the TAPE RECORDER

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DECEMBER 1963
VOL. 5 NO. 11

INCORPORATING "SOUND AND CINE"

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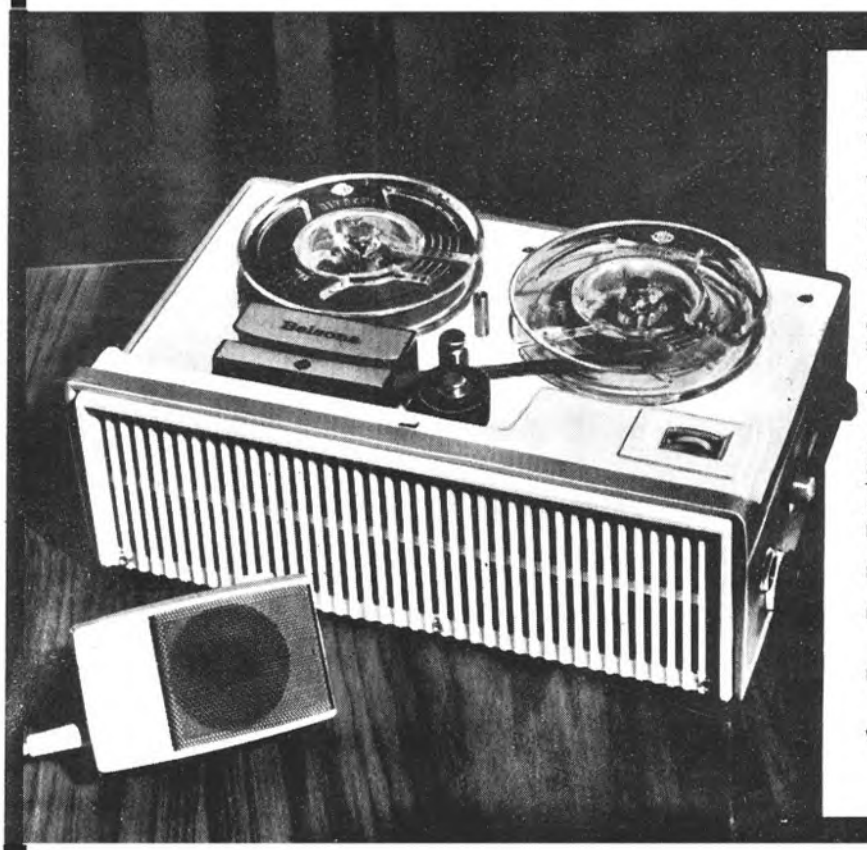

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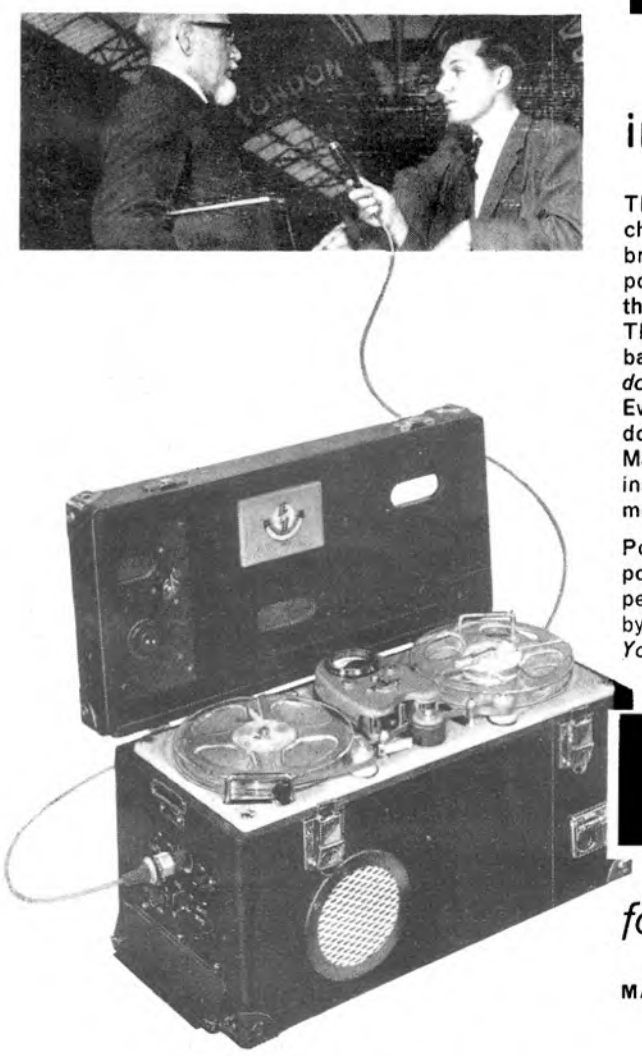

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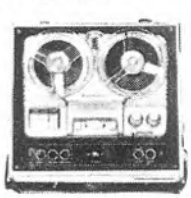

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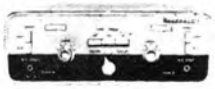
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the TAPE RECORDER

DECEMBER - - - - - - - - - 1963
VOL. 5 - - - - - - - - - - - - - - - - No. 11

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Contents

EDITORIAL

WE have always banged the big drum for tape records. In the now far off days before this magazine first appeared we were thumping it heartily in *Hi-Fi News*—urging people to make them, and urging people to buy them. We have long held the view that the domestic tape recorder should be owned as a dual-purpose machine, and that a great deal of the pleasure it can give will come from it in the form of reproduced music—from tape records. Now, after two years, we notice that these particular drumsticks have gathered a little dust, so we have decided to pound it off, changing the note of the drums as we do so. First, however, let us have a look at the score, for some amazing things have been happening in the interval. The "Teletape" catalogue sums them up very factually. Who would have thought, two years ago, that we were soon to have a choice of about twelve hundred tape records on the British market? *We* certainly never entertained such hopes, despite our unbounded faith and optimism! But that is the position today, and here are a few breakdown facts and figures.

Adding the "World Record Club" tapes to those listed by *Teletape*, we find nearly 600 monaural tape records at the 2¾ i/s playing speed, and a further 170 at the 7½ i/s speed—not including the miscellany of language and demonstration tapes. Turning to stereo, we find 222 twin-track recordings and 93 on four-track—all at a playing speed of 7½ i s. However, before we allow ourselves to be carried away by such progress, let us retain a sense of proportion by taking a glance at an American catalogue, *which lists stereo tapes only*. It runs to some 55 pages of entries and contains approximately four thousand items. Picking two composers at random, we find no fewer than seven versions of the "Fantastic Symphony" by Berlioz, and four releases of the beautiful B flat Piano Concerto by Brahms. Very clearly the scene is predominantly one of stereo in America, and though the bulk of the catalogue is made up of what is called "open reel" tapes (straightforward 7-inch reels of 7½ i s playing speed on four tracks), there is a four-page section of this tape catalogue which lists nothing but tape cartridges. These are all recorded at the 3¾ i/s speed, and they are stereo. A note in this section explains that owners of non-cartidge-type machines can play these tapes by unspooling them and playing them in the conventional way. However, by far the most interesting feature of the American stereo tape background is the large quantity of music on tape that is also available on l.p. disc—and this applies to music in all categories, from the most highbrow to most popular "pops"; and a keen disc enthusiast has merely to run his eye down almost any column of the catalogue to recognise numerous works that are available in Britain on *Decca*, *Philips* and *EMI* labels.

We have always maintained that the tape record has its rightful place as an alternative to the disc record, and we are more than interested to see how the wind has blown in this direction overseas. When it will blow in a similar way in this country is anybody's guess, but in view of the rather complicated (to us) mix-up that exists in the matter of different recordings and disc labels in different countries, it would make life very difficult for any ambitious person who wanted to import and distribute some American tapes over here. There is another barrier in the way of this idea, too, for in some cases it would be necessary for an importer to pay Copyright fees at both ends, which would make the selling price very high. But that does not mean to say that we shall not eventually see the same process repeated here—namely, a growing catalogue of tape records as an alternative to discs.

The tape record has established itself far more firmly in America than it has so far done here. Perhaps American manufacturers are more adventurous. Nevertheless, the tape demand has already begun to snowball in a small way in Britain, and monthly sales have reached an astonishing level. Stereo tapes have not moved as fast as some people expected, ourselves included, but this is doubtless partly because we have not yet a regular stereo radio service in this country. When that comes, and when people turn more naturally to stereo tape recorders as a result, so will they begin to demand stereo tape records to use on those machines. However, it is only partly the lack of stereo radio. Supply nearly always creates demand, and if we had a bigger selection of stereo tapes to pick from there is little doubt, again, that demand would increase considerably. By and large the quality of British tape records is good, and the best established labels not unnaturally seem to show the most level standards of quality. There are various ways in which the products could be improved, and they do not only cover the actual recordings. For instance, printed tape leaders should begin and end all tapes; and again, boxes should contain some form of printed slip to correspond with the disc label. As our own tape record reviewer suggests, there is a useful blank space doing nothing useful at the moment, in the lid of every box.

As a final remark, *Teletape* have recently opened a second London shop, and actually stock every tape record currently available in Britain. Such enterprise deserves notice!

SUBSCRIPTION RATES

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

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✳ *Note to Tape Recorder Owners*

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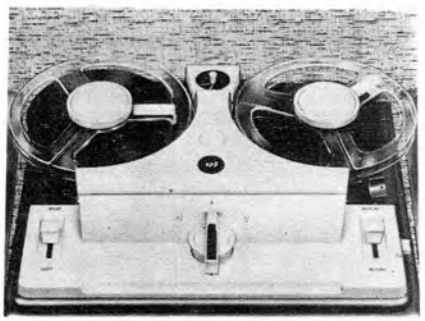


No. 24—EMI Two-Speed Deck

by H. W. Hellyer

IN a trade magazine, as long ago as mid-October, there was a two-page spread of advice to radio dealers, one section of which caught my eye. It was a piece by Brenda Marriott, Information Officer for Messrs. *Grundig*, urging the dealer to throw a party, with a tape recorder as its life and soul. There were several constructive ideas on quizzes, games of consequences, musical chairs, and so forth, and even a suggestion that a length of tape could be draped around the walls and a "guess-the-length" competition organised. The article concluded with the words: "a whole new world of sound can be open . . . if they own a tape recorder."

True Words

Readers of this magazine need no reminding of the truth in Miss Marriott's words. But one factor that those of us in the trade tend to forget is the average owner's biassed approach to the subject of tape recording, and especially to the merits and demerits of various machines. Thus, in this series of servicing articles I have tried to keep as specific an approach as possible, choosing the decks and equipment which are in the widest use, or about which the most queries have been received. This I shall continue to do, as long as the Editor is so kind as to grant me the space, and while queries indicate the readers' wishes. But now and again it is necessary to digress—to deal with a deck that may be in less general use.

Such a deck is the basic two-speed *EMI* model. This has been incorporated in several different machines, very successfully, and readers who followed my article on the *Simon* range last month will have noted that it features in the *SP2*. As this machine is described as semi-professional, and the deck is the heart of any machine, it will be obvious that its mechanics must be pretty good, and certainly worth our taking a closer look.

This is a three-motor deck, with dual, in-line, half or quarter-track heads, as required. The only belt employed is the small drive to the clock-type tape position indicator, all other drive functions being effected by motor switching and intermediate wheel drive. Several different types of switch are used, and it may be as well, before getting involved in mechanical matters, to consider the electrical switching.

Balanced Motor Loading

The particular advantage of this is that it illustrates again the principle of balanced motor-loading, and the use of series and shunt resistors for torque reduction. This is a principle that has exercised several readers, notably with other three (and two) motor decks, such as marketed by *Motek*, *Collaro* and *Truvox*. Although wirewound resistors are used, it is possible to have faults which cause incorrect loading and consequently incorrect torque, usually on take-up. Advice on this matter, with suggested modifications, has appeared already in these pages, with reference to the *Collaro Studio* deck. Comparison with the *EMI* wiring diagram, shown in fig. 1, shows that a somewhat similar principle is used, but with a very different switching sequence.

Identifying the Switches

To identify these switches, S1 is not shown, and would presumably be the main control switch for the complete equipment. S2 is a micro-switch, double-acting (see fig. 2). It is acted upon by the brake-operating arm. The two sections are mounted below, and vertical to the baseplate. The section furthest from the baseplate is engaged when the brake operating lever moves forward and the other section is engaged when the lever is $\frac{3}{32}$ in. from its furthest point of travel. To alter this adjustment, first check that the brake operating-arm is at right-angles, then bend the operating arms of the micro-switches if necessary to compensate for any discrepancies.

Switches 3A and 3B are motor switches, with sliding contacts, actuated by a pivoted lever which is linked over a spigot on the record-replay arm. Although the amount of play is regulated by the arm and lever movement, some adjustment is possible by slackening the switch mounting and moving the Paxolin plate bodily until the slider is in the "open" position, and centrally stationed, when the record-replay arm is at neutral.

Note that a return spring is fitted from the pivot point on the record arm guide plate—actually the return spring of the brake operating lever.

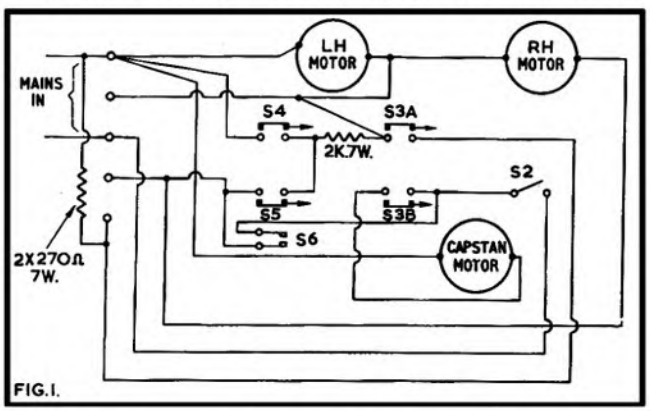


FIG. 1.

Check that this is correctly tensioned for positive action before investigating supposed switch faults. These switches bring the capstan motor into operation and shunt R1 across the feed-spool motor for reduction of torque; the two spooling motors then being in series, across the supply.

Fast Winding Arrangements

S4 and S5 are used to switch in either the take-up or feed-spool motor for fast winding or rewinding, putting R2 in series with the respective motor and across the supply. This resistor may be a single 150 ohms component or, more likely, two 270-ohm resistors in parallel. Faulty take-up with an almost empty RH spool may indicate that one of the pair has gone open-circuit. This is easily checked, but it is worth noting that tight motor bearings have been known to cause similar faults. The makers recommend a sharp tap with a small hammer at the bottom bearing of the take-up motor.

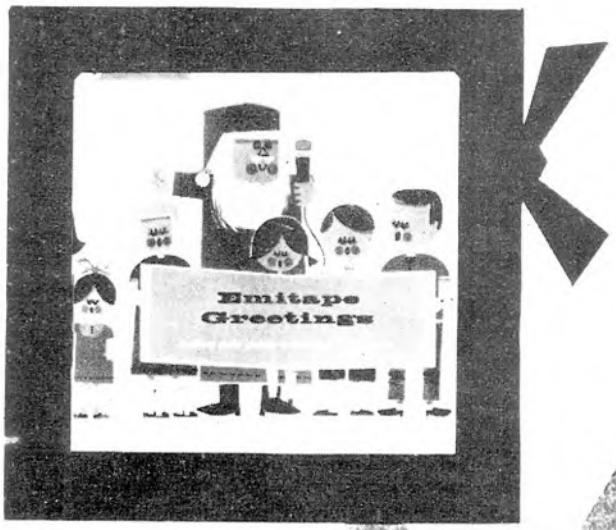
The two slide-switches are mounted in a U-bracket held by 4BA screws. The operating arm sits above the switch, with a pin mounted in it to engage with the slider. A slot in this operating lever is provided, with the Record/Replay/Rewind control (LH lever) engaging in this slot so that a large movement of this control results in a smaller movement of the switch slider. Points to note are correct mounting of the U-bracket for switch engagement for the appropriate function, and easy sliding action in its slots of the operating lever.

