APRIL 1965 TWO SHILLINGS

# tape recorder

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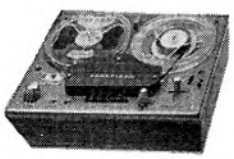

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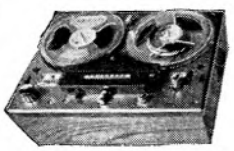

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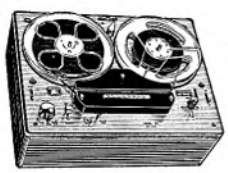

Model 823 2 track (teak case) **54 gns.**
Model 822 2 track (Portable with lid) **57 gns.**
Model 843 4 track (teak case) **59 gns.**
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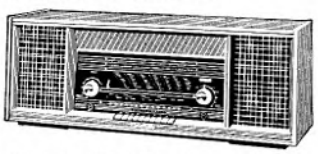

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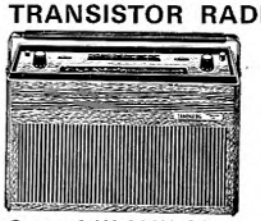

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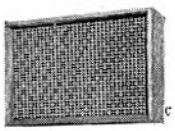
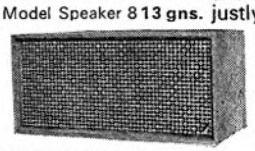


Model Speaker 8 **13 gns.**



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# tape recorder

INCORPORATING 'SOUND AND CINE'

EDITOR **JOHN CRABBE**

NEWS EDITOR **DAVID KIRK**

ADVERTISEMENT MANAGER **ROBIN WELLS**

Editorial and Advertising offices

LINK HOUSE, DINGWALL AVENUE, CROYDON, SURREY

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# editorial

STANDARDISATION IS A wonderful thing and we in Britain are more fortunate than most, having no less than three standard systems for connecting electronic equipment. Bitter opposition is to be met in all corners of the audio field, the editorial staff itself being sharply divided in favour of one or other system.

*Jack*, *DIN* and *phono* are the most widely found connections on tape recorders and ancillary equipment currently available in this country. These can be sub-divided into a total of nine different plugs and sockets, there being four basic types of jack : the GPO, three-way GPO (for specialised applications), miniature and sub-miniature versions. The DIN system comprises four different audio plugs, with variations in positioning and wiring of pins. The phono-plug takes only one form but has a big brother, the coaxial-connector, widely used in television applications and on a very few domestic recorders.

It is a fashionable line of thought to praise the Common Market Countries for their efficient and modern-minded approach to commerce and technology while bestowing denigrations on our own manufacturers for lacking similar drive and competency. On the topic of plugs and sockets, however, we beg to differ. Let us consider the advantages and disadvantages of the three systems.

The GPO jack is by far the oldest standard connection and was devised many years ago to meet the requirements of the telephone switchboard. It is sturdy, simply constructed, and easier to insert and extract than any other plug. At the same time, it locks firmly into position and can be of attractive appearance. Two major criticisms are frequently placed against it: the 'ease' with which equipment can be damaged through mistaken insertion of, for example, a low-impedance ribbon microphone into the output socket of a power amplifier; and secondly, the inability of the jack to handle more than one signal at any one time.

DIN plugs and sockets certainly solve the latter two problems and, for this reason, have become used on almost all Continental audio equipment. But in dear old Britain, where *nothing* can achieve overall acceptance, the DIN system only adds to the general confusion—and it causes more confusion than all the other systems put together. The DIN system was cleverly planned to cover all eventualities—with one exception. It falls down completely when brought into play with non-DIN connections. Under present conditions (admittedly the fault lies, to some extent, with importers), if a Continental recorder is to be connected to a British radio, or to any electronic device not fitted with DIN sockets, a patch cord must be produced by cutting a cable at some point between two plugs. The confusion of wires that spring to light takes on no apparent logic whatsoever. Which wires are connected to which pins? Simple solution to a seemingly simple question is—dismantle the plug and have a look. But no! We find ourselves back where we started, knowing nothing about which *pins* go where, which of the many sub-sockets are wired and which are not. Of course, many importers dare not (or cannot?) betray the 'look after each other' conditions within 'the trade' by disclosing such information.

For similar reasons, the 'experimenter's plug'—a DIN plug fitted with an array of pins, connected to a 'tree' of loose wires, is likely to be of questionable use. But returning to neatness and simplicity: would you find an array of coloured leads (whether you knew the colour coding or not) neater and simpler to use than, say, five jack sockets?

Phono plugs have none of the advantages of jack or DIN systems but are fairly well suited to use in such more or less permanent connections as those between amplifiers, pickups and tuners. Many types are far too weak for use as microphone connections since only a few extractions are required to pull the leads from their fixture.

It is an open question whether jacks are superior to DIN connections, the decision hinging on whether versatility or simplicity are the most important considerations in the operation and connection of audio equipment. The popular argument against jacks, already mentioned, can be made totally invalid with proper labelling of input and output sockets—labelling which is indeed to be found on all tape equipment. The fact that more than one ingoing and outgoing signal can be passed through the same plug and socket is hardly more than a gimmick in support of DIN. The fact that only one signal passes through one jack connection is the very point that has made it acceptable in professional fields, not to say the domestic recording world, since the operator is perfectly sure of what is connected to what. Leave the colour codes to resistors and capacitors. It should not be necessary to carry a chart just for the sake of wiring a plug.

While the DIN system may be ideal for the Continent where it is found on all equipment, it does not seem so well suited to this country, much of our market being filled with imported equipment, such as from America and Japan, fitted with jacks. These opinions are, of course, based on our own experience and we would welcome readers' comments on the connection controversy.

**APRIL 1965 . VOLUME 7 . NUMBER 3**



**COVER PICTURE**

The static motion of a *Weisskehlamazilie* in flight is captured on this month's cover photograph, for which we are indebted to *Grundig*. Bird recording is an art discussed in a two-part series in this issue. Just as amazing is the art of bird photography; this shot was taken with a stroboscopic flashlight, each flash lasting one-hundred-thousandth of a second.


**SUBSCRIPTION RATES**

Annual subscription rates to *Tape Recorder* and its associated magazine *Hi-Fi News* are each 30s. in the U.K. and 32s. 6d. overseas (U.S.A. $4.50) from Link House Publications Ltd., Dingwall Avenue, Croydon, Surrey.

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




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# world of tape

### BRITISH TAPE RECORDING CONTEST

FOR the first time since its foundation in 1957, the *British Amateur Tape Recording Contest* has relinquished *Amateur* from its title and been expanded to cover entries from professional recording engineers.

Three categories of entry fulfil the obvious need for revised judging technique, recordists with less than one year's experience being classed as 'Novices' and non-professionals who have owned a recorder for more than a year being 'Amateurs'. Schools and clubs are also welcomed under the same conditions of entry.

Any type of recording at any speed may be submitted, though care must be taken not to infringe Copyright regulations. Copyright material may be included if written authority is first obtained.

