mercury and intensified the current. The playback device, called the Vorsetzer, resembles an upright piano but has 88 "fingers" extending from it. It is placed at the keyboard of any piano and plays back the rolls, reproducing not only the notes and their rhythmic sequence but also the personality and dynamic range of the original performer.

The inventor, Edwin Welte, was a wealthy German industrialist who installed the equipment in his Rhine castle and invited the great pianists to record their works. The rolls were not intended to be used commercially and so were stored unused for years. During World War II they were hidden in a cave in the Black Forest.

In 1940 a Californian, Richard C. Simon-ton, bought the rolls from the then ageing Edwin Welte. First attempts to re-record were unsuccessful until one of the few remaining Vorsetzers was located in the hands of a Texas collector who had rebuilt his machine with great care. When this machine was located it was only necessary to sign the necessary agreements to have these rare and historic records reproduced and re-recorded on modern media. Quite a thrilling story, isn't it?

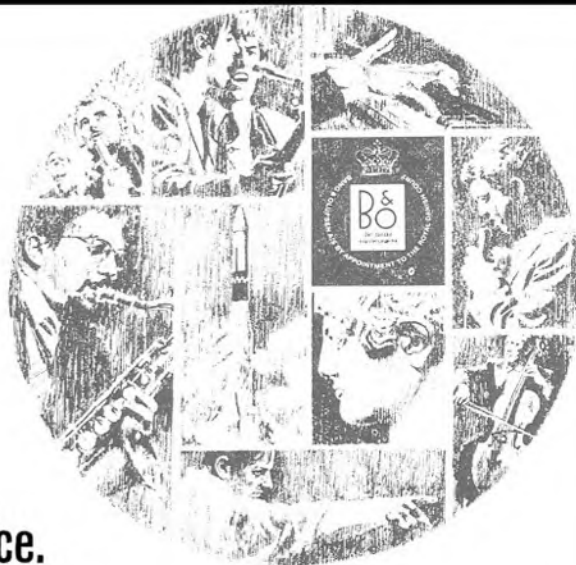
* * *

A SPECIAL note to all club secretaries. Our contributor, Richard Margoschis, who is writing our regular "Monthly Nature Notes," is offering his services as a lecturer to clubs in the Midland area. His subjects are both documentary and nature recording, and his charge will only be for out-of-pocket expenses. Would clubs interested please write to Mr. Margoschis c/o Tape Recording Magazine and I will see that letters are forwarded.

* * *

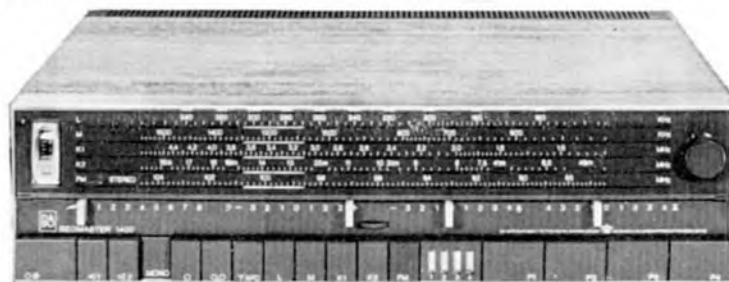
I DO get some strange correspondence. A letter that floated into the office the other day really knocked me for six. It said quite simply:

"Dear Sir, Can you please tell me how to get the music on the empty reel of tape that was given to me when I bought a new tape recorder?"



Bang & Olufsen - for those who consider design and quality before price.

From Bang & Olufsen - the Beomaster 1400 - a new sophisticated five waveband stereo radio receiver combined with a powerful stereo amplifier.



The Beomaster 1400 M. Also available—model 1400K with end speakers.

Completely modern in styling—this new Beomaster is available with or without built-in pressure chamber loudspeakers—making it either a complete table radio of the highest quality or the central unit in a quality audio reproduction system. Special features include 4 pre-set positions on the F.M. waveband, shortwave bandsread tuning, a built-in stereo decoder and high output combined with small physical size.

A brief specification is given below - but for full information see your nearest B & O dealer or write for full details.

TECHNICAL DATA

AMPLIFIER

33 Transistors.
16 Diodes.
Power output:
2 x 15 watts continuous.
2 x 20 watts music power.
Frequency response:
30-25000 c/s \pm 1 dB.
Distortion:
< 1% at 40-12.5 kc/s.
Signal/noise separation:
> 50 dB.
Tone control range:
Bass: + 10 dB—16 dB at 40 c/s.
Treble: + 13 dB—16 dB at 10 kc/s.
Channel separation:
> 40 dB at 1 kc/s. > 30 dB at 12.5 kc/s.

STEREO DECODER

Channel separation:
> 35 dB at 1 kc/s.
> 26 dB at 10 kc/s.
Distortion:
< 0.5%.
Pilot and sub-carrier rest:
< 40 dB.
Frequency response:
50-15000 c/s \pm 2 dB.

POWER SUPPLY

Voltage:
110-130-220-240 volts AC.
Mains frequency:
50-60 c/s.
Power consumption:
15-120 watts.

EXTERNAL CONNECTIONS

Inputs:
Gramophone, low ohms (47 K Ω)
Sensitivity: 4 MV/1000 c/s for full output.
Tape recorder (record + playback).
Sensitivity: 500K Ω -200mV/1000 c/s.
Speaker input: (e.g. TV sound) 4 Ω .
FM aerial: 75 Ω .
AM aerial.
Outputs:
2pairs of speakers, DIN sockets, 4 Ω .
Tape recorder. Sensitivity: 82K Ω -100 mV/1000 c/s.

TUNING

Wave bands:
F.M. 87.5-104 mHz.
Long Wave 857-2040 m (350-147 kHz).
Medium Wave 188-578 m (1600-520 kHz).
Short Wave 1: 66.6 m-200 m (4500-1500 kHz).
Short Wave 2: with bandsread. 16 m-49 m (18-5.9 mHz).
CABINET
Model 1400 M:
16 $\frac{1}{8}$ " x 4 $\frac{7}{8}$ " x 9 $\frac{1}{8}$ " without end loudspeakers
Model 1400 K:
29 $\frac{1}{8}$ " x 4 $\frac{7}{8}$ " x 9 $\frac{1}{8}$ " with end loudspeakers
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A glossary of tape terms—part 18

ULTRA-LINEAR. Many amplifiers, including some designed specifically for tape recording, have push-pull output stages connected in the ultra-linear mode. As shown in Fig. 1, the output pair of valves are tetrodes (or pentodes) and the identifying feature of such a circuit is that the screen grids are connected to tapplings on the specially wound output transformer. This gives a mode of operation between that of a triode and of a tetrode, giving a distributed load.

The advantages are: better stability, less feedback needed, greater efficiency, a reduction in harmonic distortion, lower peak variations (in current—a feature of triode output stages requiring stringent power supply design to keep distortion down at the peaks).

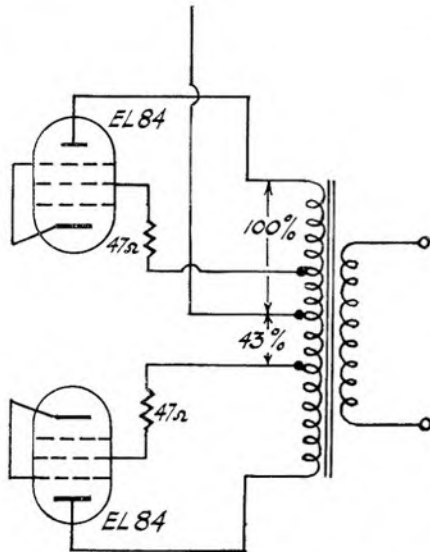


Fig. 1. The basic circuit of the Mullard ultra-linear output stage as used in the popular 5-10 amplifier

There is an optimum point for the tapping, depending on the valves used. Variations of the circuit include that in the popular Quad amplifier, where the common portion of the winding of the output transformer primary is in the valve cathodes, thus applying voltage to the grids effectively as negative feedback. This gives even greater efficiency.

UNIT. Relevant to tape recording equipment, denotes one item of a chain of equipment making up a sound recording and reproducing system. Thus, in Fig. 2, the units are interconnected, and may in some

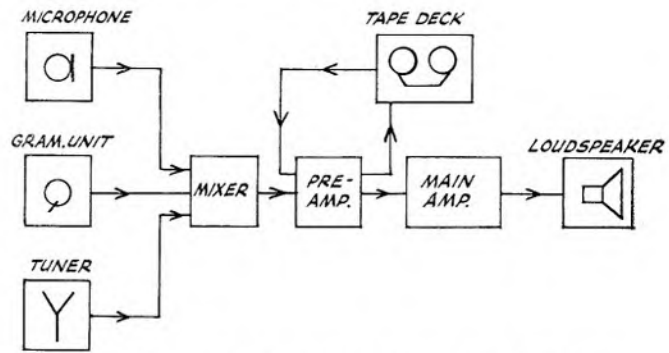


Fig. 2. Unit assembly by combining sections of equipment into a complete recording and reproducing chain

instances be self-powered and in others powered by a common "unit." Mixers and pre-amplifiers are "optional extras" and may be part of other units. A self-contained tape recorder may have most of the above units built in. But professional users generally favour the unit approach as offering greater flexibility.

ULTRASONIC FREQUENCY. Strictly, the band of frequencies just above the audible range. Used wrongly in many specifications (particularly those written by non-technical people) to denote the high frequency bias of a tape recorder. "Supersonic" is more correct. Bias actually comes within the radio frequency spectrum, being between 50,000 and 100,000 Hz. Much work has gone into the special features of the ultrasonic band, from pain-killing to industrial cleaning applications; unfortunately a discussion of these interesting developments is beyond our present brief.