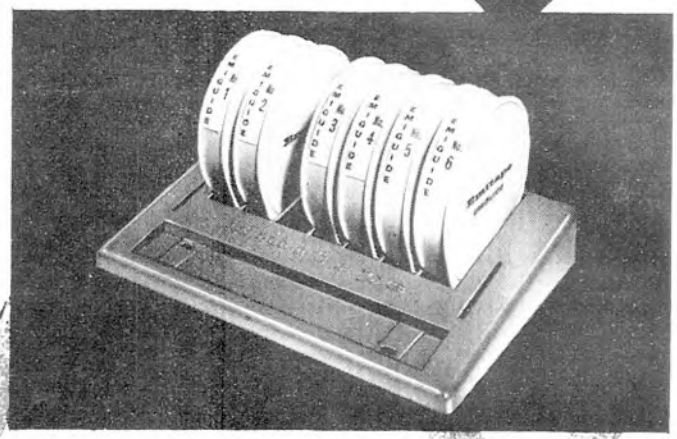
Supply Motor Switch

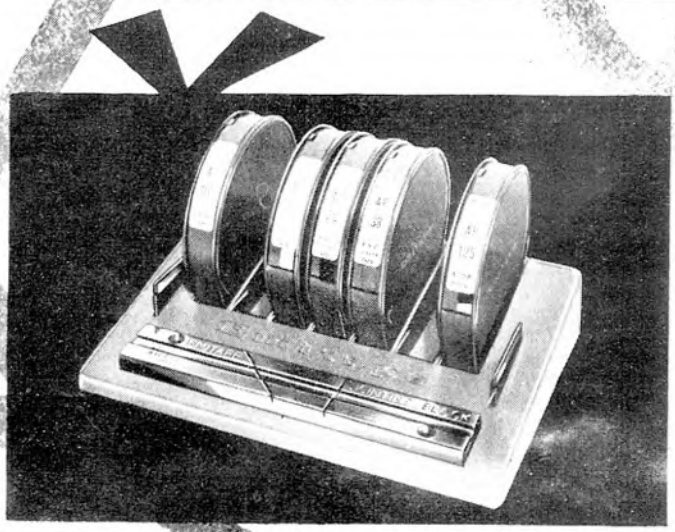
The final switch, S6, is a micro-switch in series with the supply to the motors, mounted on the plate bearing the flywheel above and capstan motor below. (The track switch is not shown in our diagram, having

(*Continued on page* 453)

What gives this Christmas?







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no function other than altering the head connections to select the appropriate head for record or replay.)

To sum up the switch action:

OFF—all open.

Rec Play—S2, S3A, S3B, S6, closed. S4, S5, open.

Forward Wind—S2, S4, S6, closed. S3A, S3B, S5, open.

Rewind—S2, S5, S6, closed. S3A, S3B, S4, open.

The brake action is quite simple, as can be seen in **fig. 2**. This is a view from beneath the deck, of the relevant parts only, with the capstan motor plate assembly removed. When the interlock plate moves in the direction of the arrow (see top of diagram), the brake and switch operating lever slides forward. S2 is contacted as described previously, and the small raised lug on the arm pushes the brake levers in the direction of the arrow, against the return tension of the coupling spring. The levers are pivoted, as shown, and the pads thus disengage from the spool carriers.

To get at these pads, it is necessary to remove the spool carriers. These are secured by two 4BA Allen screws each. The correct height of the spool carrier is when the seating face is 0·22 in. above the deckplate.

Allen Key Digression

May I digress for a moment, to urge those who have no Allen keys to invest in one of the quite inexpensive packs sold in hardware stores nowadays? Nothing is worse than a chewed-up Allen screw, in which the correct key revolves ineffectually, through some previous marauder having tackled the job, armed only with a grub-screw driver!

Next point to note is the setting of the idler wheel and capstan motor pulley. Speed change is effected by the popular method of a ramp

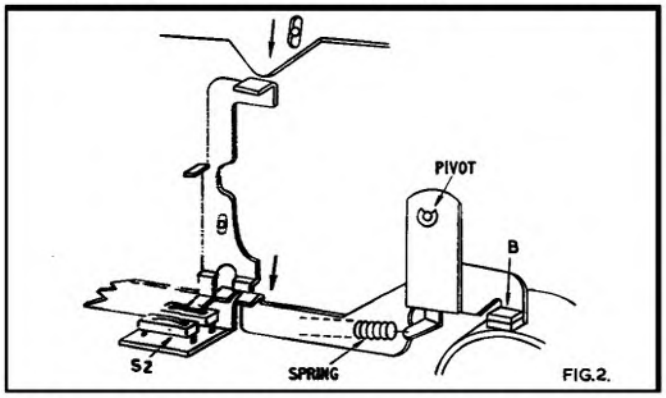


FIG.2.

on a lever, which slides as the speed-selector knob is turned. The idler wheel is mounted in a bush which is raised and lowered by the ramp, to contact the appropriate step on the motor pulley.

The pulley should be fitted so that the motor spindle protrudes just $\frac{5}{16}$ in. With this setting, the idler wheel then runs centrally on the larger step, with the speed selector control at $7\frac{1}{2}$ i s. The fan fits on the motor spindle, with its boss towards the motor bearing bracket, with just enough clearance to allow free rotation. The motor pulley fits with the threaded end toward the top.

Disc Playing for Export

Export models also have an idler drive for turntable spindle, for playing discs. The correct height is adjusted by fitting shim washers. The idler should run on the appropriate lower step of the spindle, the 33⅓ rpm step being the smallest diameter.

The other two motors are secured by three 4BA nuts each, and care must be taken in their mounting to ensure the spool carrier is at the right height and level. The nut on the post which has no spring is first tightened, then the other two screwed down slowly and evenly so that the spool support face is parallel with the deck. Finally, the spool carrier can be mounted with 0·22 in. clearance, as mentioned previously.

Turning our attention to the top of the deck, there are some particular points to note. First, a moving guide is found to the left of the sound channel. To gain access to the operating lever on the underside, it is necessary to remove the U-bracket holding S4 and S5. This is held by 4BA screws, and care must be taken, as detailed previously. Next to the moving guides are two fixed guides, the left-hand of these having an insulated bush (for auto-stop relay wiring). The remaining two guides are: first between the two R/P heads, and second between the last head and capstan spindle.

Azimuth Adjustment

Azimuth adjustment of the heads is best done with the pressure pad bracket removed. It will be noted that the two brackets have two screws each at the rear edge, the right screw in each case is used for overall height adjustment, and it is necessary to check that the top edge of the shim in the head gap just shows above the edge of the tape. The azimuth adjusting screws are then adjusted for final optimum; a maximum output from a test tape.

For quarter-track head setting, a little more care is needed: the height of each head is adjusted with the right-hand screw so that the upper edge of the shim can just be seen, and the left screw adjusted for verticality at the same time. When this has been done to the best visual setting, screw down the right screw a quarter-turn and test electrically, preferably with a test tape. (It is often easier to re-connect the record head for replay function, then adjust on test tape for maximum output, checking against comparable output from the replay head—checking with normal monitoring can affect the playing back of pre-recorded tapes, and will upset editing conditions.)

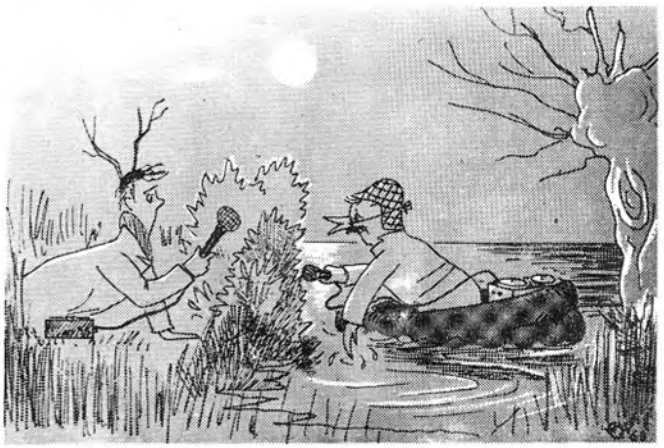
Similarly, a quarter-track erase head needs more care for accurate setting. Again, there are two screws, and the head should be adjusted so that 0·01 of the top edge of the upper track is just showing above the edge of the tape.

The final adjustment is the pressure arm itself. The vertical sense of the roller is set by two 6BA cheesehead screws. The inward movement of the pinch wheel (and pressure pads) is against spring tension. The actual pressure—or force needed just to stop the roller driving the tape, measured by spring balance at right angles to inward thrust—should be between 600 and 700 grams. But when this pressure is relaxed, there should be no more than a 100 gram difference before the roller drives again. This is a check that is often overlooked. The spring anchor lug must be bent for correct initial pressure, but if the difference is too great, the spring itself may have to be changed, and the arm, slide contacts and pivots should be examined for burrs or dirt.

Pause Control

The pause control is at the right of this lever, and exerts a direct action (in addition to applying movement to the brake lever beneath the deck). If there is a tendency to wow after the Pause control has been used, again a check should be made of the return spring tension and the height of the anchor lug.

Various marks of this deck may have small differences, such as the use of two 2K resistors in series during replay; but like most successful basic designs, it remains unaltered in its fundamentals and will probably be giving faithful service long after many of its more elaborate rivals have been consigned to obsolescence, planned or otherwise. So in closing with a seasonal wish, I can only say that if Santa leaves an *EMI* deck in your stocking, you can count yourself one of the blest.



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HUM AND NOISE IN TAPE RECORDERS

Part 1—Practical Hum Prevention

By Graham Balmain

READERS who build their own tape recorders will know just how easy it is to end up with a measured signal/noise ratio around 30-40 dB instead of the 50-60 dB which *can* be achieved, at least at the higher tape speeds. These notes are offered to them (and to anyone who wants to improve the background level of an otherwise good machine) from much practical experience of hunting hum and minimising noise in low-level amplifier stages. The tape playback amplifier using valves is discussed throughout because it is the most awkward from this point of view, but almost everything said applies also to microphone amplifiers, and some of it likewise to transistor circuits.

Odds on a Pentode at the Input

The odds are that your input stage will be a low-noise pentode such as the EF86, Z729, etc. There is no real alternative, except possibly the recently-developed Brimar ECC807 double-triode. The Mullard data

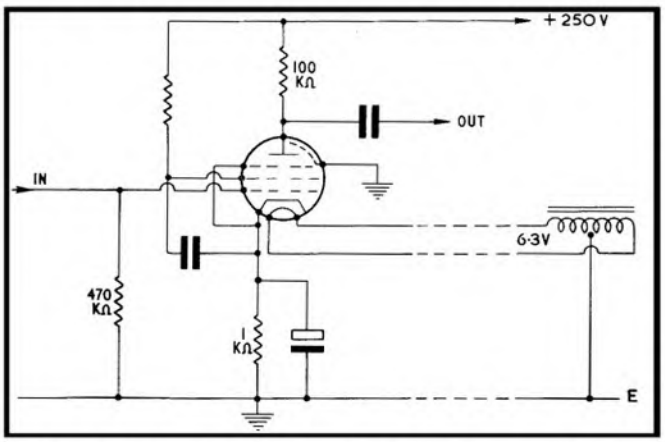

Fig. 1. *Average working conditions for EF86 voltage-amplifier valve. Quoted hum figure is 1 μV, and general noise 2 μV in the band 20-10,000 c/s, expressed as equivalent grid input and due to valve alone.*

sheet for the EF86 quotes a maximum hum figure under average working conditions (fig. 1) of 1μV referred to the grid, and a noise figure of about 2μV over the range 25-10,000 c s similarly.

What, in fact, do the published figures mean in terms of signal noise ratio? At first sight, the total hum and noise measured over the audio range (say 20-15,000 c s) seems to be 2·5μV at most. Assuming a maximum programme signal input of about 10 MV, which is typical for a high-impedance half-track head and a tape speed of 7½ i/s, we apparently have a measured wideband signal noise ratio of some 72 dB (4000:1). This would be quite inaudible on its own, and in any case because it would be 10-20 dB below the tape noise.

Effects of Bass Boost

However, we have not taken into account the bass boost which has to be applied at some point following the input stage to correct for the bass fall-off inherent in a tape system. Since this amounts to as much as 24 dB at 50 c/s in a 7½ i/s system, the majority of the measured amplifier background will be 50 c/s hum and it may be about 56 dB below the signal. Amplifier hum will thus be comparable with tape noise, in measurement at any rate, although it will probably not appear so to the listener unless he likes his music very loud indeed.

The critical signal hum ratio seems to be about 40 dB, so there is some margin for hum from other sources: but less if the track width is reduced, for the signal input from an otherwise comparable quarter-track head will be at least 3 dB less, and may be 7 dB.

Reducing the tape speed will actually improve the hum position. At 3¾ i/s, for instance, 50 c s is boosted by 18 dB instead of 24 dB, while the programme signal input drops by only 3 dB or so. A similar further 3 dB improvement in signal/hum ratio is gained by going to 1·7½8 But by this time, of course, the tape noise swamps the amplifier hum and other noise may well exceed both, so there isn't much comfort in that. Raising the speed, conversely, puts amplifier hum in complete control unless—as is invariably done in studio recorders—the input stages are DC heated.

The snag with this kind of calculation is that it doesn't usually represent practical conditions. Figures for valve hum and noise must be taken under nearly ideal conditions with resistors which are virtually noiseless and with valves suspended (almost literally) in space, well away from disturbing influences—no valveholders, of course.

Components to Avoid

Unfortunately, you and I usually have to put our valves in holders, surround them with assorted noise-producing components, mount the whole thing on a slab of metal and then put it within a foot or so of a mains transformer and up to three electric motors. Small wonder we get induced *millivolts* of hum and noise rather than basic *microvolts!* Let us tackle the hum first, since this is usually the first sound heard when one switches on a newly-built recorder.

The best way to prevent extraneous hum is to discourage it as far as possible during the actual building of the machine. The following points will give you a good start; although some may seem trivial, they are worth doing as a matter of course—and it is easier to build them into the machine than to modify it later on.

Make it difficult for magnetic fields to circulate round or near the amplifier chassis. Avoid iron or steel plate like the plague; use aluminium or, better, duralumin sheet as thin as possible consistent with adequate support for the components (18-24 gauge will usually be satisfactory). A thinner chassis means less mains-induced eddy current. Try to mount heavy components off this chassis, e.g. on the support bars, to reduce strength requirements. If the chassis is fixed to the tape deck, the supports should be brass, *not* steel.

There is not much you can do about deck parts unless you build your own deck, in which case use duralumin rather than steel wherever possible. Where there must be steel, isolate it magnetically from other steel parts by using, for instance, brass spacers and screws rather than steel ones. In general, keep magnetic circuits as short as possible and

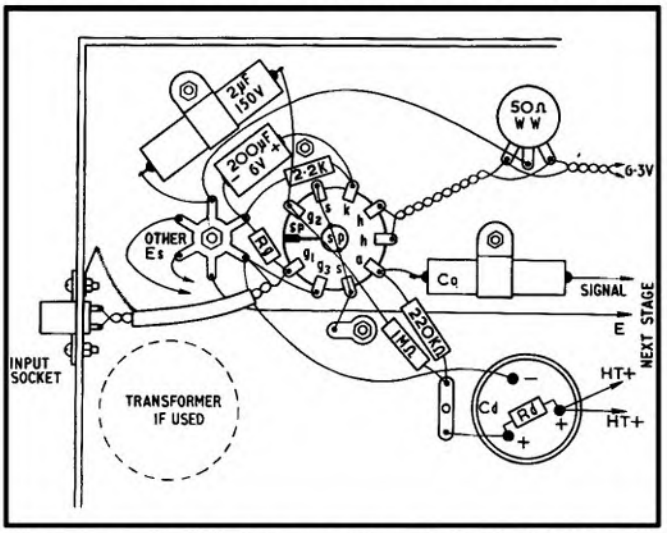

Fig. 2. *Layout for EF86 input stage using anti-microphonic holder (with normal holder the screws come opposite sp and h pins, in which case use sp for earthing instead of s). See* **fig. 3** *for circuit.*

never close them if you can possibly avoid doing so. And, afterwards, do not spoil all this virtue by putting the whole machine in a metal case, or one with a metal frame.

Discourage electrostatic hum pickup. Connect all hardware which has no direct circuit function to the chassis nearby, *not* to earth wiring.

(*Continued on page* 457)

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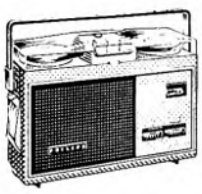

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Pay special attention to capacitor cases (except of electrolytics marked "can negative" or "can not isolated"), the skirts of anti-microphonic valveholders, all valveholder spigots, transformer screens (the inter-winding type where brought out to a tag), potentiometer cases, unused wiring tags, and any other unattached piece of metal whatever; they help capacitative hum pickup. All this applies especially in and around low-level stages, which may include quite late stages following equalisers, tone control circuits, etc. Do not use valveholder spigots as earthing points in low-level circuits.