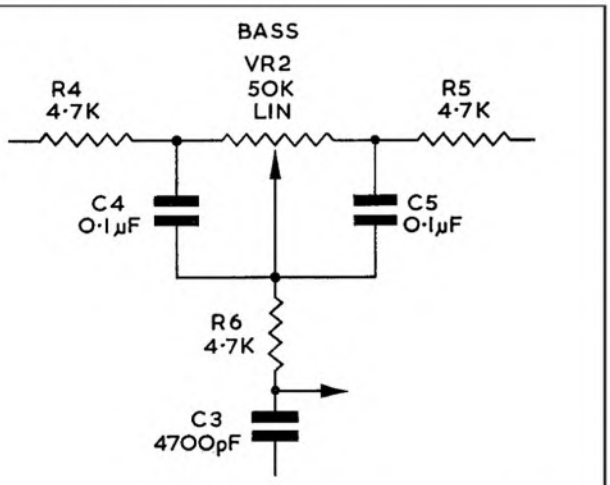
The Contest is sponsored by eight tape manufacturers: *Agfa*, *BASF*, *EMI*, *Kodak*, *MSS*, *3M*, *Philips* and *Ilford-Zonal*. Further details and entry form may be obtained from: **B.T.R.C., 42 Manchester Street, London, W.1.**

### SONY/B & O DISTRIBUTION

RE-ARRANGEMENTS in distribution of *Sony* and *Bang & Olufson* products have resulted in a change of name for St. Aldate Warehouse Ltd. The company is now known as *Debenhams Electrical & Radio Distribution Ltd.* All enquiries regarding these products should be addressed to them at Eastbrook Road, Eastern Avenue, Gloucester.

### CORRECTION TO THE MIXER

AN error appeared in the circuit **fig. 2** of the article *A Comprehensive Mixer* on page 25 of the January issue. The position of R6 (4.7K) should be as shown below. We apologise for the mistake and hope no great inconvenience was caused.




### AUDIO FAIR TICKETS

TICKETS for the 1965 *International Audio Festival and Fair*, to be held at the Hotel Russell from 22nd to 25th April, are now obtainable from the editorial office. It is important that a note stating the number of tickets required and a stamped addressed envelope be included with such requests.

## NEXT MONTH

TAPE AT THE AUDIO FAIR will be the subject of a preview in the May issue, to be published on 14th April. Robert Kendal will describe the way three writers use tape recorders to aid their literary talents, and the domestic recording scene in the Soviet Union will be detailed by Leonid Sambek. Alec Tutchings reviews the Sony TC 500, while Michael Jack describes the trials and tribulations of organ recording.

### MANUFACTURERS' COMMENT ON THE GRAMPIAN REVIEW

THE following comments have been received from Grampian Reproducers Ltd. answering points raised in the review of the Grampian Reverberation Unit, which appeared in the March issue:

'(1) The bass loss shown in the reviewer's "direct path curve" is most likely due to feeding the 10mV Auxiliary input from a low impedance source. In practice this input would be used with high impedance sources approaching the matching impedance of 50K ohms. Under these conditions the bass loss mentioned would be negligible. This limitation does not apply to the 500mV Auxiliary input which gives a level response independent of source impedance.

'(2) The socket for connection of a remote switch to control the reverberation signal is provided on all our reverberation units. The facility available "to special order" referred to in the Editorial note is in fact the provision of a switch to control the *direct* path signal as suggested by the reviewer. This feature has been found useful for "hidden speaker" effects suggested and was in fact used in this manner at the last Audio Fair by a well-known loudspeaker manufacturer. It is also desirable in conjunction with many professional mixing consoles and many units have been supplied with this facility. A word of caution, however; when the unit is used alone with no direct path, the subjective effect is unpleasant and of little practical use.'

### RECORDING COMPETITION BETWEEN YOUTH CLUBS

THE National Association of Youth Clubs is currently organising a recording contest among its 3,160 member clubs, all of which are believed to have access to a tape recorder. The contest is sponsored by *Emitape* and will be judged in the Autumn. Tapes must be of no longer than ten minutes duration, recorded at 3¾ i/s. Three recording topics have been chosen: An interview with an 'unforgettable personality', a sound picture of a youth club suitable for sending to an overseas contemporary and a ten-minute 'radio spread' showing the use to which such broadcasting time would be put if allotted to a club.

### 1965 AUDIO FAIR EXHIBITORS

| Exhibitor | Booth | Dem. Room | Lounge | Trade Name |
|---|---|---|---|---|
| Acoustical Manufacturing Co. Ltd. | 65 | 404 | — | Quad |
| Agfa Ltd. | 33 | 218 | — | Agfa |
| Akustiche U Kino-Gerate GMBH | 51 | 304 | — | AKG |
| Ampex Great Britain Ltd. | 15 | 121 | — | Ampex |
| Armstrong Audio Ltd. | 52 | 347 | — | Armstrong |
| Audio Dynamics Corporation | 37 | 321 | — | A.D.C. |
| B.A.S.F. Chemicals Ltd. | 28 | 312 | — | B.A.S.F. |
| Beyer Elektrotechnische Fabrik | 10 | 413 | — | Beyer |
| BMB Sales Ltd. | 48 | — | — | BMB |
| Boosey and Hawkes Ltd. | 55 | 117 | — | Jordan-Watts |
| Braun A. G. | 22 | 311 | — | Braun |
| Brenell Engineering Co. Ltd. | 12 | 337 | — | Brenell |
| S. G. Brown Ltd. | 73 | 320 | — | Brown |
| Celestion Ltd. | 46 | 242 | — | Celestion |
| Clarke and Smith Mfg. Co. Ltd. | 35 | 120 | — | Clarke and Smith |
| Decca Radio and Television Ltd. | 31 | 236 | — | Decca Radio |
| Decca Record Co. Ltd. | 23 | 235 | — | Decca Record |
| Denham and Morley Ltd. | 42 | 220 | — | Butoba |
| Derritron Radio Ltd. | 71 | 318 | — | Chapman |
| Design Furniture Ltd. | 45 | 442 | — | Design Furniture |
| Dual Electronics Ltd. | 66 | 415 | — | Dual |
| E.M.I. Tape Ltd. | 24 | 348 | — | E.M.I. |
| Elcom (Northampton) Ltd. | 6 | 215 | — | Elcom |
| Electroimpex Hungarian Trading Co. | 43 | 221 | — | Qualiton |
| Fane Acoustics Ltd. | 38 | 314 | — | Fane Acoustics |
| Ferrograph Co. Ltd. | 61 | 147 | — | Ferrograph |
| Fi-Cord International | 11 | 412 | — | Fi-Cord |
| N. & S. B. Field and Co. Ltd. | 21 | 447 | — | Record Housing |
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(*continued overleaf*)