VALDEMAR POULSEN. No glossary of tape terms would be complete without a reference to the "father of tape recording." This Danish inventor built the first practical wire recorder, the Telegraphone, in 1898, (although Oberlin Smith had discussed the theory in *Electrical World* some time previously). The Poulsen machine won the Grand Prix at the Paris Exhibition in 1900 and preceded the electronic amplifier which was needed to develop its potentialities. Despite initial enthusiasm, especially in America the company marketing the Telegraphone foundered, as did the Danish counterpart in 1916.

It was not until the valve became a reality, and was, in fact, applied to the Telegraphone as one of its earliest experiments with a Lee de Forest three-valve amplifier, that the possibilities of magnetic recording were realised. With the subsequent development of A.C. bias and then plastic-based tape to overcome the disadvantages of either wire or steel tape, tape recording as we know it was really under way. And this was nearly fifty years after Poulsen's first successful experiments!

VARIABLE BIAS. On better class machines it is possible to vary the bias current for optimum recording positions, usually by small capacitor or resistor changes, depending on circuit configuration. Variation of bias frequency will also be provided on professional and some semi-professional tape recorders. The bias frequency, provided it is great enough to avoid any interaction with signal currents, has small effect on the recordings.

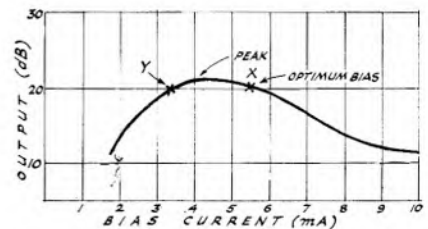


Fig. 3a. Variation of recorded signal output (on replay) with changes in bias current level

Bias current affects the output and the quality of recordings quite drastically. Its level should be adjusted to suit the tape in use (as should also the signal current—saturation characteristics differing between tapes). For a given signal input, permanent magnetisation decreases with an increase in bias current beyond a certain critical value. This reduces output. See Fig. 3a.

But an increase in bias gives a decrease in distortion of the recorded signal—this decrease being gradual, as in Fig. 3b, for a weak signal. A further complication is that for a strong signal the decrease begins steadily, then distortion rises with increased bias, giving a small peak that varies with signal, head conditions and tape, and falls away again.

Increase beyond the critical value severely restricts the high frequency response due to the demagnetising effect of the bias, most marked when signal frequencies are higher and of less strength than the lower frequencies.

Bias settings are thus a compromise. The point at which the bias gives greatest output is known as "peak bias" point—but it is not the greatest bias current. The term peak in this context refers to the playback signal. Overbias is the general rule—thus, point X on the signal level curve of Fig. 3a is about 2dB overbiased, and though it gives the same output as point Y, its position is correct because it gives less distortion than would a bias setting corresponding to Y. In addition, the shape of the curve is not symmetrical; the output falls away drastically as bias is reduced beyond peak point. Very often bias level depends on ht to the oscillator and other factors which may be affected by ageing, etc. So the selection of Y would give rapid deterioration with a fall in ht whereas selection of point X produces less overall effect when external conditions change. Peak bias usually offers a better signal-to-noise ratio. This is a small practical point, but worth noting.

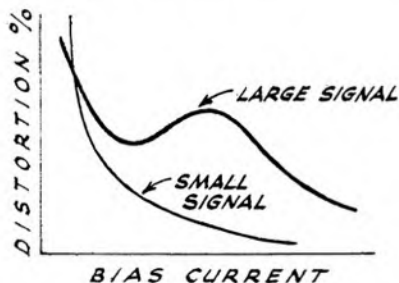


Fig. 3b. Percentage distortion decreases as bias is increased, but the constancy of this decrease depends on signal level

Adjustment of bias is best carried out, where no data is available, by recording and noting output, increasing bias to "peak point" and then overbiasing by about 2dB. Note that 2dB in the context means a bias level that gives a 2dB increase in playback signal level. Obviously, a steady tone should be used for signal current.

A further use for variable bias is the adjustment necessary for second recordings when super-imposing. The tendency is always for the second signal to partially erase the first by its bias; reduction of bias when recording the second signal gives better mixing.

VARIABLE SPEED WINDING. Several professional machines have facilities that permit changing the speed of tape transport gradually. This is not so easy to do with the average domestic machine.

A.C. induction motors are "locked" to the frequency of the mains supply, and these are mostly used with mains-operated machines.

D.C. motors depend on the voltage of the supply for the speed of running, within certain limits. A simple variable resistor device is a crude method of varying speed on this type of battery machine. But most battery-operated machines with and pretension to quality have a regulated motor supply to maintain constant speed even when the batteries begin to fail. Apart from the obvious difficulty in overcoming this regulation to vary speed manually, there is another important factor—noise level—which makes such variation a poor idea. Where such regulation is used, suppression circuits are generally "tuned" to the optimum speed of the machine. Any variation

of the speed leads to an increase in noise level.

Mechanical speed variation can be provided, as in the older Reflectograph design, where conical idlers between motor and capstan provided the variation.

A Sony device for speed regulation that also permits variation is the switched frequency oscillator which feeds a tone to the motor to control the speed. This device, in the Sony TC800, is not so effective as the servo circuit of the Nagra, which can be varied accurately within limits to match cine film variations, but has great potentialities for cine enthusiasts with a limited budget as well as those seeking new ways to obtain sound effects.

VELOCITY MICROPHONE. A type of microphone which has its diaphragm open on both sides and is thus responsive to particle velocity rather than the instantaneous pressure of the sound. An alternative term is "pressure-gradient microphone." The free-ribbon microphone is a good example of the velocity device, the ribbon being sensitive to the difference in sound pressure between the two sides. Condenser microphones follow the velocity or pressure-gradient principle, although there are combinations of each type for special purposes.

The velocity microphone is bi-directional having a figure-of-eight polar response. The most popular type, the ribbon microphone, has the advantage of high fidelity, good transient response, marked directionality (thus good noise limiting properties). One operational disadvantage is a notable rise in bass response when used near the sound source. This has to be compensated when the ribbon microphone is employed for close speech, for example.

THE HOME STUDIO *Continued from page 69*

EXTRANEIOUS SOUNDS

Unwanted sounds can be a bugbear in the home studio. Locally-made sounds can usually be tracked down and silenced at source. These include clocks, gas fires, refrigerators, telephones, doorbells, etc. As for the mechanical whirring of the tape recorder itself (plus, in some cases, odd scraping noises of tape against spool, spool on tape deck, etc., clearly audible on some competition entries that I have been asked to judge) you can sometimes throw a blanket over the machine, if over-heating does not occur. Otherwise I hope you will segregate tape recorder and microphone as much as possible (see my remarks earlier, and in subsequent chapters, on the use of a separate listening room).

We are left now with the problem of sound proofing—to keep out unwanted sounds. Complete sound insulation, to eliminate outside traffic noises, aircraft and activities elsewhere in the building, requires that the studio is isolated on all sides by a factor of about 60 dB. While this is a practical proposition in professional studios and theatres, it is ruled out for the home studio on account of cost and the fact that wholesale structural alterations would usually be necessary.

My first advice would be to move your home studio out into the country, well off the routes of jet airliners. (My friend Daphne Oram, the *musique concrete* expert, has her studio in a remote Kent oasthouse). Failing this, you may have to do your serious recording after everyone is in bed.

Extraneous sounds are of two distinct types: airborne sounds and structure-borne sounds—such as footsteps. The latter are hard to defeat, but you can reduce the former by the same kind of treatment that you use for draught-proofing and heat insulation. Figure 5 shows the sound reduction to be expected from single and double glazed windows. I reproduce this (based on the HMSO publication mentioned earlier) both to show the effectiveness of double glazing and the general insulating curve of most walls and partitions: namely that they all tend to be less effective at low frequencies. This explains the bass heavy quality of any sounds which penetrate a party wall.

I wish I could be more encouraging about sound-proofing the home studio. Perhaps ordinary draught-proofing and patiently waiting for unwanted sounds to cease are all that the busy flat-dweller can do. Next month I shall be talking about microphones.

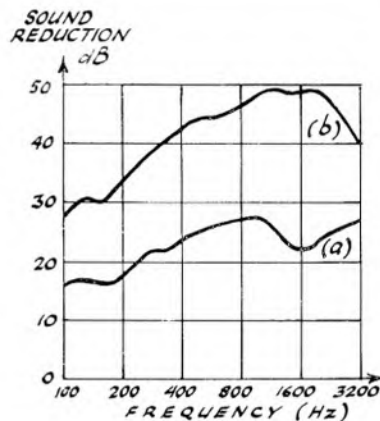


Fig. 5. Comparison of sound reduction for single and double glazed 32 oz. glass windows. The curve marked 'b' indicates the relatively greater resistance to sound at various frequencies that can be obtained by double glazing—curve "a" is for a single pane of glass

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TAPE RECORDING IS FOR THE FAMILY



I am Paul, five years old, and I am listening to Daddy's new tape recorder with these things on my ears. Daddy says stereo is the thing these days, but I can't hear the difference myself!

Do you have photographs of your children with recording equipment like this one submitted by reader A. G. Bennett of Purbrook, Hants? If so the Editor would like to see them. Tape Recording is "for the family." A spool of tape will be awarded for each picture published.

