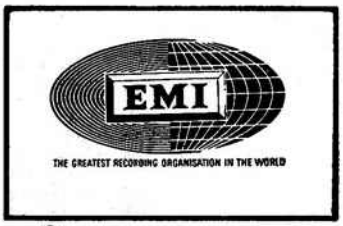
Amateur Tape Recording

AUDIO-VIDEO

June 1967 Vol 8 No 11 2/6

PORTABLES IN ACTION—Pages 16, 18, 20 ★ ATR VISITS SENNHEISER—Page 24

TIP TOP TAPES



3¾ I.P.S.

Andy Stewart

Andy Stewart and his friends of the White Heather Club

HMV TA-CLP3616

Cliff Richard

Don't stop me now

Columbia TA-SX6133

Nina and Frederik

Dawn

Columbia TA-SX6134

The 50 Guitars of Tommy Garrett

In a Brazilian Mood

Liberty TA-LBY1353

E.M.I. RECORDS (THE GRAMOPHONE CO. LTD.) E.M.I HOUSE, 20 MANCHESTER SQUARE, LONDON W.1

Amateur Tape Recording

AUDIO-VIDEO

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Vol 8 Number 11 June 1967

EDITORIAL COMMENT

The theme for this issue of *ATR* is *Summer Time is Outdoor Recording Time* and to this end much of our editorial is devoted to portable tape recorders and their use and to the subject of getting out and about generally. This issue also contains the full rules and entry form for the *British Amateur Tape Recording Contest* of which *ATR* is now one of the sponsors and your Editor a member of the committee. The reason for mentioning both outdoor recording and the **BATR** contest in the same paragraph is because of the connection between the two, not an entirely direct one perhaps, but still worth a comment. If you should happen to fancy making an actuality or documentary tape for the contest you may well find some ideas and guidance in this issue. There is more to come, for by the time this copy is on its way to the printers I shall be off on two tape and travel ventures of my own. One will be taking me to the Continent in search of 'record-your-holiday' type of material and the other to Norfolk on a recording-the-sounds-of-the-countryside safari, all of which I hope will provide more ideas for the actuality-documentary enthusiasts. Of course, the other classes in the **BATR** contest have not been forgotten and to this end there will be articles and guidance on music recording, speech and drama, technical experiment and, last but not least, recording in schools. Some of these subjects have already been dealt with in *ATR*, so a little research into some of the feature articles in recent issues may be worthwhile. Back copies of *ATR* are available (write for list, enclosing sae). Now a final appeal – please support the British Amateur Tape Recording Contest this year by making a tape. You have nothing to lose and you could win a valuable trophy and/or some useful equipment.

FCJ

FRONT COVER

This month our picture shows Moira Shippard, *ATR* Assistant Editor, recording an interview with blind Hammond organist and *ATR* reader 'Eddie' Gates of Norwich. Eddie is a member of the Hammond Organ Society and a tape recording enthusiast who is always pleased to meet *ATR* readers at the Ship Inn at Reedham in Norfolk, where he plays his Hammond every evening during the summer. Our Assistant Editor recorded some of his delightful playing with the Sennheiser MD 421 microphone and Uher 4000 Report-L portable tape recorder. A visit to the Sennheiser microphone factory in Hanover is featured on page 24 of this issue.

Greatest pre-recorded tape offer ever made!

Take one for 6/11

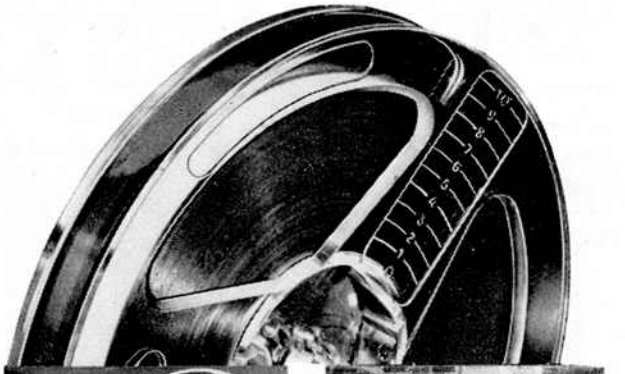
(just a fraction of basic cost)

a 3¾ ips tape

(OR 12" LP IF YOU PREFER)

HERE'S WHY We want you to *prove for yourself* that what we say about World Record Club recordings is absolutely true – that for sheer quality they are unsurpassed by any other records selling at any price. *Anywhere!*

So choose any one of these magnificent WRC recordings, and actually test it yourself on your own home equipment for 7 days. And read through the fascinating literature we shall send you about WRC, and seriously consider joining Britain's finest record club. You'll find WRC's annual programme of 120 special club releases very tempting! The cream of the World's great Classical, Folk, Jazz, Popular and other music as well – and all offered exclusively to members at special privilege prices.



70 Band of the Royal Scots Greys plays regimental music. 12 items include Colonel Bogey; Semper Fidelis; El Capitan.

60 Glorious melodies performed by Jacqueline Delman, John Larsen, Linden Singers, Sinfonia Orch./Hollingsworth.

***63** Alexander Jenner in an electrifying performance with the Bavarian State Radio Orch., led by Odd Gruner-Hegge.

61 Fidelio Overture; Brahms St. Anthony Vars; Mendelssohn Hebrides Overt; Siegfried Idyll—exciting interpretations.

362 Blue Danube; Emperor; Vienna Woods; Voices of Spring; Roses from South – glittering waltzes by Vienna Symphony Orch./Rudel.

32 Famous TV pianist Joseph Cooper plays this triumphant concerto with the Sinfonia under Dods. Also Saint-Saëns' Rouet d'Omphale.

This offer is strictly limited and is confined to one reply per household.

20 Star cast sings all the famous songs: Hello Young Lovers; I Whistle a Happy Tune; Getting to Know You, etc.

31 John Hollingsworth conducts the Sinfonia of London in a thrilling performance of this famous ballet music.

443 Seekers Chart-topping MORNING TOWN RIDE; BLOWIN' IN THE WIND; 10 more hits.

16 Sinfonia of London, conducted by Muir Mathieson, give a splendidly moving performance of this well-loved work.

14 Sinfonia of London under Muir Mathieson give scintillating performances of Bizet's two delightful suites.

302 Vintage collection of ballads by the Big Daddy of folk-singers. Tracks inc. Early One Morning, The Irish Rover.

44 Covent Garden Ballet, conductor the late John Hollingsworth, in a sparklingly fresh rendering of this lovely ballet.

30 Memorable playing by Endre Wolf with Sinfonia of London under Anthony Collins.

89 Star cast singing all the greats like Climb Ev'ry Mountain; Do-Re-Mi; Lonely Goat-herd; Favourite Things etc.

✳ Indicates Mono LP's—reprocessed for stereo reproduction.

560 Complete hit parade on one disc—includes Help; Colours; There But for Fortune; Ticket to Ride; You've Got Your Troubles; plus 7 more smash hits.

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IMPORTANT! THIS IS YOUR ADDRESS LABEL — PLEASE PRINT CLEARLY

MR
MRS
MISS .....

STREET .....

TOWN .....

406 Your membership number - please quote on all correspondence.

COUNTY .....

3/

MY CHOICE IS NO.

Enter choice number & prefix only in box.

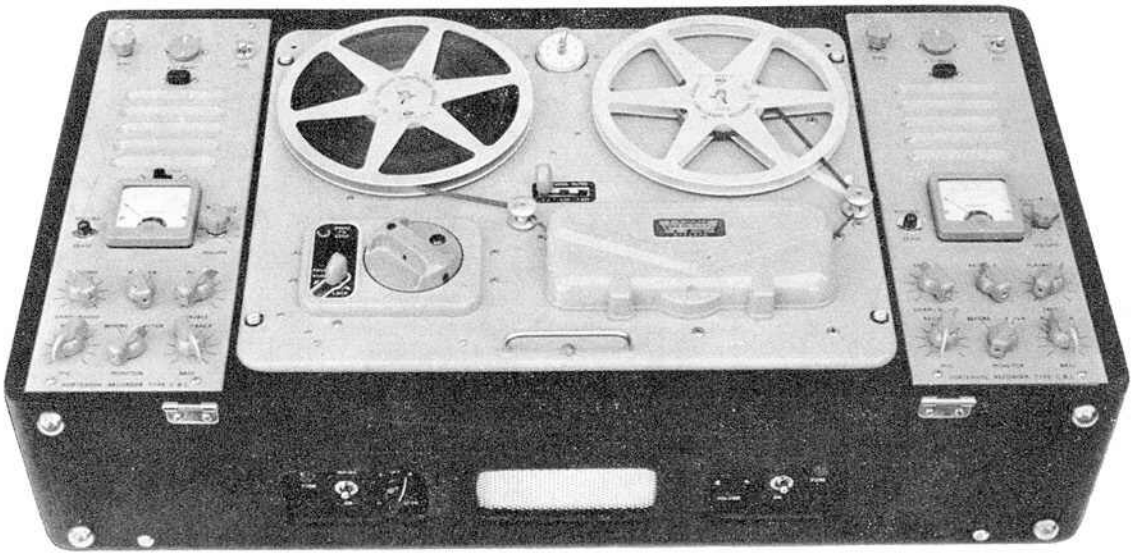
Tick for mono 12" LP | Tick for stereo 12" LP | Tick for 3¾ ips mono tape

This offer applies to G.B. and N. Ireland only.

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

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 10 0**
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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 7 0**
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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"**

THE 1967 BRITISH AMATEUR TAPE RECORDING CONTEST

Silver trophies and other valuable prizes in seven different classes

Ten magnificent trophies – a first prize of cash and equipment to the value of £100 – other valuable equipment prizes – the possibility of hearing your tape broadcast on the radio. These are the rewards awaiting competitors in the **1967 British Amateur Tape Recording Contest.** To give everyone a chance, whatever his or her special interest, there are seven different categories in which you may enter. Making a contest tape is great fun and it does not need to be a difficult technical exercise – some of the simplest tapes have been notable prize winners in earlier contests. Start planning your entry – now!

Study the classes in the contest and you should have no difficulty in getting ideas for interesting tapes. There are many sounds around you which form excellent recording material that you can begin to collect immediately. Plan your tape carefully, think out the idea clearly, consider whether you need to prepare a simple script, try a rehearsal or a 'dummy run'.

Remember, particularly, that you do not have to stretch your recording to fill the whole of the permitted playing time for entries. Shorter tapes are often better tapes, so think carefully about your editing before you submit your tapes. The Judges will take into full consideration the capabilities of your tape recorder and any other equipment you use so that you will not be handicapped by modest resources. Tapes will be judged on subject matter, quality of recording and originality. The panel of judges will have special knowledge of amateur recording and their decision will be final.

The outstanding tape in the contest will be designated **Tape of the Year** and will win a silver challenge cup plus cash and equipment valued at £100 or more. There will be handsome silver trophies awarded to each class winner and other prizes of cash or equipment. The awards will be presented at the International Audio Festival and Fair in London in the spring of 1968 and winners will have their fares paid to London for a special celebration party. All cups and trophies will be held by the winners for one year.

The Organizing Committee is composed of leading audio journalists Donald Aldous, John Borwick, Douglas Brown, John Crabbe and F. C. Judd with C. Rex-Hassan, Director of the International Audio Festival and Fair, as Chairman, Miss Brenda Marriott of Grundig as Vice-Chairman and Hon. Treasurer with John Bradley as Hon. Secretary, representing the Federation of British Tape Recording Clubs.

RULES OF THE BATR CONTEST

1. A tape recording may be entered in any of the following classes:

Class 1	**Speech and Drama**	Sketches, playlets, prose and poetry reading. Fantasy and monologues. *Maximum duration 10 minutes.*
Class 2	**Documentary**	Sound story based on fact – informative, imaginative and/or entertaining and travelogues. *Maximum duration 10 minutes.*
Class 3	**Music**	Live vocal or instrumental performances. *Maximum duration 10 minutes.*
Class 4	**Reportage**	Sound snapshots, interviews, interesting or historic sounds and on-the-spot interviews. *Maximum duration 4 minutes.*
Class 5	**Technical Experiment**	Sound compositions, electronic music, musique concrete, multi-track recording, trick recording. *Maximum duration 4 minutes.*
Class 6	**Schools**	Recordings of any aspect of school life or activities made mainly by the pupils. Age groups are – infants (up to 7 years), junior (7 to 12 years), seniors (over 12 years). *Maximum duration 10 minutes.*
Class 7	**Set Subject**	A tape letter to someone abroad. *Maximum duration 4 minutes.*

2. Prizes will be awarded for the best tape in each class. There will also be special prizes for the best stereo tape and the most humorous tape. The tape judged to be the best in the contest will be selected as tape of the year and will win a major award.

3. Tapes must not exceed in playing time the maximum durations given in rule 1 but may, of course, be shorter.

4. The contest is restricted to amateurs. Those with technical experience in professional studios are ineligible. The production of tapes, the work of recording and editing processes must be entirely that of the entrant.

5. No tapes submitted may contain anything taken from radio or TV transmissions or commercial recordings. Any competitor who has fully or in part used any literary or musical production of which he is not the author or composer and which is still in copyright must obtain authorization from the author, composer or organization owning or controlling the copyright and must produce this form and must state expressly that the author, composer or the organization owning or controlling the copyright forgoes any payment by any broadcasting organization which may transmit the recording (this does not imply that, in the countries where they apply, the normal rights of payment arranged by the organizations owning or controlling the copyright are relinquished).

6. Recordings must be made on standard ¼ inch tape at 1⅞, 3¾, 7½ or 15 ips. Stereo recordings may be entered. The programme must commence at the beginning of the tape and only one track may be used in mono or two tracks in the case of stereo or duoplay. When judging there will be no reversal of spools to hear second tracks. Tapes should begin and end with white or coloured leader tapes.

7. Each tape must be entered in one class only, but competitors may submit entries in any or all classes. The judges are at liberty to re-allocate entries to classes other than those named by the entrants where this is considered appropriate.

8. British entries for the International Recording Contest (CIMES), 1968, will be selected by the Federation of British Tape Recording Clubs from among the entries submitted to the 1967 British Contest. The prizewinning tapes in the British Contest will not necessarily go forward to the International Contest.

9. All tapes will be returned to the competitors provided that adequate return postage is sent with the entries. The contest organizers will retain copies of the winning tapes and those of the runners-up. Copyright of these will be the property of their owners but the contest organizers reserve the right to arrange for the publication of the whole or parts of any or all of them by radio, disc or tape or by any other means.

10. The contest is open only to those normally resident in the UK. The decision of the judges will be final and no appeal may be made nor any correspondence entered into.

11. The closing date for receipt of tapes will be Saturday, 30 December 1967. No entries received after that date can be considered in any circumstances. All winners will be notified immediately judging is completed and a complete list of awards will be sent to all entrants.

12. Every tape entered must be adequately packed and properly stamped and addressed to the **British Amateur Tape Recording Contest, c/o The Secretary, 33 Fairlawnes, Maldon Road, Wallington, Surrey.**

A completed entry form and return postage must be included with *each* tape. Name and address should also be written on small labels firmly affixed to the tape spools and to the containers.

Special Note: Care should be taken in reading the section of the rules covering copyright. If in doubt, consult the Mechanical Copyright Protection Society Limited, 380 Streatham High Road, London SW16.

ENTRY FORM
BRITISH AMATEUR TAPE RECORDING CONTEST - 1967

Please complete in capitals:

NAME .....

ADDRESS .....

.....

.....

AGE..... OCCUPATION.....

HOW LONG HAVE YOU BEEN RECORDING? .....

Details about the attached recording

1. Title if there is one .....

2. Exact duration .....mins .....secs.

3. Recorded at a speed of .....inches per second. (Stereo/Mono)*

4. Category in which you wish it to be entered.....
   Speech and Drama – Documentary – Music – Reportage – Technical Experiment – Schools – Set Subject *
   (* delete as necessary)

5. Make of recorder used .....

6. Make of magnetic tape used .....

7. Any other equipment used (i.e. microphone, mixer unit, tape splicer, etc.) .....

   .....

   Give details and manufacturers.....

   .....

   .....

8. When and where was the recording made? Titles of works used. Names of authors, composers, duration, etc.

   .....

   .....

9. Names of any assistants and how they helped in making the recording.

   .....

   .....

I DECLARE that the enclosed tape feature is entirely my/our own work and that I/we have not included on the tape any copyright material from radio, television, commercial recording or any other source for which authorization has not been granted.

Signed .....

Tandberg Series 9
the world's finest portable, mono record & playback system

Features:
* Available with either a teak finish or in the new 'Aero' carrying case.
* Two or four track.
* Highest quality 'built-in' speakers and amp system.
* Suitable for all Home, Office and Educational use.
* Micro-switch automatically stops spools when tape runs out.
* Remote control facilities if required.

Specification:
Recording System: 4 or 2 track mono.
Tape Heads: 1 erasing head, 1 record/playback head.
Tape Speeds: $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i.p.s.
Speed Tolerance: Better than 1.5%.
Internal Speakers: 7" x 4" Goodman at 4 ohms impedance.
Frequency Response:
$7\frac{1}{2}$ i.p.s. : 30-20,000 c/s (± 2 db 40-16,000 c/s)
$3\frac{3}{4}$ i.p.s. : 30-13,000 c/s (± 2 db 50-10,000 c/s)
$1\frac{7}{8}$ i.p.s. : 30-7,000 c/s (± 2 db 60-5,000 c/s)
Wow% R.M.S.
$7\frac{1}{2}$ i.p.s. : better than 0.1%
$3\frac{3}{4}$ i.p.s : better than 0.15%
$1\frac{7}{8}$ i.p.s. : better than 0.25%
Signal/noise ratio:
At 5% distortion: 56 db.

Price: From 69 Gns.

THE BEST TAPE RECORDERS BY **Tandberg**

Please send me full details on the Tandberg
SERIES 9
Also full details on the Series
6 ☐ 8 ☐ 12 ☐ tick as appropriate

Name .....

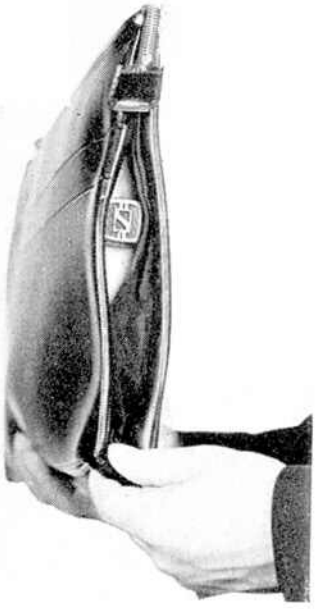
Address .....

.....

Post to Dept. ATR 11
Elstone Electronics Limited,
Hereford House, North Court,
off Vicar Lane, Leeds, 2.

THE HANOVER EXPERIMENT

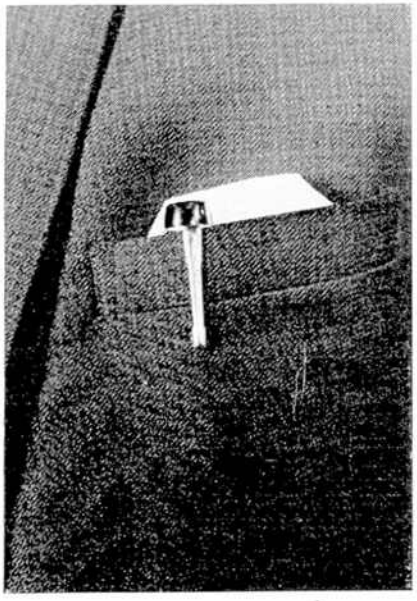
by Bob Danvers-Walker



Left: The brief-case mic in action at the Tourist Office in Hanover.
Right: The Sennheiser MD214 Lavalier microphone proves ideal for this application. It has a lift in frequency response between 2,000 and 12,000c/s which gives added presence. The moving coil element is elastically suspended within the casing to minimize handling noise.

It is a universal characteristic of the human race that people love to see their names in print, can't wait to get into the picture when a camera (still, movie or television) is around, and the very thought of having their voice recorded for a broadcast excites them beyond belief. The trouble is that the instant a camera or a microphone is directed at them they immediately become (1) completely unnatural, (2) no longer themselves but a posed imitation of what they hope they look like, (3) tongue-tied and/or (4) have a mental blackout. For a long time I have held the opinion that one day TV cameras and microphones will have to be concealed from view. Today, candid camera techniques and radio microphones are rapidly proving this point of view. Miniaturization is an important ally in this respect. The threat to the concept came with the unsavoury development of spying cameras and 'bugging' microwave mics. *It is this distasteful and frequently immoral intrusion into the technological and professional fields that is the stumbling block to those who would wish to employ the techniques in an acceptably honest way without bringing offence to personal dignity or trespassing upon the privacy of the individual.* Having made that clear, let me now tell you how I put my theory to the test. An organization which manufactures an extensive and exciting range of dynamic and condenser microphones is Sennheiser of Hanover. My plan was to carry out an experiment whereby I would talk with a number of people and record our conversations without their being aware of a microphone. I solemnly resolved to disclose the deception immediately afterwards. I also wanted to prove to my satisfaction that a visibly present microphone tends to be destructive to clear thinking and engenders nervousness. Sennheiser manufacture three ideal miniature microphones for this purpose; the MD214 dynamic Lavalier (£29 17*s* 0*d*), the MM61 'fountain pen' microphone (£5 19*s* 0*d*) worn in the breast pocket and the MM23 lapel microphone (£5 15*s* 0*d*) for the button hole. London agents of this West German organization are Audio Engineering, 33 Endell Street, London WC2.

I asked them to conceal the MD214 in a leather brief case, replacing one of the end folds with a black gauze cloth. This they did, setting the microphone into a niche cut into an inch-thick oblong of sponge rubber filling the brief case and giving extra rigidity. The mic lead draws out from a slit in the base and connects to the recorder. Thus equipped, I was now ready to proceed with the next stage of my plan. But where to carry out my subterfuge and upon whom? I talked this over with Audio Engineering and we hit upon an exciting and almost daring plan. Why not go over to Hanover, visit the factory at Bissendorf and try out the experiment during our visit to the capital city of Lower Saxony? I presented the idea to the Editor of *ATR* and a date was fixed.



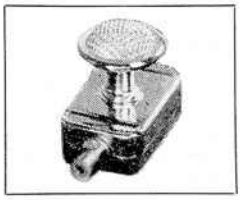
Outside the railway station at Hanover I ask a policeman the way to our hotel. Here I use the penholder mic clipped to the normal microphone holster and concealed amid the coils of the Uher mic lead. The penholder mic lead is taped to the inside of the shoulder strap. The Uher mic plug hangs loose as further camouflage. The playback afterwards almost brought King Ernst August (uncle of Queen Victoria) off his horse!

When it was *all systems go* we met at West London Air Terminal and over a cup of coffee discussed my operational programme. The Editor would concentrate on the factory side of the visit while I engaged in *the Hanover Experiment*. Maybe I could carry out the gentle trap on Professor Sennheiser himself, he said. We laughed at the very idea. Fancy, an unsuspected interview with the very man who invented these minute microphonic miracles! But he agreed that we *must* reveal the deception. 'Of course', I replied, 'that goes without saying ... even the tape *you too have just made*.' The *ATR* Editor had been my first victim!

Travelling by Boeing 727 from Heath Row we changed at Frankfurt on to the Austrian Airline's flight to Hanover. A passenger sitting opposite me, obviously interested in our chatter about microphones and tape topics generally, joined in the conversation. From beneath his seat he produced a wooden box and then introduced himself. He was Arthur Bogaerts, Vice-President and General Manager of ORBO Electronics in Hanover. The wooden box turned out to be the prototype of a brand-new portable tape recorder (not yet even named) which his organization is about to put into production. It employs a BSR deck and is fully transistorized; 24 transistors plus 3 diodes. The machine is single speed ($3\frac{3}{4}$ ips) and takes up to $5\frac{1}{4}$ inch spools. They will be marketed with the choice of a Sennheiser microphone. Production and assembly will be in Bulgaria and will be quality controlled by the State and ORBO engineers. They will also be issued with certificates of excellence conforming to DIN 45,500 which is a West German standard of quality.

That afternoon and evening I had a field day with my 'fountain pen', 'briefcase' and 'button hole' microphones. Airport personnel, German policemen, waiters in restaurants, hotel reception clerks and Tourist Office officials were all successfully recorded, each behaving naturally, chatting freely and easily. I suppose my most gratifying victory was taping the Sennheiser Export Manager unbeknown to him as he drove us in his car to the factory – the 'microphone farm' as the Editor called it, as it is located in an agricultural region and began as a farmhouse. Herr Mannhardt took it very sportingly and complimented me upon my special 'toy', the M214 in the briefcase. The quality of all snatch interviews was remarkably good and quick play-backs caused so much amusement that nobody raised any objection to the trick.

Next day, Sunday, we were driven to the East-West Frontier Zone at Oebisfelde by Herr and Frau Bogaerts. Not the first time that I have looked across the Iron Curtain into Soviet-held territory, I might add. Right through the midst of Germany runs an 860-mile-long strip of land which has been made impassable except at certain check points. This demarcation line separates the Soviet Zone in the East from the Federal Republic in the West. For those in the East the *Prohibited Zone* is three miles wide with a 500 metre *Death Strip* where it borders the West. This forbidden strip, over twenty years old, is weedgrown, sullen and sinister. It is watched over by frontier guards in blockhouses on either side, alert, suspicious and unrelenting. Barbed wire barriers and entanglements, trip wires, guard dogs, booby traps, mine fields and watch towers are the things which engender a brooding silence where roads suddenly end with signs of **ACHTUNG HALT, HIER ZONENGRENZE!**



Outside the Grundig building with the button-hole mic plugged into the same concealed lead. More Hanoverian humour, this time about the hinged-in-the-middle omnibus. The concertina bus is a familiar sight in Germany, guaranteed to send anyone round the bend.

The East-West Frontier Zone at Oebisfelde. Across the river are the fortified lines of the Soviet Sector. Herr Arthur Bogaerts carries the prototype of his portable recorder as we chat with the West German Frontier Guard. This photo was taken following the incident of the rifle shot. Hence the fact that my MD421 Sennheiser with wind gag has been laid aside.