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|---|---|---|
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| 5¾in. | 1800ft. | 25/3 |
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| | | |
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| General Gramophone Publications Ltd. | — | — | 446 | The Gramophone |
| G.K.D. Ltd | 26 | 115 | — | G.K.D. |
| Goldring Mfg. Co. (Gt. Britain) | 41 | 334 | — | Goldring |
| Goodmans Industries Ltd. | 68 | 249 | — | Goodmans |
| Grampian Reproducers Ltd. | 54 | 302 | — | Grampian |
| C. E. Hammond and Co. Ltd. | 14 | 112 | — | Hammond |
| Hanson Books Ltd. | 74 | — | — | Records and Recording |
| Haymarket Press Ltd. | 50 | — | — | Amateur Tape Recording |
| Ilford Ltd. | 62 | 113 | — | Ilford |
| Iliffe Electrical Publications Ltd. | 1 | — | — | Wireless World, Wireless Elect. Trader |
| K.E.F. Electronics Ltd. | 36 | 322 | — | K.E.F. |
| Kelly Speakers | 32 | 231 | — | Kelly |
| Kodak Ltd. | 59 | 248 | — | Kodak |
| H. J. Leak and Co. Ltd. | 69 | 448 | — | Leak |
| Link House Publications Ltd. | 39 | — | — | Hi-Fi News and Tape Recorder |
| Loewe-Opta AG | 40 | 118 | — | Loewe-Opta |
| Long Playing Record Library | — | — | 155 | Long Playing Record Lib. |
| Lowther Manufacturing Co. | 29 | 234 | — | Lowther |
| Lustraphone Ltd. | 16 | 342 | — | Lustraphone |
| Mallory Batteries Ltd. | 19A | — | — | Mallory |
| Metro-Sound Mfg. Co. Ltd. | 2A | 114 | — | Sonotone |
| Minnesota Mining and Mfg. Co. Ltd. | 58 | 420 | — | Scotch |
| M.S.S. Recording Co. Ltd. | 9 | — | — | M.S.S. |
| Mullard Ltd. | 19 | 211 | — | Mullard |
| Ortofon A/S | 3A | 217 | — | Ortofon |
| Peto-Scott Ltd. | — | 152 | — | Peto-Scott |
| Philips Electrical Ltd. | 8 | 149 | — | Philips |
| Planet Projects Ltd. | 30 | 313 | — | Planet |
| Print and Press Services Ltd. | — | — | 244 | Tape Recording Magazine |
| Pullin Photographic Ltd. | 25 | 214 | — | Akai |
| Pye Ltd. | 56 | 402 | — | Pye |
| Radford Electronics Ltd. | 5 | 122 | — | Radford |
| Reslo-Sound Ltd. | 70 | — | — | Reslo |
| Revox-Studer | 72 | 417 | — | Revox-Studer |
| Rogers Developments Ltd. | 44 | 111 | — | Rogers |
| Saba Electronics Ltd. | 47 | 212 | — | Saba |
| Scandinavian Radio and TV Co. | 13 | — | — | S.R.T. |
| H. H. Scott Inc. | 17 | — | — | Scott |
| Shure Electronics Ltd. | 64 | 349 | — | Shure |
| S.M.E. Ltd | 57 | — | — | S.M.E. |
| Sony Copn. of Japan | 49 | 315 | — | Sony |
| Standard Telephones and Cables Ltd. | 3 | — | — | S.T.C. |
| A. R. Sugden and Co. Ltd. | 34 | 144 | — | Connoisseur |
| Svenska Hogtalfabriken | 1A | — | — | Svenska Hog. |
| Tandbergs Radiofabrikk A-S | 18 | 222 | — | Tandberg |
| Tannoy Products Ltd. | 63 | 411 | — | Tannoy |
| Thorens S.A. | 4A | — | — | Thorens |
| Truvox Ltd. | 2 | 202 | — | Truvox |
| Vortexion Ltd. | 27 | 204 | — | Vortexion |
| Welmec Corporation Ltd. | 7 | 237 | — | Telefunken |
| Wharfedale Wireless Works Ltd. | 53 | 247 | — | Wharfedale |
| Whiteley Electrical Radio Co. | 60 | 449 | — | Whiteley |
| K. H. Williman and Co. Ltd. | — | — | 246 | Williman |
| Wilmex Ltd. | — | — | 153 | Wilmex |
| Wilson Stereo Library Ltd. | — | — | 154 | Wilson Stereo Library |
| Winter Trading Co. Ltd. | 20 | 111 | — | Trio |



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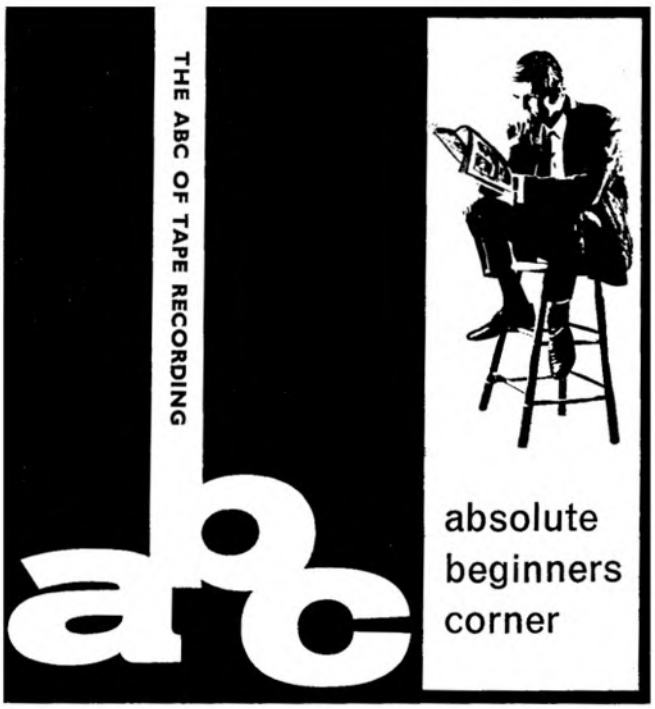


# BUYING A TAPE RECORDER

## PART ONE BY DAVID KIRK

THERE are no less than 200 different tape recorders on sale in Britain. Choosing from this vast array can be a difficult task unless one can narrow the field of purchase by deciding on a suitable price and specification. Price is really no problem. Just as one cannot buy a motor vehicle for £10 and expect it to work efficiently, so it would be foolish to expect a reliable tape recorder to cost £5.

The tape recorder comes in four price categories. Between £4 and £20 will buy little more than a toy, although a few manufacturers are now producing recorders built round the popular *BSR Monardeck* which give very good value for a comparatively small outlay. From £20 to £80 will buy what is aptly called a 'domestic' recorder—domesticated in the sense that it looks pretty, is simple to use, cannot be dismantled without special tools and will not impart an electric shock to innocent fingers.

### LIMITED LIFETIME

Domestic tape recorders can be bought for as much as £200 and they often provide good service for a period of several years. But if unlimited funds are available, the 'semi-professional' recorder ranks as 'best buy'. The 'semi' makes way more and more for the 'professional' until, on arrival at the £500 mark, a species of tape recorder unique to the broadcasting and recording studio is found. 'Professional' equipment—as meaningless a piece of terminology as one is ever likely to find—earns its keep merely by working as perfectly as is possible within contemporary technological standards. Everything is sacrificed to perfection, making the Professional recorder very expensive to run—with its huge appetite for tape—and very unsuitable, in terms of size, for domestic surroundings.

In the first of this series for beginners it is intended to introduce the basic language of the 'specification' with a view to helping the prospective purchaser of a tape recorder to understand sales literature. Since most beginners will already own a recorder, it is hoped to perform the double task of helping the owner along the short, straight road to understanding technical terminology.