Prints should be addressed to The Editor, "TAPE Recording Magazine," Prestige House, 14/18, Holborn, E.C.1. Prints can be returned to their owners only if a suitable stamped and addressed envelope is enclosed, and it is regretted that no responsibility for their safety can be accepted, although every possible care will be taken. The Editor's decision on acceptance of prints for publication will be final.

TELEFUNKEN M28A Continued from page 70

on printed-circuit boards fixed to an ingenious system of hinges—rather like the leaves of a book. If repair is needed the engineer simply flicks through the "pages," removes the faulty module and inserts a new one. Could anything be easier?

For part of our investigation we had planned to us the M28A together with a pair of Sennheiser 405 condenser microphones to take a piano recording. Unfortunately on the day of the appointment we were snowed out and so were unable to arrange for transport to the recording location. That was a bitter disappointment but we do hope to have the opportunity to undertake the same ex-

periment some time next year. Limiting our activities to voice recording we established that the Sennheiser condenser microphones can be fed directly into the M28A (via their power packs of course) and thanks to the built-in sensitivity adjustments on the mixer panel no external attenuators were required. Recordings were also taken from a Quad FM stereo tuner and amplifier.

When we came to play back it was immediately obvious where some more of that purchase price had gone. The clean, sharp quality of the sound was truly a revelation; it demonstrated just how good a really good recording can be.

With infinite regret we handed the M28A

back to its owners with grateful appreciation for the opportunity of examining it. We felt rather like the motoring correspondents must feel when they hand back the Rolls-Royce they have been test driving and return to their own Minis. We shall probably never own one of these superb instruments; nevertheless we have no doubt that a few extremely fortunate individuals will acquire this machine in the future. Designed for at least ten year's constant use they will be getting what is in our opinion extremely good value for money. The rest of us will continue to drive our Minis with undiminished enthusiasm secure in the knowledge that ultimately we will arrive at the same destination.



YOU CAN KEEP YOUR SOUND

(If you put it in the business end of a London Microphone)

Keep it true to life, capture it without trouble even under difficult conditions, bring out the best of your recording equipment. Spend far less than on any other comparable microphone: The London Microphone range gives you quality sound reproduction; sensitivity; the specification you want for a huge variety of uses in tape recording, audio-visual productions and education. Special versions suitable for transistorised tape-recorders.



LM 100 Dynamic Omni-directional microphone available in a range of impedances including a version for transistorised tape-recorders (used by leading tape-recorder manufacturers). Retail price range £2.19.6-£3.14.6

LM 200 Dynamic, cardioid microphone with balanced output



Retail price range £4.14.6 -£5.9.6

Eliminates unwanted background and gives you good recordings even under difficult conditions.

Frequency range 50-15,000 c/s
 Impedance range 60 to 500 Ohms (and dual, 200 Ohm & 50 kOhm)
 Sensitivity (60 Ohm) 0.1 mV/ubar
 Supplied with 6 ft. twin-screened cable.
 Available with a choice of practical stands and adaptors.
 Ideal as replacements in existing recorders.

Please write or ring for details and specifications:

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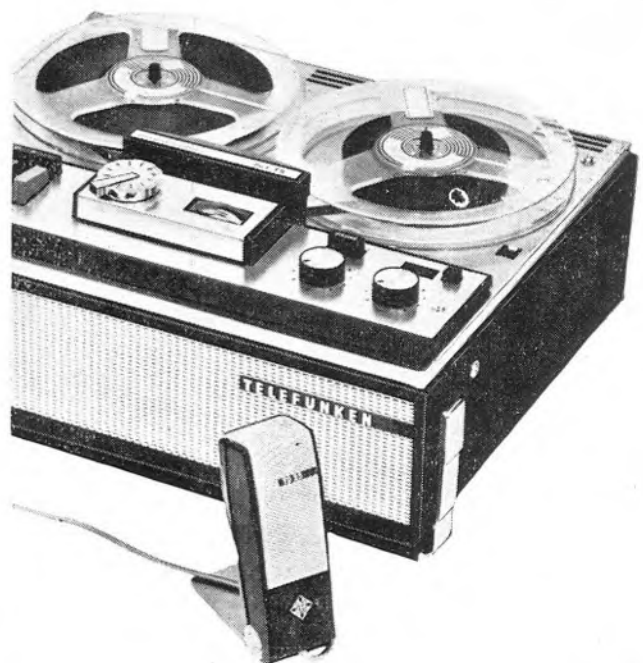
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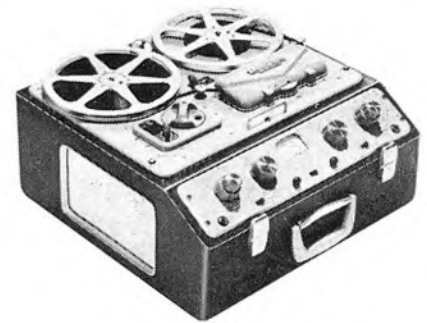
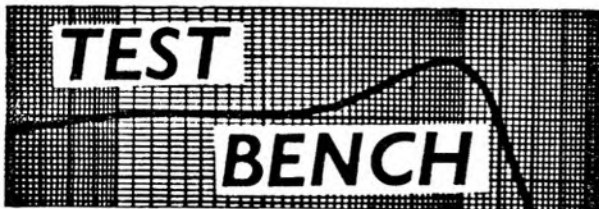


TELEFUNKEN

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FERROGRAPH 632

INVESTIGATED BY R. HIRST AND D. KILLICK

MANUFACTURER'S SPECIFICATION Ferrograph 632

Recording Medium: Standard or Long Play 1/4-inch plastic-coated tape on reels up to a maximum of 8 1/4-inch diameter (coating inside).

Record and Playback Track Width: Model 632, half-track, 0.083 inches; Model 634, four-track, 0.043 inches.

Fast Wind Time: Less than 1 minute for 1,200 feet tape in either direction.

Frequency Response: At 7 1/2 ips 30 to 15,000 Hz ± 3 dB. At 3 3/4 ips 40 to 10,000 Hz ± 3 dB. At 1 7/8 ips 50 to 5,000 Hz within 8 dB.

Record/Playback Characteristics: CCIR, 70 microseconds at 7 1/2 ips; 140 microseconds at 3 3/4 ips. Alternative models, suffix "A," supplied to NAB characteristic.

Wow and Flutter: Less than 0.16 per cent at 7 1/2 ips.

Erase and Bias Frequency: Approximately 68 kHz.

Input Levels: Input 1—2mV RMS at 1 Megohm. Input 2—35mV RMS at 0.5 Megohm.

Output, Maximum Per Track: 1 Volt RMS, impedance 1 Kohm approximately.

Output Stage: 1 Watt approximately into 3 ohm, 5-inch internal speaker.

Signal/Noise Ratio: Unweighted, including hum, 52 dB.

Track Separation, Stereo: Approximately 40 dB.

Lower Track Rejection: In "Mono" application, equal to or greater than 65 dB at 400 Hz.

Mains Supply: Suffix U, 240 V 50 Hz; Suffix E, 110 V 50 Hz; Suffix A, 117 V 60 Hz.

Power Consumption: 115 Watts.

Overall Dimensions: 17 1/2 inches wide, 18 1/2 inches deep by 9 3/8 inches high, with lid.

Weight: 47 lb.
Price: 126 guineas.
Manufacturer: The Ferrograph Co. Ltd., 84, Blackfriars Road, London, S.E.1.

FERROGRAPH 632 TEST CHART

Frequency Hz ...	Overall Response			Playback Only		Signal/Noise Ratio dB	Cross-talk dB	Distortion
	dB			dB				
	7 1/2 ips	3 3/4 ips	1 7/8 ips	7 1/2 ips	3 3/4 ips	54.5	43	2.2%
40	+0.3	-2.2	-4.5	+0.6	-3.0			
50	+1.5	-1.2	-3.5	+2.0	-2.0			
60	+1.8	-0.8	-2.0	+2.0	-1.8			
100	+1.1	0	-1.4	+1.8	-1.1			
250	+0.5	+1.2	-0.6	+0.8	+0.2			
500	+0.2	+0.8	0	+0.8	-0.6			
1,000	0	0	0	0	0			
2,000	+0.2	-0.8	+0.9	+0.4	-1.0			
4,000	+0.8	-1.6	-2.2	+0.6	-1.8			
6,000	+0.5	-1.6	-6.0	+0.6	-1.8			
8,000	+1.1	0		+1.4	-1.6			
10,000	+1.4	-3.0		+1.6	-3.0			
12,000	+1.2			+1.5				
14,000	-0.8			0				
16,000	-0.8			-0.8				
18,000	-0.6			-0.8				
20,000	-0.6			-1.2				
22,000	-1.6							
Wow and Flutter...	0.15%	0.22%						

Notes:

All measurements were taken using "Dynarange" tape with the bias setting in the "High" position. The Overall Response figures relate to record and playback. Playback Only relates to the reproduction of a 70 microsecond test tape at 7 1/2 i.p.s. (C.C.I.R.)

For Signal-to-Noise Ratio the tape was recorded at peak level and then the input signal was removed from the record amplifier. By reference to the signal level recorded and the resultant tape noise, the noise voltage was read off, with the tape still in motion. Distortion is quoted against a 1,000 Hz signal recorded at the correct maximum level as indicated by the manufacturers, and the figure is an R.M.S. value.

Wow and Flutter is also R.M.S., the test frequency being 3,000 Hz. Test equipment used includes: Bruel and Kjaer Signal Generator, B & K Frequency Analyser Type 2107, B & K Level Recorder Type 2305, Marconi Distortion Factor Analyser and Gaumont-Kaylee Wow and Flutter Meter.