At the Oebisfelde barrier Fred Judd and I were introduced to the West German guard sergeant and shown round the guard house. We were given literature and shown photographs of what happens when someone tries to escape 'over the wall' to the Western sector. No buttonhole or penholder micro-

Right: Professor Sennheiser and I in the Schalltoter *(dead sound) room at the Sennheiser factory. All my four microphones came under discussion during this conversation in the anechoic environment where, as soon as sound is emitted, it dies. Walls, ceiling and floor are fitted with dragon's teeth rockwool wedges to give a completely echoless condition. Even the floor is heavy-gauge wire mesh. Measurements of microphone frequency responses are measured in an anteroom to this acoustic chamber.*

THE HANOVER EXPERIMENT

continued

phone for me here. It's a sensitive location. One even speaks quietly. The Sennheiser MD421 with its wind gag (a bitter wind was blowing) seemed safer. But was it? 'Why are there seemingly no guards in the watch tower over on the other side,' I asked. The soldier passed me his binoculars. 'Take a look over there by that farm building,' he said, 'there are two of them watching us from a fox-hole'. I swept the powerful glasses along the line of crumbling outhouses and barns, past a gaggle of geese making for the river bank (straying animals frequently explode land mines by accident), and then I saw them. Two steel-helmeted heads peering through binoculars at our little group. We met almost eye to eye and I raised my microphone as a kind of greeting. I hadn't read the regulations carefully enough. The Zonal border conduct regulations state: *Do not seek any contact with the guards by shouting or photographing. This is very likely to be interpreted as provocation.* I have a feeling now that my MD421 with its ball-shaped wind gag may have looked like a hand grenade. Anyway, it must have provoked them because one of those Eastern Zone guards fired a shot from his automatic rifle as a sign of displeasure. I suppose they've got to do something to fill in the time. We left Oebisfelde as an evening mist was rising from the dank grass and tall weeds covering the mine field.

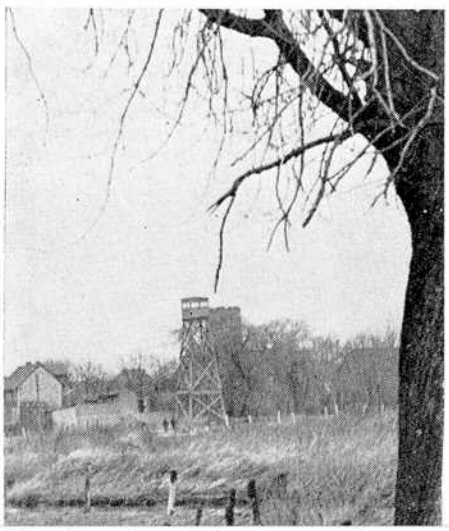
Fred Judd and I got back to London Airport on the day Mr Kosygin's plane was diverted to Heath Row from Gatwick. Our BEA Trident from Düsseldorf approached the runway with visibility at 2,000 yards which was rapidly diminishing. As the landing flaps came down we entered a dense blanket of fog which instantly reduced visibility to 500 yards. The plane made a perfect landing into a pea-souper. The Captain confirmed this over the aircraft PA system as we sat fog-bound for about twenty minutes on the landing strip waiting to be shepherded in. In a very matter-of-fact voice he concluded: 'Incidentally, that landing was by automatic control.'

One way and another, the whole week-end had been very largely a case of hiding things from view.

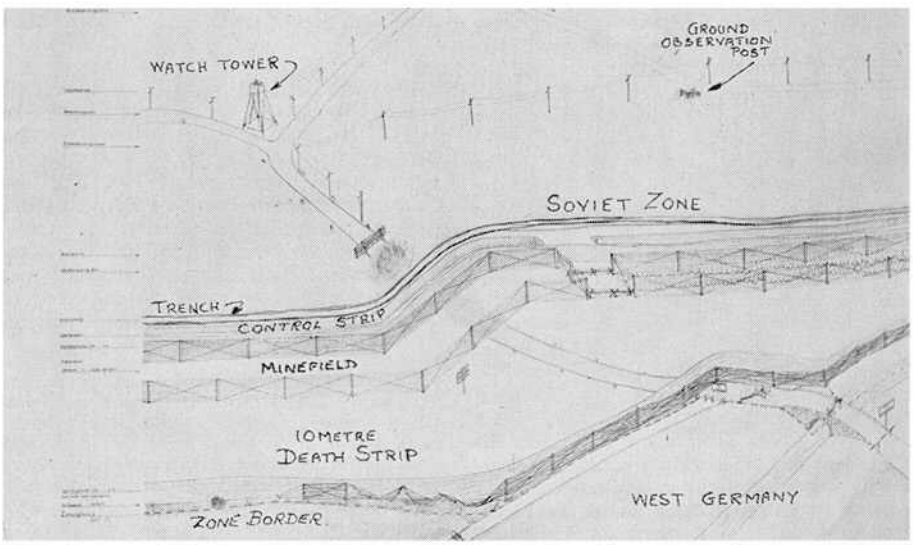
SEQUEL TO THE HANOVER EXPERIMENT

The 850-mile death strip that severs East and West Germany so completely and effectively is itself the subject of a photo documentary published in several languages (including English) by West German zone control authorities. It could, of course, be the subject of a sound documentary, a somewhat awesome one perhaps and in case you have already had thoughts about it, the following might be worth noting. Anyone travelling in Western Germany can quite easily approach the zonal border which is marked **'Achtung! Zonengrenze' or 'Halt! Zonengrenze'** as the case may be. These signs warn visitors that the demarcation line runs immediately behind them. The 10 metre strip is often no longer marked for long stretches and in many places the barbed wire fence is decayed. *By touching or passing the markings of the demarcation line there is a risk of being severely injured or even killed.* The following warning is also given especially to tourists. *Do not seek contact with East German guards by shouting or photographing. This might be interpreted as provocation.* Information for tourists can be obtained from the Zonenrandberatungsdienst für Niedersachsen, 2, Callenberger Strasse, Hanover. FCJ

The uniform and camouflage clothing of an East German border guard.



The village beyond the wire is in the Soviet controlled zone of Germany. Note the watchtower at the base of which can just be seen the two East German border guards, one of whom fired a warning shot when Bob Danvers-Walker and ATR Editor Fred Judd came too close to the wire with tape recorder and camera. This point is at Oebisfelde not far from Helmstedt.



This diagram which the Editor photographed in the West German guard hut at Oebisfelde shows the layout of the border strip at this point and which is typical of the 850 mile long 'Zonengrenze' (The annotations in English are ours).

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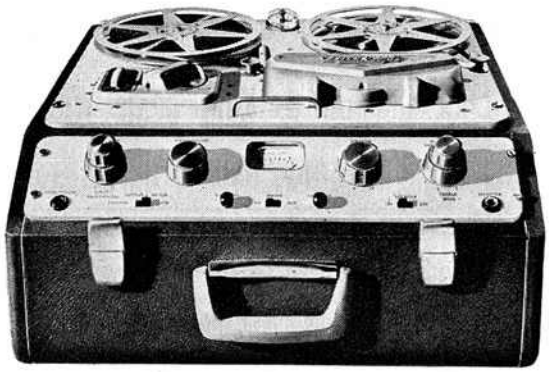

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INTRODUCTION TO TAPE RECORDING PART 2

This month Gordon J. King deals with acoustic feedback and monitoring

Last month's article took the real beginner stage-by-stage from unpacking his new recorder, through the adjustments necessary to ensure its proper operation and to the basic techniques of microphone recording and replay. There are several additional preliminary aspects which must now be considered.

Many machines nowadays have loudspeaker monitoring facilities allowing whatever is being recorded to be heard in the replay loudspeaker. Such machines have the ordinary *recording level control* plus a *replay volume control*. We have already seen that the first control adjusts the depth of the recording on the magnetic tape, while the second control adjusts the volume of the replay sound. This second control, however, may also channel some of the signal *being recorded* into the replay section and thence to the loudspeaker.

This facility can be useful, as we shall see later, for monitoring programmes being recorded from, say, a radio set or gramophone pick-up, but it can prove embarrassing when the recording is being made from a microphone. If the volume control is turned up while the microphone is being used close to the recorder, the microphone will pick up two signals of the same material, one from the speaker or instrument being recorded *direct* and the other from the recorder's loudspeaker; which, of course, is the same programme material but arriving at the microphone *indirectly*.

Acoustic Feedback

A vicious circle of sound is thus established. This can really get out of control and will be heard as a progressively increasing howl as the volume control is turned up or as the microphone is brought closer to the loudspeaker. This is called *acoustic feedback*, and the only way that it can be eliminated once it has started is by either turning down the volume (monitor) control or by putting a greater distance between the recorder (i.e., its internal loudspeaker) and the microphone.

Acoustic feedback is illustrated in Fig. 1, which shows the microphone picking up sound waves direct from the source and indirectly from the recorder's loudspeaker. Now it will be desirable at this juncture to understand that sound waves impinging upon a microphone are changed into equivalent electrical signals, and these signals are fed through the wire from the microphone to the recorder's amplifier and thence to the recording head, where they put a 'magnetic pattern' on the tape oxide.

With the ordinary kind of monitoring facility, the signals are extracted from the recording amplifier before they arrive at the recording head, and from here they are fed into the replay amplifier (or, at least, the latter section) which is the reason why they eventually emanate from the loudspeaker. It should be noted that there is another kind of monitoring facility where the signals actually recorded on to the tape are immediately replayed by a separate head while the recording is taking place. This replay head is connected to the replay amplifier which can be run during a recording session so that the signals being recorded *on the tape* can be reproduced. This is called *AB monitoring*, which will be looked at in greater detail later in this series. Only expensive machines have this more elaborate monitoring scheme, and for the moment we are considering the relatively inexpensive domestic recorder.

Anyway, to get back to Fig. 1 and acoustic feedback, we have seen the effect produced by this, and if the howl is allowed to continue it will be recorded on to the tape and the wanted sound will be completely swamped. There are times, nevertheless, when loudspeaker monitoring can be useful, even when a microphone is being used, and this is when the microphone is set up in a separate room or cubicle and therefore well away or cut off from the loudspeaker's sound field. Even if there is little sound leakage from one room to the other, a fairly large level of monitoring signal can still be used without danger of acoustic feedback. Some sort of monitoring is, in fact, desirable when the real sound source cannot be heard by the person operating the recorder. The signal will, of course, be revealed on the recording level indicator, but it is handy to know just what it sounds like when adjusting the recording level control to avoid overloading or poor signal/noise ratio, as explained last month.

Increasing Reverberation

Before leaving the subject of loudspeaker monitoring, it may be useful to know that a kind of reverberation effect can be introduced to a microphone recording when the recorder is being used in the same room as the microphone by carefully setting the volume control just below the feedback level. The microphone is best placed on one side of the room and the recorder (and its loudspeaker) on the other side.

The microphone will then respond to the direct, intimate sound being recorded and also to the indirect sound from the recorder's loudspeaker. The latter sound, however, will be coloured to some extent, depending upon the nature of the room, by the reverberation characteristics. Components of the sound will thus arrive very slightly later than those corresponding to the direct sound, and if the room is particularly reverberant a slight echo effect may be introduced. This needs careful experimentation for the best results, particularly in terms of monitoring sound level and placement of the recorder and microphone in the room. But it can be used to make a 'dead' room 'live'. An extension of the idea is shown in Fig. 2, where a fairly large room is set up with microphone and an external loudspeaker to introduce the echo effect.

Of course, the use of headphones for monitoring avoids all possibilities of acoustic feedback and reverberation effects because of the small power delivered by such monitoring devices. Headphones are generally

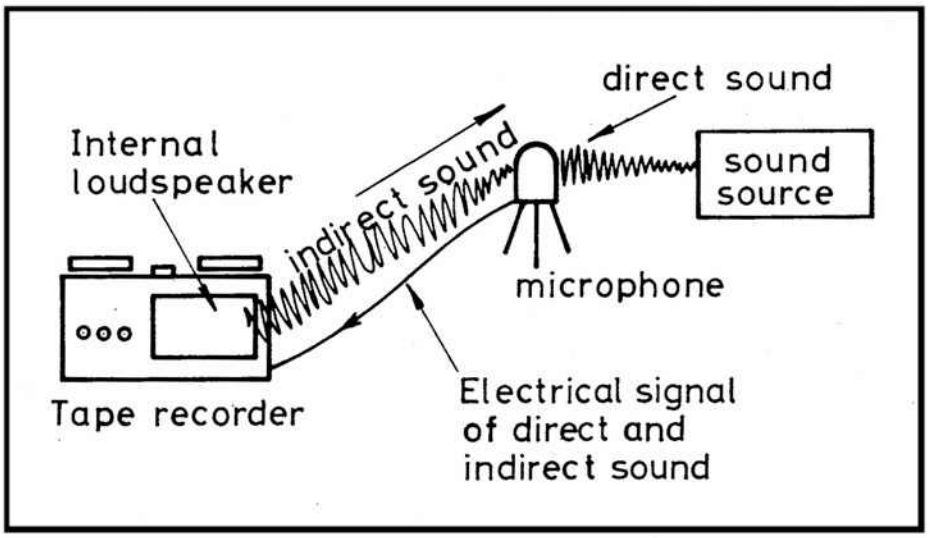


Fig. 1. Showing how acoustic feedback takes place when the recorder's loudspeaker is used to monitor a recording made through a microphone.

adopted by professional recordists and many machines, even relatively inexpensive ones, have a socket to which headphones or earpieces can be connected to monitor the signal in the recording amplifiers.

Tone Control

Some tape recorders have a *tone control*, and very few beginners know what this is really for. Well, first, it has no effect on the recording and comes into operation *only* on playback. Unless the machine is somewhat elaborate, there will be just the one tone control, which is usually nothing more than a treble-cut control. This means that when it is fully retarded it is effectively out of circuit. This allows the full treble response of the replay amplifier to be exploited when the control is advanced. Retarding or turning down the treble control may also give the *impression* of bass-lift, since when the treble is cut the bass output may be that much more powerful, relatively!

The simple curves in Fig. 3 give some basic idea of how the treble cut control works. For good quality recordings, the control should normally be set about midway but if there happens to be a high hiss level, indicating a very poor recording, the playback may be less disturbing by turning the control down a bit. This cuts the treble signal, and since the noise mentioned has high-frequency components, the treble cut will automatically reduce these. Remember, though, that it is not possible to reduce background noises *without* affecting the treble quality of the recorded signals.

The control may also be operated to give the impression of bass lift if the recording happens to be deficient in bass, but this rarely happens on the low speeds, though it could happen at the highest speed, where the full treble potential of the machine is exploited.

Some tone controls give treble cut (or effective bass boost) when turned one way (usually anti-clockwise) and treble boost when turned the other way. The treble boost effect is shown on the outside dotted-line curve in Fig. 3.

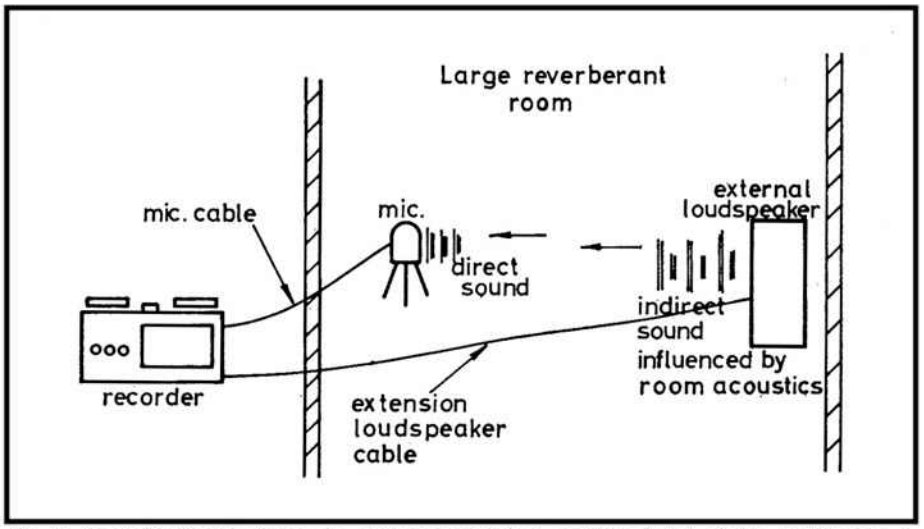


Fig. 2. Acoustic feedback can be purposely applied, as this sketch shows, to liven-up a 'dead' room.

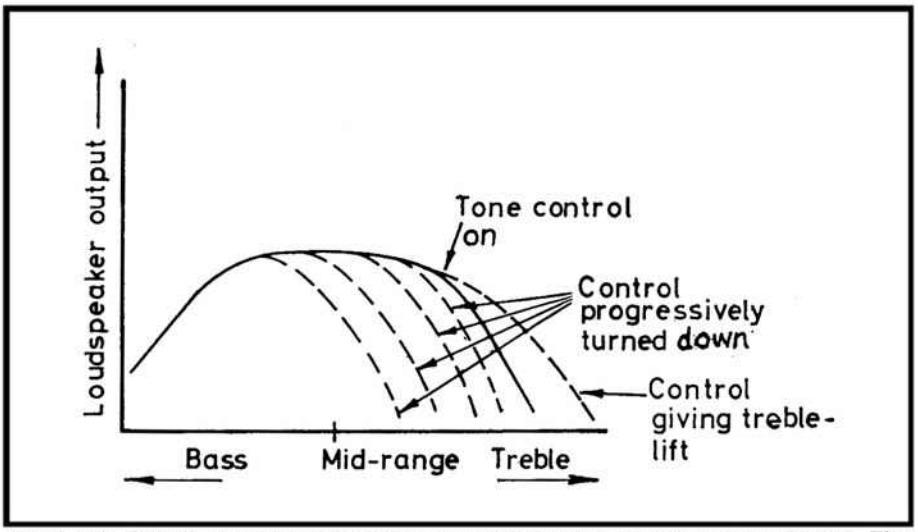


Fig. 3. The full-line curve represents the normal frequency response of a recorder. The inside dotted-lines show how the treble response is progressively reduced as the tone control is retarded. The broken-line curve on the outside shows how the treble output is boosted when the tone control is advanced.

Tape Speeds

The less costly tape recorders are internally arranged for the tape to pass the heads at a single speed, usually 3¾ ips. This is sometimes referred to in technical articles and books as the *tape velocity*. Slightly more expensive domestic machines and semi-professional models can often be switched to work at other tape velocities. The standard velocities are 1⅞, 3¾ and 7½ ips, the 7½ being twice the velocity of 3¾ and the 3¾ being twice the velocity of 1⅞. Some semi-professional machines and professional models run at 15 ips and even at 30 ips, this latter being the top velocity at one time common for professional recording. 15 ips is now mostly used, and there are indications that this may be dropped to 7½ ips.

The greater the tape velocity, the higher becomes the treble frequency response of the recorder. In modern equipment, however, full-range treble recordings can be made and replayed at 7½ ips. It may seem silly, therefore, for a professional machine to run at 15 ips and even 30 ips, when all the audio information can be recorded and replayed at 7½ ips. It seems, on the face of it, nothing more than a way of using up more tape than is necessary!

Actually, there is much more to it than that. First, domestic and semi-professional machines are able to record and replay full-range treble at 7½ ips because the gaps in the heads, particularly the replay head, are made very, very narrow indeed, and it is the replay gap which defines the fast occurring, high audio frequency magnetic patterns recorded on the tape (we shall have more to say about these magnetic patterns in a later article). Indeed, the gap spacer in modern replay heads may be little more than about one-tenth of one-thousandth part of an inch. This is microscopic, as can be imagined.

This gap dimension can only be maintained at the active surface of the head, where the tape oxide passes, and within the depth of the head pole-pieces the gap widens. Now this is all right so far as domestic machines are concerned. They get considerably less head wear than professional machines which may be working all day long. This sort of head gap dimension in professional models, therefore, would soon be widened due to the tape wearing away the pole-pieces. Thus, very narrow gaps are avoided, and to combat the fall in treble response due to this the tape is therefore run much faster through the machine.

Secondly, the response of domestic models running at the less than professional tape velocities is lifted by treble boost circuits coming into action not only during recording, but also during replay as well, on some models. While there is nothing particularly wrong with treble boosting, it can add a little more noise than is absolutely necessary, and this just cannot be tolerated on professional machines. The higher tape velocity, therefore, avoids the use of excessive treble boost to maintain the response.

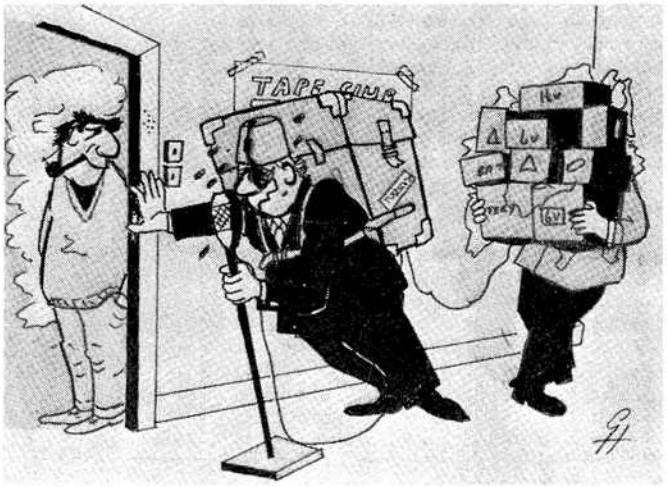
Thirdly, quite a lot of tape editing is often necessary after a professional tape recording session, and the greater the tape velocity during the recording, the more spread-out along the tape will be the magnetic components of the recording pattern. This makes it much easier to edit the tape, to add extra bits or to extract unwanted sections. Indeed, it is often necessary to cut the master tape while editing right at the

continued on page 46

The battery portable offers tape recording enthusiasts the chance of

GETTING OUT AND ABOUT EN ROUTE

by Graham Harris



'It runs on batteries.'

You name it, he had it and he'd just spent a couple of months in Turkey! He was the member who gave the club a gilt edge. Every now and again the demonstration table would creak beneath the treasures that he would pour out from an apparently bottomless sack of equipment. The day of the revolution came when, staggering into the beery, smoke-fogged hall, venue of the tape society, he and a coolie friend of his dragged the thing in!

Tearing off the leather straps and pulling the canvas cover away they produced it. A monster of a tape recorder. All of his tape recorders were huge, but this one was different. After a brief and complicated performance with a set of levers that growled like a painful 'crash' gearbox, the room rang with the merriments of an obscene Turkish lullaby. But the thing of things . . . the recorder was not plugged in! A gasp of amazement chilled the room as the secret, the revolution, was exposed. *'It runs on batteries!'*

That was ten years ago and, of course, the whole scene has been changed with the progressive move to smaller and better battery portable tape recorders. Sad to relate the affluential member disappeared soon after; judging from the size of that early battery 'portable', I supposed he must have crippled himself! Tape recording has been revolutionized with the introduction of the battery-driven models – a natural step of course, but, nevertheless, the shackles of the tape recordist have been released. It is, possibly, the easiest recorder to operate. In the effort to reduce weight many 'extras' incorporated on mains machines, have been eliminated. The mechanics are simpler and the 'electronics' are more compact. Of course, the fact that they tend to be cheaper than most mains models is also favourable for sales.

The convenience of the modern battery portable is almost an advertisement for itself. A friend recently cornered me, explaining that he was due to deliver a lecture and it had occurred to him that a tape recorder would be handy for a critical assessment of his talking. Since I own three machines, it also occurred to him that I wouldn't miss one. However, 'twas one of those days when all the evils of the time were draped around my shoulders. Two mains machines had packed up. The drive belt on one had leaped off and strangled the in'ards and the recording valve in the other had started to smoke!

So I used the battery portable. The speed and ease with which I was able to reproduce his voice seemed to send my friend into the state of a man possessed. He 'had no idea it was so easy'! Knowing him to be a music lover I had to push my 'professional experience' down his throat, explaining that he would be happier with the faster speeds, the tone and volume usually found to be more applicable on mains models. (Before any Battery Tape-recording Club rushes off to their nearest court to sue me for libel, I should add that all of the battery portables that have fallen into my hands have not been able to reproduce music to the love of my sensitive ear!)

The modern battery portable is a psychological asset in the art of creative recording. Although the sight of a tape recorder is now a familiar one, two revolving, silent spools still have the ability to paralyse. Many a robust voice has cracked beneath their menacing power. For this reason, the art of interviewing is not mastered in six easy lessons. With the coming of the insignificant-looking battery portable, the job has, of course, been made easier – for the subject! My own method of using the battery portable for the collections of assorted voices has been to hang the recorder from one shoulder, to cover the top and the spools, with a forearm, attach the microphone to the front strap, covered with a woollen sleeve and converse with the subject. The results have been, I hope and think, 'realistic'.

There are times, of course, when the interview has been too real, especially if the subject has not been fully aware that his opinions are being taped. However, there is no short cut to a polished performance and almost all interviews secured by this method require editing. (Interviews by *any* method should be edited!) Consideration should be given to the ethics of taped interviews. For one thing, drastic results can occur from spontaneous calls, devoid of any preparations. To knock on someone's door, push the microphone into their face and expect a coherent reply, is asking for too much (except repayment of a more physical nature!). Arrangements should be made beforehand with the potential interviewee. The whole

Drastic results can occur from spontaneous calls.

matter should be put to him together with a list of questions. It gives the victim a chance to rehearse and to know what is expected from him. There are times when a preliminary interview serves a good purpose. It helps towards good relationships between the subject and 'the man from the recording club'. After all, most of us have been brought up never to talk to strangers.

Even whilst the interview rages, there are other small elementary points to consider. The disturbing habit that some recordists have of constructing a miniature BBC studio in between themselves and the subjects does nothing to help the flow of speech. It's easy to be hypnotized by a microphone and those revolving spools! One would think, these days, that most tape recordists are fed up with their own voices and yet there are still many interviews ruined with the unnecessary ramblings from the man in charge. It may be courteous to say 'Yes!', 'Indeed?', and 'Really!' throughout what is being said – and to a certain extent it is encouraging – but a nod of the head is as good as a mouthful of gabble. Harsh words? Anyone who has had to try to edit such an interview and who has tried to cut out these interpolations will readily agree that it is 'gabble'. Harsher words have been used during editing sessions! There is, of course, the other extreme, the interviewer with the frozen mouth. Because of his silence he slowly, but surely, dehydrates the speaker and slaughters the enthusiasm of the whole thing. The clever interviewer will learn to say a lot without actually saying anything – if you know what I mean. It is essential that the 'man from the Tape Club' does not appear to be a complete idiot. Having listened to one very short-lived interview on tape, carried out by a young tapist and a retired colonel, I was surprised to learn that the tape recorder had not finished up inside the young man's throat. Within two minutes the Colonel had been demoted to 'Captain' and the old soldier's Enfield ·303 rifle had been reduced to a 'gun'.

The interviewer should be sure of certain facts, should know something about the subject-matter and something about the person to be interviewed. It all helps to nurture amicable relationships. The fact is, a person who specializes in taped interviews should cultivate a general interest in all things. There is no harm nor waste – in fact, there is a lot to be gained – from knowing something about forms of address. It may be that the local mayor is required to say a few words on tape and it doesn't improve the air texture if the tapist intermittently refers to him as 'Muh Lud!' or 'Your esteemed Reverence'. A quick check with a good dictionary will solve the problem. 'Mr Mayor' is the usual term. One can say, 'Your Worship' but the simplest and an adequately polite term is 'Sir'.