Hardware to the Chassis

Choose the right kind of hardware. Use skirted PTFE valveholders with screening cans in low-level stages; other types have enough surface conductivity and capacitance between pins to allow appreciable AC leakage from the heater to the cathode or grid. Use metal-cased plugs and sockets for low-level connections rather than battery connectors or

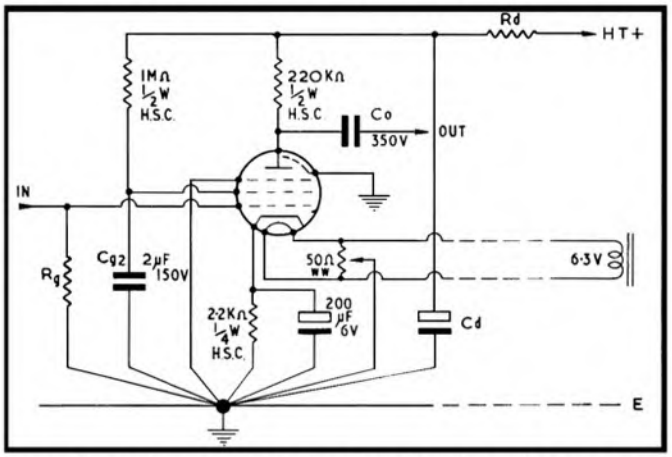


Fig. 3. ***Circuit of low-noise EF86 input stage. Note that grids 2 and 3 are returned to earth, not to cathode. Co and Cg2 must be paper or good metallised paper, metal cased. The 50 ohm WW pot is adjusted for minimum hum under working conditions. Values of Co, Cd and Rd depend on overall circuit arrangements.***

the like: metal-cased rotary switches rather than open wafers small wafers, if necessary, rather than large open ones: small wiring tags rather than large. And fasten hardware with brass screws and nuts, not steel.

Choose suitable components. Avoid wire-wound resistors and potentiometers in low-level stages: they may pick up hum. Use pot-core inductors rather than open windings: metal-cased capacitors rather than other types. Cathode decoupling capacitors can be awkward if the negative end is not at earth potential, for example when overall negative feed back is applied to a small resistor in the cathode circuit. In this case a metal-cased type is better not used—the cases of such capacitors are never isolated and they cannot therefore be earthed. Any type can generally be used safely when its negative end *is* earthed, but in some circumstances a metal-cased one may give slightly better results. Always use as small a capacitor as possible consistent with sufficient voltage rating.

Cable Screening Hints

Choose the correct cable. Any low-level signal lead longer than an inch or two should be screened, but never, *never* use the screen as the signal return lead: connect the screen to the chassis, and at one end only. TV-type polythene coaxial cable is right for high-impedance circuits: if you need to put in a signal return, use a separate lead next to the coax for short runs or twin polythene for long runs. Twin PVC will generally do for lengthy medium- and low-impedance connections, but the lower the impedance the more important it is for the twin to be twisted tightly to reduce magnetic pickup. PVC coaxial cable will often suffice for short medium-impedance connections, but *always* use twisted twins in low-impedance circuits. Rough definitions of impedance: low = up to 100 ohms; medium = 100-10,000 ohms; high = above 10,000 ohms.

Position amplifier stages and components sensibly. The input stages and the mains transformer should be as far as possible from each other. The transformer must also be kept as far as possible from the playback head, and the input stages from the motors. By the time you also have the output transformer well away from the mains transformer, and the output stage and the HF oscillator well away from the heads and the input stages, you will have solved quite a nice geometrical problem! In any case it is wise to arrange the mains transformer (and the head or microphone transformer, if used) so that it can be rotated into the best position later on. Better still, if your recorder is in a fixed installation, put the whole power unit somewhere else.

Keep all wiring as short as possible, both between and within stages. Let the signal flow through the amplifier in as near a straight line as you can manage, which means putting input and output sockets, switches, controls and so on as near as possible where they function in the circuit. The resulting panel layout probably wont be as bad as you imagine, but if you do not like it there is plenty of remote control gear to be had and the trouble is well worthwhile. Within low-level stages, let the components take up their natural positions with leads as short as possible wired directly to the valveholder pins. Group-board techniques are definitely out here (so it looks like a Christmas tree—who knows but you?).

With anti-microphonic valveholders, light components with thin leads can be wired directly, but heavy ones must be clipped down or tagged and connected with flexible leads. **Fig. 2** shows a good component layout for an EF86 head input stage. Its circuit arrangement (**fig. 3**) shows appreciable hum and noise advantages over the more conventional **fig. 1.** Some of the points incorporated will be mentioned later. When using double-triodes such as the ECC83, remember that one section is usually less hummy than the other (pins 6, 7 and 8 in this case), and should be used for the lower-level stage.

Where to Put the Mains Earth

Earth wiring is the cause of most avoidable hum trouble. The first essential is one good chassis-earthing point, best placed near the input stage, and between it and the socket through which the input signal arrives. A "starfish" earthing tag with a serrated centre-hole is suitable; otherwise use half-a-dozen solder tags, serrated or interleaved with serrated washers. This must be screwed down very firmly to minimise contact resistance—a brass screw, please, preferably 4BA. Use two or three of the tags for the input stage itself, the rest for earth leads from other stages.

No earthy signal or supply wiring whatever must be connected to the chassis anywhere but here. Hereafter the rules become a little vague, but something on the lines of **fig. 4** should give good results. HT electrolytics

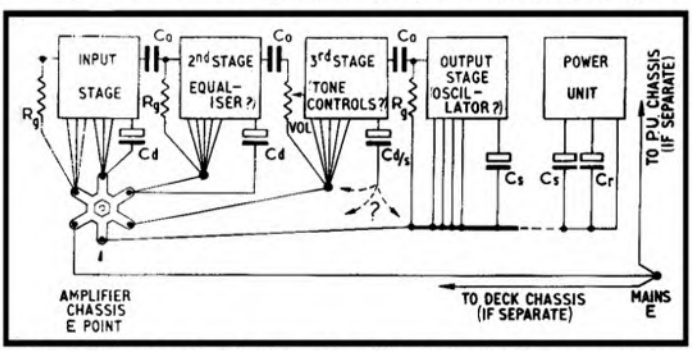


Fig. 4. ***Principles of earth wiring of amplifier in simplest form; see text for details. Cs = smoothing capacitor, Cd = decoupling, Cr = reservoir.***

are always a problem: the designer's rule is to start by connecting smoothing units back to the power unit and decoupling units to the chassis point, but how do the rest of us know where the dividing line comes? I always treat stages before the volume control as decoupled and those after as smoothed, but some experimenting with intermediate stages is usually needed to get the best results. Always insulate cases of electrolytics from the chassis.

The mains earth lead should also be connected to this chassis earthing point rather than to the chassis where the mains lead terminates, although there is no objection to an intermediate earth point on the power unit when its chassis is separate from the amplifier. If the deck is also separate, connect it to mains earth where the lead terminates.

The second part of this article will deal further with hum and noise, tackle conditions in existing recorders, and look at one or two circuit details.

by Richard Golding

SOUND AND CINE

THE CASE FOR 8 mm. MAGNETIC STRIPE

AS it is now six months since Photokina and our own Photo Fair I think it timely to present an up-to-the-moment review of 8 mm. magnetic stripe. First, let us state the case for 8 mm. separate-tape. With the use of ¼-inch magnetic tape we have good sound quality and great scope in making recordings. No special projector is required—although for good synchronisation a coupler must be added to the system. The tape can be edited easily and the system is cheaper than stripe. The points against it are that separate items of equipment must be set up to form the system, and that the tape is subject to stretch or slip; and if it breaks it can cause loss of sync (this can also happen if the film breaks). Sprockets and perforated tape send up the cost (*Cinetape A* with 16 perforations per 3¾ ins. costs 18s. 6d. per 150 ft.) and represent another operation in an already complicated system.

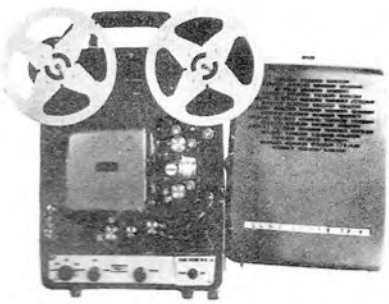
With 8 mm. magnetic stripe there is the obvious advantage of having both sound and picture on the same spool. There is only one item of equipment to set up and the sync is always correct, even if the film breaks and has to be spliced. Separation between sound and picture is now standardised at 56 frames, and films made on one stripe projector can be played through in sync on any other. Library films are available for the home movie show. Against stripe, is the high price of equipment and its *apparent* inferior quality of sound.

The Price Barrier

With regard to price, the £100 barrier has already been broken by the *Toie Talkie* and it is reasonable to assume that competition will result in other projectors being produced for around this price, or even cheaper. As to this feeling about the sound being inferior, it should not be all that bad, for most of the models on sale claim a frequency response up to 7 Kc/s and over. To get first-class results good technique is needed, however, and over half of the home recorded stripe films I have seen have been very badly managed indeed. In sales presentation, too, mistakes are being made, and I believe that sales representatives are badly advised as to choice of demonstration films and that the prospective buyer is not getting a fair and immediate picture of the capabilities of the medium.

I.A.C. Sound Symposium

Some weeks ago I attended a very well organised 8 mm. Sound Symposium arranged by the North Thames Region of the I.A.C. It was evident that there is a keen interest in the subject for all tickets had been sold (over half of the North Thames membership was there) and the audience was extremely lively. The demonstration part of the Symposium



★

Elmo TP-8

★

was given by various agents and the afternoon was brought to a close by an independent and entirely voluntary demonstration of the *Kodak Sound 8* by Desmond Roe (designer of the *Cinecorder*).

The demonstration as a whole was not entirely satisfactory, though this was not the fault of the machines but due to some of the film material. For instance, the *Toie Talkie* carried an instructional film of which the overall sound quality was much below that of the domestic tape recorder. To be fair, the sync was good, but we wanted to be shown more than that.

The *Elmo TP-8* which followed was given better treatment for it screened a B & W library print of a professional concert hall recording. The reproduction of the violin was truly excellent, the 10W amplifier feeding a 12 in. auditorium speaker by the screen. It was well done but no indication of the Elmo's own recording potentialities were given.

After this came the *Silma Sonik*, but it was not given the same chance to display its talents. The film chosen was a home-recorded Top Eight winner with a spoken commentary. This machine, designed on the principles of the well tried and trusted *Cirsesound* (now out of production) but with improvements and a German lens, was the one I had been especially keen to hear, for development problems plus a strike of Italian workers had retarded its introduction for too long. My spirits rose when the *Elmo* representative offered to lend a reserve copy of another concert hall recording to test the *Silma Sonik* for music reproduction. The film, of Arthur Rubenstein playing, was also professionally

★

Ricoh Sound 8

★

recorded, but I am afraid that all it proved was that the piano is a difficult instrument to do justice to on 8 mm. stripe. From this forced comparison the *Elmo* certainly came off best, but it would have been better, from an audience point of view, to have heard the *Silma Sonik* handling the violin piece.

The most popular demonstration was the last one, and Desmond Roe presented the *Kodak Sound 8* extremely well. The film chosen was an expertly recorded American home movie of a children's horror story with lip-sync dialogue and was a great success with the audience.

No Definite Conclusion

Add-on stripe units were a fairly early development of 8 mm. stripe and of the early models only the *Bolex Sonoriser* and the *Peterson Film-recorder* are still with us. A later development, the *Supersound* attachment, was first designed for the *B & H Moviemaster* projector but has now been modified to run with the *Bolex 18-5* and the *Eumig range* of projectors. The *Supersound* consists of a soundhead with erase/record playback heads and pressure, tension and guide rollers; a crystal microphone; a 7W amplifier which sits under the projector; and a separate 10 in. speaker. Controls include tone, gram, microphone monitor, switching and interlock button. A small modification is required to run the *Moviemaster* and the *Eumig* projectors at 24 f.p.s. The *Bolex 18-5*, of course, will run at 18 f.p.s. only. Price, £51 9s.

The separation on the *Supersound* is standard. In other words the sound is advanced 56 frames in front of the picture, and this means that any film synchronised on the *Supersound* should play back correctly on any of the stripe projectors.

The *Bolex Sonoriser*, on the other hand is completely non-conventional, for the sound-head is situated above the projector, being supported by a single column from the amplifier plinth. The sound separation is 118 frames before the gate, and this means that any film synchronised on the *Sonoriser* must be played back on a similar machine. The *Sonoriser*, however, is suitable for use with almost any silent 8 mm.

continued page 461

projector and has superimposing and erase facilities, magic eye, two inputs for microphone and tape recorder/pickup. It weighs 28 lbs. and costs £105.

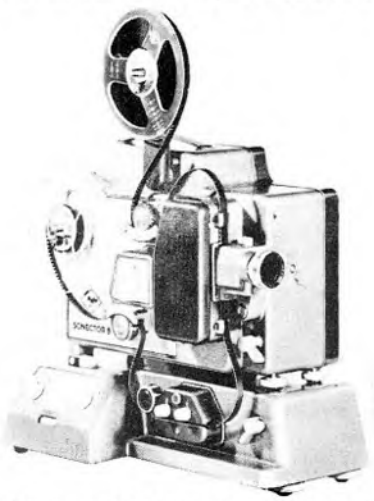
The *Peterson 8 mm. Filmrecorder* is also non-conventional, for it has a sound separation of 144 frames but, with a small modification, it can be used as a normal tape recorder. It has both sound and silent speeds, magic eye, and a detachable speaker. Frequency response is from 100 to 6,000 c/s at 16 f.p.s. It weighs 32 lbs. and costs £59.17s.

The do-it-yourself magnetic stripe conversion kit for the silent projector never really materialised, despite attempts some years ago by *P. A. Marriott Ltd.* to popularise the idea. The theory is to attach a magnetic head, connected to a tape recorder by a screened lead, somewhere along the film path on the silent projector. The best place for this is as far under the gate as possible, so that there is room for the intermittent film motion to be smoothed out. The actual place will depend on the amount of space available and the amount of hum evident from the projector motor. Hum can be found by moving the head over the projector housing.

8 mm. play/record heads are available from *E. V. T. Magnetics* at £4 10s. each. Erase heads are £1 5s. each. Frequency range of the play/record heads is given as 8 Kc/s at 16 f.p.s. and 12 Kc/s at 24 f.p.s.

It is normal to apply the stripe to the film after the film has been processed and edited, but more pre-striped stock is becoming available for use in the camera. There are two types of stripe available—liquid at about 1½d. per foot and laminated at about 2d per foot. It is generally agreed that liquid stripe is tougher and stands up better to repeated projection. Laminated stripe is supposed to make a better overall contact with the magnetic heads, thus giving higher quality of sound with less background noise.

The stripe is applied to the 8 mm. film between the sprocket holes and the film edge. There is just enough room to take the stripe (width of 0·8 mm.), and if it were placed on the slit edge it would intrude into the



★

Agfa Sonector-Phon 8

★

picture area (you can never really depend on the slit edge being correctly cut anyway). The usual positions for the stripe are on the film base, if the film is a camera original, or on the emulsion side if the film is a print or copy.

There are now two do-it-yourself striping machines on the market, but these are more likely to appeal to out-of-town dealers who wish to provide a striping service rather than to amateurs themselves. They are the *Syntronic* liquid striping machine (Rosley Ltd.) and the *Halbourn* laminated striping machine (Harringay Photographic Supplies). The *Syntronic* runs at a speed of 400 ft. per 15 minutes, the film being ready immediately for recording. Price £69. The *Halbourn* operates at the same speed but a further 15 minutes is required for drying. Price £60.

Although the show had a fair measure of entertainment it was not possible to draw any definite conclusions. What was wanted for this type of discriminating audience, I suppose, was to have them all on one switchboard, each laced with a copy of the same film, so as to run them against each other, and also to have some kind of test film available. We should have liked to have been able to test their on-the-spot recording capabilities, and to have heard how they played back against each other.