EVER since magnetic recorders have been produced commercially in this country the name of Ferrograph has been regarded as synonymous with all that is best in British craftsmanship and design. At one time we might have compared this manufacturer's reputation with the permanence, stability and incontrovertible Britishness of the Rock of Gibraltar. And yet in this changing world one cannot help wondering if Gibraltar is really as secure and as permanent as we had once thought. Just as the Spaniards are

clamouring at the gates of the Rock so the British manufacturer has to meet and fight foreign competition in order to both maintain the supremacy of earlier years and also to achieve the steady rate of business expansion that is necessary for survival under modern conditions.

In taking our very close look at the Ferrograph we shall not be overawed by the name; to the contrary, regarding this equipment affectionately as "a member of the family" we shall, if we err, tend to be more, rather than less, critical. We

shall be looking at the Ferrograph not merely as an isolated piece of equipment but as a competitor against other good quality but foreign manufactured machines now available in the world markets.

In appearance the Ferrograph is probably one of the most familiar of all tape recorders—there can be few who would not recognise one in a shop window. Ferrograph styling has become firmly fixed in the mind of the public because the very latest Series 6 models are in fact the result of gradual and logical evolution from the very earliest

of days. The manufacturer has never adopted sudden or violent change for its own sake. The result has been a continuity of styling and design with each successive model following the general outline of the last.

As is our usual procedure the machine was first subjected to laboratory checking and the results of this investigation are quoted in tabular form. Referring to general construction the laboratory used terms such as "British Battleship" and "Land Rover." Far from being intended unkindly these words indicate the kind of rugged construction that promises an ability to withstand a long life of hard usage. Closer examination of both mechanical and electronic internal parts drew the laboratory comment, "hope that craftsmanship is not lost to us for all time can be revived." Many of the manufacturing techniques employed, including impregnation of certain components and the painting of joints, have all the attributes of the very best instrumentation practice. Referring to the manufacturer's specification we find sets of figures that are by no means impressive by today's standards. How, then, does the machine measure up to this very modest specification?

Examining the $7\frac{1}{2}$ ips overall frequency response table we find an outstanding set of figures. Between 40 and 22,000 Hertz the response never varies more than 1.8 dB from the 1,000 Hertz level; the average deviation is probably less than 1 dB. Replay of the CCIR calibration tape is almost as good—maximum deviation being 2 dB up to 20,000 Hertz. If we now regard these figures in conjunction with the established signal-to-noise ratio at $7\frac{1}{2}$ ips of 54.5 dB together with record distortion of only 2.2 per cent we have a specification that might well apply to professional equipment at many times the cost. We cannot emphasize too strongly the value of being able to attain what amounts to professional standards in domestic equipment.

We would however criticise the equipment in two respects. Firstly it will be noted that frequency response at the two slower speeds, $3\frac{1}{2}$ and $1\frac{1}{2}$ ips is within specification but we do feel that this specification is not of a high enough standard to compare favourably with that quoted by certain foreign manufacturers who do appear to be rather good at achieving a wide response at slow speeds. Similarly, the wow and flutter of 0.15 per cent total RMS at $7\frac{1}{2}$ ips is within specification but we would have preferred that specification to have quoted a figure nearer 0.1 per cent. No standard is quoted at $3\frac{1}{2}$ ips and our own finding of 0.22 per cent cannot be regarded as outstanding. During the course of wow and flutter content investigations it was found that one specific irregularity could be clearly detected and this appeared to coincide with the revolution of the pinchwheel. However had this been the cause we would have anticipated even more deterioration than was noted at $3\frac{1}{2}$ ips.

On the technical side we have then reached the conclusion that in certain respects the 632 is offering a standard of performance that could hardly be improved upon, so we proceeded with user tests to evaluate the practical application of the equipment. The tape transport system is of course the Wearite deck manufactured by Ferrograph—a deck with which one of your reviewers is very familiar since he has been using it regularly for a number of years. It is usual for reviewers to use equipment for a month or two and to form opinions over this limited period of time. In the present case we can

refer to a period of six or seven years experience of the deck and during that time we have been able to prove conclusively the manufacturer's claim for "rugged reliability." As a long term investment it probably cannot be bettered. Such a long period of use has however also made us only too well aware of its shortcomings.

In operation we have found it to be relatively clumsy and awkward and also inclined to be noisy. Unlike previous models the Series 6 offers three speeds, either $7\frac{1}{2}$, $3\frac{1}{2}$ and $1\frac{1}{2}$ ips or 15, $7\frac{1}{2}$ and $3\frac{1}{2}$ ips. The model under test was the former. The erase, record and playback heads are all readily accessible beneath the hinged head cover, an ideal arrangement for accurate editing. Automatic stop is by means of a pivoted plastic tension lever operating a micro-switch, but this does not function on fast wind in either direction. The well known rotary function control is a large rotating member on the left of the deck fitted with a substantial hand grip. A new feature on the Series 6 is the incorporation of a record safety lock in the form of a red button set into the top of the hand grip. The run lever, which is immediately adjacent, now incorporates an efficient brief pause control which operates when the lever is pushed forward; it can be locked in place if required. Speed change is by a central gear-type lever with gated positions for each of the speeds. Typical of Ferrograph thoroughness, the machine will not operate unless the speed change is properly engaged and if the operator attempts to change speed whilst the tape is in motion the deck automatically stops. Pressure between capstan and pinchwheel is relaxed whenever the stop control is depressed, whenever the brief pause is operated, whenever the transport is brought to a halt by the automatic stop microswitch or if mains power is accidentally cut. It is impossible for the pinchwheel and capstan to remain under pressure unless tape is moving through the sound channel.

The control panel is conveniently sloped to give an easy working angle and runs across the full width of the front of the machine. Three pairs of ganged rotary controls operate independently for Record Gain Input 2 Channels 1 and 2 on the far left, Record Gain Input 1 Channels 1 and 2 in the centre and Playback Volume Control Channels 1 and 2 on the right. These massive control knobs are a joy to use; operating smoothly and sweetly against a properly numbered scale they compare very favourably with the inadequate controls provided on some imported equipments. Also on this panel is the single VU meter to indicate record level, together with a prominently accessible "set zero" control. Equalisation is not automatic but has to be manually selected by a three-position switch on the left of this panel. However, as another example of Ferrograph thoroughness, it was noted with approval that the tape transport will not operate unless the equalisation selector is set to the same speed as the speed selector on the deck. This safety device operates in both record and playback and is highly commendable. Another similar three-position switch selects between upper and lower tracks or stereo. The remaining three controls on the panel are two slide switches, the first marked "Output" with "tape" on one side and "Original" on the other, and the other marked "Meter" with "Upper" on one side and "Lower" on the other. A simple mains on/off switch completes the deck controls.

All connections both in and out are via

standard jack sockets concealed in a recessed panel at the rear; the mains lead is also housed in a similar rear compartment. An unusual control on the rear panel is a bias switch giving a choice of "High" or "Low" positions. This has been provided to enable the machine to be used with Dynarange tape which requires a slightly higher bias level than many other types.

The Ferrograph 632 incorporates a small monitoring loudspeaker but is intended to be used in conjunction with existing amplifiers and full range speaker enclosures. In practical tests we found the internal monitoring speaker extremely useful; it functioned as a true monitor and the output could be switched to "Before" or "After" record in the proper manner. Quality was naturally inadequate since this facility is intended for no more than a perfunctory check. For serious listening we used a Quad valved main amplifier and full range loudspeakers.

The manufacturer has adopted the term "Incomparable" and we can certainly vouch for the fact that at $7\frac{1}{2}$ ips it is most certainly justified. All recording undertaken by us was absolutely excellent. At slower tape speeds we found that the more restricted frequency response was evident and at $1\frac{1}{2}$ ips wow could be heard on long sustained notes.

To summarise our conclusions we must firstly congratulate the manufacturer for upholding the standard of British craftsmanship in an age when such values tend to be degraded. We would like to suggest that if the deck could be modified to offer smoother operation without losing any of its efficiency then this would be a vast improvement. Similarly we would like to see a more stringent specification at slow tape speeds. If such improvements could be incorporated then the Ferrograph 632 would more than hold its own anywhere in the world. On the basis of our findings and experience we would thoroughly recommend this machine to the really discerning who require the finest possible quality at $7\frac{1}{2}$ ips coupled with the prospect of utter reliability throughout long periods of heavy use. The even more particular could always purchase the high speed version giving 15 ips instead of $1\frac{1}{2}$ when they could be certain of producing recordings up to the most exacting professional standards.

One final thought. The "Manual" supplied with the Ferrograph is a model of what all tape recorder instruction books should be. A properly bound, hard-backed volume, printed on high-grade gloss paper, it is as durable and as thorough as the machine to which it refers. Such attention to detail inspires confidence—which will not be misplaced.

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ACCESSORY REVIEW



Leeraser Standard Model A31 Bulk Eraser.
Price £7 10s. Leavers-Rich Equipment
Limited, 319, Trinity Road, London,
S.W.18.

A PART from manufacturing a range of top-quality professional and industrial equipments the London firm of Leavers-Rich Limited also market bulk tape demagnetizers at prices from £7 10s. to £90. The least costly of these is the Model A31 at £7 10s. and we have been examining this accessory to evaluate its usefulness to the amateur recordist.

Firstly, why should one bother to use a bulk eraser at all? We all know that the erase head removes an existing recording; we also know that a great many people do a great deal of recording without ever handling such an appliance.