The ease in which an interview is conducted depends on the skill of the tapist and the battery portable is an invaluable asset towards this end. It can be tucked away, almost out of sight, and the interview can jolly along almost conversationally. I am not comparing the amateur tapist with the professional skill of a BBC reporter. These people are obliged to extract formal statements for the benefit of the public's condemnation! It is a mistake to compare or compete with BBC professionalism – in all subjects regarding the tape recorder. Most readers of this journal are amateur tapists

'What has been said should not have been uttered at all!'

There's nothing wrong or lowly about the term 'amateur'. The *Amateur Tape Recording* magazine proves that point. It is only when the amateur tries to mimic the professional that the rot sets in! The battery portable does everything to destroy that tendency to mimic the big boys and the results, more often than not, are far more entertaining than the 'cultivated talks and interviews' that pour out from the radio.

Recording the interview is not the end of the matter. The tapist should remember that the person being interviewed is doing a favour. He may be proud and feel honoured with the distinction, but it is still a favour. In return for this favour, he should have the opportunity to hear what he – or she – has said. It could be that some of what has been said should never have been uttered at all! Under these circumstances such things should be wiped out, there and then, in front of the interviewee. He may not be aware of the interviewer's impeccable discretion and just to assure him that everything will be edited in any case will not always soften a conscience!

The battery portable is not just a taping interviewer's tool. During the last ten years the domestic battery portables have, through an evolution of modifications, poured on to the market. The tapist's outlook should have been broadened. To a certain extent it has. Since 1960 creative tape recording has developed into another dimension of entertainment. There is still room for improvement. Originality has not yet been exploited to its limit. The battery portable has offered the tapist the chance to get out, about and to record *en route*. The human voice is not the

continued on page 46

'Those quaint old tongues of the twentieth century!'

A SURVEY OF PORTABLES

Fig. 1. *The Sony TC*800.

If it makes a noise, record it should be the motto of every tape recording enthusiast, for few realize the value of recordings which, aside from those of music, may in themselves prove useful at some time or other as sound effects. Many sounds can, of course, be taped indoors but, given a portable recorder and freedom from connection to a mains supply, the range of sounds that can be recorded outside is almost unlimited. Moreover, the portable machine is without parallel when it comes to on-the-spot interviews, the collection of sounds and background and character voices for documentaries.

A portable tape recorder used solely for sound and speech does not have to be expensive and even the cheapest of portables (not the cut-price bargain offers) will make a good recording. They may not necessarily produce a good playback because of the small size of the loudspeaker and the limited output power, but when coupled to hi-fi equipment or when the tapes are played back on a mains recorder the performance of the portable becomes apparent. However, there is one small snag to good quality recording with a low-priced portable and this can be the microphone. The often cheap crystal or dynamic microphone issued with some recorders rarely, if ever, does justice to the machine so it is worthwhile thinking about a better type. For outdoor recording this should preferably be a moving coil mic which can be fitted with a windshield.

Now about some of the portables at present available, although there are few low-priced models that can really be recommended. First on the list comes the **Sony TC900** which is a transistorized half-track mono recorder and operates at $1\frac{7}{8}$ and $3\frac{3}{4}$ ips. It will accommodate three inch tape spools and features automatic recording level control (useful in interviewing). It also has monitoring facilities and can be stopped and started from a switch on the microphone. Price is 29 guineas and it weighs only $4\frac{1}{2}$ lb. Also from Sony comes the TC800 shown in Fig. 1. This is also a transistorized half-track recorder operating at $1\frac{7}{8}$ and $3\frac{3}{4}$ ips and has an automatic recording level control system. This one, however, takes five inch tape spools and features a servo-controlled drive motor. It also is equipped with a VU type record level meter for use on manual setting and indicates the state of the batteries as well. The frequency response of this recorder at $3\frac{3}{4}$ ips is 50 to 13,000Hz. The price is 59 guineas including microphone and tape.

Grundig do two portables, one of which is their new TK6L shown in Fig. 2. This is transistorized as most portables are, and is a half-track two-speed machine – $1\frac{7}{8}$ and $3\frac{3}{4}$ ips. It can be powered from batteries or mains and takes tape spools up to $4\frac{1}{4}$ inches in diameter. It employs an electronically stabilized dc motor which runs without producing noise or speed fluctuation.

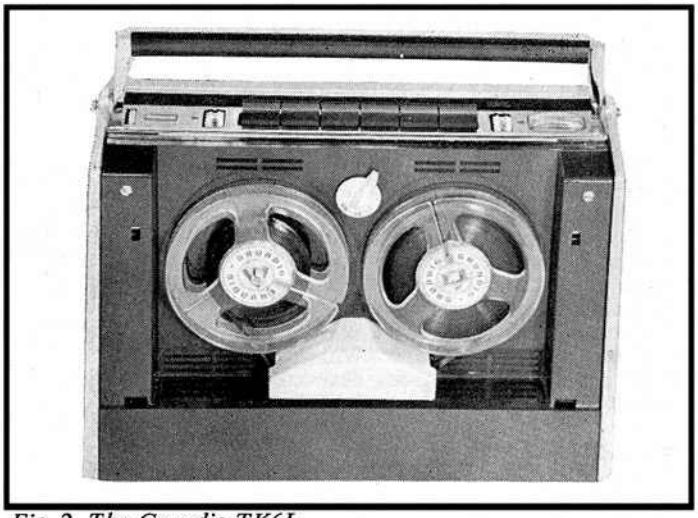


Fig. 2. *The Grundig TK6L.*

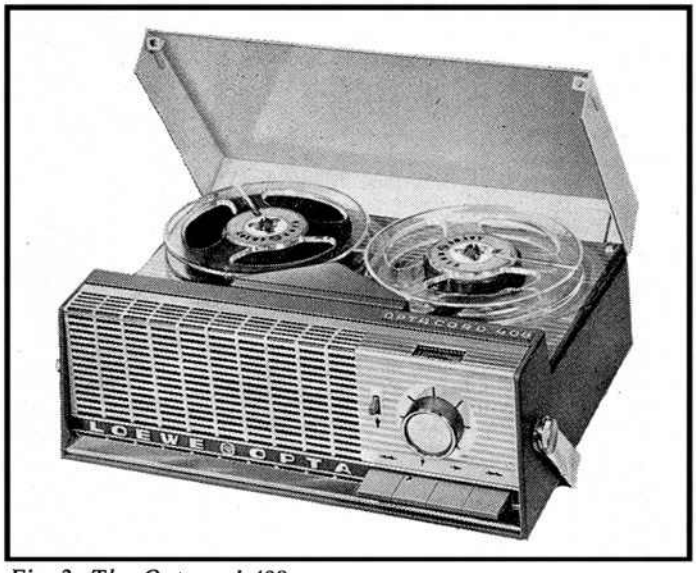


Fig. 3. *The Optacord* 408.

A recording level meter is included and this also indicates the battery voltage. One advantage with this machine is a high

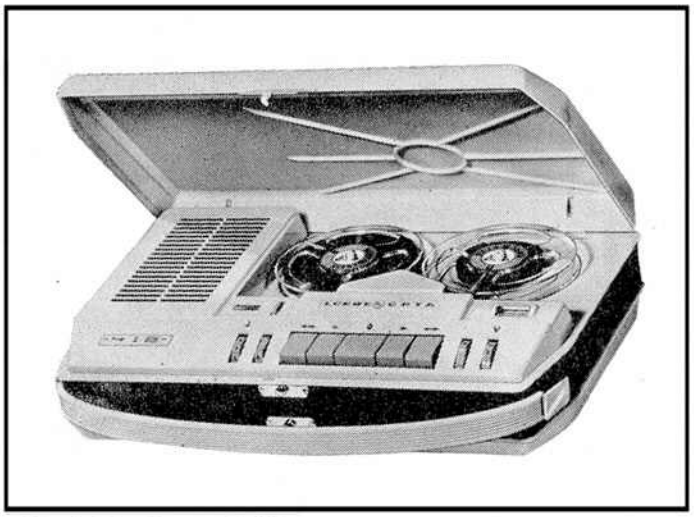


Fig. 4. The Optacord 416.

Fig. 5. The Sanyo MR212.

impedance output socket which enables direct replay via a hi-fi system or connection to another tape recorder. The price is 73 guineas.

Also from Grundig is the C100 cassette recorder, but readers are reminded that this employs a non-standard speed (2 ips) which means the cassettes can only be recorded or replayed on this recorder. Recordings could, of course, be copied via a standard speed machine. The price is 39½ guineas and, provided the speed problem is borne in mind, this should be an excellent little machine for sound hunting.

Optacord is a name not unknown to outdoor recording enthusiasts and there are at present three models available. In the lower price bracket comes the model 408 at 39 guineas which is a half-track recorder and operates at 3¾ ips. It has a frequency response of 90 to 10,000Hz, and will accommodate spools up to 4¼ inches in diameter. It incorporates a recording level meter. Higher in price at 51 guineas is the Optacord model 416, shown in Fig. 4, which operates from batteries or mains and can also be used for automatic operation of colour slide projectors. This model runs at 1⅞ or 3¾ ips and is supplied with microphone and tape. It has connections for external amplifiers and/or speaker and features a recording level meter. There is another Optacord portable which is their model 450 at 39 guineas. This takes the standard C90 cassette tapes and is supplied complete with microphone and one tape cassette.

Sanyo have quite a choice of inexpensive portables including the Model MR212 which retails at only 17 guineas. This is an all-transitor recorder and operates at 1⅞ or 3¾ ips. It has automatic recording level control and the various functions, i.e., record, play, rewind, etc, are carried out by one control knob only. It is shown in Fig. 5 and, as can be seen, is extremely compact. It weighs only 4 lb. Further details can be obtained from the Sanyo distributors (see list at end of article). They also do a cassette tape portable, the M18, which takes standard C90 cassettes. This retails at 23 guineas and is supplied complete with microphone and carrying case. It features remote control from the microphone and has a combined record level and battery voltage meter. Monitoring can be carried out by an earphone or headphones.

Philips portables are also greatly favoured by the outdoor recordists and the EC3506, now re-styled and re-introduced as the 4200, is a popular model. The retail price is 26 guineas. Operating speed is 1⅞ ips and it is a half-track mono machine. It also has outputs for external amplifier, loudspeaker or feed to another recorder for copying. Features include record level battery voltage indicator and pause control and it is supplied with microphone and tape.

The Philips cassette recorder model EL3302 at 27 guineas is also a new one and successor to the EL3301. Tape speed is 1⅞ ips with standard C60 or C90 tape cassettes. It also takes standard music cassettes. The EL3302 is shown in Fig. 7 and is extremely

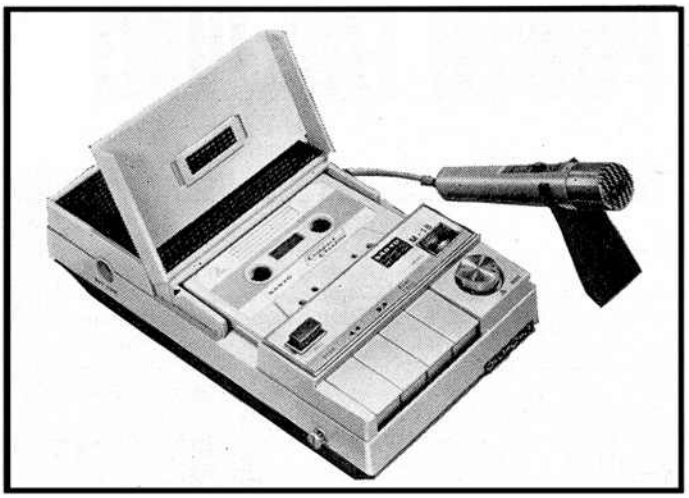


Fig. 6. The Sanyo M18 cassette model.

compact. Features are record level meter/battery voltage indicator, safety interlock controls, can be operated from the mains with extra unit, inputs for external amplifier, etc. It is supplied complete with moving coil microphone, tape cassette and leather carrying case.

Those portables so far mentioned are some of the cheaper and popular ones now on the market. If you contemplate really serious outdoor recording and interviewing and require an exceptionally high performance machine, then obviously a more expensive recorder will be needed. We often receive enquiries about a recorder that is not only of high standard for outdoor work but can be used for high quality music recording. Among the few available are the Uher 400 Report-L, which has been featured in many of the tape and travel articles in *ATR*, and the EMI series L4 professional recorder. The Uher 4000L has four-speed operation and is a half-track recorder. It is supplied with a good microphone and is the kind of recorder used by radio reporters. Details available from the UK agents (see list below). The EMI L4 comes in four versions and is a professional grade machine. The L4A is a half-track model, the L4B a full-track model, the third version being the L4C full-track with film sync pulse head. The fourth is a half-track stereo recorder known as the L4D. Each model is similar in appearance, shape and size as shown in Fig. 8 and is supplied with microphone and tape. They operate from chargeable batteries but can be run from a mains supply unit. Prices on application to EMI.

Akai (Pullin Photographic Ltd) market a quarter-track stereo portable, the X4, which comes complete with two microphones

continued on page 44

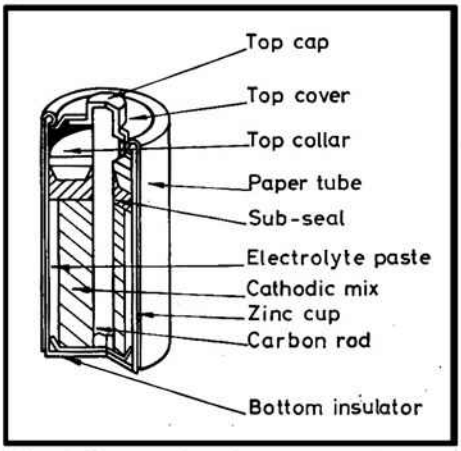


Fig. 1. Construction of standard *all-dry cell.*

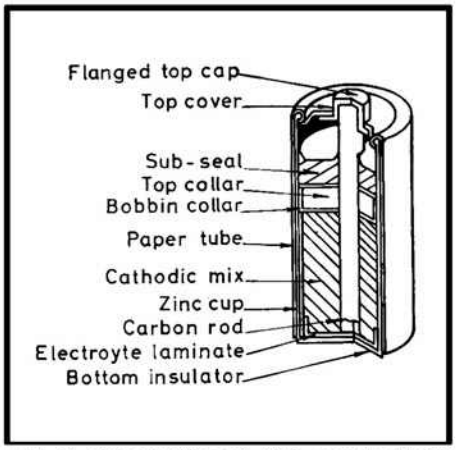


Fig. 2. Construction of high power all-dry cell.

POWER FOR PORTABLES

Peter Knight deals with the battery problem

Portable tape recorders, and, indeed, all cordless electronic and electrical devices, work because nature has ordained the translation of chemical energy into electrical energy. This process is handled by the *primary* or *secondary* cell. A number of cells connected together is called a battery (i.e., battery of cells.

Chemical energy is stored in the active components of the positive and negative electrodes and in the liquid or jelly between them, called the *electrolyte*, and when an external circuit between the electrodes is closed, electric current flows from one to the other until all the chemical energy has been used up. The cell or battery is then said to be exhausted or discharged. The main difference between primary or secondary cells or batteries is that in the latter the chemical energy can be restored by recharging. That is, by passing current from an external circuit through the cells in an opposite direction to the discharging current. The primary cell does not lend itself to such recharging, and a cell or battery of this kind is discharged when exhausted. Portable tape recorders mostly employ the expendable primary cell, though there are some designed for secondary cell powering. These feature built-in chargers for connecting to the mains power supply at the conclusion of the cordless period of activity. Since the advent of the transistor, now used almost exclusively in portable electronic devices of all kinds, both primary and secondary cells have passed through substantial stages of development to meet the needs of portable electric power. Transistor voltages are considerably less than those required by the anodes and screen grids of valves, but the current is often higher, and in audio amplifiers this usually increases with increase in audio power output. With tape recorders there is also the extra current demands of the drive motor. Battery development has thus been directed towards small, lightweight batteries of relatively low voltage but of high power potential, and these are now available in both primary and secondary forms.

Primary Batteries

Primary cells handling today's portable-power demands are highly sophisticated versions of the first-ever practical cell, called the Leclanché cell. In basic configuration this is familiar to all of us, with its cylindrical zinc can and central carbon rod in a 'dolly' of depolarizer. Some compact primary batteries comprise layers of flattened cells of this kind, each one separately wrapped in plastic skin to avoid chemical leakage, while the general design is for maximum capacity/size ratio.

There are some applications, however, that are not really suitable for the layer-type battery, and this is particularly true where the equipment requires fairly high and prolonged currents. This application is best handled by the original-style cylindrical cells, and these are usually connected as a battery when fitted into the portable recorder by internal wiring which automatically connects the cells in series when they are clipped into the battery holder.

Individual cylindrical cells of this kind are available in leak-proof, heavy-duty versions, and these are absolutely ideal for the type of recorder that requires a battery of such cells. However, before we go on to look at the cells themselves, let us see how they are made and what determines their life cycle.

The Leclanché cell gives about 1·5V across its terminals when it is brand new and loaded to the equipment which it is powering. If the voltage is measured off-load with a high resistance meter, it will possibly read something above 1·5V, while after it has been running for a while on load, its on-load terminal voltage will have fallen to something below 1·5V. This is because the internal resistance of the cell gradually rises as its chemicals wear out, and a stage is eventually reached when the on-load terminal voltage is well below 1·5V because of the high internal resistance, and the cell then has to be replaced.

Even new cells have some value of internal resistance, so that as the on-load current is increased, the on-load terminal voltage falls. The larger the cell physically, the smaller its inherent internal resistance, and the greater the current that can be obtained from it for a given drop in terminal voltage. The 'standard' *dry cell*, as the contemporary Leclanché design is called, uses a zinc container as the negative electrode or terminal and a carbon rod working in the depolarizer as the postive terminal. An electrolyte paste between the two electrodes gives the required Leclanché cell action. The depolarizer inhibits the formation of oxygen bubbles round the carbon rod, and thus keeps the internal resistance of the cell as low as possible during its useful life.

Chemical changes occur at the electrodes as the cell is used, and eventually the zinc container wears out completely and lets through some of the electrolyte paste. This

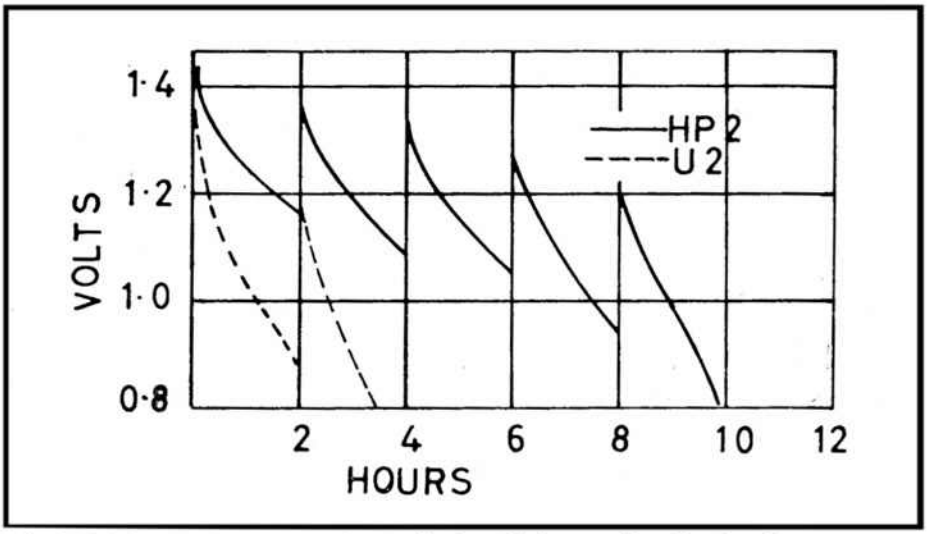


Fig. 3. Relative discharge curves for standard *and high power Ever Ready cells.*

is a dangerous state of affairs if ordinary cells in this condition are left in the equipment, for the electrolyte will almost certainly find its way into the electronics or mechanics of the equipment and will result in serious corrosion. The leak-proof battery or cell guards against this, however, but even so, it is bad policy to leave an exhausted battery or cell of any kind in the equipment, whether it be an ordinary electric torch or a tape recorder. The make-up of the type of cell used in tape recorders is shown in Fig. 1. This illustrates the aspects already referred to, but the term *cathodic mix* is used here instead of depolarizer.

High-power Primary Cells

The very latest kind of *heavy duty* or *high power* cell is basically similar in construction and is shown in Fig. 2, but it provides more cathodic mix in the same space by replacing electrolyte paste with a paper laminate and by a redesigned cell top. The extra power is given partly by these factors and partly by changes in chemical formula. Just how much better, then, is the high power cell compared with the standard cell?

This is best answered by looking at some discharge curves. Fig. 3 shows such curves for the Ever Ready HP2 (**HP** meaning high power) relative to the standard U2 cell. Now, to understand these it must be realized that the life cycle of a battery is based on the length of time that it can continue to supply the required level of current before the terminal voltage falls to a specified value. The value is called the *end-point voltage,* and that selected for the curves in Fig. 3 is 1V. The curves are also based on a discharge current flowing through a 3 ohm resistor acting as load. At 1·5V a load of this resistance passes 500mA, which is comparable to that of a portable tape recorder.

The discharge curves are also based on two-hour-per-day discharge periods. The curves clearly reveal that a standard U2 cell will be finished after about 2¼ hours, while an HP2 will provide the current demands down to 1V for about 8½ hours. Rest periods are very important for primary cells as the curves show. Indeed, after the first 2 hours the U2 on-load terminal voltage is down below 1V. This state does not occur relative to the HP2 until the fourth 2-hour on-load period. These curves thus show without any doubt the great advantage that the HP type of cell has to the portable tape recorder user.

The effect is that the internal resistance remains very low for longer periods of time, thereby allowing the HP cell to deliver greater currents for longer periods than a standard cell. From the tape recording point of view, this means that the electronics and drive motor run at optimum performance for longer periods on one set of cells. Although portable tape recorders will continue to work when the on-load terminal voltage of their batteries falls well below the nominal 1·5V per cell, their performance is invariably better when the voltage is equal to that of a new battery.

Some models, however, feature non-linear compensating circuits in the battery input. These hold the cell current fairly constant down to a certain end-point voltage. In other words, the effective battery load resistance changes according to the terminal voltage of the battery. This differs from the 3 ohm discharge curves in Fig. 3, because these curves are based on the current falling as the terminal voltage drops (following the linear law of Dr Ohm!). Nevertheless, substantially more life is given by HP cells over standard ones when used in portable tape recorders, and the extra price is well warranted. The HP cell costs about three times as much as the LP, but can easily give five times or more *better performance* life.

So much for primary cells, but what about the secondary counterparts? The best known secondary cell is the lead-acid accumulator. This basically uses two lead plates immersed in sulphuric acid, and, when charged, delivers an on-load potential of about 2V. While this kind of cell (or battery of them) is all right in cars, it is absolutely hopeless so far as tape recorders are concerned.

Nickel-cadmium Secondary Cells

However, secondary cells for tape recorders and other electronic devices have been

Fig. 4. Group of cylindrical seated N-C cells in the VR Voltabloc *series by Cadmium-Nickel Batteries Ltd.*

Fig. 5. Banks of cells in the form of transportable batteries by Cadmium-Nickel Batteries Ltd.

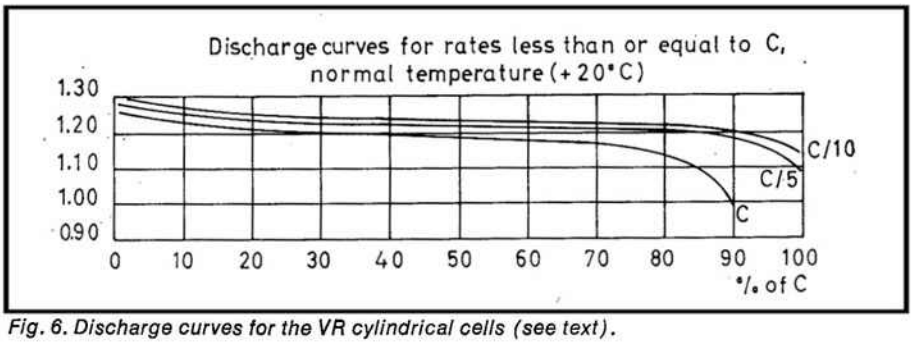


Fig. 6. Discharge curves for the VR cylindrical cells (see text).

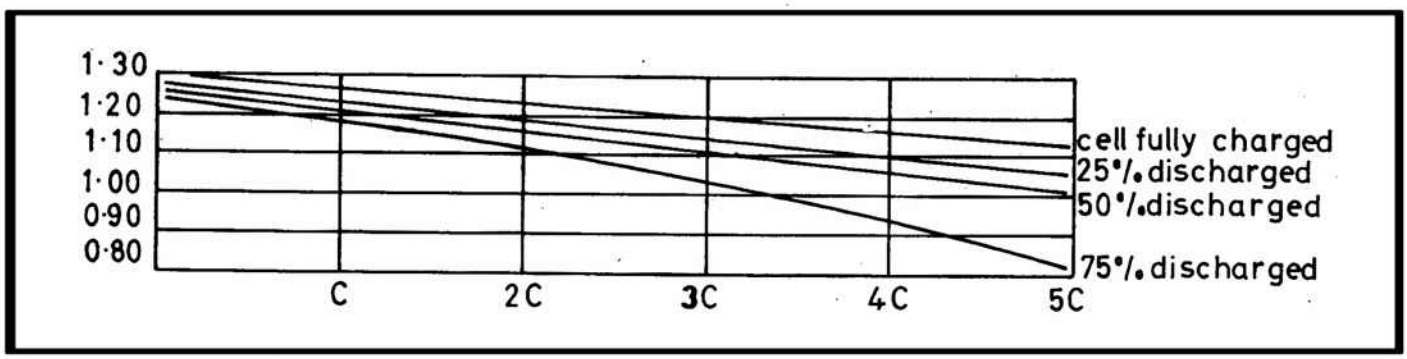


Fig. 7. Terminal voltage of VR cells during peak discharges of short duration (see text).

POWER FOR PORTABLES

Continued

developed along somewhat different lines from the lead-acid cell, and one advance in this respect is the nickel-cadmium cell. Unlike the lead-acid cell, the nickel-cadmium cell can be discharged and recharged without generating corrosive gases. Groups of such cells may thus be permanently installed along with a trickle charger (or with external facilities) in electronic equipment without likelihood of damage. This is the kind of cell often employed in tape recorders with built-in chargers.