We begin, then, with the *Manufacturer's Specification.* A typical sales leaflet will include the following factual statements, a suitable figure given beside each: Tape Speed, Wow and flutter, Output power, Frequency response, Signal-to-noise ratio, Input impedance, and finally Price.

These technical terms are not solely designed to attract admiration from the uninformed buyer. They also serve the purpose of showing standards of mechanical and electrical performance, the recorder with the 'best' figures for a given price offering the greatest value. It is initially advisable, therefore, to know the way in which these measurements are taken.

### SINGLE SPEED

Tape speed, the speed at which the tape passes the recording heads, is measured in inches-per-second (i/s). Many machines nowadays employ the single speed of 3¾ i/s, though some offer 1⅞ i/s and an even smaller percentage also run at 7½ i/s. Although some designers have been able to achieve remarkably good reproduction at 3¾ i/s, it is wise to remember the basic rule that the faster the speed, the better the quality. In the early days of tape recording (during the late 1930's) speeds of 30 and 60 i/s were commonplace. Nowadays, however, even the BBC rarely go above 15 i/s for broadcast recording and much of their equipment operates at 7½ i/s. If it is planned to enter the hi-fi field at some future date, 7½ i/s can be considered an essential speed; 3¾ i/s will suffice for speech and, depending on the machine chosen, light music.

When a manufacturer says his product operates at, say, 3¾ i/s, one can be sure that this statement is true within about ⅛ i/s. Threading a single tape from one recorder to another, leaving a certain amount of slack in between the two capstans, is the easiest way of showing basic speed variations from machine to machine. The problem of differing speeds only becomes troublesome when tapes are recorded on one machine and played on another. It would be interesting to know how many 'tape-correspondents' have a completely wrong impression of

(*continued on page* 105)

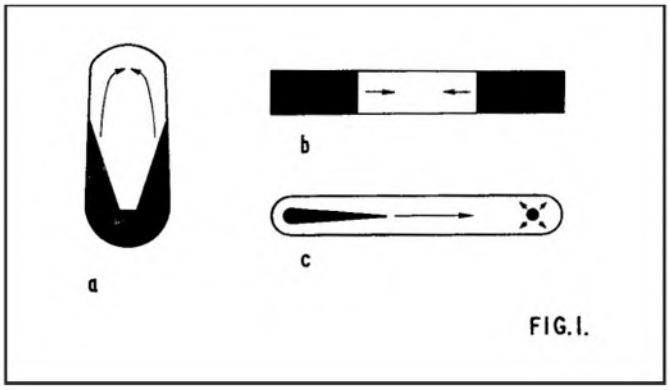


FIG. I.



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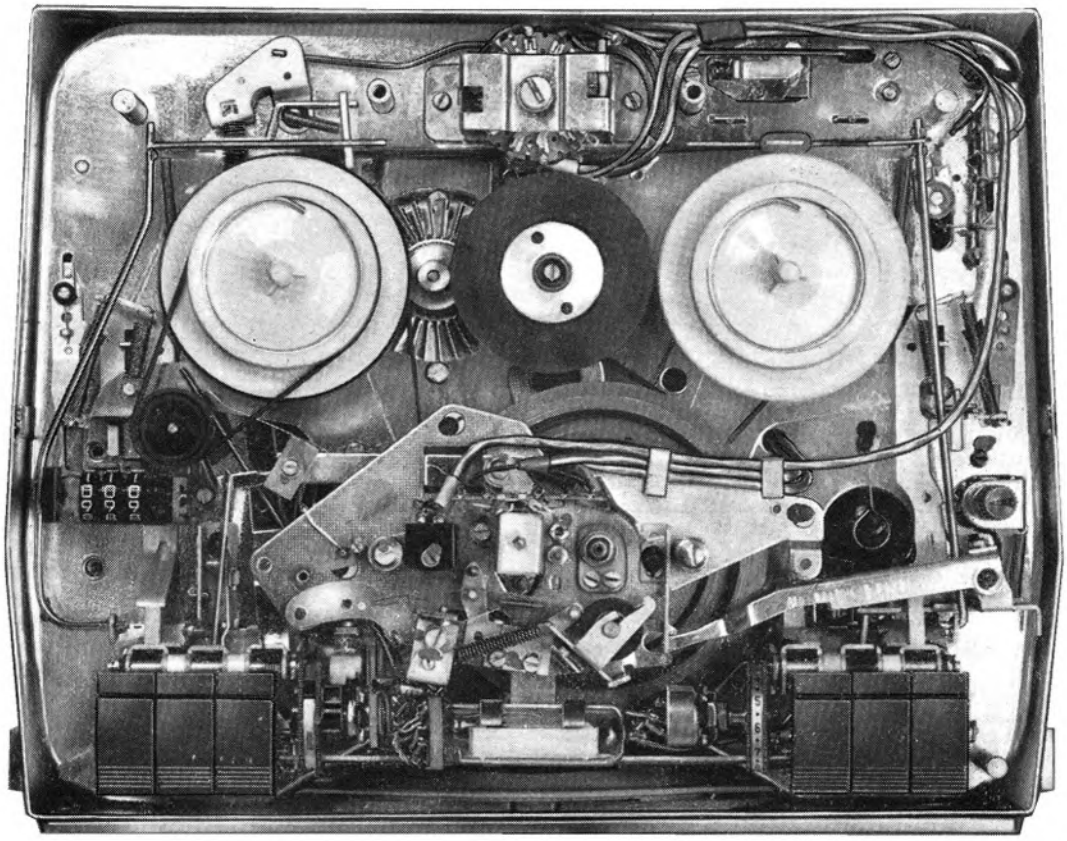

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each other as a result of variations in the pitch of their voice when widely inaccurate playing speeds are used. Generally, the effect is more noticeable on a known voice than on music.

Akin to tape speed inconsistency, indeed often confused with it, is the phenomena of *wow and flutter*. All rotating or moving parts in a tape recorder, or gramophone turntable, have a tendency—great or small—to fluctuate in speed. This fluctuation is discernible as a variation in pitch when a tape is played on a defective machine. The less well made the deck, the poorer the balance of rotating parts and the larger the variations in friction; consequently there are more speed fluctuations. Similarly, the cheaper the motor(s), the more 'tug and pull' due to pole pieces is likely to make itself known to the listener. A rapid deviation from the basic speed is inclined to give a piano, for example, a tremolo shimmering effect. It is easy to understand, when this is first heard, why the name 'flutter' is applied. By the same logic, 'wow' is a much slower and much more noticeable speed fluctuations. Whereas an experienced ear is needed to detect low quantities of flutter, wow is audible to the rawest tyro.

### DAMAGED COMPONENTS

It is important to listen for a regular and rapid wow when buying from a non-specialist-audio-cum-washing-machine dealer. This type of retailer is singularly fond of switching the machines on display in his window to the PLAY or FAST WIND position. The recorders are not, of course, actually running, but every rubber idler, pulley and spring is tensioned against solid metal. After a few hours in this position 'flats' are worn into the rubber and the manufacturers' careful grinding and lathework is ruined. *Never* buy a shop-soiled or 'reduced' recorder from a non-specialist dealer—he has no reason to feel a moral obligation towards his customer.