There are many reasons why it is essentially good practice to use a bulk eraser. Firstly, although the erase head on the recording machine does indeed remove an existing recording the efficiency with which this is done will depend upon the strength (modulation) of the existing signal and also the coercivity of the tape. Some tapes are notoriously more difficult to erase than others—particularly if very heavily modulated passages have been recorded. Most erase heads leave a “ghost” of previous recordings, but under ideal conditions this is at such a very low level as to be quite inaudible and therefore can be regarded as non-existent. The trouble arises when the ghost is of such amplitude that it begins to obtrude, particularly through the quiet passages of a subsequent recording. This situation will never arise if we always start with a clean tape, and the only way to be sure that the tape is clean is to subject it to bulk erasing.

More serious ghosting problems can arise when half-track recordings are erased on quarter-track machines or when full-track recordings are erased on half-track machines. Clearance between tracks will leave narrow, unerased ribbons of sound which can prove most annoying. Once again the remedy is to bulk erase. There is yet another argument in favour of bulk erasing. If a tape carrying an existing recording is used for subsequent re-recording in the normal manner then there is a danger that small snatches of the original programme will be left on the tape

at the points where the machine has been started and stopped. Instead of producing a good clean recorded tape we shall have intermittent snatches of irrelevant and unwanted sound between them. These can be most troublesome to remove.

There is one snag in using a bulk eraser. In operation it erases the *whole* of the tape. If it is wished to retain any part of any recording on any track of a recorded tape then that spool must never be placed on the eraser. We either lose the lot or we don't do it at all.

The operating principle of all bulk erasers is very simple. An extremely powerful alternating magnetic field is produced in the equipment which is styled in such a manner that a completely wound tape spool can be passed through it two or three times in a few seconds. When the spool is removed it will be found that all existing recorded material has been completely erased. One failing of certain equipments is a tendency to leave behind rather unpleasant pulses of white noise.

An examination of the A31 revealed an exceptionally rugged and serviceable instrument weighing 10 lb. and measuring $6\frac{1}{2} \times 4 \times 3\frac{1}{2}$ inches. Mains supply is 200-250 volts AC 40-60 Hertz. The exceptionally stout and well-ventilated metal box is provided with rubber feet at its base and on the upper surface is a simple stud spindle which may be fixed in either of two positions depending on spool size. The only control is a mains on/off switch which in the model reviewed was of the transparent red-when-on type but the manufacturer's note indicates that in the interests of efficiency this is to be replaced by a toggle switch.

When the eraser is plugged into the mains and the power is switched on the instrument emits a loud warning buzz. This is a most necessary precaution since the instructions state emphatically that the eraser should not be run continuously for more than thirty minutes at a time—presumably due to the danger of over-heating. In practice a single

tape can be erased in less than a minute and it is unlikely that any user would require to keep the instrument in operating condition for anything like thirty minutes. The warning buzz (which is an extremely unpleasant sound!) is as effective as it is necessary.

Operating procedure is extremely simple, being very similar to that used when defluxing heads. The eraser is switched on, the spool of tape to be erased is then placed on the spindle, revolved slowly and steadily two or three times and then gradually removed from the magnetic field before the eraser is switched off. By adhering strictly to these instructions it was found that previously recorded tapes were not only effectively wiped audibly clean but were also left with no more than an unobtrusive level of background noise without any pulsing effects.

The Standard A31 model will accept all sizes of double-flanged domestic spools up to 7-inch diameter and instructions are also given for erasing cassette loaded tape. The Senior model, A32, costing £20, has a maximum capacity of 12-inch spool diameter and will handle domestic NAB or European professional spools. The specialist Auto Model A38 provides semi-automatic erasure of all spools of tape or film up to 2 inches in width and $14\frac{1}{2}$ inches in diameter and costs £90.

Anyone seriously interested in producing good quality recordings should certainly own a bulk eraser and from our investigations we can confirm both the efficiency and usefulness of the Standard Leeraser Model A31 at £7 10s. As an additional bonus it will effectively demagnetize any small metal components and it performs a most useful service in defluxing editing scissors, tape joiners and other articles which, if magnetized, would impart unwanted noise on recorded tapes.

A robust accessory that will prove its worth over and over again for very many years.

D. G. K.

BOOK REVIEWS

TAPE RECORDERS PERFORMANCE ANALYSIS AND SERVICE TECHNIQUES. By P. Spring, published by Focal Press, 42s.

Although this work has been written primarily for professional radio and television engineers as a basic handbook on tape recorder principles and design, it offers a wealth of interesting information that can be easily assimilated by the ordinary reader. The author has found a happy compromise between technical and popular writing. Essentially readable even at the deepest levels, Spring has a gift for dispensing with technical jargon and stating facts in straightforward English.

In his introduction the author states that a good fundamental knowledge in basic mechanics and electronics is pre-supposed; in fact it was found that this knowledge need be no more than is required to understand the type of technical articles published in this magazine.

An invaluable book both for reference and

general reading for all recording enthusiasts who wish to improve their basic knowledge of how their equipment works and why.

TAPE RECORDER SERVICING MECHANICS. H. Schroder, edited by R. C. Glass. London Iliffe Books Limited, 21s.

This volume of 122 pages is a translation of a German work which is also devoted to providing an introduction to the subject for technicians and serious amateurs. It is also said to be suitable as a reference source for students of the City and Guilds course on radio and television servicing. About a third of this volume is occupied with explanations of mechanical problems; a similar proportion of space is devoted to electrical operation and special features whilst the last third deals with electrical measurements. Text on the repair of tape recorders is confined to a page and a half.

Tape Recorder Servicing Mechanics was not found to be so readable as the volume by Spring, although it does contain a great deal of valuable information.

FEBRUARY. A month when winter's grip is often at its tightest. Across the frozen fields the icy blast of northern winds cuts between the stark, bare branches of the trees. The black furrows of the arable fields lie exposed to the frost; the earth feels as hard as concrete to the foot.

One can only marvel that wild life survives in such bitter conditions. Yet survive it does—the hibernating creatures are deep in their annual sleep, secure from predators and winter's chilly hand. But other wild life is very much awake, devoting all its energies to the task of finding sufficient nourishment to stay alive.

This is the testing time for those who would record the sounds of nature. It is so much easier to sit at home listening to the cheerful crackle of the fire than it is to wrap oneself in a cocoon of winter garments, shoulder recording equipment—not forgetting a flask of hot tea—and then disregard the weather. The more difficult the task, the greater the willpower needed to accomplish it and the greater will be the satisfaction to be found in it.

Winter has its compensations. The weather that very nearly kept the recordist at home will probably succeed in keeping many other less hardy individuals safely indoors. Their cars will be in garages and so there will be less noise. Just because the fields and trees are bare at this time of the year the recordist will experience far less difficulty in locating and identifying his subjects than he will in either spring or summer. No, winter is a good time for those with sufficient perseverance to take advantage of it.

In the British Isles we are fortunate—some of our most attractive and tuneful birds are among the most common species. Such a bird is the Lapwing. Classified as a "Wader," it is to be found in open country throughout the breadth of the land for it is a bird of both arable and pasture habitat. In winter it also frequents mud flats and river estuaries. A member of the Plover family it is known locally by several names, including Green and Black Plover and Peewit, the latter being descriptive of its basic call note.

Lapwings are easily recognised by the beautiful crest at the backs of their heads. The colour of the plumage appears to be black on the ground, whilst in flight one can clearly see white underparts. Closer inspection would reveal that the dark plumage is really made up of a mass of metallic, iridescent colours predominantly green and brown. Unlike other members of the Plover family it has heavy rounded wings which produce a characteristic "flapping" flight. Very gregarious, Lapwings will be found in large flocks often including other species. As they feed the individual birds run along the ground in short bursts, but suddenly the whole flock will take to the air to wheel about and land a few moments later at the other end of the field. A flock of Lapwings does not maintain ordered flight; individual birds will turn and tumble through the air at will, displaying the brilliant white of their underparts as they go through complicated aerial manoeuvres.

The many different calls are all variations of the basic "Pee-wit." On the ground there is a sharp call whilst from the air might be heard a more long drawn out note. The song is a series of these calls,

NEW



SERIES

NATURE NOTES

FOR FEBRUARY

BY RICHARD MARGOSCHIS

all of which seem to be expressive of the flight movements. Later in the year, in early spring, the display flight can be seen. It involves swoops towards the ground and steep climbs with graceful wing movements during which considerable noise is made by the wings as well as by the birds' calls. A few weeks later the anxiety call is frequently delivered by the parents as they dash about to protect their young. In fact the calls of the Lapwing can provide interest from the end of January through to June.

Recording the Lapwing is not easy. Many of the calls are made from a considerable height and from quickly changing locations as the bird swoops and climbs. The greatest single aid to this work is a reflector suitably mounted on a substantial tripod fitted with either a ball and socket or similar type universal swivel head. To be effective the reflector must move quickly, often at different angles to keep the birds "on the beam." Great care is necessary in handling the reflector; the slightest movement of the fingertips on the handle will be recorded, so if a tripod is not available take a firm, comfortable grip and change the direction by movement from the shoulder rather than the wrist; in other words, keep a stiff forearm. See that the microphone cable is clipped to the rim of the reflector and that nothing else is flapping about to produce unwanted noise.

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The Kontikis
Columbia TC-SCX6191

MUSICASSETTE

REVIEWS

BRAHMS. Violin Concerto in D Major, Opus 77.