These cells are virtually indestructible and can be stored for long periods when discharged. They can be charged and discharged at fairly high rates and fail to suffer the basic overcharging troubles of lead-acid cells. Moreover, they do not need a vent of the kind normally associated with lead-acid accumulators. The cells come in a wide variety of types and sizes, and some are designed specifically for powering electric shavers and similar motorized devices. Larger ones used in transistor TV sets, tape recorders and so forth often have a charger for connecting them to the mains supply.

A group of nickel-cadmium cells in cylindrical form is shown in Fig. 4. These are by Cadmium-Nickel Batteries Ltd in the *VR Voltabloc* series. Note that some of these have dimensions matching those of well-known primary cells. Nickel-cadmium cells consist of a base of highly porous sintered nickel impregnated with active materials to produce positive and negative electrodes (respectively, nickel and cadmium hydrate). The plates are isolated by a strip of absorbent dielectric material, and the electrolyte is potassium hydroxide. Because this does not react chemically with the electrodes, but serves only as a conductor for the charge transfer between the plates, there is virtually no gassing and no high-rate deterioration in idle charged or discharged cells.

Terminal voltage is below that of Leclanché dry cells typically 1·2V, and the capacity is expressed in terms of ampere-hours (the same as lead-acid accumulators), determined over a discharge period of 1 or 5 hours, down to a specific end-point voltage. Fig. 5 shows various configurations of batteries of *Voltabloc* cells, and these packs could be used as external power supplies for portable tape recorders when the capacity of the internal batteries is insufficient to provide the length of uninterrupted operating time required for a recording session. An advantage of these cells over the primary cell is that the on-load voltage remains substantially constant down to an end-point value of 1·1V (which is only 0·1V below the fully charged voltage). On continuous discharge, for instance, and for a final voltage of 1·1, the cells give out at least 100% of their capacity at a C/5 discharge rate (where C is the capacity in ampere-hours). At a discharge rate of C and for an end-point value of 1V, the cells give out at least 90% of their capacity, while they can also provide short duration current peaks up to 5C. Fig. 6 shows a discharge curve for the *Voltabloc* VR series cells at rates less than and equal to C, while the curves at Fig. 7 show the terminal voltage of a cell during peak discharges of short duration (maximum 5 seconds) at + 20 degrees C for different states of discharge. The sealed VR cells, incidentally, work in the temperature range — 40 degrees C to + 60 degrees C.

Type	Format	Rated Capacity C* Ah	Weight (Grs) Tolerance ±10%	Dimensions (mm) Height (Tolerance $^{-0}_{-2}$)	Dimensions (mm) Diameter (Tolerance ±0·2)	Equivalent type of primary cell
VR 0.45	AA	0·45	23	50	14·6	AA or BA 58
VR 0.65	½ C	0·65	36	25	26	½ C
VR 1	RR	1	48	41	22·8	
VR 1.6	C	1·6	75	49	26	C or BA 42
VR 3	Dm	3	140	61	32	D or BA 30
VR 3.5	D	3·5	150	61	34	D or BA 30
VR 5	Fm	5	210	91	32	F or BA 401 U
VR 6	F	6	250	91	34	F or BA 401 U
VR 10		10	380	89	41	

* The rated capacity C is for discharge at the 5-hour rate at a temperature of about + 20° C after normal charge and for a final voltage of 1·1 volts.

Fig. 8. Table giving characteristics of VR N-C cells and their sizes relative to all-dry (primary) cells.

Notes on Charging N-C Cells

The cells should be charged at constant current. Constant voltage charging is not recommended. Normal charging is carried out at C/10 rate for 15 to 16 hours when the cell is fully discharged or it can be done systematically irrespective of the state of the cell's charge. Step-up to C/5 rate for 7 hours is also permissible when the cell is almost completely discharged. More rapid charging is also possible at a C/2 rate for two hours. Such a charge will yield about 80% of the cell's capacity. Trickle charging at a rate of between C/200 and C/50 is often given by inbuilt chargers. It is interesting to note that sealed cells can withstand severe overcharging without ill effect, up to 200 hours, for instance, at C/10 rate.

A cell of dimensions similar to those, say, of an all-dry U2 has a rated capacity of about 3·5 ampere-hours which, at the C/5 rate, will yield about 700mA for five hours. The table in Fig. 8 gives the various characteristics of the *Voltábloc* cylindrical sealed cells of the VR series.

We have looked at the most used primary and secondary cells. There are other versions of both kinds, but it is not possible in the compass of this one article deeply to detail these. The mercury cell, however, is well worth mentioning which, although a primary cell, differs most notably from the Leclanché cell in that its internal resistance tends to drop, instead of rise, with use. This means that its terminal voltage is held pretty constant throughout life. When the cell expires, the on-load voltage falls suddenly and the appliance ceases to function without warning, rather like the sudden discharge of a lead-acid cell.

The terminal voltage is in the region of 1·34 to 1·45V, but close-tolerance versions, for voltage reference, are available within the range of 1·34 to 1·36V. The curves in Fig. 9 show at (a) how the voltage and internal resistance remain constant under steady load conditions and at (b) how the capacity

Continued on page 43

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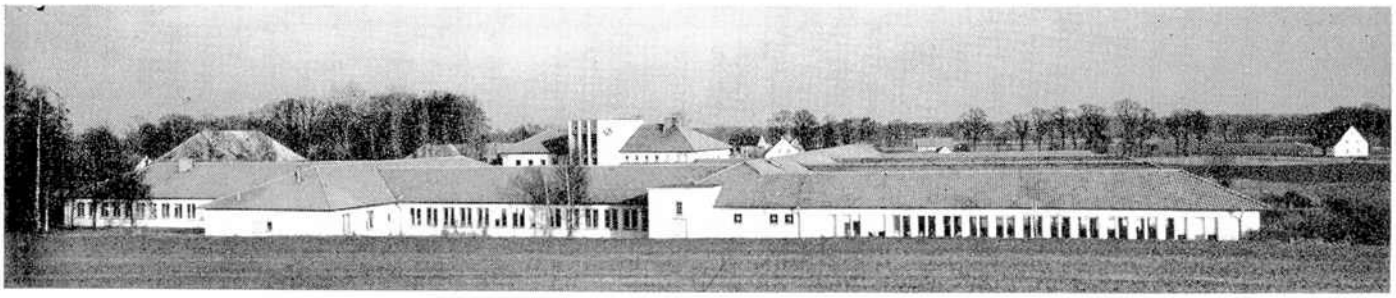


MICROPHONES IN THE MAKING-SENNHEISER

ATR visits a 'microphone farm' in Western Germany

ATR *editor F. C. Judd and Bob Danvers-Walkers examine some of the machine shop plant at Sennheiser.*

Microphone manufacture calls for intricate work. Here operatives are putting together miniature magnet assemblies for dynamic microphones.

If you study the photo of the Sennheiser factory for a moment you will realize why I have included the sub heading '*ATR* visits a microphone farm'. Being located in the farmland area at Bissendorf just outside Hanover, the long, low buildings immediately give this impression as one approaches it, so I immediately dubbed it 'the microphone farm'. I quite expected to see workers sowing 'microphone' seeds in the ploughed land around, but instead discovered one of the most efficient and most scientific factories I have ever visited.

I use the word 'scientific' in its every sense, because Sennheiser Electronics, as it is now known, stems from the Hanover College of Technology which was moved to the Southern edge of the Luneburger Heide after being bombed out in 1943. In June 1945 Professor Fritz Sennheiser established a private company then known as Laboratorium Wennebostel which at that time and with a staff of 15 concentrated on making a few items of testing apparatus and moving-coil microphones. By 1949, and despite difficulties with German currency reform, the staff was increased to 52 and the quality of Sennheiser microphones began to gain recognition. The Sennheiser rifle microphone was exhibited for the first time at the 1949 German Industrial Fair in Hanover. In the years that followed both the staff and the Sennheiser range of audio products expanded rapidly. By 1957 the staff totalled 300 and products included hi-fi amplifiers, audio frequency transformers and microphones of all kinds. In 1958 the company name was changed to Sennheiser Electronics and their first radio microphone was produced. Since then Sennheiser have established some 30 overseas distributors in addition to 10 in the Federal Republic and now they supply high grade microphones to broadcasting stations, recording studios and tape recorder manufacturers all over the world. Today the staff totals more than 650 and, in addition to the factory at Bissendorf, there are two others located at Soltan and Burgdorf.

The Head of Sennheiser

Professor Fritz Sennheiser, who is now the sole head of Sennheiser Electronics, was born in Berlin in May 1912. From 1932 to 1936 he studied at the Technische Hochschule in Berlin and was until 1938 an assistant at the Henrich Hertz Institute for Oscillation Research. He then moved to Hanover and was appointed Assistant Lecturer at the Technische Hochschule. In 1940 he became a Doctor of Engineering and in 1960 was appointed Honorary Professor at the Hanover Technische Hochschule.

Perhaps it was Professor Sennheiser's love of gardening that made him choose a site in

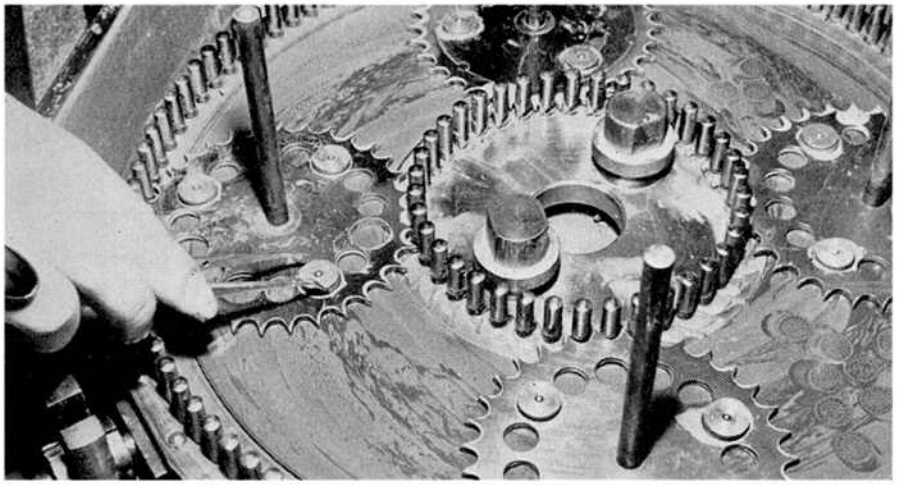
Ceramic magnets being machine moulded into surrounds by one of the many special machine tools designed and produced in the Sennheiser factory.

the middle of the North German farmland and surround it with colourful gardens and lawns. The idea seems to have become popular with the employees as the 'horticultural' decorations were to be found not only outside but also inside the factory. There was hardly an office or workshop anywhere not ornated with plants or flowers of some kind. I really quite expected to see microphones blooming in flower pots.

Around the Factory

Factory tours are best illustrated, as I have done in this article, with photographs showing some of the processes of manufacture. My impression was, as I said earlier, that of an extremely efficient and scientifically run organization dedicated to the production of high grade microphones and audio equipment. At every stage the utmost care and skill goes into the choice of raw materials, processing, production and testing and, of course, research and development. The manufacture of microphones is an intricate business demanding highly trained engineers and factory personnel as well as an enormous amount of specialized equipment. Sennheiser produce both, as they have their own engineering training department as well as a section devoted to the production of laboratory and factory instruments and special tools required for manufacturing.

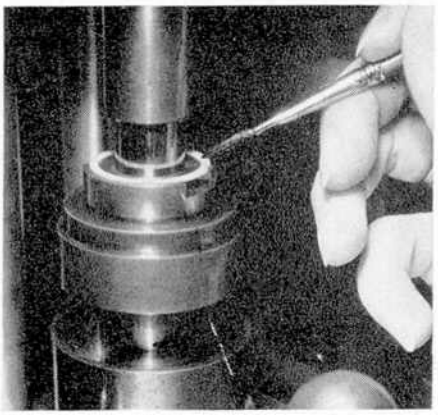
Sennheiser specialize in two kinds of microphone, the dynamic and condenser types. Dynamic microphones, which are mainly moving coil and ceramic instruments, are used a good deal for broadcasting and in the film industry and of course by tape recording enthusiasts. Condenser microphones are also used for broadcasting, and in recording studios and have a considerable number of research and scientific applications. Sennheiser condenser microphones are unique in that they employ a capacitive element and radio frequency circuitry instead of the usual dc polarizing systems used in conventional condenser microphones. With the Sennheiser system their condenser microphones are impervious to shock waves as well as humidity, mechanical vibration and electrical or magnetic fields. Condenser microphones are of course extremely expensive, at least by amateur standards, although many amateur recordists use them. The range of Sennheiser dynamic microphones also perform to a very high standard and their MD421, for example, has become almost classic, popular with tape recording enthusiasts as well as professional users.



Magnets being ground flat in a machine specially designed by Sennheiser for this purpose.

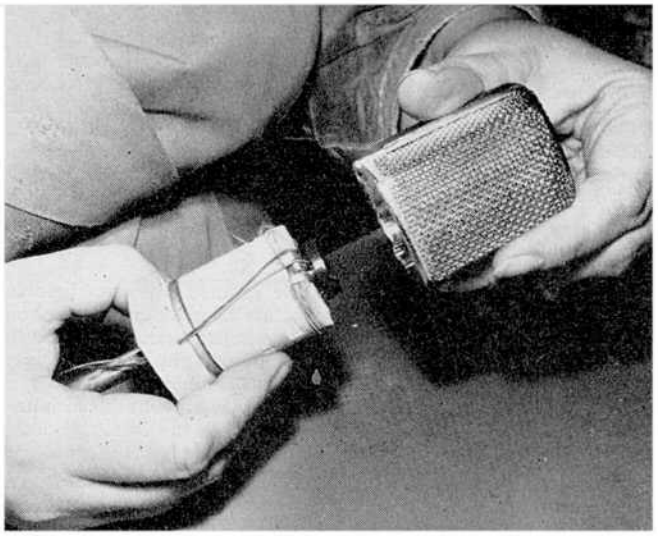
Other Sennheiser Products

Aside from the manufacture of microphones, Sennheiser are also concerned with hi-fi systems, loudspeakers and precision testing equipment, all of which are now available in the UK. Their transistorized *Hi-Fi Philharmonic* equipment for instance was shown for the first time at the recent London Audio Festival and Fair. The system includes a stereo amplifier with a novel remote control system, an FM tuner and loudspeakers. Their range of test equipment too is very comprehensive and includes an audio valve voltmeter, a distortion measuring meter, audio filters of various kinds and inductance, capacitance and resistance decades. Last, but not least, two rather special kinds of microphone must be mentioned. They are the Sennheiser radio microphone and the rifle (directional) microphone. The radio microphone is quite unique because the radio transmitter is actually built into the microphone case. The signals are picked up by a small FM receiver and then fed to the amplifier or recording

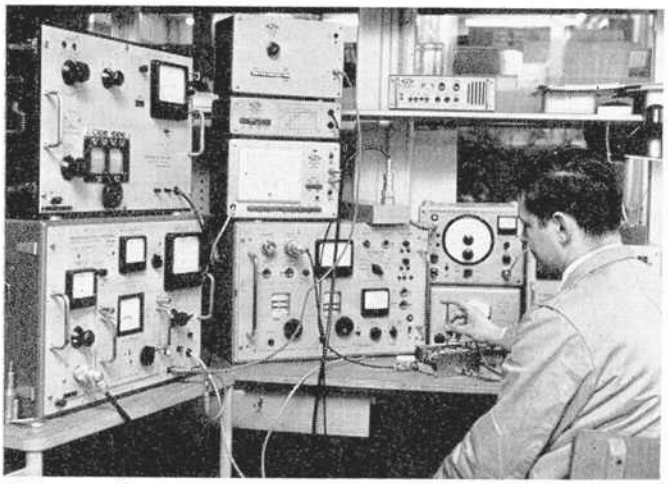


In this machine a moving coil is being attached to a microphone diaphragm.

The final assembly stage of an MD421 reporter/studio microphone. This microphone has a unique magnetic frequency response control system.



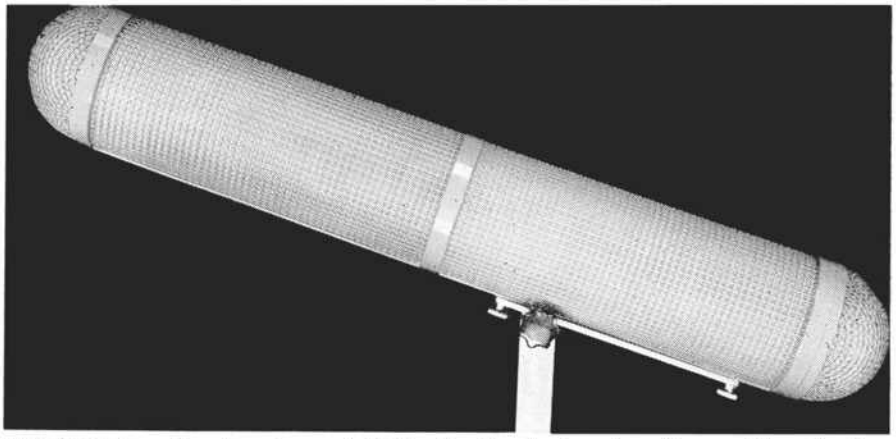
The exceedingly fine metallic material used for the diaphragms of condenser microphones is first plated with pure gold by a process known as gold sputtering. Again the machine for doing this is one specially designed by Sennheiser.



This vast collection of electronic instruments is used in the testing of Sennheiser radio microphone systems.

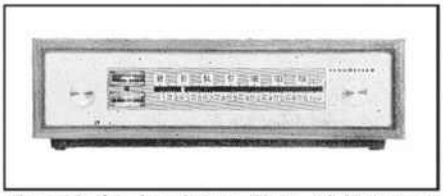
A miniature anechoic chamber and pen-recording frequency response measuring equipment are employed for the final checking of every Sennheiser microphone.

The Sennheiser MKH104 studio condenser microphone is favoured and used by many advanced amateur recordists.



The Sennheiser rifle microphone. A highly directional microphone for special applications where unwanted noise must be reduced, e.g. in birdsong recording and other sounds ocurring at long distance.

A typical example of the Sennheiser range of testing instruments. This one is the RV55 audio frequency voltmeter.



One of the Sennheiser Hi-Fi Philharmonic units – the FM tuner.

system (see photograph). The rifle microphone is also something of a technical achievement, being as it is a highly directional instrument with a number of applications. Directivity is obtained by concentrating wanted sound into a special acoustic tube.

Left: The Sennheiser radio microphone system. The radio transmitter is built into the microphone container. Signals are picked up by a special FM receiver and from there fed to the recording or amplifier system.

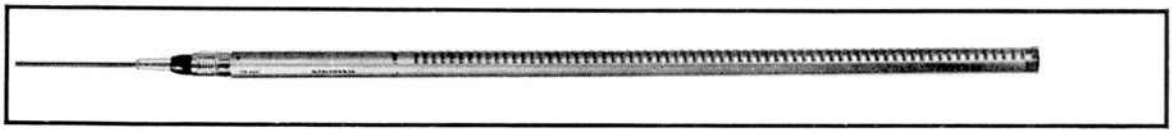
At the end of the tube is an acoustic filter which compensates for certain frequency losses in the tube. Unwanted sound is rejected by phasing slots along the length of the tube. I shall be using this particular microphone for birdsong recording in Norfolk by the time this article appears in print and will be reporting on its performance in *ATR*.

In Conclusion

To describe the detailed processes involved in the manufacture of even one microphone would take up a whole article. I hope that the accompanying photographs and their captions will provide some idea not only of manufacture but of the amount of specialized equipment needed. For instance, the design of microphones and testing of prototypes requires the use of an anechoic chamber (see *The Hanover Experiment* by Bob Danvers-

Continued on page 46

Your tape recorder is only as good as its microphone



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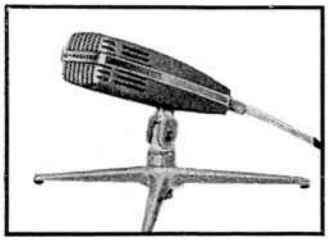
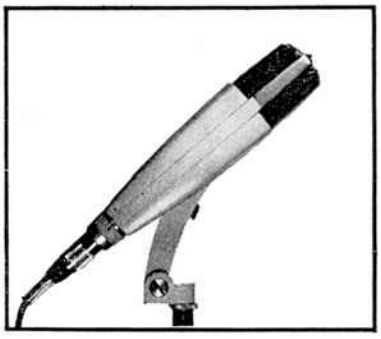
MD 411 SUPER-CARDIOID ultra directional microphone. Developed from the now famous Sennheiser studio microphones, MD 411 cuts out background noise and gives professional "close-up" sound in difficult domestic surroundings. Triple impedance suits any recorder. Complete with table stand and zip-up case. **£13. 9. 0.**



MD 211 OMNI DIRECTIONAL The finest dynamic microphone in the world. Condenser sound from a rugged dynamic capsule 40 c/s-20 kc/s. **£35. 15. 0.**



MD 421 DYNAMIC STUDIO CARDIOID Sennheiser's most famous microphone is used by almost every broadcasting station in Europe and over 30,000 amateurs have saved up to buy this "acoustic Leica". Accurate cardioid characteristic and smooth frequency response permit high quality sound recordings in difficult situations. Ideal for prestige public address sound reinforcement and stage use. Built-in dual impedance transformer and variable bass attenuator control. Only the huge amateur demand for this professional microphone has brought the price down from £70 to **£31. 12. 6.**

Do you know the rest of the Sennheiser range of products? RF. condenser microphones (like the "gun mic." shown above), radio microphones, miniature magnetic microphones and earphones, hi-fi reproducers, audio test equipment.

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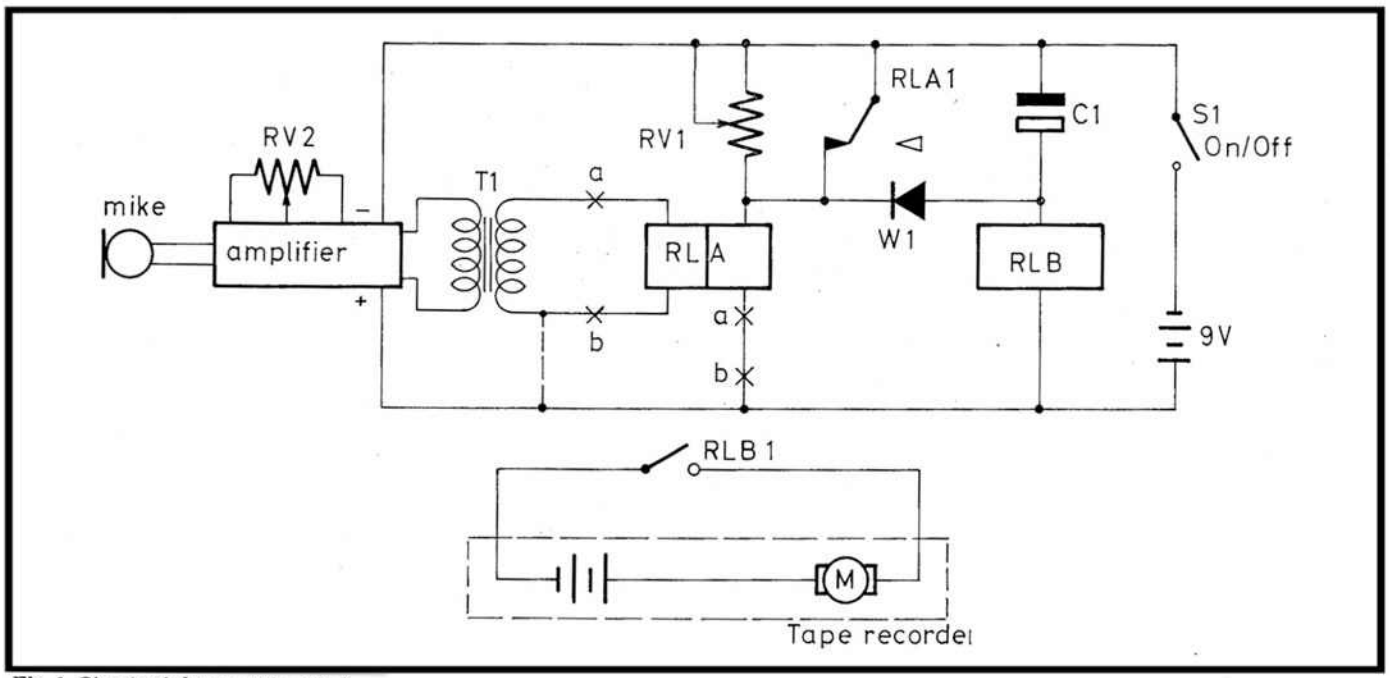

Fig. 1. Circuit of the acoustic switch.

AN ACOUSTIC SWITCH

Another constructional feature

by B. E. Wilkinson

One of the problems of recording conversation or discussion is that a good proportion of the recorded tape is wasted due to gaps in the speech. Wasted tape means wasted time, for clearly a tape which is run continuously will not last as long as one which runs only when there is a useful signal. The obvious way around the problem is a manually-operated switch, closed by the speaker just before he speaks. Such devices are incorporated in dictation machines, but would be inconvenient where more than one speaker is involved. The arrangement would be particularly inconvenient when recording a lecture from radio or television, or someone else's dialogue, where it is impossible to anticipate or gauge the pauses. This leads us to consider the ultimate tape economizer – the acoustic switch. This is a device where the signal to be recorded is used to switch on the recorder. As someone starts to speak, the sound of his voice operates a mechanism which completes the circuit of the motor in a tape recorder set to 'record'. The obvious disadvantage is that the first word or so of a conversation must actuate the mechanism and may be lost completely. This is inevitable, but generally does not affect the sentence intelligibility. Associated with this problem are pauses between words, sentences, etc; these gaps are not long enough to justify stopping the recorder and if we allow the mechanism to follow them too precisely, we shall lose words due to the frequent restarting of the recorder. It is thus necessary for fast action in switching the recorder on and slow when switching off. In practice, a delay of about 5 seconds after the speech has stopped is sufficient to cover natural pauses and breaks.

The sound pressure level of normal conversation is not sufficient to operate a switch directly and so it is necessary to convert the sound into electrical energy using a microphone and apply it to an amplifier in order to raise it to a useful power level. The obvious method of using the amplifier output is to operate a relay, which in turn switches on or off the tape recorder motor circuit. Fig. 1 shows the complete circuit, the acoustic input being to the microphone at the left and the switch contacts being on the right. The microphone indicated is separate from the one associated with the recorder. It would be possible to use one microphone to drive both the recorder and the acoustic switch, but I decided that separate instruments give certain advantages. First, it is not necessary to split the output; this would reduce the power available for both amplifier and switch. Then again, with its own microphone, the switch is completely independent of the recorder and can be used to switch other devices. In practice, the switch microphone needs to be sensitive, but there is no quality requirement, so that a very cheap instrument will be satisfactory. Microphone output is weak, being of the order of millivolts, and so an amplifier is absolutely necessary. The unit shown is a three-stage transistor amplifier of Japanese manufacture. Power output is adequate for our requirement.