I am sure that 8 mm. magnetic stripe is here to stay. At the moment there are seven machines available, with prices ranging from just under £100 to just over £200, and there are more on the way from Japan and the Continent. One last word, however, before we go on to details of these models. Good recording of a final sound-track on any medium is a task that requires mastery of the correct technique. Although the magnetic stripe projector is a fairly simple machine to operate, recording of anything more complicated than a simple commentary will require more than one pair of hands. For adding effects and music a tape recorder is very useful and, indeed, sometimes essential; and it is wise to keep this in mind when contemplating the purchase of a new stripe projector.

A Quick Survey

The *Nizo Visacustic* is the highest in price at £215, and it is also the least conventional in design, for it lies flat on its side like a tape recorder. A prism unit is used to bring the picture the right way up on the screen, but it can also be used to throw a picture into the screen in the case-lid and so provide 8 mm. magnetic sound editing on the machine. Its more vital statistics are as follows: Choice of lens. Running speeds 16 and 24 f.p.s. Reverse and still picture. Amplifier output 3-4W with mixing for two inputs. Magic eye. Superimposition. 8V 50W lamp. Weight 28 lbs. *W. Germany.*

The *Agfa Sonector-Phon* is basically a silent model (*Agfa Sonector 8*) but is equipped with a base containing magnetic heads and amplifier. It costs £185 16s. 9d. Lens: f/1·6 *Variomar* 15-25 mm. Zoom. Running speeds 18 and 24 f.p.s. Reverse running. Amplifier 2½W. Two inputs with mixing facility. Magic eye. Superimposition. 8V 50W lamp. Weight 36 lbs. *W. Germany.*

The *Kodak Sound 8* is priced at £185. Points are often made on the rapid starting-up speed, the extra room in the gate to compensate for bad film slitting and the big flywheel which keeps wow and flutter down to less than 4% (as good as most domestic tape recorders). Against these points some people may mark the lack of superimposing facility. Lens: f/1 *Ektanar* ¾ in. Running speeds 18 and 24 f.p.s. Reverse running at 24 f.p.s. Still picture. Amplifier 2½W. Two inputs on one volume control. Neon volume indicator. 12V 100W lamp. Weight 30 lbs. *U.S.A.*

The *Elmo TP-8* at £165 has probably the simplest threading system of them all, for the film has only to be inserted in a fairly wide groove. Lens: f/1·5 Zoom. Running speeds 16 and 24 f.p.s. Reverse and still picture. Amplifier (11 transistors) 10W. Three inputs on separate mixer. Magic eye. 21·5V 150W lamp. Weight 42 lbs. *Japan.*

The *Ricoh Sound 8* at £139 10s. has a rather curious styling, insofar as the flywheel casing seems to have been added-on rather than have been built into the projector. Frequency response is given as 100-8000 c/s at 24 f.p.s. and wow and flutter less than 8% at 24 f.p.s. Lens: f/1·4 15-25 Zoom. Running speeds 16 and 24 f.p.s. Reverse running. Amplifier 3W. Two inputs with mixing. Recording level meter. 115V 150W lamp. Weight 42 lbs. *Japan.*

The *Silma Sonik* costs £139. To my mind it has the nicest line but it is the heaviest of the magnetic stripe projectors. Choice of lens. Running speeds 18 and 24 f.p.s. Reverse and still picture. Amplifier 3½W. Two inputs with mixing. Magic eye. Superimposition. 21V 150W lamp. Weight 45 lbs. *Italy.*

With the *Toie Talkie*, priced at £99 10s., there is also the facility for the playback of optical prints on 8 mm. Whether this will be an advantage in two or three years time I cannot say, but at the moment it looks extremely unlikely that any choice of 8 mm. optical prints will be available during the next twelve months. Lens: f/1·5 25 mm. Running speeds 18 and 24 f.p.s. Reverse running through the gate but without picture. Amplifier (transistorised) 6W. Two inputs with separate mixer. Magic eye. Superimposition. 21V 150W lamp. Weight 23 lbs. *Japan.*

The seven projectors listed above are all available now from the dealers, but there are more to come. The *Canon Sound 8* is expected to have complete auto-threading, and other details released from Japan include: Lens: f/1·5 *Canon* 15-25 mm. Zoom. Running speeds 16 and 24 f.p.s. Still picture. Amplifier 8W. 8V 50W or 21·5V 150W lamp.

The *Carena Sound 8* projector has a claimed frequency response of 60-8000 c/s at 18 f.p.s. and 60-10,000 c/s at 24 f.p.s. There will be a choice of lenses, semi-auto-threading, separa microphone and gram inputs with mixing control, separate monitoring head with monitoring phones and recording level meter. This machine sounds very good indeed from these details.

Heurtier (Actina Ltd.) propose to introduce a sound stripe projector shortly to make up the trio of new models. And so the march towards greater choice (and consequently cheaper prices) goes on.

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stereo in bed!

by: rafe seabrook

AS it is true that one can rarely do two things properly at the same time, I can only hope that my readers will enjoy this short article as much as I am enjoying Mr. Rudolf Kempe and the Vienna Philharmonic Orchestra at the moment, for they are playing me a magnificent version of Johan Strauss's *Radetsky March* (HMV tape SAT1022) as I write. *Bring the orchestra into your living room*, was the theme of an advertisement for a brand of Hi-Fi equipment; but I have gone one better than that. I have taken the whole lot to bed with me! Furthermore, in less than five minutes I shall kick them all out and bring in the full cast of *West Side Story* (Saga tape STE3005). As a matter of passing interest I have Lumbago in bed with me, too; and that is what gave me the idea for this article.

Something really special

Seriously, though—and very seriously—stereo listening via headphones has something incomparable to offer to music lovers who are ill, convalescent, or permanently bedridden. It cannot be described: it must be experienced. But for that matter, too, stereo via headphones is something special for almost every household—and the smaller the house the greater its value.

There are several technical arguments against the view that headphones can provide the truest form of stereo, and it is important to deal with this point because anyone hearing it for the first time will almost certainly be swept away on wings of enthusiasm. There are also technical methods for simulating the scientifically "true" stereo image (see *Hi-Fi News*, March 1963, page 698) for those who want it that way. But for all practical purposes—for real enjoyment, without any technical clouds to fog the issue—straightforward stereo from headphones, taken as it comes, is something really out of the ordinary. Indeed it may be taken as fact that a reasonably good tape recorder and a good pair of stereo headphones can reproduce an apparently far superior sound than is often heard the conventional way, from average equipment and inexpensive speakers.

A tape at bedtime

I use stereo headphones for monitoring stereo when recording, and I have tried several types. My personal preference is for the *AKG* lightweight type K50, illustrated on this page: though *Brown's* Super K are also very good. I have used the K50 for more than a year for my "Stereo-in-bed" listening, which I often enjoy at night, just as many people enjoy a chapter of a book. I plug them straight into the output sockets of a *Tandberg* Series 6. This, being a 4-track machine, allows me to change around from 4-track to twin-track stereo tape records as I require, and also to play myself the occasional mono recording when I feel like it. I have long promised myself (and the equipment) a matching transformer, but have not yet got around to keeping the promise, partly because I have yet to find the time and partly because the Tandberg's 2,000 ohm sockets and the AKG's 400 ohm units have not yet quarrelled—and contrive to fill my ears and head very adequately with very good quality sound.

Those who have never listened to stereo by headphones should emphatically make a point of doing so, and everyone else who owns a stereo recorder should at least think over the advantages of a pair of stereo headphones as an important accessory, for *Stereo in Bed* is only a goodnight luxury, and there are two other noteworthy points to consider—hence my earlier remark, "the smaller the house, etc." First (assuming that the reader has not yet tried any form of headphone listening) it must be realised that when the 'phones are in place, pressing gently against the ears, one is "deaf" to all but the loudest external sounds once the music is playing. It is therefore most comfortable to sit in one's favourite armchair, with eyes closed, or with one's back to the goggle box, and to live in a world apart from other members of the family, whatever programme they may want to watch or listen to.

Second, those same members of the family may want to talk or read —or even enjoy half an hour of anything *but* the music that you, personally and greedily, want to hear; and this they can do without the slightest form of interruption, because the very low-level signal required to drive your headphones is quite inaudible to anyone sitting more than a couple of feet away from you. This is, of course, one of the most fascinating discoveries that the newcomer to headphones has to make. A full orchestral crescendo in the ears creates the impression that the whole room is filled with music. It seems impossible that the neighbours cannot hear it two houses away. It can be so loud that the wearer of headphones almost shouts to make himself heard above the music—and wonders why people are laughing at him, until he pulled the 'phones an inch or so clear of his ears and realises that he has been shouting into silence!

A Sax behind the nose

With "gimmicky" stereo recordings there can be some very unusual headphone results, too. For example, a saxophone can appear to be located inside the head, just behind the bridge of the nose, while a squeeze-box plays somewhere behind the ear. There is also the effect of hearing a musician moving across the head, inside the forehead, from left to right. Listening with closed eyes is a definite advantage. When listening to stereo (or to mono for that matter) one is accustomed to the fact that the sound is coming from a loudspeaker, or from a pair of speakers, and if any illusion need be created—or distraction dispelled—it is a common habit to look at the ceiling. Many people call it "staring into space". But somehow it is different when listening via headphones, because the sound is right in the head; and therefore almost anything destroys the illusion that this extreme "closeness" creates.

A seat amongst the players

Stereo through headphones cannot be likened to any other form of listening. One is immediately, from the first notes, right in amongst the players—not merely right in front of them. And with a well-recorded operatic performance (eyes closed) the illusion of being a part of the play is truly dramatic.

Anyway, as I said at the beginning, I hope this short burst of enthusiasm will result in enjoyment—ultimately, and via headphones—for other readers. Several of my friends have gone in for it after five or ten minutes of listening (and shouting) to some of my stereo tapes. But, as a final word, I do emphasise that it is *stereo* which brings headphone listening into sparkling life, however useful or entertaining the idea may prove to be for mono tapes. So, even if you do not yet own a stereo recorder, somehow find an opportunity of sampling it. And if you are one of the fortunate ones, borrow a pair of 'phones and see what you have been missing. Goodnight!

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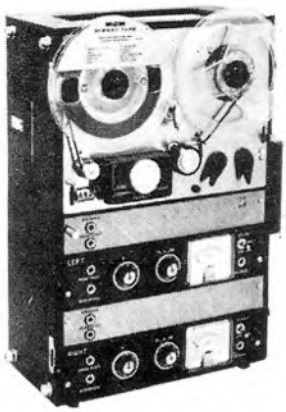

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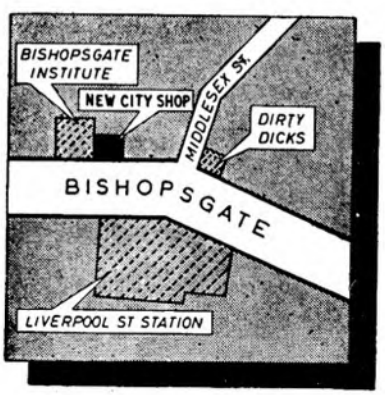

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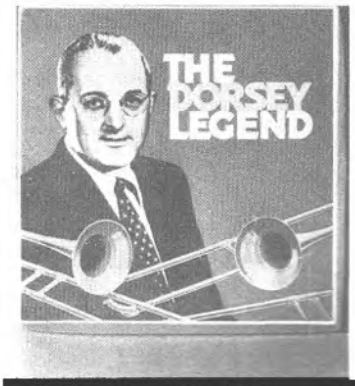
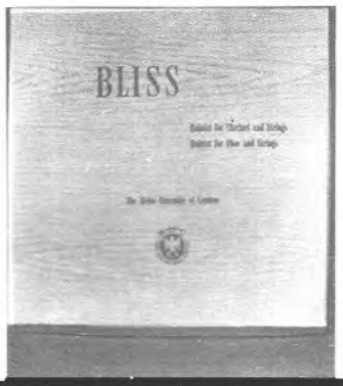
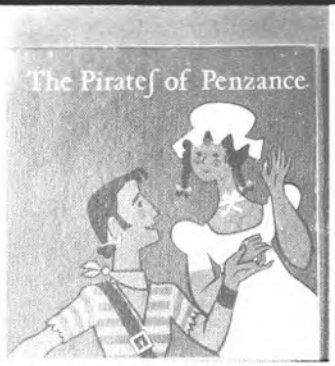




TAPE RECORDS REVIEWED



THIS month we have a mixed-bag again, comprising a modern musical, a jazz pianist, dance music, two quintets, a jazz singer and some Gilbert and Sullivan; all are 3¾ i/s mono. The musical is Lerner and Loewe's *My Fair Lady*, with Hubert Gregg, Elizabeth Larner, John Slater, John Harvey and the Knightsbridge Theatre Orchestra and Chorus, directed by John Gregory. Fourteen key items from the show are included on *Saga STG 8057*, and the recording is quite fair, with all the voices heard clearly.

★ ★ ★

While lacking some of the infectious verve of a stage production, the performance is a good "all-rounder" and will no doubt serve to remind many people of a most enjoyable night at the theatre. The various types of English accent are put on well, which makes up to some extent for the lack of visual class-distinction between the performers.

★ ★ ★

Art Tatum was a legendary figure in American jazz. Born in 1910, by the age of 18 he was broadcasting from his home radio station. He was partially blind and died at the tragically early age of 46, which accounts for the title of our next tape: *Tribute to Art Tatum*. Tatum was a pianist, and on *World Record Club TT 208* there are eight solo pieces recorded in 1949, and four items with bass and guitar accompaniment recorded in 1952. The bass is played by Slam Stewart and the guitar by Everitt Barksdale.

The age of the recordings does not detract noticeably from the quality of sound, and the playing makes this a collector's piece. The music is essentially inconsequential stuff, but it is played with such aplomb and verve, and the phrasing and finger-work are so precise and catchy, that one can easily see why Art Tatum became so popular. The Chopinesque delicacy is well matched by the other players in the non-solo items, and Stewart manages to coax some extraordinarily interesting sounds from the string-bass at times.

★ ★ ★

Another very popular American musician who also died in 1956 was Tommy Dorsey, and some of the best of Dorsey and his Orchestra is offered as *The Dorsey Legend* on *WRC TT 245*. This is dance music, and the tape carries eleven pieces representing a wide range of Dorsey interpretations.

The selection commences with the endearing signature tune *I'm getting sentimental over you*, with Dorsey's own masterful trombone playing setting a virtuoso scene right at the start. After a few moments Dorsey himself introduces the programme. The recording is very reasonable despite its age, and the skill and concerted enthusiasm of a great dance band comes over all the way through. That trombone comes back from time-to-time, and it is played with such consummate skill and smoothness that the tape is worth having for these episodes alone.

★ ★ ★

A high degree of skill applied to an utterly different type of music is found on *WRC TCM 42*. This carries two *Quintets* by Sir Arthur Bliss, one for clarinet and strings and the other for oboe and strings. The players, known as the Melos Ensemble of London, comprise a string quartet and Gervase de Peyer (clarinet) and Peter Graeme (oboe).

The music receives a smooth and clear recording and well-balanced and controlled playing, but this is taut and rather difficult material which might be described as "musicians music". With familiarity these pieces reveal satisfying patterns, and the serious follower of modern chamber music will find much of interest.

★ ★ ★

Quite at the opposite pole of modern music is the American jazz singer, in the person of Anita O'Day on *WRC TT 244*. Called *Anita Sings Jazz*, this tape has twelve songs in the modern jazz idiom, with Anita accompanied by Oscar Peterson (piano), Herb Ellis (guitar), Ray Brown (bass) and Milt Holland (drums).

Anita O'Day is one of those American singers who projects her personality in a rather special sort of way via her voice. Beguiling and suggestive twists of phrasing and intonation give one the impression that her words are directed at the listener personally (if male!), which no doubt accounts for such singers being all the rage across the Atlantic. The accompaniment is very good, but singing (and the singer) is the thing. The recording is clear and fresh.

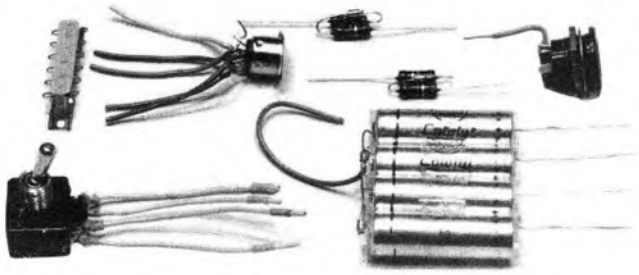
★ ★ ★

Singing of a much more open and rumbustuous kind, as befits the simple punnish humour of W. S. Gilbert, is found in the *Pirates of Penzance* on *WRC TT 125*. The performers are: William Dickie (Pirate King), Patrick Halstead, Christopher Keyte, Edward Darling, John Gower, Elizabeth Harwood, Barbara Elsy, Patricia Beech and Noreen Willett, with an un-named orchestra which plays very well indeed. Sixteen items from the operetta are included.