BEETHOVEN. Violin Romance No. 1 in G Major, Opus 40.

Arthur Grumiaux, violin. Concertgebouw Orchestra, Amsterdam, conducted by Eduard Van Beinum and Bernard Haitink. Philips CPC0013, 40s.

This Musicassette is an outstanding edition to the Philips classical repertoire. Recorded quality is excellent, stereophony very good and throughout the soloist's brilliant performance offers an unforgettable experience.

In the 1st Movement of the Brahms Violin Concerto Arthur Grumiaux has chosen to perform the Joachim cadenza. This I find to be so inspiring as to warrant the purchase of the album for its own sake.

The Beethoven work, altogether lighter in character than the Brahms, makes an excellent coupling to provide an album of distinction.

One still marvels that such quality as we find on this tape is possible at 1½ ips. Background noise is commendably low and tonal quality is good. Recommended.

RIMSKY - KORSAKOV. Scheherazade, Opus 35, and Capriccio Espagnol, Opus 34. London Symphony Orchestra, conducted by Igor Markevitch. Philips CPC0010, 40s.

In spite of its popularity Scheherazade has never been one of my favourite works. The sleeve notes suggest that its popularity is such that Rimsky-Korsakov is threatened with the title of "one work composer."

Scheherazade itself is essentially narrative, being based on themes from the Arabian Nights. Perhaps I am out of sympathy with the oriental gentleman whose little weakness consists of taking a new wife every night and having her executed in the morning. Surely a wasteful procedure?

Our heroine, Scheherazade, indefinitely postpones her own untimely end by telling a story in serial form in the best of modern TV techniques so that His Highness had to keep her alive for fear of missing the next thrilling instalment.

By contrast Capriccio Espagnol requires no excuse for its existence and is said to have inspired Tchaikovsky to comment that its composer should regard himself as the greatest master of the day. The album has some very pleasant orchestral sound in both works and the recording balance is excellent. Both these pieces should find a place in any library of lighter classical music.

MENDELSSOHN. Music to Shakespeare's play, A Midsummer Night's Dream, Opus 21 and 61. Concertgebouw Orchestra, Amsterdam, conducted by Bernard Haitink. Philips CPC0009, 40s.

Including what is perhaps some of the most popular of "classical" scores, Mendelssohn's incidental music to Shakespeare's Midsummer Night's Dream now appears in the Philips lists. This was to my mind a dangerous work to issue in Musicassette form. One of the unavoidable weaknesses of the cassette system is a deterioration in what we commonly call the signal-to-noise ratio by comparison to, say, 7½ ips con-

ventional tape or disc. The important aspect of signal to noise is the manner in which it obtrudes. In certain types of programme at moderate levels the inherent noise in the recording medium will pass unnoticed. Here we open with delicate passages pianissimo. The obvious danger is of the system noise being greater than the programme content! After checking the opening bars very carefully a number of times I am forced to conclude that Philips have got away with it—but only just.

This should not be taken as a wholly derogatory remark as it could be interpreted as a compliment to the conductor and recording engineer for their faithful interpretation of the composer's intention. Having said this I must at once indicate that in other respects this album is very acceptable. It is important that we should have available a reasonable repertoire of classical works in Musicassette form. As yet the list is tiny but the publishers' enterprise in including this difficult but popular work augurs well for the future.

THE SOUND OF MUSIC with the original members of the London cast. EMI TC-CSD1365, 40s.

Once again we have a Musicassette of a popular London musical which provides not only the best items from the show sung by the original cast but also remarkable quality and movement which realistically convey to the listener the atmosphere of the theatre.

From its opening, *Preludium*, to its Finale, *Climb Ev'ry Mountain*, the recording and stereophony could hardly be bettered. For those who have seen the show this Musicassette is bound to evoke the happiest of memories; those who have not yet been so fortunate will still enjoy the ever-popular numbers.

The selection includes: *Maria, My favourite things, Do Re Mi, You are sixteen, The sound of music, So long farewell, How can love survive?, The lonely goatherd, Climb ev'ry mountain, No way to stop it, An ordinary couple, Processional, and Edelweiss*, as well as the opening number already referred to.

Jean Bayless is to my ear far more convincing than Julie Andrews in the film version. My only reservation is with Constance Shacklock's performance which I feel to be out of context with the rest of the cast. A lighthearted acquisition that will give continued pleasure for a long time.

THE PIPER AT THE GATES OF DAWN. The Pink Floyd. EMI TC-SCX6157, 40s.

Here we have an offering of absurd words, ridiculous sounds and appalling recording techniques. Here we also have a brilliant Musicassette filled to overflowing with that rarest of attributes—originality.

Do I contradict myself? And why shouldn't I? This album is the most infuriating and yet at the same time fascinating contradiction that I have heard for many a long day. Had the sounds (I will not call them music) been composed by Stockhausen or Roberto Gerhart we should talk loftily of inner, hidden, meanings. We should have been equally obtruse had the words been written by James Joyce or Proust and we should have talked in terms of "stream of consciousness."

As it is we have to speak in terms of pop, which in my humble opinion these numbers are not—they transcend what is commonly known as pop music to exist as contemporary manifestations of expression in a completely different idiom.

The names of both the producer and the recording engineer are shown on the sleeve,

as well they deserve to be. This is a *tour de force* on the part of both the artistes and the technicians. It must be heard to be believed, and when heard it will be both hated and loved. What a pity the titles of some of the numbers adopt the terminology of science fiction when the sounds themselves are so obviously derived from radio-phonics (which is associated with interplanetary adventure only by the unthinking).

The titles (which mean everything and nothing) are: *Astronomy Domine, Lucifer Sam, Matilda Mother, Flaming, Pow R. Toch H, and Bike*, on track 1 and *Interstellar Overdrive, The Gnome, Chapter 24, The Scarecrow, and Take up thy Stethoscope and Walk*, on track 2.

Dare I pray to hear more of Pink Floyd?

LES GRANDS SUCCES DE RICHARD ANTHONY. Columbia MCC6002, 50s.

This is another of the E.M.I. Continental imports which unfortunately cost 10s. more than standard Musicassettes and are recorded mono instead of stereo. When reproduced on stereo equipment they will, of course, give a "double mono" output.

The additional cost worries me rather more than the lack of stereophony. Importation costs have to be met by someone, so as usual the poor old customer has to pay, but we do get something for that extra 10 bob. Typical of such albums the one now being reviewed could only have been produced in France. Here is the real, Continental, sound—one could almost smell the garlic!

All the items are put over with that characteristic panache that only the French can achieve without assuming affectation. They comprise: *Fentends siffler le train, Donne-moi ma chance, C'est ma fête, Tiens bon, Ecoute dans le vent, et A toi de choisir* on side one, and *Hello Pussycat?, Je me suis souvent demandé, Au revoir mon amour, Ca serait beau, Tchou, Tchou, and Ce monde* on side two.

Richard Anthony's interpretation of *Hello Pussycat* really has to be heard to be believed. It is superb. If you can't afford a Continental holiday this year, try the next best thing. Believe me, after listening to this album I really did feel that I was back in France, and perhaps fifty shillings is not too much to pay for such an illusion. Jolly good fun and strongly recommended.

THE SENSUOUS STRINGS OF ROBERT FARNON. Robert Farnon and his Orchestra. Philips CPP1022, 40s.

As the title suggests, this is yet another selection of mood music offering pleasant sounds to afford quiet background music. The recorded items are: *The touch of your lips, To a young lady, Isn't it romantic, I'm in the mood for love, Moonlight becomes you, When I fall in love, Two cigarettes in the dark, La casita mia, Hey there, Something to remember you by, Just a memory and Alone together.*

The sleeve notes suggest that the "voluptuous sounds" from the tape will stir senses other than those of the ear. The listener is invited to visualise "all kinds of sultry situations." Sorry—I did try very hard, but it didn't work! Perhaps I was too busy finding fault with the recording itself, which could be better, and also with the performance, which in places lacks cohesion. If the object of this collection is as stated to "unfurl the perfect invitation to an evening where two people get together and think of little else but themselves" then from my point of view it was a failure. My mind was much too busy on other things.

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MUSIC ON TAPE

7½ ips STEREO

BEETHOVEN. Symphony No. 5 in C Minor, Opus 67, **MOZART.** Symphony No. 41 in C Major, K 551 ("Jupiter"). George Szell with the Cleveland Orchestra. Epic EC839, 4-track Stereo, 7½ ips. 75s.

This version of the Beethoven Fifth is of considerable interest because we recently reviewed a performance of the same work by the Berlin Philharmonic under Herbert von Karajan on Ampex DGA 8803 (March, 1967). Comparisons between the two are inevitable.

Unfortunately George Szell is competing against one of the greatest masters of Beethoven interpretation. By comparison with Karajan his tempi are pedestrian and the work lacks subtlety. This feeling is emphasised by a tendency towards muddiness in the lower middle regions of the Epic recording. The finer delicacies of tone and dynamics achieved by the Berlin Philharmonic are not equalled in the Cleveland performance, in spite of Karajan's reputation for "massive sound."

Having made this comparison, however, I must stress that the Szell version is a very long way from unacceptable. A decision on which to buy is likely to be influenced by the works with which the two Beethoven Fiftths are coupled. The Ampex tape gives us Beethoven's Fourth on the other side, whereas Epic have recorded Mozart's Jupiter Symphony. Personally I prefer Szell's Mozart to his Beethoven. He exhibits an altogether lighter touch and has produced some very pleasant sound.