Circuit Operation

The amplifier output transformer T1 provides the signal which operates the trip relay RLA. This is a very sensitive device, a suitable type being the Siemens high speed or Carpenter relay. To maintain sensitivity, this type of relay is fitted with a single change-over contact. Perhaps the most obvious way of using the relay is to connect it in series with the secondary of T1 and allow the af signal to energize it. This is quite satisfactory, but a more sensitive arrangement is to use the af signal for de-energizing rather than energizing. A relay which requires 0·5mA to energize it, for example, may not release the armature until the current falls to 0·2mA. If we therefore arrange to hold the relay with a steady

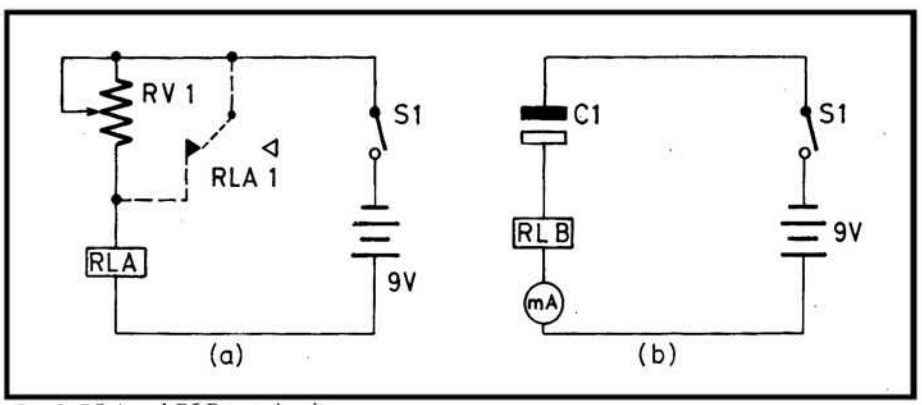

Fig. 2. RLA and RLB test circuits.

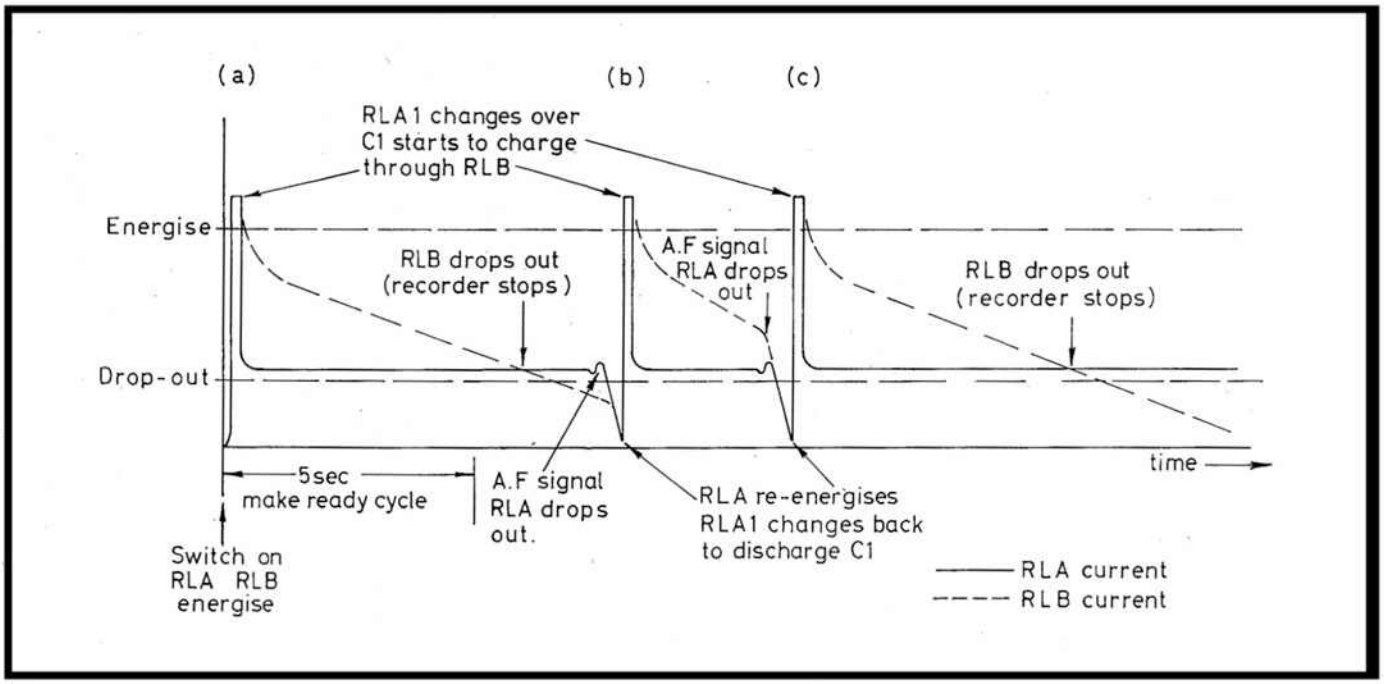

Fig. 3. Graph of the switching cycles.

0·5mA, then 0·3mA (0·5-0·2) opposing the hold current, will release the armature. For our purpose, we want the relay as sensitive as possible and so we go a step further. In the de-energized condition, RLA1 short-circuits a resistor RV1, so that when current is applied it passes directly through the relay coil. The current is great enough to ensure that the relay energizes, but as RLA1 changes over, RV1 becomes part of the relay circuit and is arranged so that the relay current is just sufficient to hold the armature. Referring to our numerical example above, initial current through RLA would be, say, 0·6mA, while the resistor would reduce this to 0·25 mA. Thus, a change of 0·05mA, opposing the hold current would drop out the relay. Apart from the improved sensitivity, this arrangement has the advantage that a signal sufficient to overcome the holding current causes the relay to drop out so that the RLA1 change-over is complete. Where the T1 signal is applied to energize the coil directly, one contact would simply lift off momentarily and the other contact would not make. Fig. 1 shows RLA with two windings. This is the better arrangement as it keeps the T1 and RLA circuits separate. However, where a single winding relay only is available, the T1 secondary is connected as indicated, between the coil and the positive line.

The relay RLB has two functions:

(a) it switches on the recorder motor (RLB1).

(b) it provides the necessary delay after the T1 signal has stopped.

Let us consider the RLB circuit, ignoring for a moment the rectifier W1 and the effect of RLA1. When the supply is connected across the RLB/C1 series arrangement, the current through C1 is high as the capacitor starts to charge. The current falls gradually until, when C1 is fully charged, there is zero current flow. The initial current at *switch-on* is higher than that required to strike RLB and as the flow falls it must pass the drop-out point. RLB will thus energize, remain held for a short period and then de-energize simply by the act of applying the current. When RLB strikes, RLB1 changes over to switch on the recorder motor. The time between energize and drop out depends mainly on C1. We require a delay of about 5 seconds (not critical) and this is effected using a capacitor of approximately 200μFd.

Still ignoring the rectifier W1, it will be observed that RLA1 is connected across C1. When RLA is in the ready (energized) condition, awaiting a signal from T1, RLA1 is changed over. As soon as a signal is received, RLA drops out and RLA1 changes back. This action immediately resets RLA to the ready condition and momentarily short-circuits C1 which discharges. During this short interval, RLA1 also applies current directly through RLB so that the relay energizes across the supply and is held by the C1 charging current when RLA1 changes over. The effect of the combined RLA/RLB circuit is that each signal which trips RLA starts the recorder motor. This will run for about 5 seconds and then stop. If, as is probable with speech, the next signal is applied before the delay is complete, C1 is discharged and the cycle restarted. RLB does not drop out because in discharging C1, RLA1 holds the relay and the recorder continues to run. In other words, each signal restarts the delay cycle so that the recorder does not stop until there is a gap in the speech of at least 5 seconds. Unfortunately, the arrangement necessitates RV1 and C1 to be connected in parallel and this modifies the current flow through RLA. There is, in fact, a considerable loss in sensitivity and, to offset this, the rectifier W1 is connected as shown. The rectifier is wired up so that current through RLA does not pass through C1. Current is not impeded in the reverse direction, however, so that when RLA1 changes back, C1 can discharge through W1, which will also pass a direct RLB energizing current. The circuit is supplied by a 9 volt battery. This is the source required for the amplifier and by using it for the relays also, the switch unit requires only one battery.

Fig. 4. The completed acoustic switch with signal microphone and testing unit.

AN ACOUSTIC SWITCH

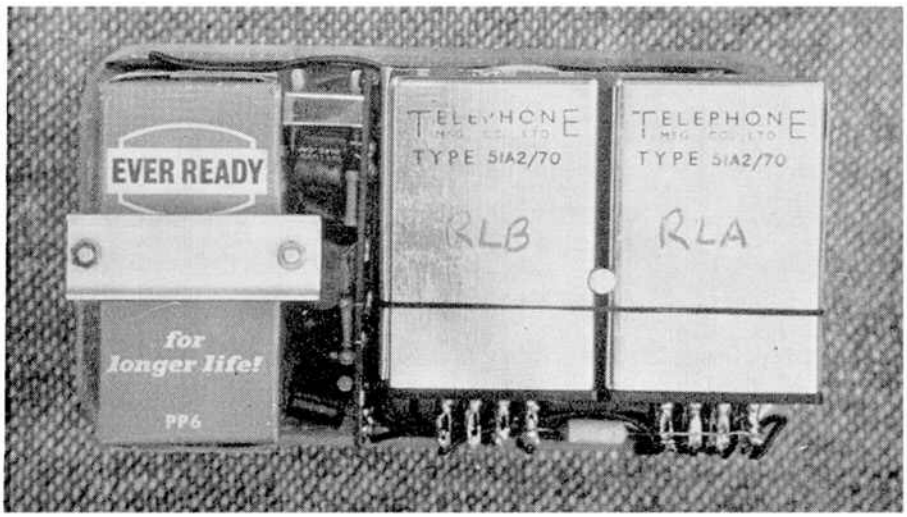

Fig. 5. Layout of interior showing battery and relays.

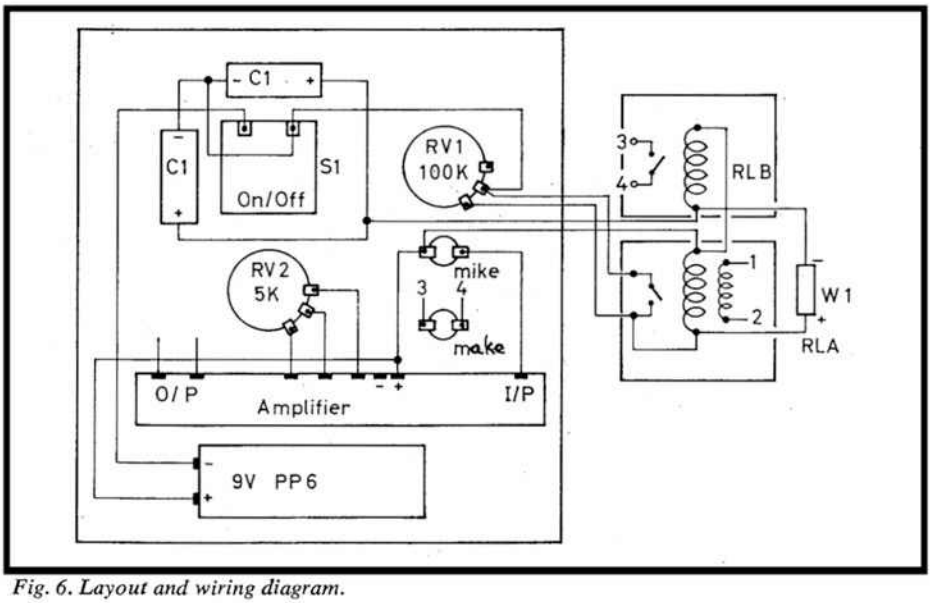

Fig. 6. Layout and wiring diagram.

Construction

The success of the switch depends mainly on RLA. In the unit shown, RLA and RLB are identical, but this is not vital. RLB can, in fact, be less sensitive than RLA. I have already mentioned that Siemens high speed or Carpenter relays are suitable for RLA. I have experimented with both of these types and found them very sensitive, but there are, of course, other types that would be suitable. The requirements for RLA, apart from high sensitivity, are:

(a) two windings (if possible).

(b) 'one-side-stable' contact system.

It has been stated that the two-winding arrangement is better, and certain types of Carpenter relay have more than one winding – the type shown has three. However, if the reader cannot obtain such a relay, a single winding can be used efficiently if care is taken. The difficulty arises with the series arrangement and is due to the possible direct connection between one side of the T1 secondary and the amplifier earth line (positive); this is a feature found in commercially-made amplifiers and is shown dotted in Fig. 1. Since we are using one battery only for amplifier and relays, we must take care to see that the earthy side of T1 is not connected to the negative side of RLA. Fig. 1 indicates the correct insertion of T1 into the RLA circuit. Other ways of getting round this problem are isolating the T1 secondary from the earth line or using separate amplifier and relay batteries. The impedance of the RLA winding does not seem to be at all critical. I have had perfectly satisfactory results using relays with winding resistances as far apart as 150 and 2500 ohms.

The term 'one-side-stable' indicates that, in the de-energized condition, the relay armature will always be at the same side. Energizing current will change it over, but disconnection will cause it to return. Many of the relays available are of this type (such as the Siemens high speed type), but several in the Carpenter range are of the 'each-side-stable' type. Here, the armature remains at the side to which it was last operated. Now, in this type of relay, the armature position in the de-energized condition is determined by the influence of two permanent magnets, one on each side. Where the magnet strength or the armature/magnet distances differ, the armature will return to the stronger or closer magnet respectively; conversion from 'each-side-stable' to 'one-side-stable' is simply a case of reducing the influence of one magnet. I found that a small shim of cardboard placed under one magnet is sufficient to cause the armature to return always to the other side. The inclusion of permanent magnets to influence the armature position means that the energizing current must be DC and must be applied with the correct polarity. As we shall see, our circuit arrangement allows such a (polarized) relay to respond to the af signal from T1, but it must be connected across the 9 volt supply the correct way round.

Having selected RLA and having determined that it is a 'one-side-stable' type, or can be converted, the next step is to connect up the circuit shown in Fig. 2 (a). The resistor RV1 is high – of the order of 100k and is set to a maximum when the switch is closed. The value is now decreased until the relay RLA strikes. If the resistor shaft is now turned to increase resistance, the current will decrease until the relay drops out. In practice, the difference between energize and drop-out currents may be small – perhaps only half a milli-amp. RLA on the switch shown, strikes at about 0·3mA and drops out at 0·2mA, though the sensitivity is greatly increased by the circuit arrangement mentioned. Relay sensitivity can be further improved by adjusting the contacts to limit the armature travel to the shortest distance possible, consistent with a clean break and make of the contacts.

The simple circuit of Fig. 2 (a) leads directly to part of the actual switch circuit, by connecting the break contacts across the resistor RV1; this is shown dotted. When the circuit is now switched on, RLA should energize strongly and be held via RV1 as RLA1 changes over. If RV1 is now increased, a point should be reached where the relay buzzes. This is the point where RV1 is too large to pass a holding current so that as RLA1 starts to change over, the relay drops out. RLA1 thus changes back to re-energize RLA and so repeats the cycle rapidly. Clearly, the most sensitive condition of RLA is with RV1 just short of allowing RLA to buzz. Now, I have specified a value of 100Kohms for RV1, and while this is consistent with the applied voltage and a sensitive relay, it may be found that a potentiometer of lower value could be used. On the other hand, if the relay cannot be persuaded

to buzz at any setting, the RV1 resistor should be replaced with a component of higher value. Ideally, RLA should start to buzz at about half-way along the RV1 sweep. This ensures that there is considerable adjustment on each side to offset the interaction of other parts of the circuit, when connected. At this stage, the action of RLA can be checked. It is not necessary to have an amplifier at this stage, as a suitable signal can be derived from a transistor portable radio, tuned to a station broadcasting speech. Most of these receivers are fitted with an earphone socket which provides a signal for RLA in a suitable form. The radio output is applied in series with the RLA winding (across the second winding if available). At first, I thought it would be necessary to rectify the radio output and apply the resulting DC to RLA to oppose the just-hold current. However, this is not necessary as the opposing half-cycles of the af signal are sufficient to trip the relay. It is quite easy to determine if the radio output is actuating RLA because the contacts chatter. If the relay is now disconnected from the 9 volt supply, it will behave as a somewhat inefficient earpiece, the armature following the af signal, but not changing over. If the supply is then re-connected, the characteristic chatter will be restored. If the volume control of the radio has to be set high in order to make RLA chatter, then RV1 should be adjusted (resistance increased). If the sensitivity is increased too much, RLA will start to buzz, so that the setting must be short of this point. The radio receiver volume control can now be reduced to a setting consistent with the satisfactory operation of RLA.

When the trip relay functions satisfactorily, attention should be turned to the delay relay RLB. This does not require the sensitivity of RLA – though by using two sensitive relays, a measure of battery economy is effected. The relay RLB test circuit is shown in Fig. 2 (b). Here, RLB is in series with C1 and the 9 volt supply, the milliammeter being included to follow the current change. When the circuit is switched on, it will be observed that the initial current is high and falls to zero. The fall is rapid at first, but becomes slower as the current decreases. Initial current should be high enough to ensure that RLB strikes, but not excessive. On the switch shown, the initial current is about 3mA. Since the striking current of RLB is less than 1mA, the relay energizes easily. I do not consider 3mA to be too high in this case, but if it was in excess of about 4mA, I would connect a series resistor in the circuit to limit the initial current. The delay is dependent on the value of C1, which for 4 to 5 seconds should be of the order of 200μFd. In the switch shown, this is made up of four 50μFd electrolytic capacitors taken from a discarded transistor radio. These components are conveniently small due to their low working voltage. The reader should note that after RLB has de-energized, due to the fall of C1 charging current, the delay cannot be restarted simply by operating the on/off switch. C1 will hold its charge for some time – certainly of the order of minutes, perhaps longer. To restart the delay cycle, it is necessary to short-circuit C1 momentarily. The delay circuit should present no problems and should work without difficulty.

The two circuits can now be brought together to form the complete switch. The connection takes place at three points:

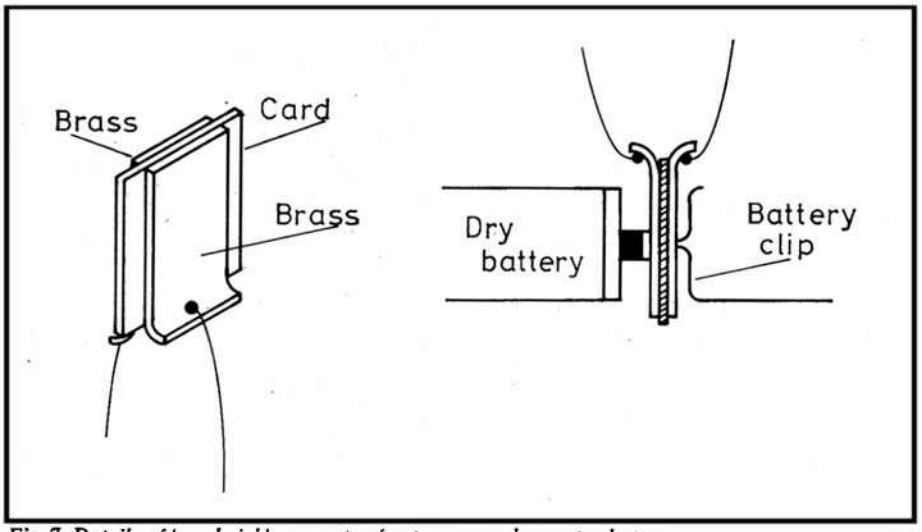

Fig. 7. Details of 'sandwich' connector for tape recorder motor battery.

(a) the negative supply lines of the circuits are joined.
(b) the positive supply lines of the circuits are joined.
(c) the RLA side of RV1 is connected via the rectifier W1 to the positive side of C1.

It is important that W1 is connected the correct way round – that is with the positive or red end to the trip relay RLA. The relays RLA and RLB are quiet in changing over so that it is inadvisable to rely on the 'click' as an indication that the circuit is working. The 'make' contacts of RLB1 should be connected up to a series bulb-and-battery circuit so that visual indication is effected. Now Fig. 3 shows the correct action of the circuit for three possible conditions. (a) shows the effect of switching on. The current through RLA and RLB is seen to rise above the 'energize' level so that the relays strike. It will be noted the duration of the striking current is short as RLA1 changes over immediately. Since RLA is now held via RV1, the current has dropped to just above the drop-out level, where it remains. In the meantime, RLB is held via C1 and the current falls (dotted). After the 5 second delay, the RLB current has fallen below the drop-out level and the relay de-energizes. I have termed this the *make-ready* cycle as it sets RLA to its most sensitive condition, thus preparing the circuit for an af signal. When a signal is received from T1 (b), it will be observed that part of it falls below the drop-out line. This is sufficient to drop out RLA. The change-over of RLA1 resets RLA and discharges C1, causing the cycle to repeat. At (c), the condition shown is where a signal is received before the delay cycle is complete – i.e., the recorder is still running. As part of the af signal lies below the drop-out level, RLA will trip and reset and C1 will discharge to start a new cycle. In practice, a graph of the acoustic switch action would be very much more crowded with resetting peaks. It must be remembered that normally RLA resets itself before the sound that tripped it has stopped. Where a sound is continuous – which in this case implies a duration of more than a few milliseconds, RLA will tend to buzz, as the af signal will not allow it to remain just-held. It is difficult to detect this effect as it occurs only when there is a sound, which, of course, masks it.

It is now necessary to replace the radio, as a signal source, with an af amplifier. I found it convenient to use a commercially-made unit, incorporating an output transformer and volume control. The cost of buying components to produce an equivalent unit would not be significantly less and a commercially-made unit is of proved design and performance. Suitable amplifiers are available for a little over £1. With a microphone connected to the amplifier input, the switch unit should be tested as follows:

(a) set the amplifier sensitivity (gain) to a maximum.
(b) speak normally into the microphone, adjusting RV1 to the point where RLA trips to follow the speech.
(c) now move away from the microphone, increasing the RV1 sensitivity to a maximum.

The circuit sensitivity is now a maximum and the switch should operate well away from the source of sound. It should respond to general conversation if placed at the centre of a normally-spaced group. For noisier environments, or where the switch is used by one person, the sensitivity can be reduced. The construction described is 'breadboard' style – that is, with the components wired up on a flat surface and no attempt being made at neatness or compactness. The result is that the circuit is completely accessible and adjustments or changes are readily made. Once the switch is functioning satisfactorily, it should be dismantled and rebuilt in a suitable container. Plastic lunch boxes make excellent cases for electronic equipment of this type and can be obtained for a couple of shillings. The box shown in Fig. 4 is an 'elevenses' pack which, as one might expect, is slightly smaller than a lunch box. It measured $5\frac{1}{2} \times 3 \times 2\frac{1}{2}$ inches originally and a section of 0·6 inches was cut out to reduce the height to 1·9 inches. I found the box to be made of a good quality plastic which did not tend to crack. It will be observed that the components are very compactly fitted (Fig. 5) so that with relays larger than the Carpenter type, this size of container might be too small. Fig. 6 shows the arrangement of the controls, amplifier and battery, all fitted to the inside of the lid. This layout is intended only as a guide and the reader's arrangement will clearly depend on the shape and size of the box and the types of relay, etc, available. However, mounting the components in the lid is very convenient as they are easy to fit and readily accessible for repair or battery replacement. It will be noted that I have fitted a white

AN ACOUSTIC SWITCH

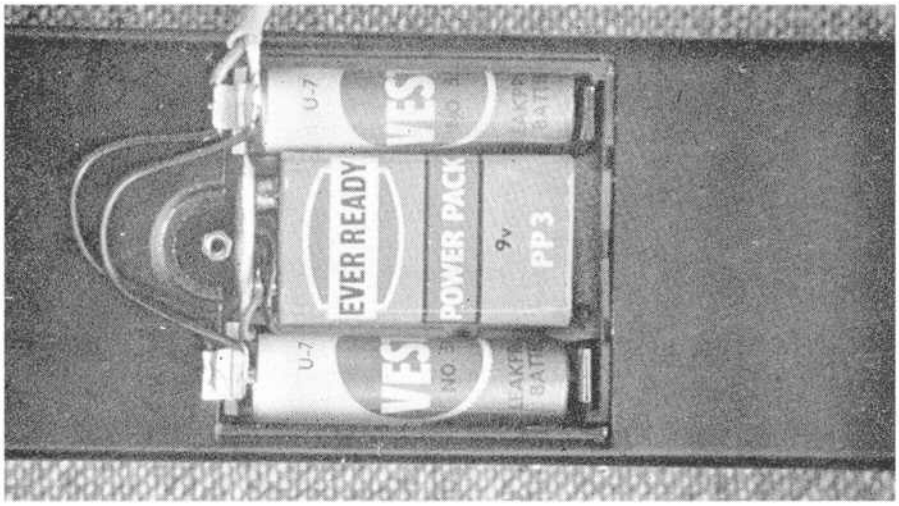

Fig. 8. Typical battery compartment in a portable tape recorder.

panel in the transparent lid, indicating the various controls. This is a piece of white card, typed with the necessary information. It is held against the inside of the lid by the potentiometers, battery and amplifier when in position. All the components incorporate fixing devices except the battery. I used two lengths of 6BA threaded rod to receive the PP6 battery. The rods are secured to the plastic lid with 6BA nuts and the battery held with a short section of aluminium curtain rail and two 6BA nuts. Carpenter relays are fitted with two 8BA threaded holes in the base and I found a good method of mounting was to secure the relays together, side-by-side using a small Tufnol strip and two 8BA bolts. Since the bases are slightly wider than the actual cases, a narrow gap was inevitable between the relays so that I passed this over a slot filed in a length of 2BA bar, which projects through the face of the lid. The nut on the bar draws the relays tight against the flat backs of the two potentiometers.

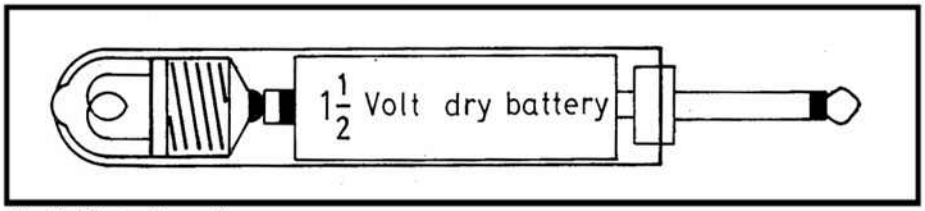

Fig. 9. The testing unit.