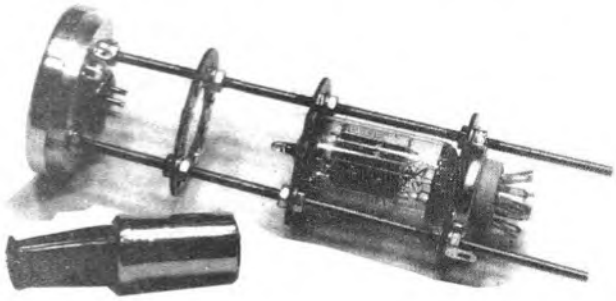
The performance has a slightly "studio" character but is very effective, with the irresistable high spirits of Gilbert and Sullivan coming through all the time. Singers and orchestra are well-matched throughout, and, as is essential in this sort of work, every word can be heard clearly. G & S lovers could hardly go wrong with this excellent tape.

1. *Here is the complete kit of parts, as unpacked. In the centre of the picture are the main components of the microphone. All the larger items make up the power pack. The locations of most of them can be seen in the other photos.*

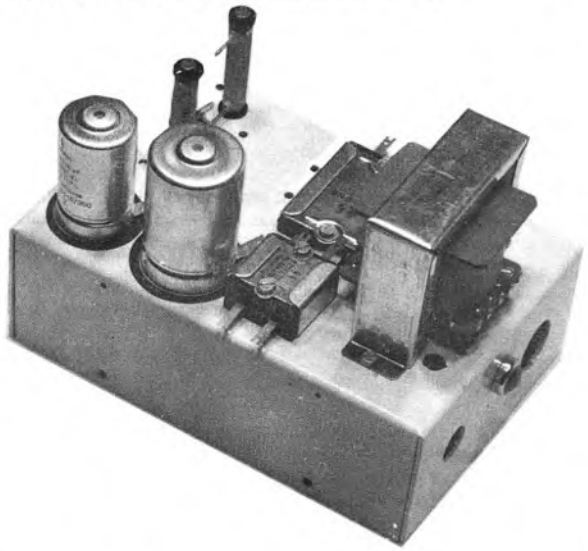
4. *Here is the finished job. It looks good and it is good. The construction of the microphone/pre-amplifier unit demands really clean, careful work. The foil diaphragm is now supplied in finished, capsule form, thus obviating the most delicate work. Total time taken was* 10 *hours.*



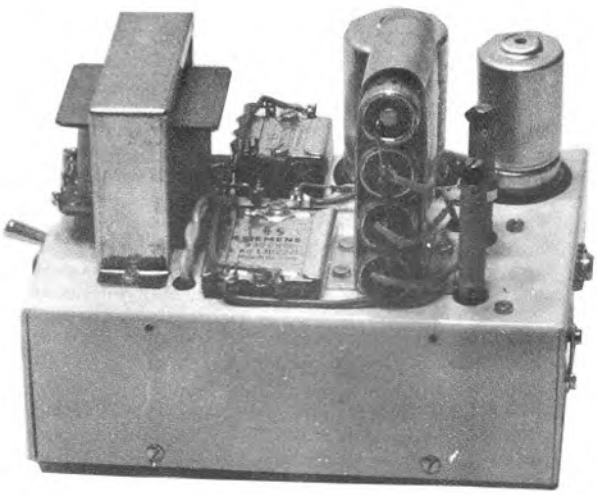
2. *To simplify construction one is advised to prepare several components for the power pack before mounting them on the chassis. This avoids soldering in cramped corners and ensures a better job.*



5. ***This stage shows the mic/pre-amp unit completed mechanically and ready for wiring. The only "tricky" work is in the first step, with soldered joints to the 5-pin base plug. See photo 7 opposite.***



3. *The power pack chassis, shown here, has been fitted with all the components that can be mounted without preparation. The items in photo* 2 *are then added and the unit is completed with very little wiring.*



6. *The finished power unit. Comparison of this photo with picture* 3 *shows the result of adding the prepared items of photo* 2. *There is very little under-chassis wiring. A straightforward job.*

BUILDING A MICROPHONE

WE first introduced this microphone in the form of two articles in *Hi-Fi News*, contributed by its Indian designer, M. R. Ratnagar, who arranged for kits of parts to be made available. Very great interest was shown in the unit and it has now been put on the market commercially, in two alternative forms—as a kit and also made up as a finished product. Its official name is the Microkit condenser microphone, and the sole distributors for the world are Chateau Productions Ltd., 25 Denmark Street, London, W.C.2.

A review of the microphone by Stanley Kelly appeared in *Hi-Fi News*, and in *Tape Recorder* last month, and we have since received numerous enquiries from readers who are interested in the possibility of building up the kit, but who wish to know just what is involved and what standards of "Know-how" are needed. In view of this interest we publish this constructional report to supplement Stanley Kelly's enthusiastic review, because we consider that these few pictures will serve three useful purposes. First, they will show readers exactly what standard of workmanship is needed. Second, they will fill in the gaps in the current instruction manual, which only contains circuit and wiring diagrams and a few line drawings; and this additional guidance should bring the whole job within the reach of a wider readership. Finally, they will save readers (and ourselves!) a lot of unnecessary letter-writing.

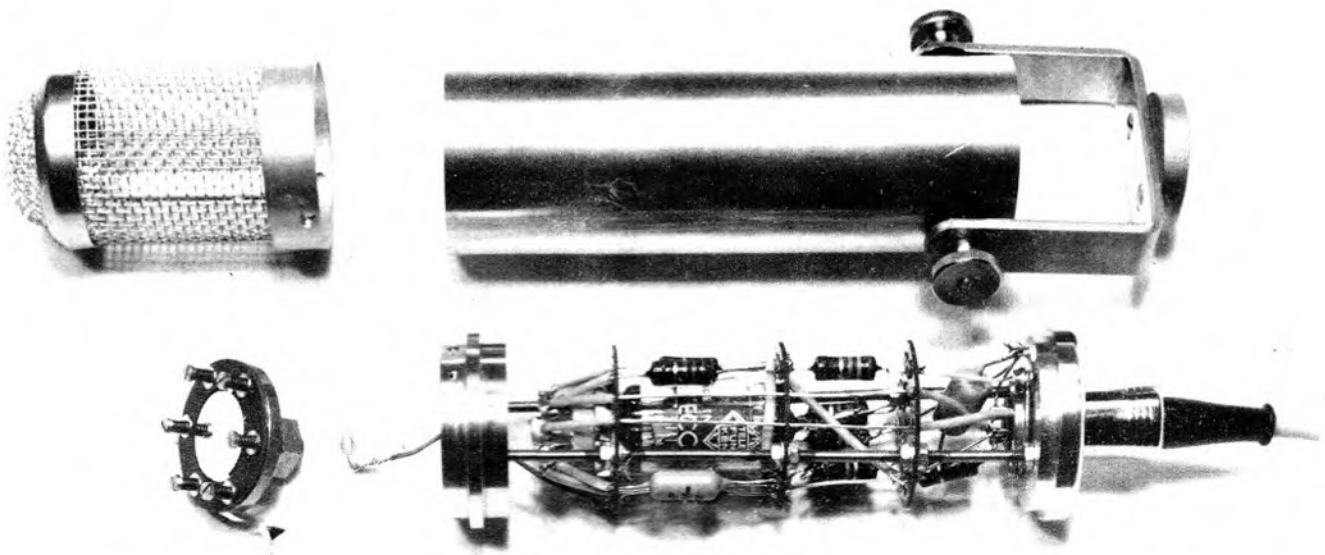
Broadly speaking, there are three groups of electronic do-it-yourself enthusiasts—those who can work from a bare circuit and a photo and components list—those who can follow the "A to B to C" technique, so brilliantly contrived by *Heathkit*—and those who dearly love to build, but who always contrive to make a bird's nest of wiring and solder blobs from even the simplest of kits. This is no exaggeration. We have seen one or two such results which actually sat on the bunch of wires that could not be crammed into the chassis! Of course they did not work. That is why we saw them, because they had been sent to the makers "for attention".

Well, in order to build this condenser microphone you do not have to belong to the first group, because the instruction manual and the extremely well finished chassis and casework make the job easy. The bits all fit perfectly. But if you are a *bird's-nester* type you may have some trouble when it comes to wiring and finishing the microphone-cum-amplifier unit, although there is nothing downright difficult about it. And because of this we have no hesitation in recommending anyone who is interested, and who is prepared to spend a bit of time on *careful, tidy*, work, to have a go at it. After all, if the worst comes to the worst, it can always be sent back "for attention" and it will be returned in working order on payment of a fee of about one pound plus postage. This is the type of service that most reputable kit suppliers offer.

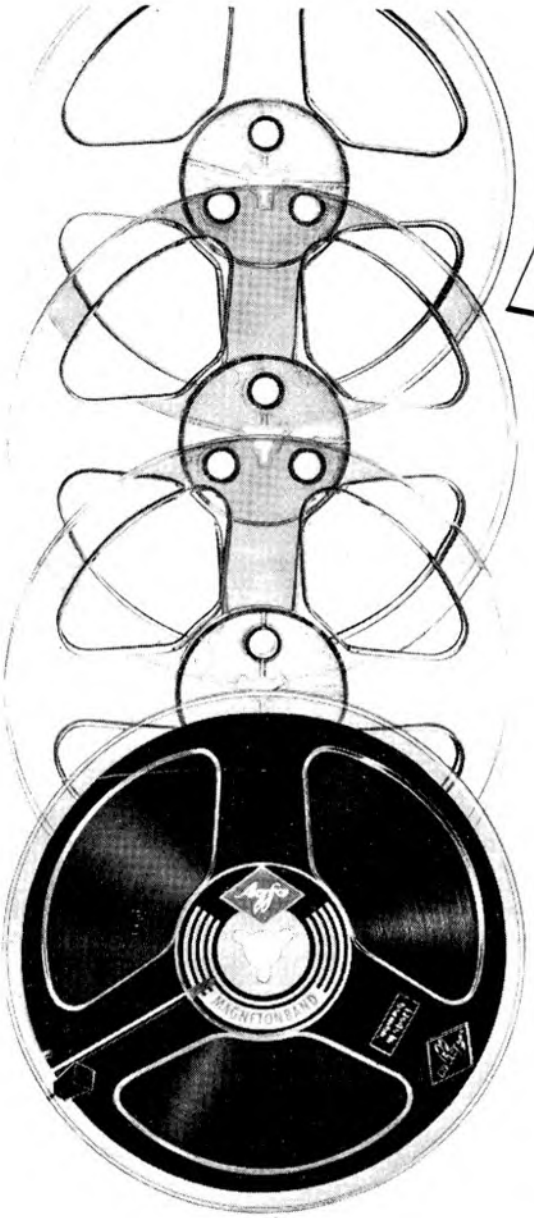
We always make a big issue of *neat and careful work*, because of the principles involved—namely, that a piece of electronic equipment is likely to work better, and for longer, if it is built carefully; and a sloppy finish is *nearly* always a reliable indication of bad work at vital points—i.e. soldered joints. Also, even if a sloppily finished job works, it is a nightmare for the service engineer to sort out when it stops working.

A good point to remember is that there usually comes stage at which one seems to need three hands. When that stage is reached, reduce the need to the two that nature provided before continuing. Somehow (with a vice if it is available— contrive to fix the work *firmly*. It is impossible—quite impossible—to hold the job, plus a wire that has to make steady contact with a tag, plus a piece of solder, plus a soldering iron, so that all are in the right place at the right time, *for the correct and vital few seconds*. Don't try it. For instance, the tags of the socket in the base (photos 5 and 7) have little slots, but they are too narrow to grip the wire. You can ease them open a trifle, *very delicately*, with a knife blade. You can then slightly flatten the end of wires with pliers, and gently press wires into slots. That saves one missing hand; a vice to hold the work (or someone to hold it steady, against the table) saves another. You now only need two—one to hold the solder, and the other for the iron. Hold solder against wire end, hold iron against tag. Remove both two seconds after the solder has flowed. Don't move the work for five seconds.

Never over-solder. Don't use three inches of wire when the run is 2¼ inches. Keep wires reasonably straight—but do not stretch them out like violin strings! Work on this basis and you will never end up with a bird's nest. Check each point immediately and it should work the first time when finished.



7. Sleeving is recommended, but our constructor preferred bare wires for simplicity, except at the 5-pin plug and where there is danger of contact with chassis via metal valve base ring. Gentle tension holds bare wires rigid. Terminal wires of resistors are used as wiring. The assembly is now slid into the case. Top plate (by solder tag) is screwed down on the rods. Tag is screwed to capsule, which is locked by grub screw, and gauze cap fitted.



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FUNDAMENTAL BUILDING ACOUSTICS

Part 4—Sound Insulation

By M. F. Woodward

FORMER articles have described the behaviour of sound in space: this considers sound in structures, leading to the practical problems of sound insulation.

As will be known, sound in space consists of alternate compressions and rarefactions of air. When a physical barrier is met, that barrier is set into structural vibration and becomes in effect a loudspeaker 'cone', radiating further rarefactions and compressions in all directions. Structural vibrations can be complex and can travel by devious paths—not necessarily the most direct ones (see **Sketch 1**). A structure can also be set into vibration by a physical shock such as a door slamming or a footfall.

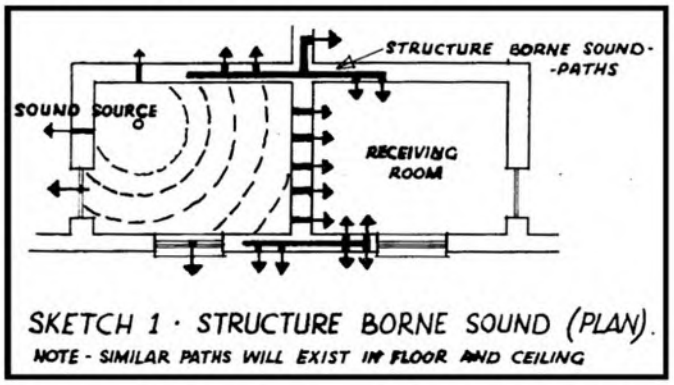
Now for the all essential theory. The threshold of audibility for the human ear has been defined (for all practical purposes) as a sound pressure of ·0002 dynes per sq. cm. at 1000 c/s. The pressure of 1000 dynes per sq. cm. at 1000 c/s has been selected as the threshold of feeling (i.e. when a sound is intolerably loud). Due to the mechanism of the hearing system, which recognises equal *proportional* changes of sound pressure rather than equal absolute changes, the logarithmic scale is used between the two extremes quoted above for intermediate reference, and thus we are back to the ubiquitous decibel. The "sound pressure level" in d. corresponding to a pressure of P dynes per sq. cm. is defined as:

$$20 \log_{10} \frac{P}{\cdot 0002} \text{ dB.}$$

Sound *power* is normally proportional to the square of sound *pressure*, thus when two equal sounds are combined (i.e. the power is doubled) the increase in pressure is $\sqrt{2} = 1{\cdot}4$.

Table 1 shows dB values for sound pressure and power between the two extremes; in practice, to the ear a 1 dB difference is *just* perceptible. 2 dB is perceptible and 3 dB is a memorable difference.

The logarithmic scale not only gives a truer indication of the effect sound pressure registers on the ear, it simplifies calculations. It is much easier to say that a particular construction reduces sound passing through it by a fixed ratio irrespective of the total actual energy rather than by a fixed amount. Thus a partition of insulation value 30 dB reduces a 70 dB sound to 40 dB, a 90 dB sound to 60 dB, and so on.