Wow and flutter, although essentially two different things, are measured as a combined percentage variation from the basic tape speed.

A machine with ±100% wow and flutter would obviously be continuously stopping and doubling in speed while ±50% would rapidly rise and fall between 1½ and a half the speed of measurement. Figures of this magnitude are never (to my knowledge!) met with in practice and are only given to illustrate a point. Normally, a domestic recorder can be expected to remain within 1% peak-to-peak of 3¾ i/s, a slightly greater percentage being permissible at 1⅞ i/s, following the rule of quality deteriorating with speed. The words 'peak-to-peak' indicate simply that the stated percentage is the difference between the fastest and slowest 'peaks' of speed variation.

### 'COOKED' SPECIFICATION

Should the letters 'RMS' appear after the percentage, one has the first faint suggestion that the entire specification may be 'cooked'. The most useful way of showing wow and flutter, from the purchaser's viewpoint, is the 'peak' value—half the figure of the peak-to-peak percentage. This value is the percentage variation from the given tape speed—no more and no less. But the RMS value is 0.707 (roughly two-thirds) of the peak value. Thus a lower figure can be quoted for a given wow and flutter level by taking the RMS, to the manufacturer's advantage when a non-technical person peruses his specification. The RMS figure provides the more-or-less average departure from playing speed during a given time, but a huge instantaneous deviation from true speed, accompanied by an otherwise low level of flutter, might only register as a slight deterioration of the RMS level.

From the tape transport mechanism we move to the amplifiers; note the plural, a mono tape recorder incorporates at least two amplifying networks, the *record* and the *playback* circuits. *Frequency response* is the publicity man's favourite pair of words. This is the amplifiers' response (or reaction) to certain audio frequencies. All sound is composed of rapid vibration: in the violin, guitar, 'cello and piano it is a taut wire that vibrates, the motive force coming, respectively, from scraping, plucking, scraping again, and hammering. In the trumpet, accordion and pipe organ, air is forced through vibrating reeds or tubes. The electronic organ feeds a loudspeaker with electrical vibrations from an audio oscillator.

Having converted the acoustic vibrations into electrical ones (via a microphone) they are fed through a conglomeration of valves, resistors, capacitors and transformers, by which they are amplified, before being converted into magnetic 'vibrations' by the tape head. This conglomeration is quite happy to amplify signals within a certain range of frequencies, but functions less efficiently with relatively high or low audible frequencies. Thus some sounds, or components of sounds, become amplified more than others. The amplifier's partiality for certain frequencies often means the upper and lower limits of the audio range are not reproduced with any useable volume: the tingling triangle and the snaredrums, with the double-bass and the bass-drum, are invariably degraded on domestic tape recorders—to the annoyance of the music lover. The better the amplifier, the wider its 'palate' for audio frequencies. Microphones, tape heads, tape and even the direct-recording lead, have similar preferences for certain frequencies. The wider the frequency range over which this chain of components will operate—the better the reproduction. A cheap recorder may have such a poor frequency response that it is little better in quality than a transistor radio.

### RANGE AND RESPONSE

It will be noticed that both frequency *range* and frequency *response* have been mentioned. If the frequency *range* of an electronic device is given as *a* c/s to *b* Kc/s, then these are the lower and upper limits beyond which the unit will not operate. Should these figures be qualified by the addition of a relative signal level (measured in decibels), we then have the frequency *response*. The frequency band over which the response is 'flat' (i.e., equal amplification is given to all

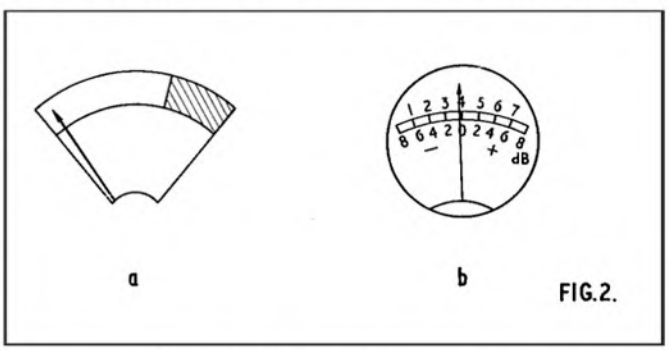

FIG.2.

frequencies within the band) is likely to be considerably narrower than the total frequency range.

Next on our list is the *modulation indicator*. This is a vital instrument without which one would be unable to tell whether the tape was being overloaded or under-recorded. There are two basic types of indicator—the luminous-anode valve (magic-eye) and the meter. Recording level meters and their associated circuitry can be made to indicate two different components in an audio signal. These are termed the VU-meter (Volume Unit) and the PPM (Peak Programme Meter.) VU-meters (and the circuits that drive them) are quite cheap to manufacture and have recently become popular with manufacturers of domestic tape recorders. A properly designed VU-meter should show the average volume level of the sound being recorded. In practice, however, even the best VU's fail to do this, the movement of their pointer depending, not only on volume, but on frequency and 'subject material'. Experiments by the BBC have shown that a professional VU-meter calibrated to one speaker's voice can react quite differently to another. Since this is an unforgivable fault in a component designed to measure distortion level, the BBC make use of the rather more expensive peak programme meter. This is a highly sensitive device, the pointer of which changes its position in accordance with the maximum level of a sound signal. It has a very short 'rise time', responding to sharp bursts of sound (peaks) which would scarcely cause the VU-meter to move. A VU-meter is quite sluggish in rising and falling since it follows the average sound level.

(*continued on page* 107)



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continued

Messrs. *Tandberg* are one of the few manufacturers of high quality equipment who have had the courage to retain luminous-anode indicators on their recorders—some of which sell for over £100. Incorporated in the first machines designed for the domestic market, the 'magic eye', as it is reverently termed, follows the principle used in the PPM of indicating peak signal level. They are much cheaper to produce than PPM's but are often more efficient at their job, having no mechanical resistance to movement to overcome.

All three magic eyes shown in **fig. 1** use the same general principle as a television tube. Electrons emitted by a heated cathode are hurled towards a positively charged anode plate, 'focused' by a grid. On striking the phosphor-coated anode, the energy in each electron is given off as light—the *position* of the light source depending on the voltage at the grid. **Fig. 1(b)** shows the most common magic eye: two shaded areas representing the glowing 'pointers'. The latter move together to-and-from the centre of the eye and are normally aligned to indicate the onset of distortion when the beams clash. Slightly lower on the list of popularity is the eye shown in **fig. 1(a).** On this model distortion occurs when the beams clash at the top of the indicator. This type of eye can also be found on a wide range of FM radio receivers, where it is employed to assist tuning. Only one moving beam is used in the 'exclamation mark' eye of **fig. 1(c),** the right-hand spot remaining stationary, but varying in brilliance. The first type of eye to find regular use in the domestic field, the 'exclamation mark' is comparatively dim and sluggish; in practice, distortion was generally aligned to begin long before the beams clashed.