Wiring – Step by Step

The wiring-up procedure should be carried out step by step as follows:

(a) connect the positive side of the battery clip to the amplifier earth and the negative side to one terminal of the on/off switch.

(b) connect the amplifier input to the miniature jack socket (mic), taking care that the centre contact of the microphone plug will connect with the non-earthy side.

(c) wire up the amplifier sensitivity or gain control potentiometer.

(d) now, connect a pair of earphones to the amplifier output, plug the microphone into the mic socket and close the on/off switch. Check that the amplifier is working and that the sensitivity control is wired the right way round – i.e., sensitivity increases with clockwise rotation. If the reverse is found, change over the connections to the two outer tags of the potentiometer.

(e) connect the negative supply side, via the on/off switch, to the wiper connection of RV1 and take one side of the resistor to the appropriate side of RLA coil. Take the other side of RLA back to earth (positive). Wire RV1 so that clockwise rotation increases the resistor value and connect the break contacts of RLA1 across RV1.

(f) now operate the on/off switch. Check that RLA strikes and that RV1 can be adjusted to make the relay buzz.

(g) connect the negative supply side, via the on/off switch, to the negative side of C1 and take the other side of the capacitor to the appropriate side of RLB coil. Now connect the free side of RLB coil to earth.

(h) check that RLB is working correctly by switching on and listening for the drop-out 'click' after the delay. If you miss it the first time, remember that C1 must be short-circuited before trying again.

(j) connect the rectifier or crystal diode W1 between the negative sides of RLA and RLB.

(k) connect the 'make' contacts of RLB1 to the second jack socket (make).

(l) wire the amplifier output transformer T1 to the second winding (if available) of RLA, or otherwise disconnect the RLA/earth line and insert the secondary so that the non-earthy side is to the negative – see Fig. 1.

The switch unit is now complete except for two items of ancillary equipment. The reader will have noted that the 'make' contacts of RLB1 are to be used in the motor circuit of a portable tape recorder and the problem arises of how to introduce the switch without modifying the recorder. Now, dry batteries are usually mounted in clips which hold them and also effect the necessary electrical contact. The switch is inserted in the motor circuit between the positive battery pole and its associated clip contact. The insert takes the form of a sandwich made from a piece of thin card between two brass shims (Fig. 7). Co-axial microphone cable is connected to the shims and taken to a jack plug, which can be inserted into the 'make' socket. Where batteries are connected in parallel, an appropriate number of brass/card/brass sandwiches should be made up and wired in parallel with the switch lead. The other possibility is where the amplifier and motor supplies are separate. Here, we interrupt only the motor circuit, leaving the amplifier switched on throughout the whole recording. The photograph (Fig. 8) shows the battery compartment of a transistor tape recorder. The amplifier battery is shown in the centre, with the 1·5 volt motor batteries on each side and connected in parallel. The small sandwich connectors are placed between the positive battery poles and the battery clips, while the co-axial switch lead is seen at the right. Glued firmly to the card, the brass shims are slightly smaller than the card so that distortion at the edges does not effect an accidental short circuit. When fitting, the connectors should be put in position first and the batteries then inserted. Attempts to slide the connectors in after the batteries may well result in the brass shims being peeled off.

The second item of ancillary equipment necessary is a 1·5 volt bulb-and-battery test circuit with a jack plug for insertion into the 'make' socket. This is a useful item for testing the sensitivity and checking the delay time before the acoustic switch is used with the recorder. It will be found that the bulb gives a better indication of the circuit performance than can be gained by watching the recorder spools turn and stop. The unit shown in Fig. 9 was made from a single-cell, miniature torch. Originally, a button at the rear was pushed to light the bulb, the effect being to move the battery against a spring so that the positive battery pole was brought against the central bulb connection. In modifying this, I took out the button and fitted in its place a miniature jack plug. The actual prod of the plug is secured to the torch body by a threaded ring cut from the plug handle. I made the ring small enough to allow the central plug connection to project beyond it and, in order to get the ring screwed conveniently on to the plug from the inside, I cut a small rectangular slot in the

continued on page 46

THE THINGS YOU SAY

Posting Tapes
May I say a word about the way tapes, and in particular the smaller 3 inch variety, are mailed. The unprotected tape is invariably enclosed in a 'stout manilla envelope' which, when opened, discloses a cracked reel which has to be replaced – at 2*s* 6*d* a time! Surely the sensible thing to do would be to box the tape properly for mailing, and by so doing ensure safe delivery to its destination.
It only involves a little trouble and a few coppers extra, and is good insurance against damage or loss.

A. C. Heatly Maguire

Christchurch,
Hants.

Most tape manufacturers now produce special mailing tape supplied in protective boxes (Phonopost Tapes). Ed.

Editing Facilities
I wonder if any other Brenell owners have thought it would be an advantage if one could hear sound on re-wind to enable 'inching' to find an exact spot on a tape, and so facilitate editing. Apparently this facility is available, although I don't think it is widely known.
I found it quite by accident, as, although not an electronic expert, I can dismantle my Mark VM machines for minor adjustments. I was trying to rectify a sticking pause button one day, had taken out the deck and amplifier units and re-connected them so that I could see it actually working. I noticed that on re-wind I could hear the sound, and couldn't understand why! When finally re-assembling the machine, I discovered I had left unplugged the little phono plug (brown lead) on the right-hand side of the machine. Not being sure whether this would have any ill effect on the machine if left unplugged, I contacted Brenell, who informed me that it was quite in order, and they had, in fact, made this a plug and socket connection to enable this facility to be easily available.
I have mentioned this to various tapespondents, and although one was not impressed, the others think it a good idea, and feel that others might like to know.

Mrs Jean Weir

Gillingham,
Kent.

Video Apathy
It was with great relish that I read your cynically sarcastic crack at British manufacturers for their inept apathetic attitude towards video recording, for it seems that they have capitulated to the more enterprising 'foreigners' who have had the perspicacity to invest new fortunes in their development of this booming market.
It is not generally known (and if it had been it has doubtlessly been conveniently forgotten) that as long ago as 1963, this company approached the trade *en masse* in an attempt to persuade *someone* that there was about to be a revolution in the video tape field and that a new technique we were experimenting with had proved itself entirely practicable to the extent of being ludicrously simple and obvious. Demonstrations were given to many of the *big* companies but always the cry went up: 'we haven't got the team at present, colour TV you know' or 'we will make it if you bring it to us in a package-unit with all the bugs squashed'! This was the attitude of wonderful TV industrialists on the verge of factory closure, due to the stagnant moribund boards of directors swayed by the blasted accountants who would rather put the profits into Gilt-Edged than risk a few bob on an almost certain shot in the arm for the industry.
After the most frustrating two years one could possibly experience, we have decided to 'go it alone' and cock the proverbial snook at these dead-heads, for we back our judgment with our limited resources and press on, spurred by the visions of red faces when we launch our machine on the stagnant waters of the British domestic market (Electronics Division).

John M. Birch,
Vale Electronics Ltd

Mono into Stereo
I wonder if any other reader has tried this experiment? I've got plenty of stereo records and tapes, but purely for interest purposes, I made a *stereo* tape from a *mono* record. It turned out perfect. I have no elaborate equipment – my present recorders are a Brenell STB1 and a Beocord 2000 de luxe. With these I made a perfect stereo recording of a Morecambe and Wise sketch from their mono LP.
There is no 'hole in the middle' effect, and the sound does *not* keep jumping from one speaker to the other, but the effect is that Morecambe is on one side and Wise on the other (and *viz* the other characters). There is an audience laughing and clapping, too, and they do *not* move from side to side either.
I'm quite pleased with this experiment – I realize it can only be done with people talking – music (orchestras, etc) is a different matter! Anyone know how I did it? I expect there are several ways, but none can be any more succesful than this.

Eric Pepperell

Warrington,
Lancs.

Participation in Local Radio
Early this year you published an open letter to all tape clubs from Mr Bob Danvers-Walker, on the subject of club participation in the BBC 'local radio experiment'. At that time, it seemed very likely that the Liverpool area would be chosen as one of the experimental station sites, and this has recently been confirmed; hence the keen interest aroused among Merseyside Tape Recording Society members.
While at the Audio Fair I had the very great pleasure of meeting Bob Danvers-Walker at the BASF display, and he readily agreed to convey his views on tape to our members; this resulted in a twelve-minute interview which was warmly received by our members. In the course of this interview he stressed that *ATR* was the ideal medium for publicizing this entire question, either through the club news page or the letter columns, to 'help keep the pot boiling'.
We at Merseyside would gladly hear the views of clubs or individuals, and meanwhile would like to throw out the following opinions, if only to start the ball rolling in your columns (mixed metaphors creeping in!).
Already at Merseyside the Press has carried the initial advertisements for the station staff. One glance at the required qualifications ended any pipe-dreams of applying for jobs – the fifteen or so people permanently employed will obviously have more than 'keen amateur' qualifications. But we don't feel this leaves us out in the cold altogether; we feel there still should be scope for outside contributions.
Through the efforts of John Bradley and the Federation, and through our own letters of inquiry which have now gone to the BBC, we hope to arrange a meeting with the Merseyside station controller on his arrival in the area. The points we intend to make are as follows:
1. To quote Bob Danvers-Walker, 'clubs may be capable of producing items, for the sheer pleasure of it, taking immense time and trouble, and going to lengths which would be impossible if boiled down to the economics of ordinary radio programme production'. Or, as someone in our club said, 'the BBC have the equipment – be *we* have the time'.
2. But let's not give ourselves illusions: we *are* amateurs, and while some of us have recorders costing over £100 and microphones and accessories that do justice to them, our efforts might not sound quite so impressive to trained professionals using studio equipment.
3. However, let's not despair either, and let's keep our ambitions within the scope of our equipment and abilities. Even a weekly half-hour programme would tax us in many ways, assuming the station controller wanted it anyway; but what about the shorter items, as used on the national *Today* programme? Here, we feel, is the individual's or the club's outlet, at least until more experience is gained.
With these thoughts in mind, our letter to the BBC, and (we hope) our eventual meeting with the local controller, features the following questions:
Will there be scope for the short snappy item, already mixed and spliced and introduced, probably from two to four minutes in length . . . the type of item which may not be burningly topical but which has local interest, throws the spotlight on an interesting character or institution, and which a club could spend an entire week gathering, editing and polishing for the fun of it?
Will there be scope for a 'scoop'? If one of our members happens to be on the scene when a local story breaks – a fire, explosion, protest march or what-have-you – and records some actuality or interview material, even on a fairly humble but surprisingly useful cassette portable for example, will it be worth his or her while ringing up the station and offering the tape for use? This might, for instance, mean all the difference between the station putting out a bare news announcement, and one which would include

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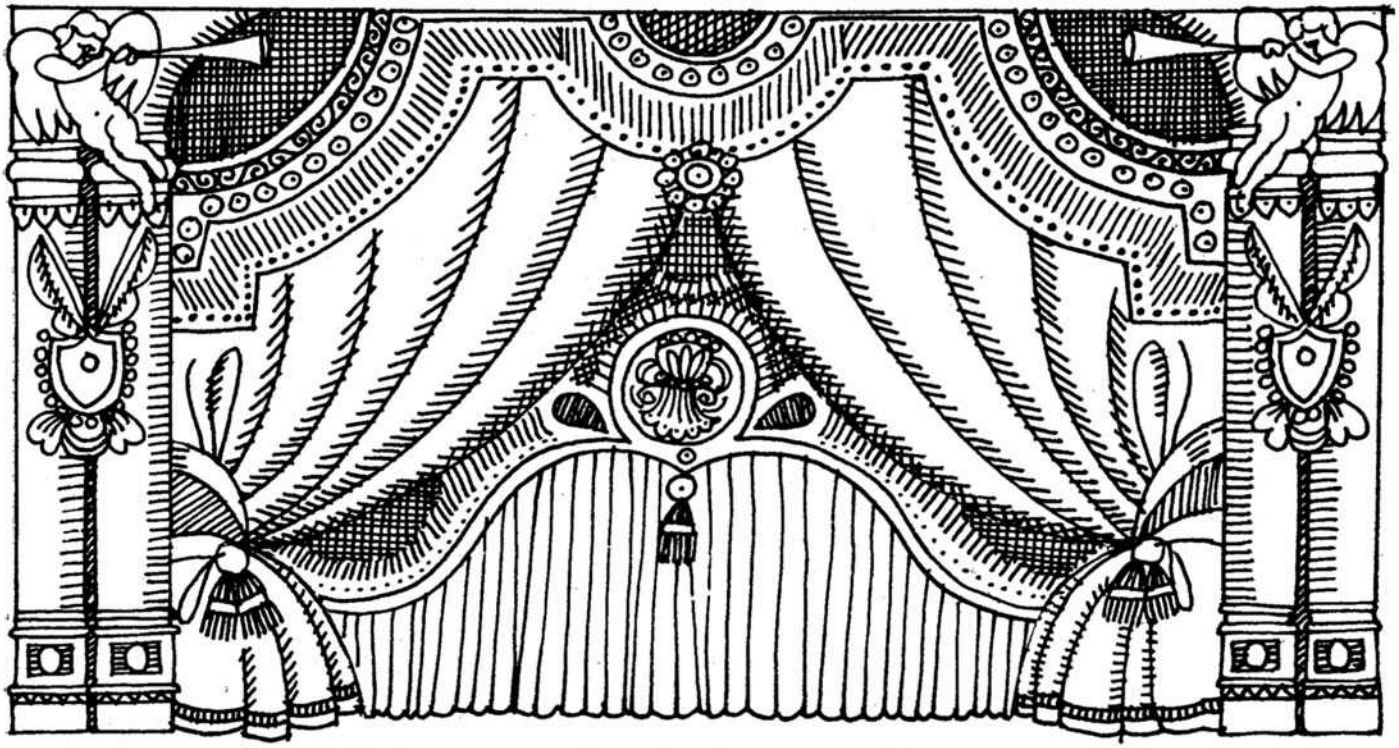

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GRUNDIG

TEST REPORT – BSR UA70 AUTOMATIC/MANUAL TURNTABLE UNIT AND CERAMIC CARTRIDGE

by Peter Knight

Single-play motor, pick-up arm and cartridge combinations designed for hi-fi and, needless to say, of impeccable performance and specifications could well take £100 from a hi-fi enthusiast's pocket. It may seem amazing, therefore, that BSR Ltd, Monarch Works, Old Hill, Staffs, are offering an auto changer complete with ceramic pickup cartridge, and of a quality directed towards the hi-fi world, to sell for about £15. The standard auto unit is £12 18*s* 3*d* and the C1 ceramic cartridge £2 7*s* 0*d* with sapphire point and £3 1*s* 9*d* with diamond.

The pedantic hi-fi enthusiast, of course, would never consider the use of an ordinary auto changer with his records, let alone purchase one complete with cartridge for a mere £15! For this type – demanding nothing below the existing perfect – the 'Rolls Royce' audio equipment is exactingly designed and virtually tailor-made. Hence its great cost.

Nevertheless, there is a wide gap between the average radio and radiogram and true hi-fi, and the current trend would appear to be directed towards bridging this gap with equipment above average but below true hi-fi. This could be termed 'domestic quality audio' or something like this, and the field at the present seems to be wide open for enterprising manufacturers. Already this audio gap is being breached by one or two manufacturers and in your reviewer's mind the BSR UA70 with its cartridge fulfils this requirement. Indeed, the demand for this sort of equipment is quite fantastic. It is the step that many music lovers first take before jumping into the hi-fi deep.

If one examines the UA70 with a hi-fi hat on, the outcome would not give a true reflection of the unit, and it is not going to be examined on this basis – in this report, anyway. There are many people, appreciative of good sound, disliking the task of manual record changing yet unable to afford the luxury of the true hi-fi changer (ie, avoiding the detracting effects of spinning records one on top of another). The UA70 is a unit designed to solve their problem.

Past activities of BSR have been directed essentially to the supply of record units to radiogram makers, and the company has attained a high level in this kind of business since its first motor in 1947 and first changer in 1951. While the UA70 will be purchased by set makers in the same way, the production is geared to quantities allowing the unit also to be supplied individually to constructors and enthusiasts wishing to build their own record playing equipment. This makes it possible to produce large numbers (albeit, not cheaply) at less cost.

Fig. 1. Unit mounted in plinth.

The unit mounted in a base and shown full-face with the arm displaced for better appraisal is shown in Figs. 1 and 2. The turntable is 11 inches diameter and is energized from an induction motor underneath the unit which is rubber mounted. This can be seen towards bottom-right of the picture in Fig. 3. The motor can be adjusted to suit supplies of 100 to 125V 60Hz and 200 to 250V 50Hz.

Changer or Single-play

It is possible to use the unit either as a changer or single-player, the centre turntable spindle being changed to suit the requirement. For changing, a stacker-spindle is fitted and this accommodates up to eight 7, 10 or 12 inch discs, while a stub-spindle is used for single-plays. The two spindles supplied are easily interchangeable. The record sizes used on one session of auto-changing must be the same; it is not possible to mix diameters on one stacking.

Idler-wheel turntable drive is adopted, but this wheel is automatically disengaged when the unit is switched off. This attribute avoids the formation of 'flats' which would affect the wow and flutter performance. The speed-change mechanism is also based here, and the four disc speeds of 16, 33, 45 and 78 rpm are available, selected by a lever at the front right-hand corner (Fig. 2). At right-angles to this is the functions lever with three positions, *off*, *on* and *reject*. For manual working, this lever is pushed to *on*, which starts the motor and gives free arm movement. The pick-up can be applied to the disc by means of a lifting finger attached to the head or, more exactingly, by the raising and lowering device fitted to the bearing end of the arm. More will be said about this later.

When a record comes to the end (on manual operation) an automatic stop operates, and the arm returns to its rest

TEST REPORT- BSR UA70 AUTOMATIC/MANUAL TURNTABLE UNIT AND CERAMIC CARTRIDGE

Continued

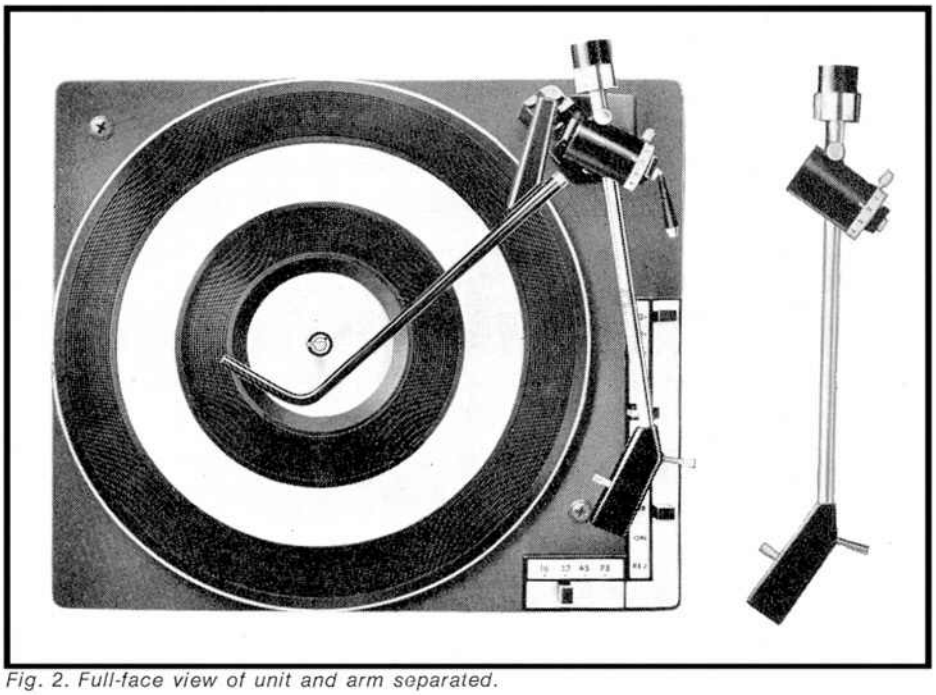

Fig. 2. Full-face view of unit and arm separated.

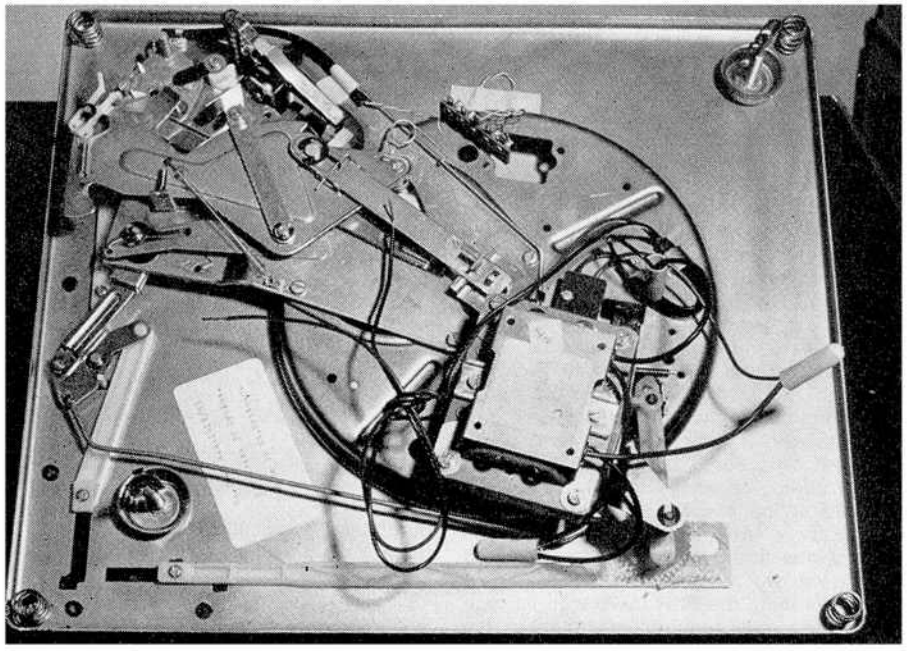

Fig. 3. Underside view of unit.

and is lightly secured in position, while at the same time the motor switches off. If one wishes to terminate the playing of a record before the end, the lever is pushed to *reject*, and the cycle as just mentioned occurs. For automatic changing, the lever is pushed to *reject*. This instigates the auto cycle, as we have already seen, but when discs are piled on the stacker-spindle the first one drops on to the turntable and is taken over by the pick-up. The switching-off cycle is avoided by a feeler arm coupled to the mechanism. Operating the *reject* lever during an auto-play, however, causes the pick-up to leave the disc it is playing, whereupon the next disc in the stacked pile is lowered on to the turntable, on top of the one that was previously playing.

A close-up picture of the bearing end of the pick-up arm is given in Fig. 4. The white control knob to the right of the main drum assembly is calibrated in stylus pressure, while the knob at the far end of the arm proper (see also Fig. 2) is a counter-balance weight which can be released for in/out adjustment by loosening an adjacent knurled clamping screw. This counter balance equalizes the arm, head and cartridge, and the idea is to make adjustment for optimum balance with the calibrated pressure knob at zero. The required tracking pressure is then turned on as required by the calibrated knob. This works out quite well in practice, although pressure tests made with an independent balance indicated a small error in the calibration of the sample. The pressure is applied by tightening a coiled spring located inside the drum seen in Fig. 4.

Arm Lifter

The arm lifting and cueing device is extremely neat and effective in operation. The lever operating this is not visible in Fig. 4, but can be seen in Figs. 1 and 2. When the lever is lifted upwards, the small platform below the spring-loaded knurled screw, shown in Fig. 4, rises and thus applies a lifting movement to the arm bearing. The knurled screw can be turned against the loading-spring pressure to regulate the height of the cartridge/arm lift.

The whole of this mechanism is very well balanced and nicely machined. The vertical bearing of the arm has remarkable freedom of movement, almost equal to that of some good quality hi-fi arms, but the lateral bearing (or arm movement) appeared to be stiffer than it need be. One must expect this arm movement on changers to have some shortcomings, of course, since the bearing has to extend through the base-plate to engage with the arm-moving mechanism. Even when released, therefore, the arm has to move a metal plate, but the unbalance effect due to this is countered in the BSR unit by an opposing counter-weight coupled to the bearing spindle beneath the base-plate. On the sample unit it was discovered that slightly less lateral-bearing friction could be achieved by reducing the pressure of a piece of spring metal pressing against the bottom of the bearing, acting as its spring-loaded vertical thrust surface. The three signal wires emerging from the end of the arm are very fine and operate over a reasonably large radius, and it was not thought that they contributed significantly to the lateral friction. However, since they are unscreened they could represent a hum source.

A purist would consider the turntable of insufficient mass for serious work, it being made of two pressed-steel plates partnered together and welded and with a momentum that kept it spinning for about 20 seconds after switching off from 78 rpm. A purist might also be fascinated by apparent turntable wobble when applying finger pressure to the edge. Actually, much of this movement appears to result from the nature

of the turntable bearing mounting, but there is still a small degree of slack in the bearing proper, though this does not appear to impair the performance of the unit. Indeed, when the turntable is energized in the ordinary way from the motor this bearing slack seems to disappear or, at least, it sets down in one direction with no particularly ill effect in practice, and no cyclic tilting.

The drive motor is a four-pole induction type dynamically balanced, and, considering the price of the whole unit, is a very good motor. Over the normal range of mains voltages (220 to 240 volts, since the sample was indicated as being 230V), the speed remained substantially constant. The unit is designed for mounting on four corner springs, clearly visible in Fig. 3, and their purpose is to damp down vibrations from the motor board to the pick-up, via the disc, bearing in mind that the unit will certainly be employed extensively in radiogram outfits.

There are very few internal or mechanical preset adjustments, the mechanism comprising a series of clip-on levers, springs and so forth, as shown in Fig. 3. There is one important adjustment, however, and that is the set-down point of the stylus on the disc. Early changers had shortcomings in this connection, the pick-up setting down either straight on to the grooves or on to the turntable mat. BSR has solved this by a simple-to-adjust screw, seen in Fig. 2, directly to the rear of the pressure adjusting control.

The cartridge in the test sample was the well-known BSR C1. This is stereo and ceramic, favouring loading into 2M across 100pF. So loaded, no equalization is needed in the amplifier, and the response taken with the Decca SXL2057 test record (by the makers) is shown in Fig. 5(a). The separation characteristics taken with the Westrex IA record are given in Fig. 5(b). In spite of its small price, the C1 can give a very good account of itself and, as shown in Fig. 5(a), is capable of a high output voltage, meaning that it can be used fully to drive relatively insensitive amplifiers.