SKETCH 1 · STRUCTURE BORNE SOUND (PLAN).
NOTE - SIMILAR PATHS WILL EXIST IN FLOOR AND CEILING

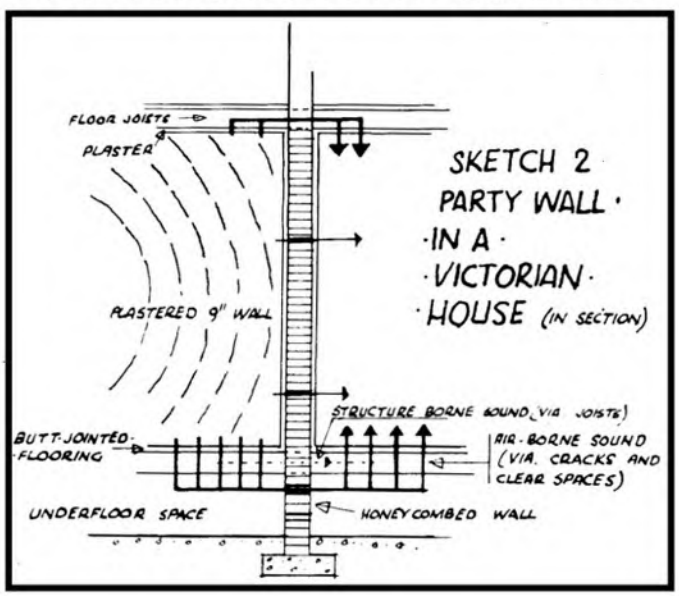
The theory so far has been concerned with sound at constant frequency (1000 c/s) but the ear is not equally sensitive to sounds at all pitches (pitch is the subjective equivalent of frequency).

Following experiments, a scale has been set down for comparing the loudness of sounds of differing frequencies as registered by the ear. This is shown in **Table 2**, and it will be noted that the term "phon" is used: sounds of differing frequency but of the same value in phons will appear equally loud to the ear, even if their actual sound pressure level in dBs is quite different.

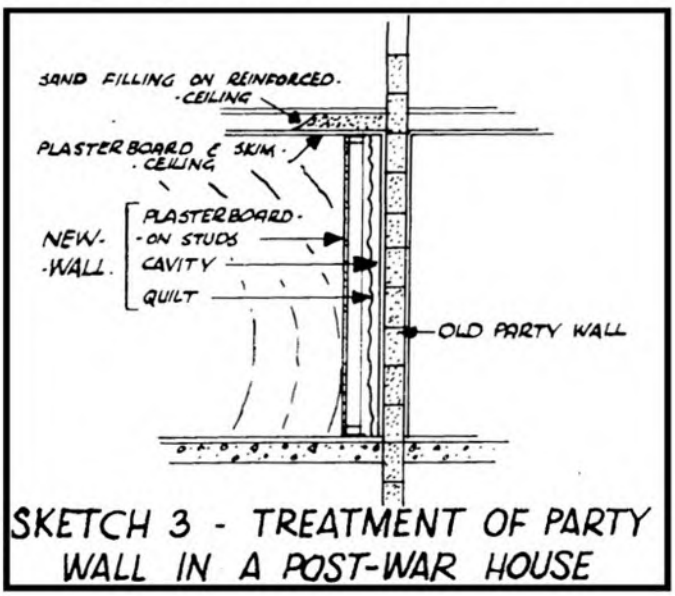
Now to practical applications, **Table 3** shows average noises and their sound pressure levels, whilst **Table 4** shows the reduction to be expected from various types of construction.

Broadly speaking the sound insulation of an element depends on its mass, but it is vital for any sound barrier to be complete. Any cracks or small holes can let through a wholly disproportionate amount of sound. A glance at **Table 5** should be all that is necessary to emphasise this. Thus when "sound proofing", look especially for cracks in floor boards, ill-fitting doors and windows, air ducts, ventilators, air bricks, holes for heating pipes, even fireplaces sharing a common flue. A common problem in modern offices is presented by the fact that partitions butt up only to a lightweight ceiling, which is suspended in turn some inches from the structural floor or roof overhead. Sound from one room travels up into the space between structure and ceiling, and then down the other side of the partition into the adjacent room.

If it is impossible to use heavy construction to resist the passage of sound, then compound or discontinuous construction can be used; see **Table 4**, (Part B). Note that discontinuous construction means what it



SKETCH 2 PARTY WALL · IN A · VICTORIAN · HOUSE (IN SECTION)



SKETCH 3 - TREATMENT OF PARTY WALL IN A POST-WAR HOUSE

(Continued on page 471)

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says: the separate walls must not be joined in any respect by common framing, or ties, neither should they even rest on a common foundation. without some insulating pad being interposed.

Theoretically all the ingredients are now available for you to "sound proof" a room; all that is missing is a fundamental knowledge of building construction and this is the difficult part—standards of design varying so widely apart from the complex nature of the subject. Probably the best way is to go step-by-step through two practical examples.

Semi-Detached Victorian House

Firstly, a high fidelity listening room in a semi-detached Victorian house. the problem being to avoid annoying the neighbour next door. A section is taken through the room as in **Sketch 2**, and it will be seen that the room has an air-space—perhaps even a cellar—below it; furthermore. the floor joints are built into the party wall or are even common with the neighbouring house. Despite an apparent 9 in. wall separating the two. removal of a floor board will show that the wall is "honeycombed" below floor level to allow air to circulate (and, human nature being what it is. to economise in bricks). Thus the apparent 50 dB wall is by-passed. as sound passes through floorboard cracks, and the honeycomb wall. then up through the other side. The joists themselves, if common with next-door, will be set into structural vibrations and will transmit the sound through the wall direct. The cure is not easy!

Firstly, shift the loudspeaker to the other side of the room then fill all the cracks in the floor with glue/newspaper mash or, better still. screw or pin hardboard or, for yet more improvement, 1 in. chipboard all over the floor. Consider building the honeycomb wall up solid and cementing up the openings through which the joists pass, but beware of stopping the underfloor air circulation by doing this and letting yourself in for dry rot. Consult an architect first and make sure your neighbour agrees. If you don't and his floor collapses in five years he will probably sue you.

TABLE 1

Relationship between sound pressure, sound power and decibels

Ratio of Power	Decibels difference	Ratio of Pressure
1·3	1	1·1
1·6	2	1·3
2	3	1·4
2·5	4	1·6
3·2	5	1·8
4	6	2
5	7	2·2
6·3	8	2·5
7·9	9	2·8
10	10	3·2
100	20	10
1000	30	32
10,000	40	100
100,000	50	320
1,000,000	60	1000
10,000,000	70	3200
100,000,000	80	10,000
1,000,000,000	90	32,000
10,000,000,000	100	100,000
100,000,000,000	110	320,000
1,000,000,000,000	120	1,000,000

Probably some openings exist in the party wall through which the first floor joists pass or meet those of next door. To prevent sound travelling along this space and openings, fill the space between ceiling and floor boards with *bone dry* sand packed close to the party wall—make sure that the ceiling will take it, old lath and plaster ceilings can do a lot of damage if they fall! If in doubt, reinforce the ceiling but make sure that no gaps are left in the interspace for sound to travel next door: the slightest gap will have an effect.

Sound will also travel externally via cheek-by-jowl bay windows. Make sure the window facing the neighbour is sealed shut. and if you want to be doubly sure, construct a second inner window with as large a cavity and of as heavy a glass as you can manage, sealed to the existing window frame with foam plastic.

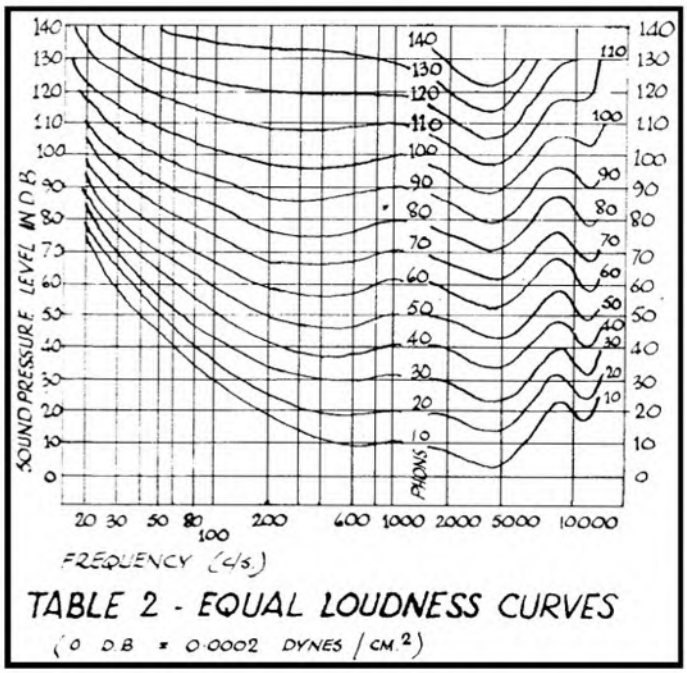

TABLE 2 - EQUAL LOUDNESS CURVES

(0 D.B = 0·0002 DYNES / CM.²)

Finally, check again that there are no complicated indirect paths for sound to travel through to next door; bass notes are particularly difficult to deal with and can travel great distances underfloor, finally to emerge triumphant in your neighbours house.

The Mid-Thirties House

Next, the mid-thirties onwards semi-detached house. This will probably have a solid ground floor of timber or plastic tiles on concrete, but may have a lightweight party wall and a light plasterboard ceiling.

To treat the party wall, erect a new partition 3 in. (more if possible) away from the party wall. This should be of 4 x 2 in. timber studs with ½ in. plaster board (not fibre-board or hard-board) nailed thereon; before nailing the plaster-board on, glue other pieces of plasterboard about 1½ in. square on to the rear face of it, the extra pieces registering, of course, with the spaces in between the studs. Fill the joints in the plaster-board wall and around the perimeter with filler and face up with lining paper. Hanging a glass-fibre or mineral-wool quilt in the cavity is a refinement worth trying.

Ceiling Treatment Again

Treat the ceiling by adding some dry sand as described previously, making equally certain it doesn't fall down; also attend to the bay window. Then sit back and gauge the effect. If there is still trouble it may be due to a lightweight cross partition built into the party wall causing the said party wall still to vibrate. The cure? Face up the cross partition with a false partition just as described for facing up the actual party wall. We are now getting to the stage where it is cheaper to move into another (detached) house unless you are an avid do-it-yourselfer.

One point worth mentioning is that if you use your party wall as one part of a speaker enclosure don't think you can satisfy your neighbours by treating the ceiling. The moral is obvious: watch direct structural vibrations with great care.

Recording Studios

Finally, recording studios, where any intrusive sound is a disaster and standards are so much higher that expedients are worse than useless.

The first defence is planning. Locate a studio away from street or other noises. isolate it from corridors, lavatories and noisy areas, by lobbies and heavy double-doors or other rooms, and lay soft floor coverings.

Windows, if tolerated at all, should face on to quiet areas, and be double-glazed and kept shut. This probably means an artificial ventilation

(*Continued on page* 473)

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system, itself a potent generator of sound problems. Ventilation fans need to be slow-running and very silent. (trade names include"silent" and "super-silent" - but these should be treated with suspicious). Remember that a duct communicating with another studio or the open air can be a perfect entry for unwanted sound. Heating systems and plumbing can give trouble ranging from clonks and bonks as valves open and shut, the noise being transmitted along the metal pipework, to an elusive hum whine from a circulating pump.

Sound in the Frame

Particularly in a framed building structure borne sound can be a nuisance, and the best defence is to set the studio as a separate "box" with heavy floor, walls and ceiling on a resilient mount within a main floor area

Those who suffer in certain large cities from a gentle but intrusive rumble have got underground train trouble and this is no mean problem unless the recording can be cut off at 60 c/s.

Now we are talking of skilled professional advice, and I hope you have some bags of gold to pay your builders. Alternatively you could always give it up altogether: I always wanted to be a steam-engine driver but I suppose they too have their problems.

TABLE 3

Sound pressure level (in dB) of some typical sounds
(0 dB = 0·0002 dynes/sq. cm.)

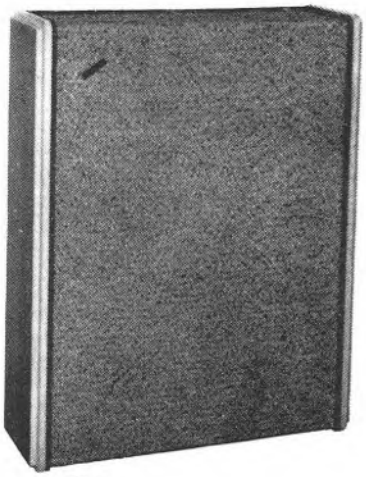
Subject	Distance (feet)	SPL (dB)			Remarks
		125 c/s	500 c/s	2 Kc/s	
Large jet liner taking off	125	121	124	120	Maximum power. directly overhead
Curb side. London rush hour	15	81	79	67	—
Noisy canteen (Average)	Reverberant	54	67	61	Peaks of plus 20 dB can occur
Male voice (Average)	3	55	66	60	—
Average Quiet living room (ambient sound)	—	40	30	28	—
Recommended ambient sound level in concert hall	—	38	18	11	It is a major problem to attain this in a busy City
Ditto in a theatre with over 500 seats	—	43	28	20	—
Powerful Hi-Fi in a living room	Reverberant	80	75-80	72	Exceptional peaks can exceed this
Quiet conversation in a quiet office	Reverberant	45	35	34	—
Noisy typing office with acoustic ceiling	Reverberant	64	56	55	—

TABLE 4

Sound reduction factors for typical types of construction

Part A—Simple Construction

Construction	Weight (lbs. per sq. ft.)	Reduction factor (dB)			Remarks
		125 c/s	500 c/s	2 Kc/s	
2 in. straw slab (self supporting with t. & g. timber joints at panel junctions)	3½	19	28	35	Joints must be airtight.
Two thickness' 2 in. strawboard one each side of 4 x 2 in. studs set at 16 in. centres.	7	25	33	42	Weight quoted ignores weight of studs.
⅜ in. plasterboard each side of 4 x 2 in. studs at 16 in. centres.	4	21	30	37	As above.
As before. but ½ in. plaster on each face.	14	25	35	42	As above.
3 in. clinker block (unplastered).	20	15	23	30	This is a porous material and does not perform so well as its mass suggests.
As above, but plastered ½ in. both sides.	25	29	39	49	Note the improvement for a modest increase in the weight.
4½ in. brick, plastered both sides.	55	35	45	55	—
9 in. brick, plastered both sides.	100	41	50	61	For all practical points of view, a 9 in. wall is the best compromise for performance and cost in solid construction.
13½ in. brick, plastered both sides.	145	44	53	64	—
11 in. wall of two 4½ in. skins brick and 2 in. cavity, outer faces plastered.	100	41	50-53	63	Improved performance at low frequencies can be obtained by a wider cavity (in the region of 8 in.)
Single window, closed, with 32 oz. glass.	—	17	25	23	—
Double window. tightly shut with 32 oz. glass. 8 in. space between glass. absorbent on reveals.	—	30	43	47	—



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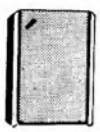

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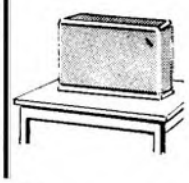

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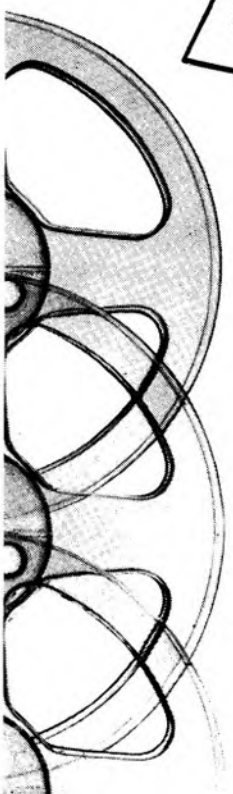

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TABLE 4 continued

Sound reduction factors for typical types of construction

Part B—Discontinuous Construction

Construction	Weight (lbs. per sq. ft.)	Reduction factor (dB)			Remarks
		125 c/s	500 c/s	2 Kc/s	
Two leaves of 3 in. clinker blocks, plastered externally, no ties between leaves. 2 in. cavity.	40	40	49	60	Compare with heavier solid construction above. Improved performance at low frequencies can be obtained by wider cavity (aim for 8 in.).
Three leaves of 2 in. clinker blocks, with one 2 in. and one 14 in. cavity, outer faces of partition and one face of inner leaf plastered.	50	70	70	102	Compare with heavier solid construction above. It is essential that that there are no flanking paths of lower insulation value allowing sound to "by-pass" this barrier.