Perhaps through the subconscious influence of my dislike of VU systems, I have omitted to mention the display calibration used for domestic units. It would seem logical from **fig. 2(a),** which shows a typical domestic VU, that correct recording level was being attained when the pointer scanned the unshaded graduation, only occasionally passing into the shaded area. In practice, however, this could lead to a very high level of distortion since the peaks (momentary jumps in volume) will continually be moving above the distortion level. The effective range of the VU-meter is reduced to a mere $\frac{3}{16}$in. in some cases, while the miniature meters found on cheap battery recorders sometimes are really worse than useless—even detracting from efficient guesswork.

Few recorders outside the professional category incorporate peak-programme meters; *Reps*, *Brenell* and *Ferrograph* are three of the few semi-professional brands currently doing so. Whereas the sensitive magic-eye attempts to follow every peak and trough in the volume contour, the PPM registers only peaks, depending on the programme material. **Fig. 2(b)** shows the layout of the PPM face, which is calibrated in decibels (dB) above and below the distortion sector, which is designated zero.

### COMPARATIVE SPECIFICATIONS

These, then, are some of the more important points to be considered when purchasing a tape recorder. Do not be fooled by over-impressive specifications when they are applied to domestic equipment. Such publications as the *Hi-Fi Yearbook* reveal many cheap recorders claiming performance equal or superior to equipment in the professional price bracket. Take, for example, the machine listed at just under £280, claiming a frequency response of 50 c/s to 10 Kc/s ±2dB and wow and flutter of 0.25% at 7½ i/s. This compares most unfavourably with another machine costing a few shillings over £30, which claims a frequency response from 70 c/s to 12 Kc/s ±3dB and wow and flutter of 0.15% at 7½ i/s. The manufacturers of the latter model also list two more of their recorders, using the same mass-produced tape deck, as having *different* wow and flutter levels. No publicity man worth his salt would make slips like this—but why not leave it to a more technically informed employee to cook the specificational books? Perhaps the firm does not have any!

Next month we shall examine the basic layout of the tape recorder and the principles by which it operates.

# PRINTER'S ERROR

BY H. W. HELLYER

THE trouble is, we don't know when we are well off. The pundits tell us that printed circuits are a great advance on old-fashioned hand-wiring. They give us, so we are assured, much more reliability and a considerable reduction in cost.

On the second score there is little to be said. As a mere engineer, I am not able to argue without my book of matches, but some ardent economist would no doubt refute my cynical argument that any saving that accrues is more likely to augment the profits than cut the price—except in the case of the multi-million, mass-produced tape recorder. In these cases, the vicious wind of competition helps to keep the price down, and printed circuits have certainly enabled us to have many cheaper, 'popular' models that we would otherwise never have seen. Hence, we have possibly recruited a few enthusiasts to the ranks via their pop model introduction to the art. As the Editor commented in the rather disgruntled opening to the December 1964 issue of *Tape Recorder*, quite good tapes can be made with even a modest machine.

### DIFFERENT PROBLEM

But on the first score a very different problem may be posed. Is reliability really improved? And, come to that, what do we mean by reliability?

Those pundits we quoted above will tell us that reliability means the machine will work for a longer time without deterioration or failure. This may be true of the satellite, or the mysterious chunks of defence (sic) electronics that proliferate about us. Presumably, a very high standard of construction and test is applied. It can hardly be true of the printed panel with flimsy fixing clamps or bolts, extremely thin and ill-bonded plating or 'wiring' and components of barely sufficient tolerance.

The point seems to be that no comparable advance in techniques has been made in component ratings. Far too often, capacitors get 'leaky', or open-circuit at the lead-out wires, and resistors overheat and go 'high', even under apparently normal conditions. More often, design parameters are so fine-cut that component tolerances teeter on the brink of failure.

Given that the printed circuit panel has a reliability 'life' factor in direct proportion to the quality of components and efficiency of design, what of when parts break down? Bang goes not only the reliability factor but also the temper of the poor bloke who has to test and repair. Some manufacturers are kind to us, providing not only circuits, but also layout drawings and a 'see-through' reproduction of the printed panel. Even more helpful is the panel which bears coded references to the circuit, and even test points.

### GINGERLY SOLDERED

Yet the problem of replacing parts still exists, and even more annoying, the problem of being unable to disconnect a component to make a test without the possibility of destroying it. Usually, one unsolders the one end gingerly and prises, waiting for the ominous 'crack'. Then the spares box is ransacked for a similar part, and this, when triumphantly discovered, is seen to be about three times too big. Hence some of those mended machines that look rather like an old Christmas tree, with parts hanging precariously from the panel. Neither the problem of test, nor replacement arises with the conventional 'hand-wired' circuit.

It is perhaps significant that one of the largest USA television manufacturers—ironically, a pioneer of printed circuitry—came out brazenly with an advertising slogan a couple of years ago, "All circuits wired by hand".



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THE signal voltage induced across the winding of a replay head has an amplitude that is proportional to the dimensions of the pole piece and the length of the gap. The signal amplitude, of course, is also proportional to the depth of the recorded material. That is, proportional to the strength of the magnets recorded upon the tape. The greater the strength of these magnets and the larger the dimensions of the replay head, the greater will be the amplitude of the signal across the winding.

From this, it follows that a single-track recording would give a somewhat greater replay head signal than, say, a ½-track recording of

Since the overall length of these two magnets is equal to the recorded wavelength of the audio signal, it follows that length here is a maior parameter of signal information. That is, indeed, true, as the length decreases with increase in frequency.

This is straightforward basic theory with which we are probably conversant. The important aspect so far as this article is concerned, however, is that the *width* of the recorded magnets carries no audio information. The basic audio signal pattern is essentially unaffected by the width of the magnets. From this point of view, therefore, the tape could be divided into any number of tracks and still carry isolated

# TOWARDS BETTER TAPING · PART 13 · BY GORDON J. KING

# MERITS OF MULTI-TRACK RECORDING

similar recorded level, other things being equal. A ¼-track recording would give an even smaller replay head signal under similar conditions.

The reason for this is that the voltage induced across the head winding is directly related to the number of lines of magnetic force that cut the head pole pieces and thus the winding. Here we have the basic dynamo principle where the armature winding is caused to cut the lines of force of a magnet or where the lines of force of the magnet are caused to cut the armature winding. The greater the number of flux lines that cut each turn of the winding, the greater the output voltage. This means, then, that the output voltage can be stepped up by (a) increasing the strength of the magnet and (b) increasing the number of turns of the winding.

### SPECIFIC VALUE

The winding of a replay head is designed to provide a specific value of impedance, of course, but a high impedance head has a greater number of turns on its winding than a low impedance head, and it is for this reason that a high impedance head always gives a higher signal voltage output than a head of low impedance. In practice, the signal from a low impedance head is generally stepped up by a matching transformer possessing a step-up ratio from the head to the input of the amplifier, but this is another story.

Now, when a tape is recorded, the record head imparts upon the oxide surface of the tape two magnets for each full-cycle of signal, as shown in **fig. 1.** This happens because when the current in the head winding rises, say, on the positive half-cycle of signal, the head pole pieces either side of the gap become polarised magnetically as shown in the drawing, while on the subsequent half-cycle the polarity reverses.