The cartridge in the UA70 was tested on various discs, including the high modulation and acceleration tracks of the Vanguard Stereolab Test Record, VSD100. Tracking could be achieved at 2gm, but high modulation levels called for a little over 3gm for the least buzz and distortion. Incidentally, the pressure can be adjusted on the unit from zero to 6gm, with the arm counter balanced to zero.

Subjective wow and flutter and rumble tests were performed with test records and the latter by mounting the stylus on a sounding box resting on the unit. Rumble was above noise at full volume setting of the amplifier and bass flat, but only just, and at normal volume settings it was barely discernible, even with the sounding box. On the silent parts of ordinary records it was insignificant.

Flutter was tested on a 3KHz track and, although very slightly present to the keen listener, was by no means troublesome on music. The same applied to wow-low-frequency cyclic speed variations.

When the unit is appraised on the basis of the definition given at the beginning of this report, it most certainly has much to commend it. There is no doubt that it will find a massive market, for it is good value (including cartridge) for £15 or thereabouts.

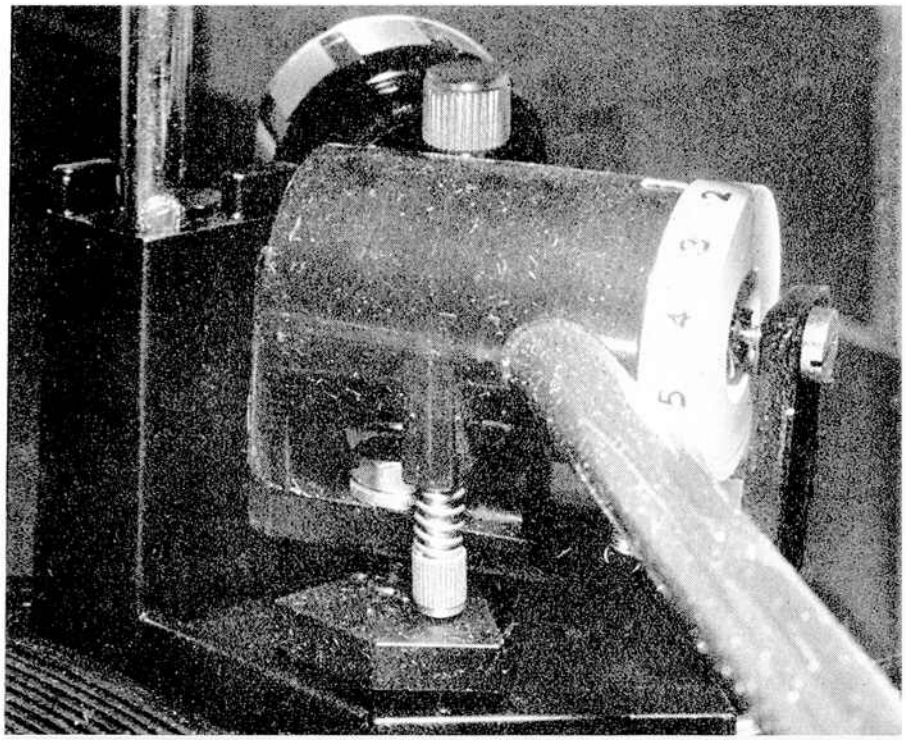

Fig. 4. The arm bearing mechanism, showing raising platform and adjusting screw (see text).

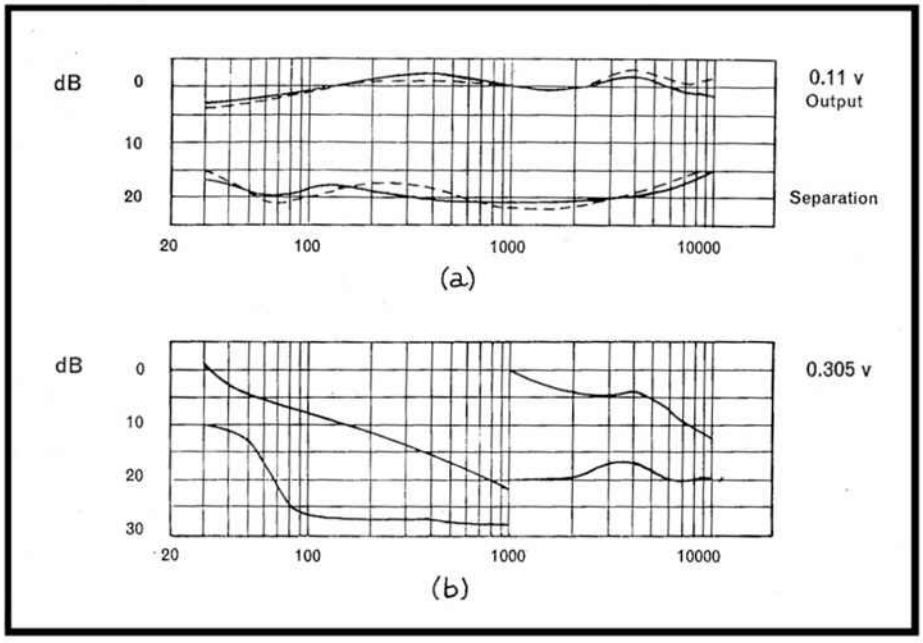

Fig. 5. (a) C1 response curve with Decca SXL2057 and (b) channel separation characteristics with Westrex 1A.

Maker's Specifications

Capacity: Maximum record stack height 0·572 inch. *Speeds:* 78, 45, 33 and 16 rpm. *Power supply:* Dual-voltage four-pole motor to suit 200-250V and 100-125V supplies. *Cartridge:* Any standard Mono or stereo cartridge suitable. *Wow:* Below 0·2% rms. *Flutter:* Below 0·06% rms. *Rumble:* —29dB at 1Hz. *Finish:* Satin-black mainplate with black turntable mat inlaid with brushed aluminium rings. Combination of black and brushed aluminium trim for pick-up arm and controls.

C1 Ceramic Cartridge

Colour: Graphite blue. *Compliance:* 5·2 c.u. *Sensitivity:* 110mV ± 2dB at 1KH from Decca SXL2057 (at 1cm/sec velocity). *Stylus pressure:* 2-6gm, depending on arm. *Equivalent capacity:* 600pF. *Loading:* 2M/100pF. *Channel difference:* less than 3dB. *Channel separation:* 16dB at 1KH.

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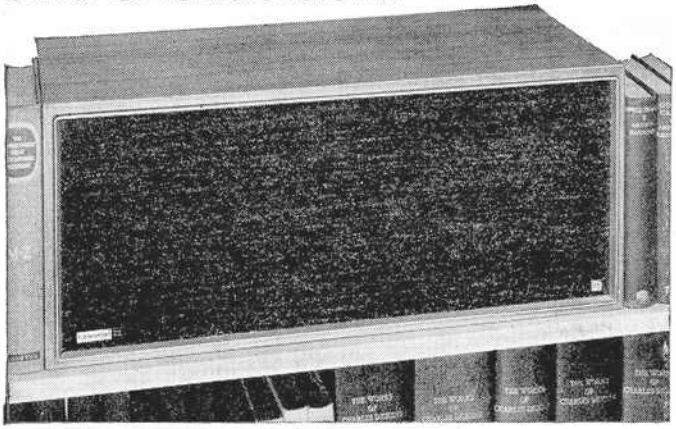

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THE DECIBEL AND ITS USE IN AUDIO

by Gordon J. King

We do not have to go very far in tape recording and hi-fi to come up against the term *decibel*. The unit is widely adopted not only in technical specifications of tape recorders, microphones, amplifiers and so forth, but also in sales literature, and its meaning is not always fully understood. What is the decibel, what advantages has it over equivalent ways of describing performance, etc., and how is it employed in audio work? These questions are fully examined in this article in such a way that, it is hoped, the non-technical reader will understand.

Our senses respond to stimuli in a logarithmic manner. This means that if we are hearing sound at an intensity of, say, 2 watts we should not be conscious of the intensity having doubled by turning the power up to 4 watts. The impression a listener gets when a sound of certain intensity is suddenly increased is proportional to the logarithm of the ratio of the energy or power of the two sound levels.

This applies to other things like our senses of touch, pain, smell and sight, following the Weber law but outside our present scope of activities. A similar law applies to the musical scale. Between octaves the ratio is 2 to 1, but between tones, of which there are six in an octave, the ratio is 1·1221 to 1 and this as we shall later see is the absolute voltage ratio of 1 decibel. A specific number of Hz (cycles) between each tone would result in discords.

The decibel is derived from the term *Bel*, after Graham Bell, the inventor of the telephone. In the early days telephone engineers discovered that this logarithmic ratio could be applied to telephone signals, easing the computation of gains and losses in repeater amplifiers and cables. It was given the label *Bel*, and has since been handed down and developed to suit all aspects of audio engineering (as well as engineering in other fields).

Our dynamic range of hearing corresponds in total to about 13 Bels, starting at a sound intensity near the threshold of hearing and rising to a point where the sound begins to be painful. A 13-Bel scale is too rough for serious work, however, so each Bel is divided into ten parts, and each part is called a decibel (*deci*, meaning ten). The abbreviation is thus **dB**. Some people use the capital **B**, as I have done, since it is the first letter of the name Bell, but sometimes the abbreviation is dB. I prefer the former. Note that the decibel divisions are themselves made on a logarithmic scale between Bels.

Since the term is logarithmic, therefore, we can express the number of decibels thus:

$$ndB = 10\log_{10}\frac{P2}{P1}$$

dB	*Power Ratio*	*Voltage Ratio*	*dB*	*Power Ratio*	*Voltage Ratio*
1	1·26	1·12	15	31·6	5·62
2	1·58	1·26	20	100	10
3	2·0	1·41	30	1000	31·6
4	2·51	1·58	40	10^4	10^2
5	3·16	1·78	50	10^5	316
6	3·98	2·0	60	10^6	10^3
7	5·01	2·24	70	10^7	3160
8	6·31	2·51	80	10^8	10^4
9	7·94	2·82	90	10^9	31600
10	10	3·16	100	10^{10}	10^5

Table 1. Power and voltage (or current) decibel table.

Power Ratio	*dB*	*Power Ratio*	*dB*	*Power Ratio*	*dB*	*Power Ratio*	*dB*
1·0	0·000	3·3	5·185	5·6	7·482	7·9	8·976
1·1	0·414	3·4	5·315	5·7	7·559	8·0	9·031
1·2	0·792	3·5	5·441	5·8	7·634	8·1	9·085
1·3	1·139	3·6	5·563	5·9	7·709	8·2	9·138
1·4	1·461	3·7	5·682	6·0	7·782	8·3	9·191
1·5	1·761	3·8	5·798	6·1	7·835	8·4	9·243
1·6	2·041	3·9	5·911	6·2	7·924	8·5	9·294
1·7	2·304	4·0	6·021	6·3	7·993	8·6	9·345
1·8	2·553	4·1	6·128	6·4	8·062	8·7	9·395
1·9	2·788	4·2	6·232	6·5	8·129	8·8	9·445
2·0	3·010	4·3	6·335	6·6	8·195	8·9	9·494
2·1	3·222	4·4	6·435	6·7	8·261	9·0	9·542
2·2	3·424	4·5	6·532	6·8	8·325	9·1	9·590
2·3	3·617	4·6	6·628	6·9	8·388	9·2	9·638
2·4	3·802	4·7	6·721	7·0	8·451	9·3	9·685
2·5	3·979	4·8	6·812	7·1	8·513	9·4	9·731
2·6	4·150	4·9	6·902	7·2	8·573	9·5	9·777
2·7	4·314	5·0	6·990	7·3	8·633	9·6	9·823
2·8	4·472	5·1	7·076	7·4	8·692	9·7	9·868
2·9	4·624	5·2	7·160	7·5	8·751	9·8	9·912
3·0	4·771	5·3	7·243	7·6	8·808	9·9	9·956
3·1	4·914	5·4	7·324	7·7	8·865	10·0	10·000
3·2	5·051	5·5	7·404	7·8	8·921		

Table 2. Power ratios expressed in decibels, at tenths of a decibel.

where ndB is the number of decibels, P2, say, the output power and P1 the input power (both in watts). The *10* below the *log* indicates the common log to the base of 10, while the 10 in front is because we are dealing in *decibels* and not Bels. This expression holds for any change in power, electric as well as acoustic. For instance, any change of power output in a hi-fi amplifier would give a corresponding change in acoustic power from the loudspeaker, so the two powers are related.

Power Ratio

Let us suppose that our tape recorder is delivering 1 watt to the loudspeaker on

replay and we turn up the volume control to give an output of 2 watts. Since the first power was known, we can say that by turning to 2 watts we have doubled the power, or increased it by a ratio of 2 to 1. It would mean nothing simply to say that we have increased the power by 1 watt if the original power was unknown. With decibels, therefore, we must have two values to work with to give a *ratio*, for a decibel is nothing more or less than a ratio. We cannot say that an amplifier or microphone has an output of so many dB. We must have a datum or reference level to work from.

Now to get back to our illustration. If we multiply the logarithm of this 2 to 1 ratio by ten times, as in the above expression, we should find that the power had been increased by about 3dB (3·01dB to be exact). On the other hand, if we started with 2 watts and dropped to 1 watt, the power would have decreased by 3dB; or we could say that the power has changed by — 3dB. The minus sign in front of the dB number means a fall in power. If a minus sign is not used, one would assume a gain or increase, but this may be qualified as a *loss*, such as by saying that the power has *reduced* by 3dB. There is no need for us to work out the logs of power ratios to get the dB number, neither is it necessary to invert the process to get a ratio from dB numbers. Decibel tables are readily available and the best of all engineers work from them.

Voltage and Current Ratios

The dB is also used for *voltage* and *current* ratios as well as for power ratios. However, when used in this way it is most important to ensure that the resistances or impedances (R) in which the current (I) and voltage (E) operate are equal. Unequal impedances at the input and output of an amplifier must be taken into account when dB gain translations are made. In this respect it is very important to note that dB tables of voltage and current ratios assume that the impedances are equal (or near enough equal). When they are equal we can express the number of decibels thus:

$$ndB = 20\log_{10}\frac{E1}{E2}$$

where ndB is the number of decibels, E1 is the output voltage and E2 the input voltage (the voltage ratio). When dealing with current, the same expression is used, but a current ratio, i.e., I_1 and I_2, is used instead of a voltage ratio.

Decibel Tables

The table in Fig. 1 gives power and voltage (or current) ratios in terms of decibels from 1 to 100dB, while the table in Fig. 2 gives power ratios only from 1 to 10dB in tenths of a dB. These tables will cover the majority of requirements but it is possible to extend them by having in mind (a) that a power ratio has *half* the dB value of a voltage ratio (for example, a 2 to 1 voltage – or current – ratio is 6dB while a 2 to 1 power ratio is 3dB, taken to the nearest whole number) and (b) that by adding 10dB on the power scale or 20dB on the voltage (or current) scale a multiple of 10 is created in the actual ratio.

As we have seen, such tables dealing with voltage and current ratios assume similar values of input and output impedances or resistances. What happens, then, when the impedances or resistances differ? The answer is that we need to modify the expression a little so that we get:

$$ndB = 20\log_{10}\frac{E1}{E2} + 10\log_{10}\frac{R1}{R2}$$

where E1/E2 is the voltage (or current, by substituting I for current) ratio and R1 is the impedance or resistance in which E1 is working and R2 is the impedance or resistance in which E2 is working.

We get the different expression for voltage and current ratios because the decibel is essentially a unit for indicating *relative powers*. Thus, when it is used to express current or voltage gains and losses, allowance must be made for the fact that the power varies by the *square* of the change in current or voltage. For instance, an increase in current or voltage by a factor of two results in the power being increased by a factor of four. When ndB is known, the power, current and voltage ratio can be computed by using the expressions:

$$\frac{P1}{P2} = \text{antilog } ndB/10 \text{ and } \frac{E1}{E2} = \text{antilog } ndB/20$$

and the latter expression is also used for current ratios, E1/E2 then being replaced by I_1/I_2. That is all there is to it mathematically!

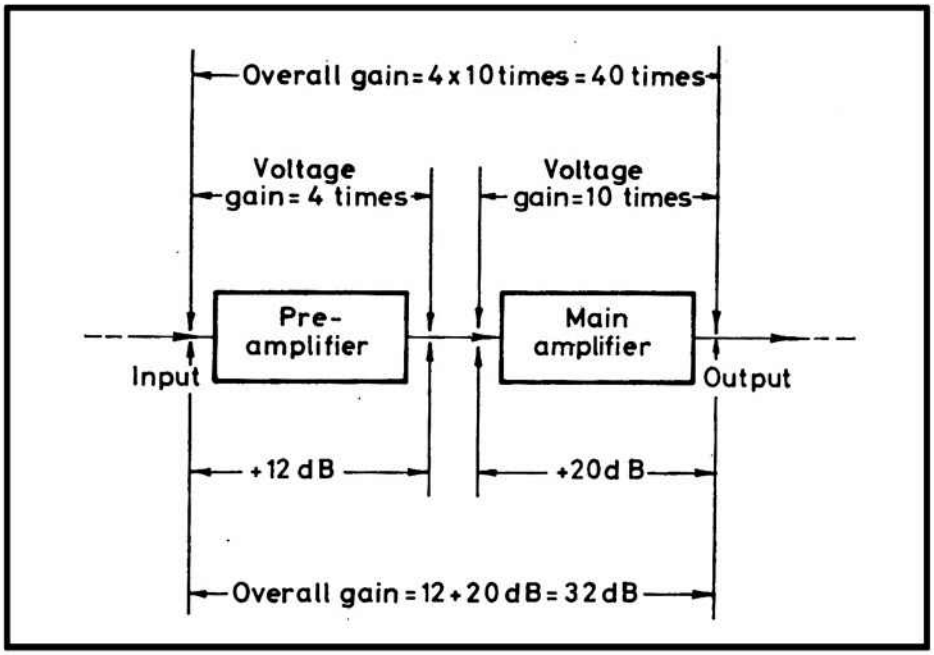

Fig. 1. Block diagram of cascaded amplifiers illustrating the use of decibels (see text).

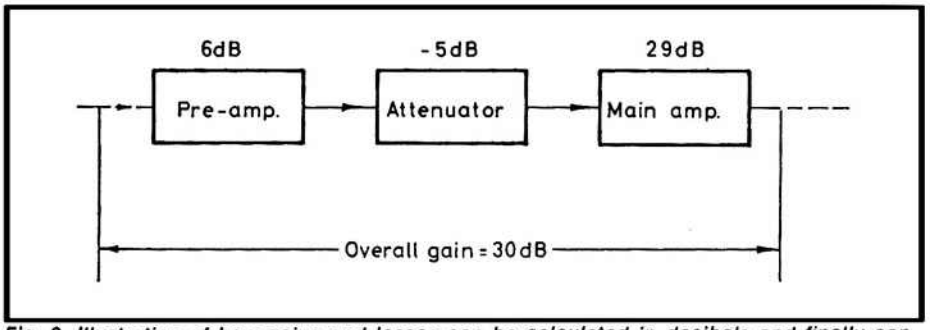

Fig. 2. Illustration of how gains and losses can be calculated in decibels and finally converted to an overall voltage ratio.

Gains and Losses

Now let us look at some practical uses of the decibel. Fig. 1 shows a block diagram of a preamplifier connected to the front of a main amplifier. The preamplifier has a 4 times voltage gain and the main amplifier a 10 times voltage gain. The overall gain can be discovered by multiplying the two gain values; that is, 4 times 10, giving 40 times.

Table 1 shows that a voltage gain of 2 times is 6dB, which means that a voltage gain of 4 times is two times 6dB, or 12dB, and that a voltage gain of 10 times is 20dB. The overall voltage gain, therefore, is simply 12dB + 20dB, or 32dB. This is one illustration of the easy way in which decibels can be used. It is only necessary to add their value arithmetically, rather than multiply real voltage gains, which can prove tiresome when the ratios go into fractions or several decimal places.

Look at Fig. 2. Here we have a preamplifier, followed by a network giving attenuation (i.e., loss), which could be a matching filter, finally followed by a main amplifier. We add the two gains first (6dB + 29db = 35dB) and then simply *subtract* the loss (35dB — 5dB), which works out to an overall gain of 30dB. From Table 1 we quickly discover that this corresponds to a voltage gain of 31·6 times. This would, however, be difficult to work out purely in terms of voltage ratio gains and loss. Thus, we have seen that a complex chain can be worked out in overall gain or loss by adding the gain decibels and subtracting the loss deci-

THE DECIBEL AND ITS USE IN AUDIO

continued

bels. One can realize, therefore, why Bell's telegraph engineers delighted in the use of bels and decibels.

In our application the frequency response of amplifiers, pick-ups, microphones and, in fact, almost everything, is given in terms of decibels. Look at Fig. 3, which is a frequency response curve (not a very good one). Here the 1Hz point corresponds to 0dB, so the various frequency points along the curve can be examined relative to 0dB. At 20Hz, for instance, the output is about — 20dB, while at 100Hz it is about 10dB. We can say that the response is down by 18dB at 20Hz and up by 10dB at 100Hz. We can continue to analyse the curve in this manner at any number of frequencies.

Now, 0dB is usually referred to a specific signal voltage. If, in Fig. 3, 0dB corresponds, say, to 1V, then we know from the curve that 1V of signal is delivered at 1KHz, and that at 20Hz the output is about 20dB below 1V (Table 1 tells us this is 10 times below 1V i.e. 100mV), while at 100Hz the output is about 10dB above 1V (that is, about 3 times above 1V, i.e. 3V).

Frequency response curves should never be looked upon to mean so many dB output at particular frequencies. There is no such thing as dB output. *The decibel must always be given a reference level*, usually at 0dB, as we have seen. The output of some microphones and pick-ups is often given in terms of dB. Take a microphone first. This may be quoted as having an output of, say, 60dB below 1V/dyne/cm^2. Now, the dB reference here is relative to a fixed level, and for microphones this is 0dB relative to 1V (that is with a sound pressure of 1 dyne per square centimetre). Thus, the output of the above microphone is 60dB below 1V, which works out to 1mV because 60dB corresponds to a ratio of 1,000 to 1, and a thousandth part of 1V is 1mV. Easy when you know how!

Similarly, a pick-up with an output of, say, 40dB below 1V per cm/sec. of recorded velocity corresponds to 100 times below 1V, or 10mV. Pick-up makers nowadays, however, generally quote the actual output voltage, but this is not so with microphones. As soon as the decibel is understood, one automatically starts looking at gains and losses and response curves in terms of the unit, rather than in voltage (or current) and power ratios direct. It is hoped that this short article will put readers on the right road or, at least, give them some better understanding of makers' specifications.

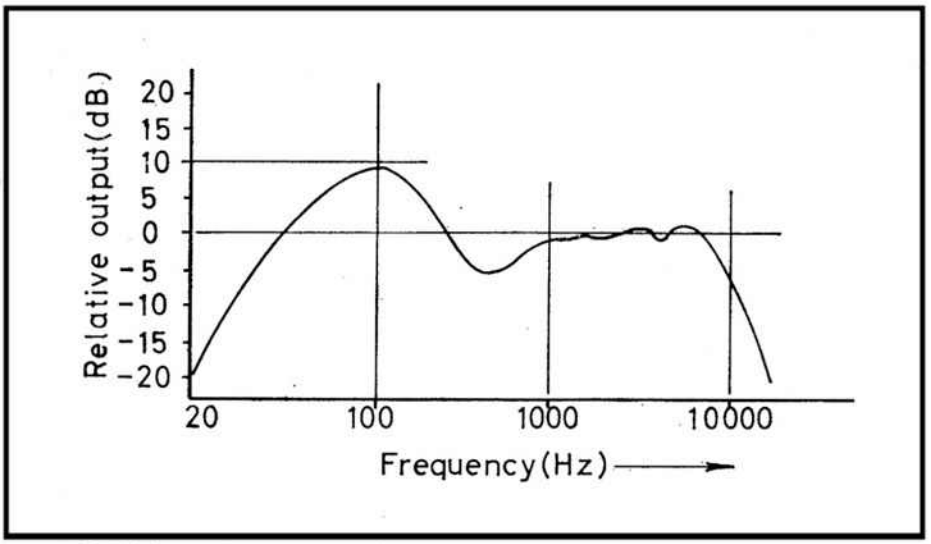

Fig. 3. Explaining a response curve in terms of output decibels.

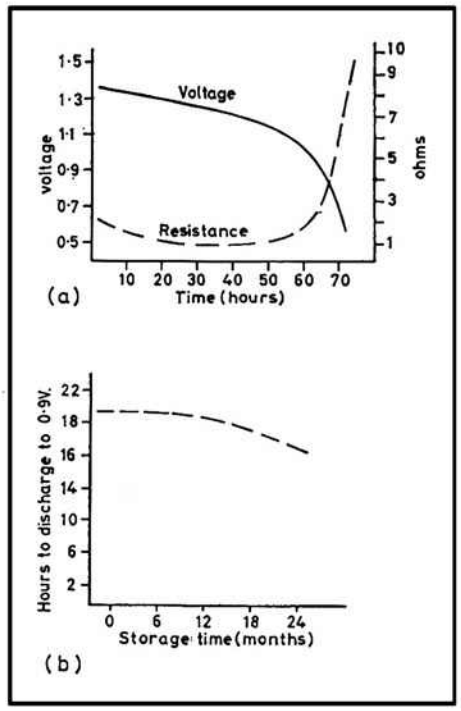

Fig. 9. (a) showing how voltage and internal resistance of mercury cells varies with discharge time. (b) showing the little change in capacity of the M-C with storage time.

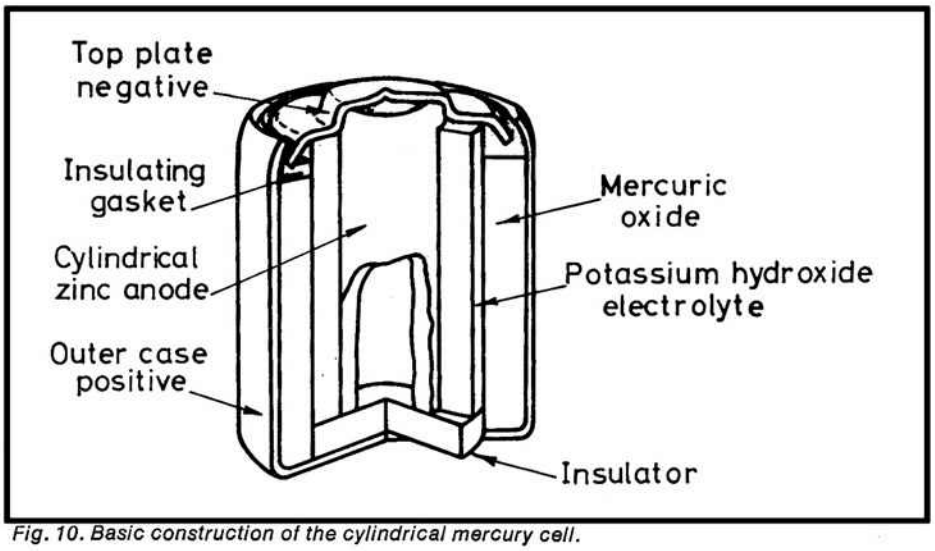

Fig. 10. Basic construction of the cylindrical mercury cell.