TABLE 5

Effect of a $2\frac{3}{4}$ x $6\frac{1}{2}$ ft. door in a wall about 13 ft. long by 9 ft. high

Construction	Average reduction of original SRF of partition to:		Remarks
	For 45 dB partition	For 50 dB partition	
Any door with large gaps around perimeter.	27	27	—
Light door, well fitting and draught stripped.	30	30	—
As before, but a heavy door.	35	35	—
Double doors separated by an absorbent sound lock or lobby.	45	49	Note that a 9 in. wall only shows superior insulation when the door is specially chosen to approach its own standard.
Single window, 6 x 3 ft.	30	30	The above remarks apply also in the case of windows.
Small hole for heating pipe or a crack $\frac{1}{4}$ in. wide by 12 in. long in wall.	38	38	The moral is obvious, a 50 dB wall is very vulnerable to weak links in the chain.

TRADE NEWS

Sennheiser Appoint Importers

SENNHEISER Electronics Limited, of Bissendorf, West Germany, recently appointed *Inspectron Limited, Empire House, Chiswick Road, London, W.4* as their sole importers. U.K. Distribution is being handled by a special section, *Light & Sound Limited*, of the same address.

Sennheiser microphones are fitted as standard equipment to all Telefunken tape recorders and are also supplied to recording studios. The range covers moving-coil, stereo, noise-cancelling, and communication microphones, as well as a large selection of transformers and amplifiers.

★ ★ ★

Dansette Service Agents

A SOLE agency for Dansette spares and service in the North of England and Scotland has been granted to Philips Woolfson Limited. They are now equipped with a comprehensive range of spares for customers in Scotland and the four countries of Northumberland, Durham, Cumberland, and Westmoreland. The head office of the company, which has branches in Aberdeen and Newcastle-on-Tyne, is at: **33 Cadogen Street, Glasgow, C.2.**

★ ★ ★

KEF Price Revisions

DUE to recent increases in the cost of materials and components used in their loudspeaker systems KEF Electronics Limited have found it necessary to increase the prices of several of their models. The new prices are also to finance improvements in the finish and packaging of their products. Only cabinet systems and baffles are affected, the prices of separate units and other equipment remaining unchanged.

The original *K1* series, which includes the *Monitor*, *Slimline*, and *K1 Baffle*, have been redesigned internally with consequent improvements in performance. The latest production omits the mid-range unit and has less phasing trouble at the cross-over points, giving enhanced smoothness. New prices:

Celeste £24 19s. K1 Baffle £28. Duette £39 19s. K2 Baffle £22. Slimline £39. Monitor £52.

★ ★ ★

Video Recorder Makes Public Debut

THE first demonstration of portable video-recording equipment ever to be held in this country took place recently at the Earls Court Industrial Photographic & Television Exhibition. The new Carrion P1-3V was shown in use with closed circuit cameras. Running at $6\frac{1}{4}$ i/s it allows nearly two hours continuous picture and sound recording on a $10\frac{1}{2}$ reel of one-inch tape and costs £4,340. They are already in use in hospitals, security and government installations, education, nuclear and chemical hazard control.

The demonstration proved to be one of the high-lights of the exhibition.

★ ★ ★

Triple-Play Tape

INTRODUCED into the range of *Electronic World* tape is a relatively inexpensive triple-play brand. Said to be stronger and more stretch-resistant than most double-play tapes, it is available in all reel-sizes from 3 in. to 7 ins. Prices are as follows:

		£ s. d.
3 in.	475 ft.	Two for 1 6 6
$3\frac{1}{4}$ in.	650 ft.	17 0
4 in.	900 ft.	1 3 6
5 in.	1,700 ft.	2 0 0
$5\frac{1}{2}$ in.	2,300 ft.	2 12 6
7 in.	3,300 ft.	4 0 0

A new, fine grain, oxide coating is now being used on all *Electronic World* tapes to provide higher quality and reduce dropouts. They are distributed by: **De Villiers (Electronic World) Limited, 16-20 Strutton Ground, London, S.W.1.**

See Page 464

for the professional

IRISH

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Readers' Problems

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

Belt Slip on the Telefunken

Dear Sir, I have a Telefunken Magnetophon 95 recorder which has started to suffer from a considerable amount of wow when using 7 in. spools. This trouble also occurs with smaller spools, to a lesser degree. but not at all with 3 in. spools. I have found that the take-up spindle does not rotate fast enough until about 12 ft. of tape is on it. Please can you advise me as to the cause and elimination of this trouble.

Yours faithfully, **A. J. P., Battle.**

You would appear to be suffering from belt-slip on take-up on your Telefunken 75. The take-up turntable is driven by a belt from the capstan pulley, which is tensioned during playback (or record) by the inward movement of the capstan idler lever. A certain amount of slip is allowed for varying tape weight, but the tensioning arm has a pivot screw with a locknut for setting its inward movement. Ensure that this setting screw is correct and the locknut tight. Finally, make sure this is not over-braking of the left-hand spool, which has a slight braking action applied normally, to eliminate spillage. Make a loose loop of tape at the left and run through, noting if the wow is lessened, or if take-up of the commencement of the 3-inch spool is improved. If so, reduce the braking of the left-hand spool by its adjustable rod which runs diagonally across the deck (beside the solenoid).

★ ★ ★

A Haunted Recorder?

Dear Sir, I am the owner of a Brenell Three Star tape recorder. Recently it seems to have developed a fault on play-back as, after setting the volume to a reasonable listening level it will suddenly increase to such an extent that I have to jump up to turn the volume down, and then, just as abruptly, it will revert back to its former level with the result that the volume is then too low.

This happens several times during the play-back of a seven inch tape. Have you any ideas as to the cause of this fault?

Yours faithfully, **R. A. E., Harlow.**

The fault of intermittent volume level on playback could be caused by several different things.

I presume you have proved this fault occurs only on playback, first by playing known good recordings and noting the fault, second by making a recording, playing it back several times and noting that the increase and decrease of volume does not always occur at the same passage of the recording.

From there on, you will have to check the circuit. If the change in volume is very sudden, and responds to movement of the volume control, perhaps accompanied by crackling, I would suspect the control itself. If it responds sluggishly to the movement of the volume control, the EL84 output valve may be running into grid current when the signal approaches a certain level. There should be an additional symptom of a hum, in that case. A more likely cause is a faulty ECC83 valve.

★ ★ ★

Equalisation Characteristics

Dear Sir, I have a Sony 464 tape recorder which I normally use in conjunction with a Leak Varislope stereo pre-amp and stereo power amplifier for recording and playing back through a DIN five-pin socket on the recorder.

Up to now the question of recording characteristic has not arisen but I have decided to obtain a Truvox tape deck which I shall use for replay only, direct from tape lead to the Leak pre-amp for purposes of editing and re-recording. I would therefore like to know the recording characteristic of the Sony machine. The only reference to the subject in the instruction book states that the magic eyes are calibrated to NARTB standards but whether this means that the whole machine is thus calibrated I do not know. I do know, however, that nearly all recorders in this country are to CCIR standards but my machine was purchased in Singapore and may therefore be calibrated for the American market. I am enclosing the instruction book as well as a service manual obtained in this country and would like to know if there is any difference in the equalisation circuitry (i.e. is my machine NARTB and the English model CCIR)?

If the recorder is NARTB how shall I fare when playing pre-recorded tapes, which I presume are CCIR? Finally, I note that the output impedance of the 464 is given, in the Hi-Fi Yearbook, as 15 ohms, whereas my instruction book gives it as 8 ohms.

Yours faithfully, **B. H. M., Lowestoft.**

The Sony 464 is equalised to the NARTB characteristic, 50 microseconds, with 3 Kc/s turnover. This means that a tape recorded with a CCIR characteristic will have a pronounced dip in the replay response at about 800 c/s, levelling out at 5 Kc/s or thereabouts, played at 7½ i/s. This is the condition that would be obtained if you played back a pre-recorded tape on the Sony, but replaying a pre-recorded CCIR tape on the Truvox-Leak combination should be satisfactory.

Your problem arises in two ways; playing back on the Truvox-Leak set-up a tape recorded on the Sony, and playing back directly on the Sony a pre-recorded CCIR tape. In the first case, the amount of pre-emphasis could be compensated with the Leak stereo-amp controls, and should not present you with great difficulty. The second case, however, may be more serious, and if you intend to do this, you will have to experiment. I would suggest switching in the modified circuits, and as a start you could try damping the input to allow for the change in pre-emphasis, by switching 2·2 megohms, or even less, across the grid of V1-1 and V1-2. Then try increasing C19 and C20 to 100 pF each and perhaps increasing C21 and C22 to 250 or 300 pF. You could also try experimenting with the value of C23 by increasing it, or by adding resistance in series with it, so that some manual compensation could be made during playback, (duplicating any change made in the other channel, of course.) As a final modification, you could increase the value of the coupling capacitors, C3 and CC4 to about 0·05 mfd.

I do not think there is any modification of Sony machines sold in this country, for the only time this problem arises is when pre-recorded CCIR tapes are used. Nevertheless, it is a problem that will grow as more people with NARTB machines wish to replay CCIR tapes. As for the output impedance, that is quite in order, the 8 ohm spec. being equivalent to our 15 ohm, with only a different reference level.

★ ★ ★

A Head for the Soundmaster

Dear Sir, I recently acquired an old Baird Soundmaster tape recorder which unfortunately had the record/playback head removed.

As an experiment I used the set as a straight amplifier finding that the response and sensitivity were very good; but when I used a head from a Collaro Mark II deck to record I found, on playback, that the tape was very distorted and had almost no bass.

Could you please suggest a suitable recording head for this machine?

Yours faithfully, **A. C., Rugby.**

You require a low impedance R/P head for the Baird Soundmaster tape recorder. Suitability depends on physical mounting, and you may have to use a little ingenuity in fitting any of the modern low impedance heads. But a suitable type would be available from Miniflux Ltd.; indeed, you have a choice of several and would be best advised to refer to them, stating the deck it is required for and adding that it is matching into a 40:1 transformer, on Playback.

Do not simply ask for a low impedance head, as they may interpret this as meaning a head suitable for transistor input operation. I should think their WM5T model would be suitable, and this retails at £3 7s., complete with mumetal shield.

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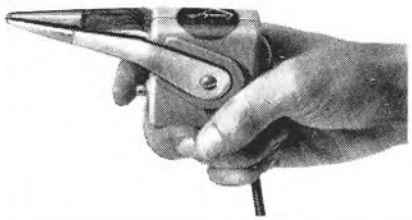

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TAPE, RECORDERS & ACCESSORIES

FIRST DETAILS OF NEW PRODUCTS

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

★

Telefunken

Magnetophon 55

★

ONE of the least expensive recorders in the Telefunken range is the new *Magnetophon 55*. Automatic stop, remote control, tape splicing groove, and digital counter are just a few of the many facilities offered by this versatile machine. Two speeds, 3¾ and 1⅞ i/s, are incorporated, with a specified frequency range from 40 c/s to 16 Kc/s and 40 c/s to 9 Kc/s respectively. Maximum spool size is 5¾ in. giving a playing time of six hours using DP tape at 1⅞ i/s. Two outputs are provided, for extension speakers (4·5 ohms), and monitoring headphones (18 K-ohms). Wow and flutter is claimed as ± 0·2% RMS at the faster speed, signal-to-noise ratio 46 dB.

The dimensions of the recorder, which weighs 22 lb., are 14½ in. wide x 13 in. deep x 6 in. high (including lid). The price, including tape and recording lead, is £45 3s. **Distributors: Welmec Corporation Limited, Lonsdale Chambers, 27 Chancery Lane, London, W.C.2.**

★ ★ ★

★

Fidelity Playmaster

★

AN interesting new recorder was recently introduced by *Fidelity*. It incorporates a BSR TD2 tape deck which is ingeniously merged with the control panel giving a pleasant "continental" styling. Available in a two or four track version the *Playmaster* has a single speed of 3¾ i/s and controls for tone and volume. These also function as mains switch and recording level controls. Frequency response is specified as 60 c/s to 8 Kc/s, wow and flutter 0·25% RMS.

A tape position indicator is a standard fitting on the four-track machine but the two-track can be provided with one at an extra £2 2s. The price of the Playmaster is £21 (two-track), and £24 3s. (four-track). **Manufacturers: Fidelity Radio Limited, London, W.11.**

★ ★ ★

Multicore Transistor Solder Pack

ADDING to their extensive range of pre-packed solder lines, Multicore are introducing a completely new solder pack, to be known as the *Size 10*. With the increasing use of small components for transistor equipment it is expected that both service-engineers and home-constructors will find the new pack particularly useful. The Size 10 contains 250 ft. of 60/40 alloy, 22 gauge Ersin Multicore five-core solder, wound on a re-usable plastic reel. Available from most electrical dealers the retail price is 15s. **Manufacturers: Multicore Solders Limited, Marylands Avenue, Hemel Hempstead, Hertfordshire.**

★ ★ ★

Miniflux Film Sound Heads

A NEW range of 8 and 16 mm. film sound heads has been brought out by *Miniflux*. Available in both high and low inductance types, for use with valves or transistors, the 8 mm. heads incorporate a special magnetic alloy, *Alfenol*, which is said to reduce head-wear.

Low-loss ferrite erase heads are also available for both sizes of film. Full technical details can be obtained from the manufacturers: **Miniflux Electronics Limited, 8 Hale Lane, London, N.W.7.**

★ ★ ★

★

Sony TC500 Stereo

★

TELLUX (Hi-Fidelity Division) recently announced a new Sony tape recorder, the *TC500*. A four-track, stereo machine it has speeds of 3¾ and 7½ i/s, and incorporates sound-on-sound, automatic stop, and an automatic tape-lifting device. Independant recording and playback amplifiers provide a response of 30 c/s to 18 Kc/s at 7½ i/s. A belt-less drive mechanism enables it to be used horizontally or vertically.

Two *Sony F87* cardioid microphones are supplied as well as two full-range, balanced satellite speakers. More details of the recorder, price £111 6s., are available from the distributors: **Tellux Limited, Gallows Corner, Romford, Essex.**

★ ★ ★

Coloured Timing Tape

A USEFUL new accessory was announced recently by *Zonal* that, amongst other things, will provide an inexpensive, accurate way of determining the exact running speed of a tape recorder. The whole length of the tape is divided into sections exactly 7½ ins. long. Thus a known number of sections can be spliced into a tape and the precise speed calculated. It is marked for identification purposes and can be used as leader tape.

Available with white, red, green, blue, and yellow backing the price, per 100 ft. is 4s. 6d. **Manufacturers: Zonal Film (Magnetic Coatings) Ltd., Zonal House, Heron Trading Estate, Westfields Road, London, W.3.**

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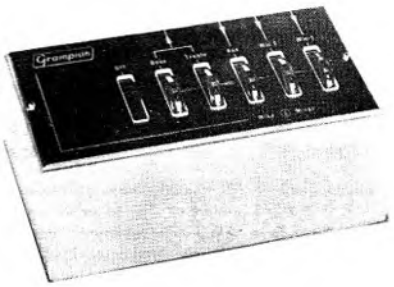
EQUIPMENT REVIEWED

GRAMPIAN MIXER



Manufacturer's Specification: Inputs: two low level microphone inputs and one auxiliary high level input. **Connection:** unbalanced. **Matching impedance:** 600 ohms for Mic 1 and 2. **Sensitivity:** 300 microvolts. **Auxiliary:** matching impedance 1 meg. **Aux. Sensitivity:** 500 millivolts. **Output:** connection unbalanced. **Source impedance:** 600 ohms. **Maximum level:** 1 volt. **Frequency response:** ±1 dB 50 c/s to 15 Kc/s on all inputs. **Tone controls:** bass cut 0 dB to −10 dB at 100 c/s. Treble cut 0 dB to −20 dB at 10 Kc/s. **Noise:** overall, all channels closed, tone controls level, −68 dB; all channels open, tone controls level, −50 dB ref full output. **Consumption:** less than 10mA. **Controls:** bank of six rim-operated controls (numerically calibrated) on sloping panel comprising: on-off switch, bass cut, treble cut, aux. gain, mic. 2 gain, mic. 1 gain. **Connections:** group of four standard jack sockets at rear of unit. **Battery:** . r Ready PP9 or equivalent. **Transistors:** 3 Mullard type AC107, 2 Mullard type OC45. **Size:** 8¼ x 5¼ x 3½ ins. overall. **Weight:** less than 4 lbs. inc. battery. **Finish:** gold enamel with black perspex escutcheon. **Price:** £19 10s. **Manufactured by: Grampian Reproducers Ltd., Hanworth Trading Estate, Feltham, Middlesex.**

THIS transistorised mixer unit is designed to mix the outputs of two low to medium impedance microphones and one auxiliary input, which could be a gramophone pickup or the output of a radio tuner or tape recorder.