Thus, while the polarity of the pole pieces is alternating, the tape is passing the gap and magnets of north-south, north-south and so on are produced on the tape.

information, provided heads are available to handle the small-width magnets.

Nevertheless, the width of the recorded magnets is important so far as signal noise ratio and signal output voltage are concerned. **Fig. 1** shows that the tape magnets are truly representative of the classic bar magnet. A bar magnet produces lines of force in a pattern similar to those depicted in **fig. 2.** The dimensions of such lines of force is governed, as we have already seen, on the strength of the magnet, and the strength of magnetism that can be imparted to a piece of magnetic material is considerably dependent upon the dimensions of that material.

Since the magnetising field so far as tape is concerned emanates from the pole pieces across the head gap, it follows that the greater the length of the gap (i.e., the wider the track), the greater will be the strength of the magnetism imparted to the tape.

Clearly, then, a single-track fully-recorded tape will give considerably more replay head voltage than a fully-recorded ½- or ¼-track tape. This is simply because on playback the wider track will result in a greater number of lines of magnetic force cutting the head pole pieces than a narrower track recording. We have thus arrived back to where we started from.

### STRONG SIGNAL DESIRABLE

It is always desirable to secure as much replay head signal as possible so as to obtain the best signal/noise ratio. A large head signal means that the tape and circuit noises are adequately masked, thereby improving the signal/noise ratio. Last month we saw that the head signal can be increased by increasing the intensity of the recording. This, of course, can only be taken up to a certain level, after which distortion rises badly. The solution, then, is to employ as wide a track as possible. Half-track recordings give excellent results on both professional and domestic type equipment, as is very well known, but



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there is no doubt that full-track recording has the edge on ½-track, the reason, of course, why it is adopted by broadcast and super-professional operators.

Quarter-track recording can also give very good results, but from the foregoing discussion we can see why this style of tape recording can never be really as good as full and ½-track recordings.

This, then, brings us to the question of the so-called "compatibility" aspect of ¼-track recorders. Compatibility in this context refers to the ability of this type of machine to play ½-track stereo or mono tape records. **Fig. 3** shows at **(a)** the gap of a mono ½-track head relative to a ½-track (shaded) and at **(b)** the two gaps of a ¼-track head relative to the same ½-track tape.

**(b)** shows that the gaps in the ¼-track head line-up with the two ½-tracks of the tape, and it is here that the feature of compatibility is displayed. The gaps of the ¼-track head embrace just a little less than a half of ½-track width. We have seen that from the signal aspect this

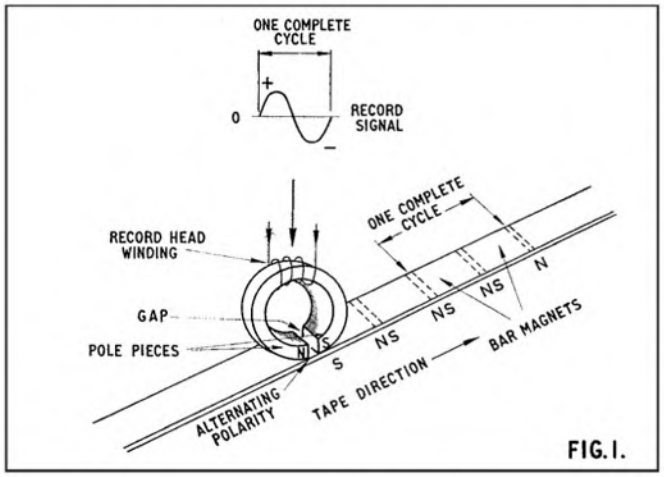

FIG. 1.

is not highly important, for the signal information is complete even over a fraction of the width of the recorded track.

We will now understand, of course, that the effect of the shorter gap covering only a portion of the recorded area will be a lower amplitude head signal because only the corresponding portion of the available recorded magnetic field will be cut by the head pole pieces as the tape passes the gap on playback.

Many tape enthusiasts are disappointed with the relatively poor reproduction that is obtained by playing a ½-track recording on a ¼-track machine. To secure a reasonable playback volume under such conditions greater amplification is required—calling for a more advanced setting on the playback volume control—and this tends to accentuate whatever inherent noise there is present in the playback amplifier of the recorder and on the tape itself. In other words, the signal/noise ratio suffers, as we have already seen.

## REAPPRAISAL OF DESIGN

There is not a great deal that can be done about this, for to improve the playback signal/noise ratio would certainly call for a reappraisal of the design of the first amplifier stage. Moreover, a ½-track head working in conjunction with a ½-track tape record is less likely to reveal tape irregularities and dropouts, because with a ¼-track head there is only half the chance of masking such shortcomings !

Early recorders of the ¼-track variety were more prone to the shortcomings referred to above. With the progressive improvement in both equipment and tape, ¼-track recording nowadays can produce quite good results; but if the same improvements are afforded to ½-track machines, then with ½-track recording one still cannot achieve the same standard of quality as obtainable from ½-track recording. Nevertheless, there is a great deal to be said for ¼-track recording in terms of tape economy and for the versatility of the ¼-track machine itself.

One big advantage of the four-track machine is the extra head facility. A ½-track recorder usually has just a single head and winding, for this is all that is necessary to cover half the tape at a time. A ¼-track machine, however, has two head sections and separate windings and

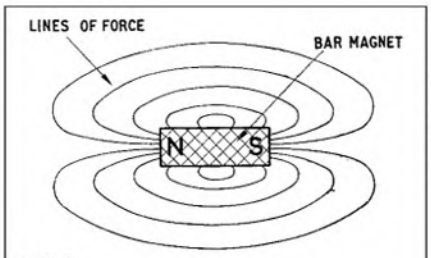

FIG. 2.

*Diagrammatic representation of force field surrounding a bar magnet*

for normal mono applications only one head is in use at a time. This means that the other head is available for either recording or playing back simultaneously on a second track. Let us see just what can be done in this respect.

On many ¼-track machines the replay head not in use at the time is either terminated across a socket or connected in parallel with the head in use by means of the track selector switch (some machines have a position which puts both heads in parallel) or on machines with press-button track selection by depressing two keys at once. This method of parallel connection means that the output from two tracks can be applied simultaneously to the playback amplifier.

## POPULAR EXPLOITATION

A popular exploitation of this facility relates to the combining of, say. the music on one track with a home-recorded vocal on the other track or sound effects on one track with speech or drama on the other track. The output from the speaker is then a combination of the two recordings. This is worked in practice by making the main recording first on one track, running the tape back to the start of this recording, switching to the second track and then on that track recording the material it is required to combine with the main recording. The tape is then again run back to the start of the recordings and, with the machine switched to "playback", either one of the recordings or

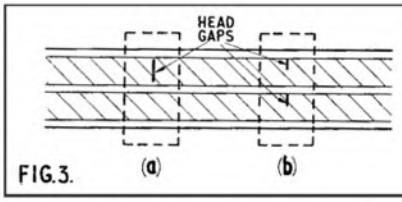

FIG. 3.

*Half and quarter-track heads relative to half-track scan.*

both of them together can be reproduced, depending upon the setting of the track selector switch.