So there we have it. If your prime interest is in Beethoven then I would recommend the Ampex tape but I would certainly accept the Epic Fifth if I were to be buying mainly for the Jupiter. It is very satisfactory to find that tape catalogues are now reaching the stage where the purchaser has a choice of alternative performances of the same work by different orchestras. The ideal of course is to purchase both and then form your own conclusions. . . !

BEETHOVEN. Symphony No. 3 in E Flat Major, Opus 55 (Eroica). Berlin Philharmonic Orchestra conducted by Herbert von Karajan. Ampex DGC8802, Stereo, 7½ ips. 75s.

My remarks about Herbert von Karajan in relation to Beethoven's Fifth also apply to this recording of the Third. Sound quality is excellent, interpretation is excellent and the performance is exemplary. What more can one say?

This is probably one of the most popular of the Beethoven symphonies and should undoubtedly be included in every music lover's library. The story of its dedication is too well known to bear repetition. The composer finally added to his score the subtitle, "Composed in order to celebrate the memory of a great man." He had found, like so many others both before and since, that his idol was not quite the man he had thought. However, we must be grateful that Beethoven's inspiration was stimulated to such heights of genius by his sincere admiration and so enabled him to compose this great work which otherwise might not have existed at all.

Like all the Karajan Beethoven symphonies, strongly recommended.

We have received many requests to publish details of equipment used by us when listening to stereo tapes for review. The items used this month are therefore listed below. It will be noted that every component is duplicated—each tape is heard on two quite different combinations of playback equipment before comments on quality are published. Amplifiers—Quad valved and Wharfedale transistorised. Loudspeakers—Celestion and Jordan-Watts. Tape Recorders—Akai 3000D and Tandberg 64X.

FOUR ITALIAN FLUTE CONCERTOS.

Jean Pierre Rampal with the Saar Radio Chamber Orchestra conducted by Karl Ristenpart. Vivaldi: Concerto in A Minor for Flute and Strings, P 77; Pergolesi: Concerto No. 1 in G Major for Flute and Strings; Tartini: Concerto in G Major for Flute and Strings; Sammartini: Concerto in F Major for Flute and Strings. Epic EC844, 4-track Stereo, 7½ ips. 75s.

"The magic of Rampal still seems to be unique. In his hands the flute is three or four music makers—dark and ominous, bright and pastoral, gay and salty, amorous and limpid." This quotation from the *Washington Evening Star* is given prominence on the rear of the tape box. It is an adequate and fully justified comment on the performance of this renowned instrumentalist.

The sleeve notes include some most interesting remarks about the flute itself. The word "flautist" was apparently adopted into the English language some 250 years after the more simple term, "flutist," had been in common use. The point is made that in the seventeenth and eighteenth centuries the popularity of the instrument was due to a fascinating combination of social influences. During this period the only home diversion for cultivated persons was the "musical evening" in which both the host and guests took part. The violin was not socially acceptable; as an instrument played by wandering gypsies or hired musicians it could not be played by a gentleman. The cello was thought to be more refined but too bulky; the harpsichord was played by ladies—not gentlemen. But the flute was ideal. Its cost was reasonable, its size was no difficulty and the amateur could learn to perform upon it with a little perseverance.

The result of these social nuances was the production of a vast library of music for the flutist, specially written to meet popular demand.

In these four concertos we have some of the very best of the works that might well have been performed at happy social gatherings in any gentleman's residence. In the present age of technological achievement we have so much—and yet we have lost so much. The keen enjoyment and satisfaction of producing music as a pastime for its own sake is today rarely found in private houses. Is the television set really a substitute?

However, the excellent recorded quality of this programme enables the listener to recreate something of the charm and grace of an eighteenth century house party. Overall sound is very good indeed with a minimum of background noise. There is an ever growing interest in baroque music today, doubtless because it stimulates revolt against twentieth century superficiality. For those who would like to forget the world of nuclear physics, computers and financial crises for a brief spell this album is thoroughly recommended.

THE KING OF INSTRUMENTS.

Catharine Crozier at the Aeolian-Skinner Organ, Programme 2. Ampex ASC503, 7½ ips, 4-track Stereo. 75s.

This second album is a worthy successor to the Programme 1 under the same title (Ampex ASC 502 reviewed September, 1957). Catharine Crozier again displays both her own virtuosity and the magnificence of the great Aeolian-Skinner organ at the Auditorium, World Headquarters, Reorganised Church of Jesus Christ of Latterday Saints, Independence, Missouri.

The items comprise *Prelude and Fugue in G Minor*, Dupré; *Sonata de 1° Tono*, Lidon; *The Burning Bush*, Berlinski; *Toccata and Fantasy for Flute Stops*, Sowerby; *Chaconne in G Minor*, Couperin; *Noel Etranger*, Daquin; *Concerto in F Major Opus 4 No. 5*, Handel; and finally *Sonata No. 5 in C Major*, J. S. Bach.

Rarely have I heard such brilliance and depth in any organ recording. As I commented on the Programme 1, this tape is also remarkable for its dramatic sound which will delight the heart of any hi-fi addict. One of the characteristics of the organ as a musical instrument is its "mellow" tonal quality. Both strings and brass have in reality a very sharp edge, or bite, to their sounds. The organ produces a smoother, round sound which can sometimes make recordings sound flat or lifeless. There is nothing either flat or lifeless about this album. To the contrary, it reveals a thrilling sparkle which may well be a revelation to some who did not realise the instrument's potentialities.

For sheer delight I would thoroughly recommend the Berlinski and Sowerby works which together epitomise the best of the virtuoso performance and the instrument's capabilities. This will be a recording I would hate to have to part with.

CHARGE! Felix Slatkin conducting the Percussion Brigade. Capitol ZT1270, 4-track Stereo, 7½ ips. 75s.

"Obviously," says the sleeve notes, "Alfred Lord Tennyson never heard of stereo." A reasonably safe assumption, from which we may conclude that poor Tennyson was never aware of the sonic possibilities of the Charge of the Light Brigade as now portrayed in glorious stereo. Posterity need not despair; Felix Slatkin has made good this serious deficiency by providing for our entertainment this album under the title Charge!

We are told that this is "an album to excite and delight anybody who ever read the Charge of the Light Brigade, likewise military historians, brass band aficionados, students of percussion, stereo enthusiasts, collectors of lead soldiers, descendants of highland bagpipers, and people for whom such words as grenadier, hussar and dragoon have romantic connotations. This covers almost everybody, and the few who were inadvertently excluded will like this album too. For it brings to startling life a chapter of history that has long passed into dust; the days when men marched into battle to the tune of martial music."

Well! So we are going to bring to life a chapter of history? The album opens with a lusty voiced battledcry of "Charge!" followed by cannon roaring right, left and centre and trumpets all over the place. I have quoted at length from the notes because they obviously intend to convey the recreation of the Balaclava scene, or at least the Balaclava atmosphere. The claim to bring these events to "startling" life is fully justified. I was nearly startled out of my life

by the sound of the lusty voices crying "Charge!" Why? Because even in that one word they had the broadest American accents I have heard for many a long day!

It should not take our history dons too long to revise the story of the Crimea. The Light Brigade was in fact a small mounted detachment of U.S. Marines whose heroism was immortalised by a guy named Alf (alias Lord) Tennyson, a hitherto little known Manhattan scribbler.

Having got most of the resentment out of my system I can begin to think a little about the recording. As you might guess it is gimmicky stereo but I must grudgingly admit that it is rather brilliantly done. My military knowledge is not sufficient to enable me to definitely classify the many bugle calls but I suspect their derivation to be wholly American. There is of course not the slightest reason why the Americans should not portray this significant historical event—but what a crying shame that it could not have been done authentically in this country. One can only conclude that had it been then the recorded quality would not be comparable to what we hear in this album.

Under the sub-title "Drummer Boys" we hear some of the most spectacular military drumming that I have ever come across, while Bugler's Dream is a medley of bugle calls. On side 2 we have Marching Fifes and Drums followed by Bagpipes and Drums with massed musicians concluding with When Johnny Comes Marching Home.

An invaluable recording for all the listed category of persons likely to be interested but I feel it should be made obligatory listening in all secondary school history departments.

JONAH JONES, GLEN GRAY. The Jonah Jones Quartet with Glen Gray and the Casa Loma Band. Capitol ZT1660, 4-track, Stereo, 7½ ips. 75s.

If it's sound you're after then you will certainly get your money's worth out of this collection. Not only is there plenty of it, but in the hands of the Jonah Jones Quartet the trumpet performs feats of acrobatic improbability which strain at the listener's credulity as well as his eardrums.

Not all the numbers are blast and blare; there is a fine sense of instrumental delicacy generously displayed in the performance of: *Baubles, Bangles and Beads*, *Echoes of Harlem*, *Two o'clock Jump*, *I Can't Get Started*, *Boy Meets Horn*, *Hot Lips*, *After You've Gone*, *West End Blues*, *Ciribiribin*, *Tenderly*, *Sugar Blues* and *Apollo Jumps*.

These titles cover arrangements, or groups of arrangements, intended to offer a suitable vehicle for the performers' dexterity. And believe me they do.

Recorded quality could hardly be better. Stereo is brilliant verging on gimmicky and the entire mixture adds up to a must for the devotee of dazzling trumpet techniques. I doubt if such a display has ever been bettered anywhere. By ingenious manipulation Jonah Jones maintains his own distinctive style throughout whilst at the same time reminiscing musically into the idiom of the stars whose identity will forever be linked with the numbers they are performing. A clever and original recording.