The performance of such a unit can be measured in many ways, and each method of measurement may give a different answer. Only one set of measurements defines the performance of the unit under practical working conditions, and I hope that a step-by-step analysis of my measurements and their relation to the above specification will give

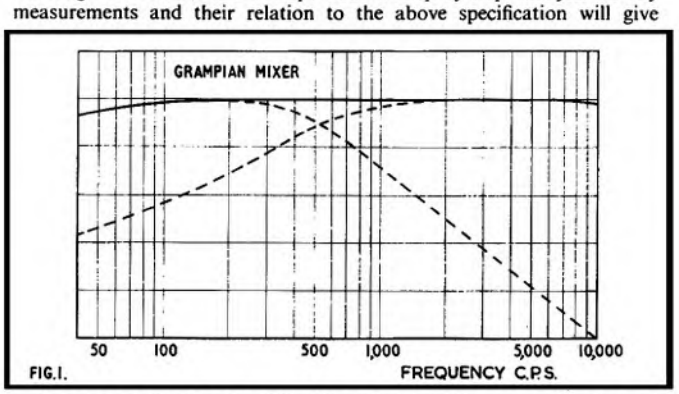


FIG. 1.

readers an insight into the difficulties of: (a) writing a specification of such a unit, (b) relating measurements to the specification and (c) deciding which measurements and which parts of the specification most accurately describe the performance of the unit in normal use.

Output Stage Overload

This was measured by setting one channel to full gain and increasing the input signal until waveform distortion was evident on an oscilloscope connected to the output jack. A valve voltmeter was connected to the same jack to measure the RMS voltage at which overload occurred. There was no disagreement with the specification here. Waveform distortion commenced at precisely 1 volt RMS. *But* let it be noted that this is open-circuit voltage. If the output is terminated by a 600 ohm load, the undistorted output falls to less than half a volt.

Frequency Response

Fig. 1 shows the response with bass and treble controls set to 10 (full line), and with them set to 0 (dotted lines). Again, measurements agree with the specification.

Signal Noise Ratio

The specification tells us that noise should be better than 50 dB below 1V on a single channel with the gain full on.

In fact the noise was −45 dB with no input jack inserted on the channel under test (input short circuited), and −42 dB with a 600 ohm resistor connected across the input jack to simulate the source impedance of a medium Z microphone.

Opening up the gain of all three channels reduced the signal-noise-ratio to barely 40 dB.

Why the 10 dB discrepency between my measurement and the specification? A clue to this will be found in the next measurement.

Gain

With a single channel set to full gain (10), the input signal which just overloads the output stage is 0·3 mV, or 300 microvolts. This again agrees with the specification—but what does it mean in practice? A DP4M (600 ohm) microphone delivers a mean open-circuit voltage of approximately 0·25 mV, with peak voltages 12 dB above this level (i.e. 1 mV) on medium voice at a distance of about 6 ins. from the microphone. This means that the output stage will be violently overloaded if such a

(*Continued on page* 483)

EQUIPMENT REVIEWED—(*continued*)

microphone is used under these conditions with the gain control fully advanced. To prevent such overload the gain must be reduced by about 12 dB so that the transistor noise reaching the output stage is also reduced by 12 dB (4:1). Thus the effective signal/noise ratio is better than 50 dB (42 dB plus 12 dB) under these actual conditions of use.

If, however, a relatively insensitive ribbon microphone is used at a distance of several feet from the sound-source, then the mean output voltage may well be in the order of 0·1 mV or less, and the gain control may have to be fully advanced to bring the output voltage peaks to 1V. In these circumstances the peak signal-to-noise ratio will agree with our measurement, and will in fact be about 40 dB.

Comment

This mixer is well designed mechanically, and I like the bold numbering on the edge-operated gain controls and the input/output arrow markings which join each control to the appropriate input or output socket. I do think, however, that the margin between adequate signal/noise ratio and output stage overload is rather fine, and that output overload will tend to occur unless most of the controls are used near the bottom of their range (below 3-4). I suggest that the AC feedback around the output stages should be increased to reduce the overall gain by 10 to 12 dB. The resultant voltage gain of 60 dB (1 mV in for 1V out) should be adequate for all normal purposes, and the full range of each control could be used with little chance of output stage overload. **A. Tutchings.**

our readers write . . .

. . . about modern batteries

From: F. M. Shaw, 232 Burrage Road, London, S.E.18.

Dear Sir, Although a very interesting article, I was surprised that no reference was made in "Modern Batteries" (September issue) to the voltage of the different types of cell mentioned. Hence, unless the voltage of the mercury cell is the same as the Léclanché type, they can hardly be interchangeable in a set.

Voltage of the older types of primary cell varied from 0·75 Lalande to 2·075 Bunsen with the Léclanché in between at 1·4V. I shall be interested to find out if there is a mercury equivalent of the U11.

Yours faithfully.

Mr. M. G. Shaw replies on behalf of Mallory Batteries Limited:

The initial voltage of a commercial Mercury cell is 1·4V, and of a Manganese cell 1·5V. Although the voltage of the Mercury type is 0·1V down on the Zinc-carbon or Léclanché type (1·5V) it quickly stabilises at 1·25V, at which level it remains for the vast majority of its long life. Léclanché types, on the other hand, continue to "drop" in voltage as they are being used, so that for only a brief period do they register a higher voltage than Mercury types.

Both Mercury and Manganese types can therefore replace Zinc-carbon types. However, the Mercury system is expensive to produce, and it lends itself more to "miniature" sizes, the U11 not being one of them.

It was to meet the need for powerful standard-size cells that the Manganese system was developed. This has the same basic properties as the Mercury system and, in addition to the improved performance—no need for rest, etc.—it offers an economic replacement, in terms of running cost per hour, for Zinc-carbon types.

★ ★ ★

. . . about tapes for the blind

From: J. W. Crockett, Hemel Hempstead Round Table, 25 Bennettsgate, Bennetts End, Hemel Hempstead, Hertfordshire.

Dear Sir, We are a charitable organisation, at present engaged on a project for helping blind people, which will entail a certain amount of tape recording. Unfortunately our members lack technical "know-how" in this field and we would welcome advice and/or assistance from any of your readers who would be prepared to help us in our work.

Yours faithfully.

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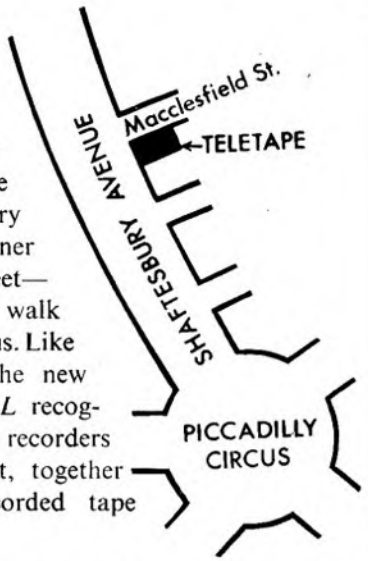

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NEWS FROM THE WORLD OF TAPE

Braille Tape Recorder For The Blind

AFTER consultations with the Royal National Institute for the Blind, the Grundig TK18 *Magic Ear* recorder was chosen for use with the blind. Its automatic recording level circuitry abolished the need for visual tuning, which, up to now, has been the main drawback for sightless recordists. The control keys have been specially marked in Braille relief and operation of the machine has been simplified as far as possible. It is in fact so simple that the Institute state that no instruction book is necessary.

Mr. John Jarvis of the R.N.I.B. accepts a Grundig TK18 from Dennis Marks of Grundig, at the London Hilton

The first of these new models was presented recently, at the Hilton Hotel, by Mr. Denniss Marks, Grundig's Managing Director, to Mr. John Jarvis of the R.N.I.B. They are available, at no extra cost, by individual order placed through Grundig retailers. Price, including microphone and tape, is £40 19s.

★ ★ ★

Survey of European Recorder Owners

ACCORDING to a recent survey of Britain and the Common Market published by the *Reader's Digest Association*, Britain and Holland lead Europe in tape recorder ownership. The figures they give are 9% for Britain and Holland, 8% for Germany, Luxembourg 6%, and Italy which, together with France, has 3%. It was not, however, possible to assess how these machines were being used!

★ ★ ★

Rank Language Laboratory

AN interesting postscript to the article on language laboratories in the August issue is the announcement by the *Audio Visual* section of the Rank Organisation that, in co-operation with Truvox Ltd. they are introducing a new all-British laboratory. Modified versions of the new *Series 90* tape-decks are used in the control console and students' booths. These booths are available in two types; one which can be converted into a normal desk when not required, and a permanent booth which has considerably taller side walls.

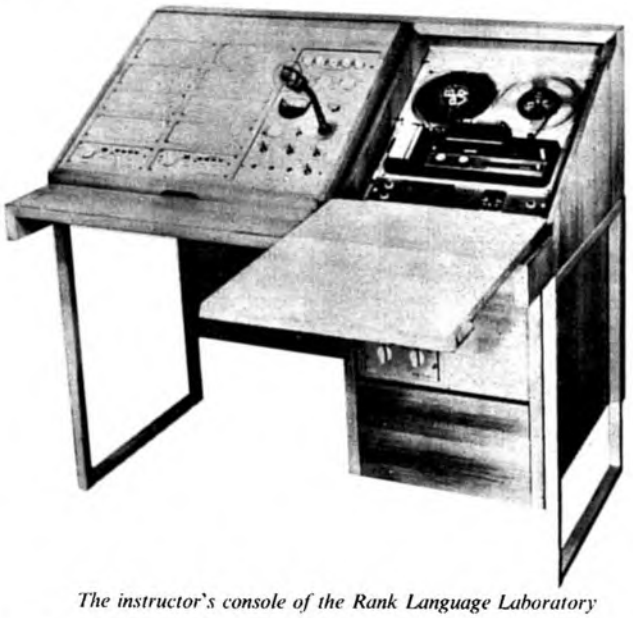
The booths can be converted, by the pupil, for use with the left or right hand. The conversion entails taking out a panel in the desk and sliding the tape-deck across the booth, replacing the panel. For reasons

(*Continued on page* 487)

of hygiene each student is issued with a set of personal earphone-pads. These are fitted to light-weight A.K.G. earphones which, with a built-in microphone boom, allow personal speaking and monitoring.

The console has been developed for use by non-technical staff and comprises a Truvox tape-deck, a switchboard, and an FM tuner from which educational broadcasts can be relayed or recorded.

A system has been developed by Rank which permits the pupils to see each word on a screen as they hear it on tape. This is an invaluable



The instructor's console of the Rank Language Laboratory

assistance as it forces the students' mind to associate the foreign word with the object rather than with an equivalent English word.

The main argument in favour of the language laboratory is that prominence is given to vocal training rather than reading and writing, which present day systems of teaching rely on. Pupils do almost no written work until about the fourth year of the course.

The laboratories are relatively inexpensive, a class of twelve booths and a console costing £1,730. Regular maintenance is provided during the three major school holidays and includes a complete overhaul of all equipment. Emergency servicing is available where necessary. More information can be obtained from: **Rank Audio Visual, Woodger Road, Shepherds Bush, London, W.12.**

★ ★ ★

International Radio Communication Exhibition

THE annual Radio Communication Exhibition was held recently at Seymour Hall, London. In an opening speech, Mr. F. C. McLean, Director of Engineering of the BBC, spoke of the debt owed by professional broadcasting to the early radio amateurs. Without them, he said, the development of radio would have been a considerably longer process than it was.

The exhibition contained disappointingly little to interest the recording enthusiast however, although one stand demonstrated, as its main feature, a new stereophonic tape recorder, a demonstration marred by mis-placing of the loudspeakers.

The *Radio Society of Great Britain* celebrated its Golden Jubilee, having been in existence for sixty years. The RSGB stand contained an array of home-built amateur equipment and was, in common with all their exhibition displays, manned by enthusiastic members of the organisation.

We wish to point out an error in the "More Readers Problems" section on page 383 of the October issue. This was entitled "Noise on the TK6" but should have read "Noise on the TK14".

The TK6 is, in fact, one of the latest additions to the Grundig range, a battery portable recorder, and was mentioned in "New Products" of that issue. We apologise for any inconvenience this may have caused Grundig or any readers.

CLASSIFIED ADVERTISEMENTS

No responsibility will be accepted by the editor, the publishers, or the printers of "The Tape Recorder" for the quality of any goods offered, bought, or exchanged through the medium of these columns, or for any failure in payment, etc., though the greatest care will be taken to ensure that only bona fide advertisements are accepted.

Advertisements for this section must be pre-paid and accompanied by a postal order, money order, or cheque. The rate is 6d. per word with a minimum charge of 7s. 6d. Box numbers may be used for an extra charge of 1s. 6d. The trade rate is 9d. per word, plus 2s. for a box number, conditions on application. **Send replies to box numbers, c/o "The Tape Recorder", 99 Mortimer Street, London, W.1.**

Advertisements for the January issue must arrive not later than December 2nd.

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"The Tape Recorder", 1959, 1961 to 1963 inclusive, 2s. each. S.A.E. please. Northcott, 11 Thornberry Terrace, Penzance, Cornwall.

Bogen high impedance record replay and erase heads absolutely unused. Cost £15. Offers. Box No. 359 (Scotland).

Ficord 1a. Grampian D.P.4. Desk Stand. Charger, 2 sets batteries. Several tapes. Beautiful condition. Hardly used. £45 o.n.o. Ball, 121 Sandford Road, Birmingham, 13.

TRADE

Ferrograph 5A/N, 422 and 424, Revox F36, etc., always in stock. City and Essex Tape Recorder Centres (see page 476).

Cinesmith Depolariser demagnetizes your record/playback heads in situ. Use occasionally for better recordings without hiss and with background silent as the grave no matter how often played. From your dealer or Cinesmith Products, Regent Street, Barnsley. £2 5s. Write for leaflet.

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(Continued on page 490)

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WANTED

Good Cash prices for tape recorders. Phone: Maryland 5879 (see page 476).

Highest cash prices offered for good quality Tape Recorders and Hi-Fi. See our ad. page 484 this issue. R.E.W., 266 Upper Tooting Road, London, S.W.17.

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

Tired of the same old Jazz/Classics? Free advertising of your unwanted discs. Join Atlas X change-A-Disc Club. S.A.E. Details of Membership. A.X.D.C. P.O. Box 51, William Road, London, N.W.1.

Elizabethan Auxiliary amplifier for Model FMT3. Condition unimportant. Details to 18 Highclere Street, Sydenham, London, S.E.26.

Wanted urgently. Collector will pay handsomely for recordings of stereo broadcast (mono will do) of "Songs Worth Singing" on Saturday, 6th April, 1963. Box No. 360 (Warks).

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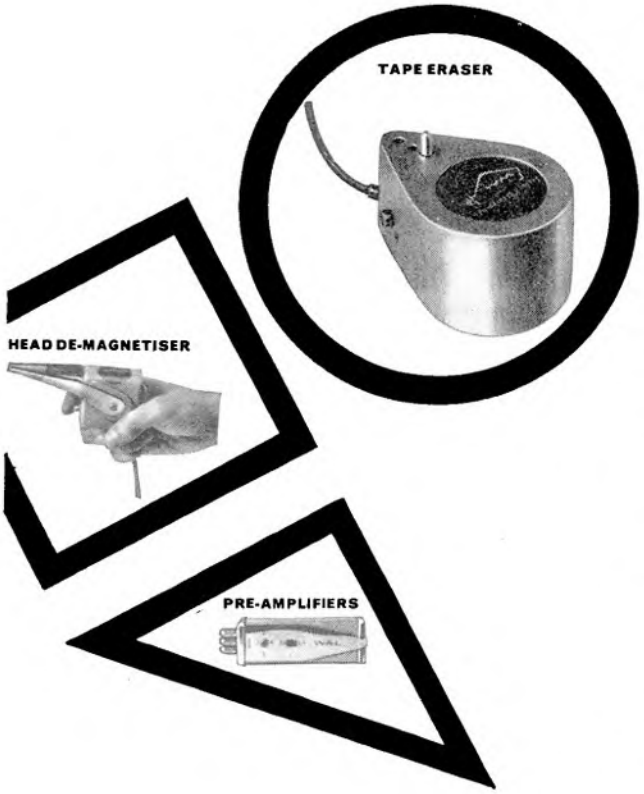

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