POWER FOR PORTABLES

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is barely affected after two years' storage time. Here the capacity is rated as the number of hours of discharge to 0·9V. The construction of the basic Ruben-Mallory Mercury cylindrical cell is shown in Fig. 10. So much, then, for the type of batteries which are used to power our tape recorders in the field. Most of us will continue to use the dry cell, and the high power version is far more desirable than the ordinary or *standard* version, as we have seen. To conclude, let us recapitulate on the factors which determine the life of a dry battery in particular. These are: size, initial current drain, end-point voltage, hours of use per day, temperature and storage period before use. Without information on all these factors, therefore, it is impossible for anyone to say just how long the dry batteries in our portable recorders will last!

TAPE CLUB NEWS

AMTRC COMPETITION WINNERS

The **Coventry TRC** has been judged the winner of the third annual competition of the Association of Midland Tape Recording Clubs. The number of entrants was higher than the previous years, so it is with great satisfaction that the club finds itself top of the tree.

Continuing its policy of encouraging members to make more use of their microphones, the club staged another of its live recording sessions. Two folk singers, Rob Armstrong and Rod Felton, accompanied themselves on guitars with American folk blues numbers. Members used a variety of equipment including the Reslo ribbon and Beyer dynamic mics, Revox, Tandberg, Ferguson, Fi-Cord and Philips machines. The proceedings, as at the previous meeting, were filmed by Geoffrey Taylor. It is hoped to include copies of the films taken at meetings with the club's quarterly magazine, thus making Coventry one of the few – or perhaps the only club – in the country producing an illustrated magazine.

Club secretary is Mr K. W. Preston of 42 Four Pounds Avenue, Coventry.

SOUND EFFECTS

Special effects were provided by the **Brighton TRC** for a play presented by the Scottish Association Drama Group. Effects included were sea wash (genuine Brighton variety!), whistling, singing and cars driving away. These effects were far simpler to produce than those for *Under Milk Wood*, presented by the Brighton Youth Theatre. This play centres on a small Welsh village, and to illustrate this, some 70 sound effects and masses of equipment were required. For full details of the club, please contact the contact the secretary, **Mr Keith Upton, 47 Kingsley Road, Brighton 5.**

ROUND ROBINS

The **Friern Barnet TRC** presently has four round robins circulating. The first, their *General Purpose Round Robin*, is divided into 150 sections, allowing about 7½ minutes for each member to record anything he chooses. The second is the *Cliff Hanger RR* on which a melodrama is maintained with each member leaving the hero (or heroine) in a difficult situation from which the next member must extricate him. Others are the *Stereo RR* and *Technical RR*. Last month the club had a most entertaining tape slide show prepared by one of their overseas members, Jim Smith of South Africa. It took a most novel form, describing Jim's meeting with his wife, the places they visited, their jobs and their marriage. This was a very good club night and the Tape Club News Editor of *ATR* was present, seeing how things are done at Friern Barnet.

Club secretary is **Mr R. A. Longhurst of 72 Grasvenor Avenue, Barnet, Herts.**

SILVER SPOOL TROPHY RESULTS

Perpetual Journey, a tape-drama about a train journey with a mysterious stranger, won Gordon Furneaux of the **South Devon TRC** the *Silver Spool* Trophy and 2,400 feet of BASF double-play tape. Second prize was awarded to David Pletts for *Some Like it Hot*, an actuality recorded at bath time, and third prize went to George Jones and Bernard Peirce for their joint production of *Sound for a Picture Evening*.

The club secretary is **Mr G. Furneaux of 45 Kenwyn Road, Ellacombe, Torquay.**

VISIT FROM CINE SOCIETY

Through member Marian Tourell, the **London TRC** had a visit from the Hampstead Cine Society. Mr Ernie Smith, their chairman, came along with a wonderful array of equipment: 8mm and 16mm projectors, tape recorders, speakers and numerous other gadgets. They provided a very fine evening of amateur cine and sound that was enjoyed by all present. Mr Denys Killick, well-known writer and broadcaster, recently spoke to the club on *The Creative Use of the Recorder*. He brought along his own sound equipment and, using many fine examples, was able to demonstrate first-class reproduction of creative recording.

Full details of club activities are available from **David Campbell of 46 Aberdare Gardens, London NW6.**

A NEWS BULLETIN 100 YEARS HENCE

Members of the **Derby TRC** were carried far into the future as they listened to the entries of this recent competition. There were some highly imaginative items in the news and, judged on both entertainment value and technique, Dennis Land was the winner with Martin Stanway second and Arthur Jeffries third.

At a later meeting the club heard a recorded documentary by blind member Stephen Hassall describing the making of a piano, which ended with Stephen himself playing the end-product.

Chairman Ernest Flecknoe announced that in the recent Midlands Association of Tape Recording Clubs competition, Derby TRC's entry came second. This gave a glow of pride and satisfaction to the group that produced this eight-minute feature tape about the influence of TV.

Further details of the club are available from **Mr A. F. Stanway, 8 Midland Road, Derby.**

TAPE IS BETTER THAN DISC

This motion was debated at the **Leeds and District TRC** by Mr Plant and Mr Smith opposed by Mr Eagle and Mr Rowe. This was conducted under the strict laws of debate with Mr J. Newton in the chair to ensure fair play. With members from the floor contributing, this was very informative and the motion was carried by an overwhelming majority. This idea is recommended to other clubs.

Mr Plant and Mr Rowe recently travelled to the Chapel Allerton Hospital to provide PA and background music for a fashion show arranged by the Friends of Chapel Allerton Hospital to raise funds for the two new dayrooms being built for the patients.

Secretary Mr W. H. Rowe can be contacted at **34 Bristol Road, Leeds 7.**

HOSPITAL BROADCAST SERVICE UNDER WAY

The past month has been, very busy for the **Doncaster and District TRC** because of their new hospital broadcasting service. The Mayor of Doncaster, Councillor Hardy, visited the club and recorded the opening message, wishing the service every success. On hearing the playback, he commented: 'This is the first time I have heard my voice on tape'.

The committee has just completed a new and interesting programme. Further details are available from the secretary, **C. K. Young, 28 Chelmsford Drive, Doncaster.**

VOICESPONDENCE GOES TO SEA

Peter Battey, the **Voicespondence Club** Publicity Assistant, in Essex, recently led a small party of club members on an official visit to the Radio Britain vessel stationed off Frinton-on-Sea to make documentary recordings. These are for distribution to the clubs and to many sightless and disabled members both in this country and overseas. The party was welcomed aboard the 186-foot ship by Jack Curtis of Radio Britain, who then led them on a complete tour of the installations and the twin £30,000 studios. The party were able to interview several of the DJ's for the recording which will be put into the club's own library which is available free to all members.

UK Publicity Chairman for the Voicespondence Club is **Robert Coote, 27 Royal Oak Road, Bexleyheath, Kent.**

SURVEY OF PORTABLES

Continued from page 19

and tape. The X4 is a four-speed recorder operating at $\frac{15}{16}$, $1\frac{7}{8}$, $3\frac{3}{4}$ and $7\frac{1}{2}$ ips. It features the Akai crossfield recording system and has twin VU record level meters and push button control. This recorder was reviewed in *ATR* in October 1965.

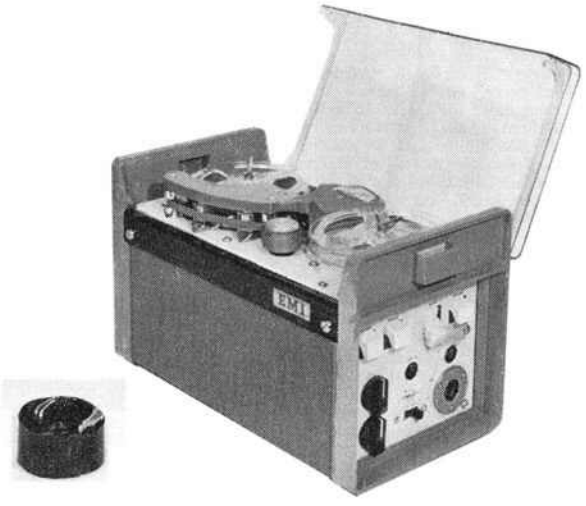
Portable tape recorders

Manufacturers and/or distributors

EMI Electronics: Hayes, Middlesex.
Uher: Bosch Ltd, 205, Gt Portland Street, London W1.
Philips Electrical: Century House, Shaftesbury Avenue, London WC1.
Sony: Debenham, Sony Division, Gloucester.
Optacord: Highgate Acoustics Limited, 71/3 Gt Portland Street, London W1.
Sanyo: Sanyo Sales & Service, 164 Clapham Park Road, London SW4.
Grundig: Newlands Park, Sydenham, London SE26.
Telefunken: AEG Limited, 27 Chancery Lane, London WC2.
Akai: Pullin Photographic Ltd, 11 Aintree Road, Perivale, Greenford, Middlesex.

Fig. 7. The Philips EL3302 cassette model.

Fig. 8. The EMI L4 portable.



CLASSIFIED ADVERTISEMENTS

Classified advertisements in 'Amateur Tape Recording' cost 1*s* per word, minimum 10*s*. Box Nos. 1*s* 6*d* extra. Advertisements and remittances should be sent to Classified Advertisement Department, ATR, 9 Harrow Road, London W2.

PERSONAL

Major breakthrough in sleep-learning economics. At last we are able to offer a machine which is not only ideal for Sleep-Learning and Therapy and gives excellent results on music, but is at the same time at a sensationally low price – only 25 *gns*. Send now for our latest catalogue of Separate Accessories and Complete Kits for Sleep-Learning together with latest Press Reports, etc., on this Vital New Subject. Dept. ATR, The Institute of Sleep-Learning, 153 Fellowes Road, Swiss Cottage, NW3. Telephone: 01-722 3314. (12/67)

Highest cash prices offered for good quality Tape Recorders, Hi-Fi Equipment and LP Records. **REW Earlsfield Ltd, 266/8 Upper Tooting Road, London SW17. Tel BAL 9174.** (TC)

If you are genuinely seeking a marriage partner, let the **Margaret Lynn Bureau, 78 Cedar Grove, Yeovil, Somerset,** help. Strictly confidential. Brochure on application. (10/67)

You ought to send for a copy of 'Psychology and Whisper Teaching' to **1 York House, Huddersfield – 5*s* 9*d* post free.** (6/67)

Amazing results! Immediate introductions. Friendship, marriage. **Jean's Bureau, 15 Queen Street, Exeter.** (1/68)

Most readers need from time to time to refer back to previous issues of *ATR*. If you keep your copies in one of our de luxe binders they will always be in perfect condition. These binders are sturdily constructed and smartly finished in leathercloth with gold lettering. They hold twelve copies of *ATR* and will open flat at any page of any issue. They cost only 20*s* (including packing and postage) from: **ATR BINDERS DEPT, 9 Harrow Road, London W2.**

The East Anglian Bureau. Friendship/Marriage. Action now could mean an end to loneliness. Confidential details from **93 Pottergate, Norwich.** (2/68)

Autocourse – a review of international motor sport. Copies of this annual covering the season 1963-64 are now available at 15*s* post free from **Book Sales Department, Haymarket Press Limited, 9 Harrow Road, London W2.**

Repairs. Our modern service department, equipped with the latest test equipment including a wow and flutter meter and multiplex stereo signal generator, is able to repair hi-fi and tape recording equipment to manufacturers' standard. **Telesonic Ltd, 92 Tottenham Court Road, London W1. 01-636 8177.** (TC)

TAPE/DISC/TAPE

Tape to Disc Recording. Finest professional quality: 10 in LP, 42*s*; 12 in LP, 48*s*; 7 in EP, 21*s*; 40 ft recording studio; 48 hour postal return service. Any speed tapes. SAE for leaflet. **Deroy Sound Service, High Bank, Hawk Street, Carnforth, Lancs.** (8/67)

Rapid Recording Service. Records made from your own tapes (48-hour service). Master Discs and pressings. Recording Studio – Demo Discs. Mobile recordings, any distance. Brochure from **21 Bishops Close, E17.** (TC)

If quality and durability matter (especially with LPs from your precious tapes) consult Britain's oldest transfer service. Our mobile units attend anywhere for Mono-stereo master recording. Studio with professional facilities available. Records published tax free for schools, choirs, orchestras. **Sound News Productions, 18 Blenheim Road, London W4. Tel: 995-1661.** (8/67)

EQUIPMENT FOR SALE

15%-20% discount on most new, guaranteed, tape recorders and Hi-Fi. Cash only. SAE details. **Hi-Fi Club, 70A Liverpool Road, Liverpool 23.** (12/67)

Unbiased guide. Our latest 65-page, photographically illustrated hi-fi catalogue (5*s*). Advisory service, preferential terms to members. You'll be glad to have consulted **Audio Supply Association, 18 Blenheim Road, London W4.** (8/67)

Sleep-learning equipment for sale. SAE. **K. D. Davies, Shirenewton Farm, Rumney, Cardiff.** (6/67)

Save up to 20% on tape recorders and Hi-Fi. New and guaranteed. Cash only. SAE lists. **Microservice, Fourways, Morris Lane, Halsall, Lancs.** (12/67)

20% cash discount on most famous makes of tape recorders, Hi-Fi equipment, cameras and typewriters. Join England's largest Mail Order Club now and enjoy the advantages of bulk buying. Send 5*s* for membership card, catalogues, price lists or SAE for free quotations and leaflets. **CBA (Dept A5), 370 St Albans Road, Watford, Herts.** (8/67)

A better deal for cash customers. We do not provide interest free credit but offer a generous discount of 15% for cash. Call, write or phone. Every item of equipment despatched brand new in sealed cartons on receipt of remittance with order. Agent for all leading makes. Amplifiers, Tuners, Motors, Pick-ups, Loudspeakers, and Tape Recorders. **Audio Services Ltd, 82 East Barnet Road, New Barnet, Herts. Tel: Barnet 6605.** (6/68)

Sapphire Cutters. New Sapphire Cutters available for all types of disc recording heads. Re-lapping service. Details on request. **Martin Watch Laboratories, London Road, Binfield, Bracknell, Berks. (Tel: Bracknell 4935.)**

PRE-RECORDED TAPES

American 4-track stereo tapes covering most famous labels at realistic prices. Why pay more? Imported directly by us, saving distributors' profits. Vast selection at 75*s* each – send SAE for free lists or call at London showrooms. **Teletape of Marble Arch, 33 Edgware Road, W2.** (TC)

Four track stereo tapes are expensive! Join the WSL Stereo Tape Library and enjoy every tape for only a few pence per day. World-Wide service. Send 9*d* postage for full details to: **104 Norwood High Street, London SE27.** (6/68)

MAGNETIC TAPE

A unique tape buy. Top brand 7 in, 2,400 ft. 25*s*; 5¼ in 1,200 ft 15*s*; P & P: 1 at 2*s*, 2 at 2*s* 9*d*, 3-6 at 3*s* 6*d*. Bargains in all sizes. SAE for list. **E. C. Kingsley & Co Ltd, 93 Tottenham Court Road, London W1. EUSton 6500.** (TC)

RECORDS

Aaron Copland or Broadway Musical. All American records to order at lowest possible prices. Send for free price list or complete catalogue 5*s* (Classical Artists Catalogue 8*s* 6*d*). **The Gramophone Shop, 1017 Argyle Street, Glasgow.** (8/67)

AN ACOUSTIC SWITCH

Continued from page 32

side of the torch body. This is visible in the photograph (Fig. 4) showing the acoustic switch and the test unit. A small battery now sits in the body, with its negative casing against the central plug connection. The bulb, in a threaded holder, screws into the torch body and makes contact with the positive battery pole before the screw reaches its limit. The bulb circuit is thus from the central plug connection, through the battery and the bulb and back through the torch body to the other plug connection. By short-circuiting the plug connections, the lamp will light. In the arrangement shown, the battery must retain its paper cover to prevent the case from touching the side of the torch body and so short-circuiting the jack plug.

The reader may well wonder, as I did, how a recording is affected by the use of the acoustic switch. First, of course, there is no unrecorded gap longer than 5 seconds. But the most noticeable effect occurs when the recorder is started from rest by speech. Where the amplifier is already switched on (as in the recorder I used), the recording starts as soon as the tape moves. If the motor batteries are in good condition – and this is important – the recorder attains its correct running speed quickly and there is no pitch variation due to slow tape acceleration. I found that, on the average, the first two words of a sentence are lost when speech starts the recorder from rest. Instances where this loss would affect the sentence intelligibility must be rare, but where there is a necessity for all relevant speech to be recorded, an initial short command could be given if the recorder spools are stopped.

MICROPHONES IN THE MAKING – SENNHEISER

Continued from page 26

Walker in this issue). The final testing of all microphones at Sennheiser is carried out in miniature anechoic chambers specially constructed for the purpose and every microphone undergoes a pen-recorded frequency response test before leaving the factory. So if you buy a Sennheiser microphone you can rest assured that its performance will be second to none and that the finest possible research, design and engineering have gone into its manufacture. I would like to conclude by extending thanks to Sennheiser Electronics for making my visit to their factory possible and by saying that if you're interested in buying a Sennheiser microphone drop a line to their UK distributors, Audio Engineering Ltd, 33 Endell Street, London WC2, who will be pleased to send you brochures on Sennheiser products. Now read *The Hanover Experiment* on page 10 which features Sennheiser miniature microphones.

FCJ

GETTING OUT AND ABOUT *EN ROUTE*

Continued from page 17

only sound to be captured; there are others, but that is another story yet to be finished. However, the human voice is a study of its own. Within this study there is a monumental job yet to be done; the capturing, before they become extinct, of dying dialects. There are a few, and only a few, people who are doing their best to preserve this facet of the language. To end on a depressing, but nevertheless a stimulating thought for tapists and, in particular, the battery portable tapists, the whole world is becoming a very cosmopolitan place. It would be nice in the future to listen back to those quaint old tongues of the twentieth-century peasants – I'm sorry, I should have said 'commuters'!

THE THINGS YOU SAY

Continued from page 33

even ten seconds of background actuality material. The station will, of course, have a mobile recording van, but it can't be everywhere at once, and we'd like to know if an amateur's 'scoop' could be accepted, perhaps despite technical limitations – rather as a newspaper may publish a reader's cheap camera snapshot if the topic merits it and if no professional picture could be taken.

Finally, what about 'commissioned' work? Could a tape club form the nucleus of a local pool of freelancers whom the station controller could contact for assistance if for any reason the permanent staff were unable to attend any function or newsworthy event? Perhaps, as Bob Danvers-Walker said, 'This might be jumping right on to a union toe – I don't know . . .' We don't know either; but we hope to find out! This latter idea, especially, could pose problems galore, but it might be worth thinking over. We would welcome your views on these points: the BBC's views; readers' views – anyone's views, provided the subject is kept alive in your columns! – as we do feel this is a subject of great potential interest to amateur recordists.

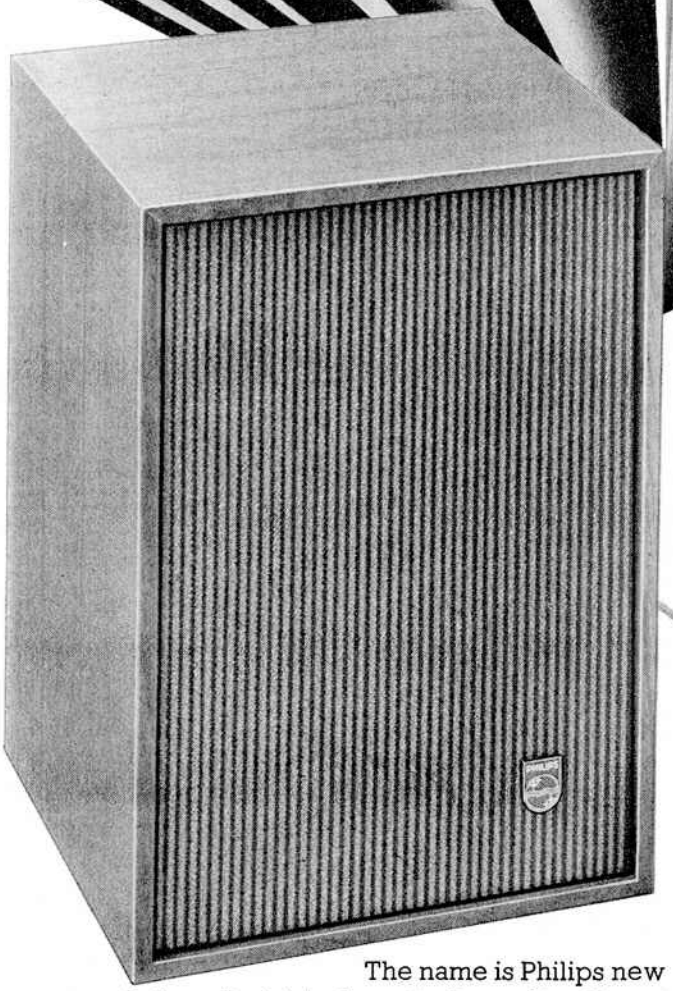
J. Ashcroft,
PRO, Merseyside TRS

INTRODUCTION TO TAPE RECORDING – 2

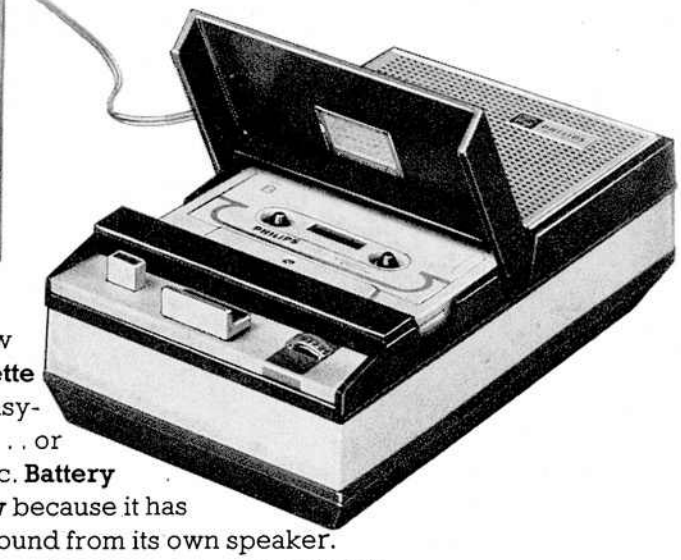
Continued from page 15

end of a musical beat for instance. Or it may be necessary to extract a not-quite-up-to-standard part from one recording and replace it with a good recording. This could not be done successfully with recordings made at lower tape speeds. At the higher tape velocities it is possible to cut out a bad bar of music or even a single wrong note and splice in a new one. This avoids having to re-record a whole musical work in the event of some small musical or technical error. We are not particularly worried about these aspects of recording at home, of course, but it is just as well to have in mind the reasons why professional recorders run at generally higher tape velocities than domestic models, in spite of the latter being able to record and replay over a range of frequencies equal to that of professional machines. These factors also account for the greater cost of professional models, which also have to be designed for continuous running.

THE BIG SOUND



Can be heard on Philips new Portable Cassette Recorder



The name is Philips new Battery Portable Cassette Recorder. **Cassette recorder** because you simply snap-in easy-loading tape cassettes to make recordings . . . or Musicassettes, to play your favourite music. **Battery portable** so you can use it anywhere. **New** because it has doubled output for big new sound. Big sound from its own speaker. Even bigger sound from the Hi Fi extension speaker it now powers without a separate amplifier. The frequency response (now 70-10,000 c/s) is better, too—it gets the high notes and the bass ones, loud and clear. It's even been restyled—in smart black and anodised aluminium. All input/output sockets. Transistorised motor for greater speed stability. Get full details from this issue's article on the machine, then try it at your Philips dealer. A really satisfying buy at 27 gns complete with demonstration cassette, microphone with stand and detachable remote stop/start control, library rack, carrying case and recording/playback lead. Optional extra: GL559 Hi Fi speaker 10 gns + 3/1d pt surcharge.

PHILIPS

Philips Electrical Ltd., Century House, Shaftesbury Ave., London WC2

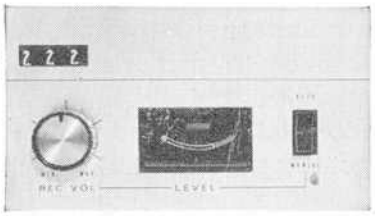
Only SONY can produce portable tape recorders of this quality

Sony research makes the difference. This has been the company slogan for twenty years, and it has proved to be true—most convincingly.

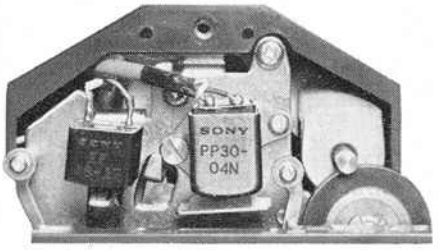
Throughout its history, Sony has continually pioneered new methods and ideas and the extreme skill and experience of Sony Craftsmen are reflected in every product, from the largest stereo tape recorder to the smallest portable.

These three portables are all fine examples of Sony research. Each one weighs no more than an average briefcase, making them ideal as a mobile recorder and for use about the house by every member of the family.

TC 800



Servo-controlled motor allows for accurate tape speed control and low wow and flutter irrespective of the state of charge remaining in the batteries. All transistor circuit. Piano key operation. Manual/Automatic recording selector.



Energised erase head for maximum depth of erasure. Radicator for both recording level and battery state indicator. Operates from U2 batteries, 12 volt accumulator or mains. 2 speeds, 3¾ ips and 1⅞ ips. Supplied with microphone and remote control switch for dictation purposes. Separate inputs and outputs for matching into quality sound equipment. Weight 11 lbs. 59 gns. *

TC 135

2 track recording and playback. 5" diameter spools, 2 speeds 3¾ ips and 1⅞ ips. Complete with dynamic microphone and plastic carrying case. Weight 7 lbs. Earpiece for personal listening. 25 gns. *

TC 900

Fully portable, battery or mains operation. 2 speeds, 3¾ ips and 1⅞ ips. All transistorised. Dynamic microphone with remote control. Separate monitor socket for earphone. Simple 4 position switch controls all functions. Weight 5½ lbs. 29 gns. *

All these models feature the "SONY-O-MATIC" automatic recording level control system.

* Recommended retail price.

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