The tapes reviewed this month are issued by the following companies:—

"Epic" "Capitol": Distributed by E.M.I. Records Ltd., Imported Tape Division, Blythe Road, Hayes, Middlesex.

"Ampex": Distributed by Ampex (Great Britain) Ltd., 72 Berkeley Ave., Reading, Berks.

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NEW PRODUCTS

AMPEX TAPE DECK

A COMPACT stereo tape deck offering after-record monitoring facilities, sound on sound, sound with sound, echo and duet effects has now been placed on the market by Ampex Great Britain Limited.



Designated the Ampex 753, it is smaller than all previous models, measuring 15½ x 13 x 6½ inches. The new deck has three heads, erase, record and playback, permitting precise monitoring and a range of sophisticated audio techniques. The machine has twin VU meters, 3 speed operation, all solid state electronics, automatic shut-off and dual capstan drive which is claimed to reduce wow and flutter to a minimum. The specification quotes an overall record/reproduce frequency response measured at the preamplifier output as 40-15,000 Hertz plus or minus 3 dB at 7½ ips, 50-7,000 Hertz plus or minus 4 dB at 3½ ips. Signal-to-noise ratio from peak record level to broad band noise is given as 46 dB unweighted at 7½ ips and 43 dB unweighted at 3½ ips. The weight of the deck is 23 lb. and it can be supplied with a solid teak cabinet and Plexiglass cover at an extra cost of about 6 guineas. Basic price of the 753 is 91 guineas.

Ampex International, 72, Berkeley Avenue, Reading, Berkshire.

NEW QUAD ALL-TRANSISTOR

THE Acoustical Manufacturing Co. Limited announce the introduction of their completely new fully transistorised amplifier, control unit and FM tuner.

Dealing firstly with the control unit, designated Quad 33, this performs the normal function of such an apparatus by selecting and controlling the radio tuners, gramophone pick-up and tape recorder connected to it and feeding the loudspeakers via the main power amplifier for either stereo or mono on either or both channels from all inputs. In addition the new 33 model (unlike its valved predecessor) offers monitoring and track selection facilities for tape. Connections at the rear are by standard DIN sockets which include a 5-pin combined record/replay receptacle.



Equalisation to suit different makes of pick-ups or different tape recorder requirements is provided by means of plug-in printed circuit boards. On the face of the control unit is the volume control and on/off switch, separate bass and treble controls together with filter slope control. Push keys provide mono/stereo operation, track selection and choice of inputs, disc, radio 1, radio 2 or tape. Depression of the tape button while another input is also selected provides the AB monitoring facility "off tape" during recording. An additional row of push buttons gives a cancel setting to remove all tonal correction, and five, seven and ten kilo-Hertz preset filter controls which when used in conjunction with the filter slope will remove record surface noise, high frequency distortion, etc.

The specification of the Quad 33 control unit claims less than 0.1 per cent distortion for any control settings at any level within overload ratings within the range 30-10,000 Hertz. Frequency response for any input, any output RIAA or flat as appropriate is 20-20,000 Hertz plus or minus 0.5 dB.



The Quad 303 power amplifier is a single compact unit housing both channels, designed to accept the output from the Quad 33. Not only does it employ entirely new circuitry designed for continuous operation but it is claimed to offer an outstandingly high quality of sound reproduction. The manufacturer points out that the distortion content from a transistor amplifier must be appreciably lower than that of its Class "A" valve equivalent for the quality of reproduction to be as acceptable. The Acoustical Manufacturing Co. Limited then claims that the Quad 303 is ten times lower in distortion than the best valve amplifiers and about one hundred times better than most other transistor amplifiers.

The claimed distortion at 10 kilo-Hertz is better than 0.1 per cent with unrestricted band-width at any level up to 45 watts 8 ohm load. Frequency response is quoted as

minus 1 dB (reference 1 kilo-Hertz) at 20 Hertz and 35 kilo-Hertz into 16 ohms. The 303 power amplifier has been designed for any purposes where the output will be fed into a load impedance greater than 8 ohms. Below 8 ohm applications should be restricted to music and speech reproduction or intermittent sine wave duty.

The FM stereo tuner is a self-powered unit with automatic switching for stereo reception. When connected to the 33 control unit the operator can override automatic stereo reception by switching independently to mono if reception conditions are difficult.

Prices of the new equipment are: 33 Control Unit £43, 303 Power Amplifier £55, FM Stereo Tuner £40 plus £8 5s. purchase tax. The familiar Quad Electrostatic Speakers are continuing in production at £57 but owners are warned that those models with serial numbers prior to 16800 must be modified before being used with the Quad 303 Amplifier.

The Acoustical Manufacturing Co. Limited, Huntingdon.

NEW NAGRA DISTRIBUTOR

A CHANGE of distributor is announced for what must be acknowledged to be the world's most famous battery portable recorder. Distribution of the Nagra is now in the hands of Hayden Laboratories Limited, East House, Chilton Avenue, Amersham, Buckinghamshire. All inquiries for new equipment and service to existing equipment should now be addressed to this company.



Hayden Laboratories Limited, East House, Chilton Avenue, Amersham, Buckinghamshire.

MORE SUGDEN TEST GEAR

ANOTHER new piece of test equipment from Sugdens is the Si 452 Distortion Measuring Unit.

Designed as a low-cost but efficient instrument, price was effectively reduced by deliberately omitting to include a millivolt meter. It was reasoned that those wishing to acquire a distortion measuring unit will undoubtedly already own a millivolt meter, and so the manufacturers offer a piece of equipment which avoids duplication and does not make the user pay for a second instrument he does not want.



Features include variable gain controls, a set 100 per cent switch passing the full signal when operated and an "LF reject" switch bringing in a 12 dB/octave high pass filter for the rejection of 50 and 100 Hertz ripple present on the input. The omission of an expensively calibrated dial for tuning has resulted in considerable cost saving. When the input frequency is known it is merely necessary to operate a tuning control to produce a null. There is no purpose in measuring a known frequency.

Styling is identical with other Sugden instruments and features all PVC clad exterior surfaces for durability and easy cleaning. Power is by batteries which are said to last for months and the size is 10 x 5 x 7 inches. Weight complete is 10 lb. Price £25 carriage paid UK and delivery is from stock.

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ALL packs of Mastertape in spool sizes 5 inches, 5½ inches and 7 inches are now offered in an entirely new type of container.

Moulded in the form of a book from black, high-strength polypropylene, the box has grained front and back covers with an elegant gold lettered brand label on the front. The brand name is repeated on the spine in a colour which identifies the thickness of the tape inside (red for standard play, yellow for long play, etc.). This is also printed, together with the reel size and tape length, on a spine label. Both the front cover and the spine are hinged with snap-in fasteners to keep the box closed in storage.

Apart from the reel of tape in its polythene envelope the box also contains a printed index card and a tape clip and is sealed for despatch in plastic film.

With the introduction of the new box Mastertape are also reorganising their distribution arrangements with the appointment of a number of regional wholesalers so that individual customers should encounter little difficulty in acquiring supplies.

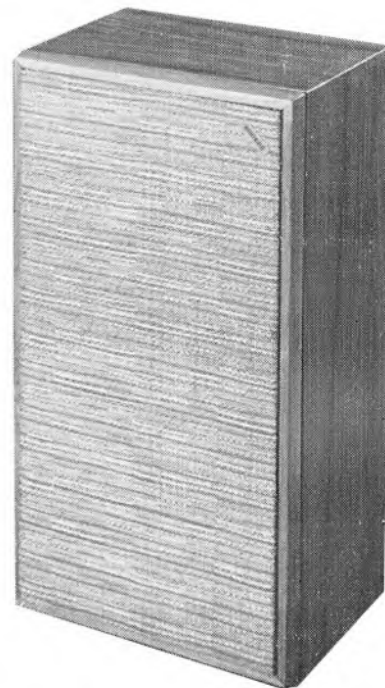


Typical prices are 7-inch standard play 1,200 feet, 33s. 6d.; 7-inch long play 1,800 feet, 50s.; 7-inch double play 2,400, 77s. 6d.; and 7-inch triple play 3,600 feet, 100s.

Mastertape (Magnetic) Limited, Prescott Road, Poyle Trading Estate, Colnbrook, near Slough, Bucks.

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Cost of the Compact model illustrated above is £25 plus purchase tax £4 13s.; Standard model £39 10s.

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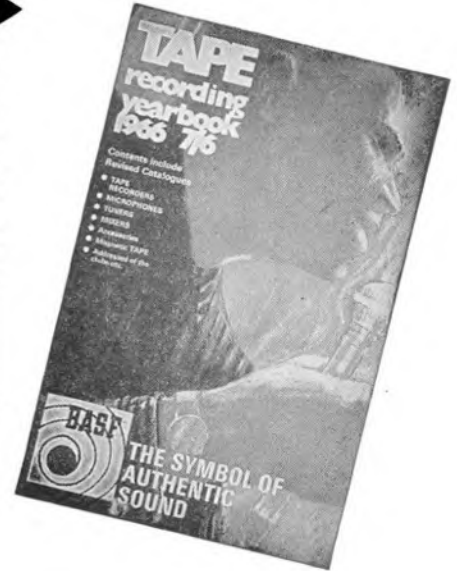
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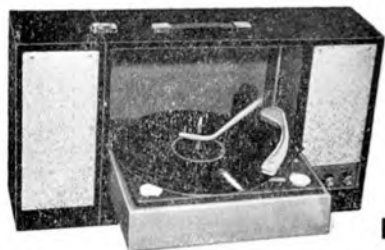


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