Here, then, we have a much more sophisticated method of super-imposition. Each recording can be made under optimum conditions and two are effectively mixed at the input of the replay amplifier.

Moreover, with this method it is possible to monitor one track while the other track is being recorded. This is accomplished by utilising the head not in use during the time that the second recording is being made to monitor the first recording! This generally means that a small preamplifier has to be connected to the head in use to monitor the first recording so as to lift the weak head signal sufficiently to work a pair of headphones or stethoscope earphones.

The first recording can then be clearly heard. If this is background music, say, for a vocal, then the vocalist will have no difficulty in achieving perfect synchronism, a factor which can cause quite a problem when such an exercise is attempted by simple superimposition. Incidentally, this is the basic technique adopted by professionals for multiple instrumental recordings and for self-sung duets.

Small transistorised preamplifiers are available commercially for the job of stepping up the weak head signal. The output is sufficient to work a pair of headphones, as mentioned, or for driving a hi-fi amplifier or even for connecting to the pickup sockets of a radiogram or radio set. It is by no means outside the scope of the enthusiast to build a preamplifier of this kind at home, and it is hoped next month to provide details of such a project, along with more information towards better ¼-track recording.



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## TECHNICAL NOTES

**Perspective**

(*Scene* 1) Both actors start by facing away from the microphone; they turn slowly towards it while speaking.

Note that Sir Gregory turns away briefly and then turns back. This imparts a sense of movement. Use this technique whenever dialogue can be improved by it.

(*Scene* 2) The actors start at a close-mike voice-position. Create Sir Gregory's movements (fetching the oil-can, etc.) by the turn-away-and-turn-back technique mentioned above.

Mr. Jones's footsteps encircle the imaginary room—i.e., they start from, and return to, the mike. In reality, Mr. Jones remains at a close-mike voice-position. He only turns away to descend the imaginary staircase. His cry for help must "descend"—i.e., decrease in volume—so he steps quickly to a distant voice-position. Sir Gregory remains at the mike.

**Acoustics**

(*Scene* 1) Use a large, empty room or hallway; or sitting-room with carpet rolled up.

(*Scene* 2) Use a "dead" location to contrast with the former acoustic. Unroll the carpet and draw curtains—or move into a very small room.

**Sound-effects**

(*Scene* 1) Subdued footsteps accompany the characters' approach.

(*Scene* 2) A selection of ironmongery will yield some suitable clanks. Increase resonance by clanking items inside deep wooden box.

Oil-can: produce orally, clicking the tongue.

Mr. Jones's armoured footsteps: fill two small tins with coins and pebbles, etc. "Walk" them over flat surface.

The last effect: run down a passage, clanking one heavy bucket inside another. Finish by pushing over a precarious pile of kitchen-ware. If preferred, work on this effect separately and splice it into the dialogue.

SIR GREGORY: It's the best idea I've ever had!

JONES: Sir Gregory, I understood that I was to act as an *ordinary* door-keeper.

SIR GREGORY: (*relentlessly*) Come along, Mr. Jones—it's nearly half-past two! I must get you encased as soon as possible.

JONES: (*shrieking*) Encased? Let go of me! What's going to happen? Where are we going?

SIR GREGORY: Don't hang back, Mr. Jones! We're only going upstairs to my little workshop. Come along!

JONES: (*protesting*) Sir Gregory! Sir Gregory!

(*Fade out on last line*)

(*Fade in. Scene 2: the workshop. A brief succession of mallet-blows upon metal.*)

SIR GREGORY: You're nearly done. Lift up your arms, will you? I just want to fit the shoulder-irons to the breastplate.

JONES: (*plaintively*) Had I *known* I was to wear a suit of armour, Sir Gregory, I would have come prepared. I would, for example, have worn my big red sweater. This breastplate is distinctly chilly.

SIR GREGORY: (*preoccupied*) Lower your arms, Mr. Jones.

JONES: *And* I would have worn a thicker pair of pants.

SIR GREGORY: All you need now is the helmet. Here we are . . . this fits over your head—like this. [*clank*] We'll leave the visor up, of course. (*coaxingly*) Try walking round the room to exercise your legs. (*pause*) Go on!

(*We hear slow, heavy clanks as Jones labours round the room. He gradually comes to a stop*)

JONES: (*sulkily*) The knees are stiff. So are the ankles.

BY DAVID HAINES

# situation vacant

ANNOUNCER: We present a short play entitled *Situation Vacant*. (*Scene* 1: *echoic hall. Sir Gregory and Mr. Jones approach while talking and halt nearby* [*i.e., at close-mike*]).

SIR GREGORY: (*heartily*) Well, Mr. Jones—I've now shown you the entire house. D'you think you can manage the job?

JONES: (*earnestly*) I'm sure I can, Sir Gregory. I consider it a great privilege to be offered employment in such a noble and historic residence. Furthermore, I—

SIR GREGORY: (*interrupting*) Your basic work is simple. From April onwards, we open the house to the public at three o'clock, closing at seven. You, Mr. Jones, will stand by the front door and issue the tickets. Don't let any of the damned trippers inside unless they pay the five shillings. Is that understood?

JONES: Yes, Sir Gregory.

SIR GREGORY: You remain on guard, as it were, while I conduct the parties round. (*pause*) Have you ever worn a suit of armour?

JONES: (*surprised*) A suit of armour? No, I can't say I have . . .

SIR GREGORY: (*breezily*) Don't worry, Mr. Jones—I'll soon fix you up. [*turning away*] Follow me!

JONES: (*puzzled*) I'm afraid I don't understand.

SIR GREGORY: [*turning back*] Listen, Mr. Jones. You're now in the stately-home business. That means you're in *show* business. (*with gusto*) The public don't want to see an *empty* suit of armour—they want to see a *knight* in armour! Standing at the front door!

JONES: (*primly*) Sir Gregory, your advertisement in *The Daily News* said nothing whatsoever about a suit of armour.

SIR GREGORY: Perhaps the joints need a little lubrication. Stand still and I'll get the oil-can. (*crosses room, opens and shuts cupboard; returns*) Now then . . . left ankle (*prink-prink*) . . . right ankle (*prink-prink*) . . . left knee-cap (*prink-prink*) . . . right knee-cap (*prink-prink*). And I might as well do the elbows . . . (*prink-prink; prink-prink*)

JONES: (*with dignity*) It's no use, Sir Gregory—I've decided I don't want the job.

SIR GREGORY: (*outraged*) You don't want the job? After all the trouble I've taken to get you ready? You applied to me for a job—and I've given you a job. Where's your sense of moral obligation? (*sternly*) Take your sword and shield, Mr. Jones—and go downstairs to the front door!

JONES: (*browbeaten*) Very well, Sir Gregory.

SIR GREGORY: And don't forget—it's a spiral staircase. Take extra care.

(*Jones turns away to descend the staircase. Suddenly, he slips and utters a long, drawn-out cry*)

JONES: He . . . l . . . lp!

(*He clanks the rest of the way in heavy but rhythmic diminuendo. Finally, he crashes to a magnificent stop in the distance. Pause*)

SIR GREGORY: (*lifting his voice*) Mr. Jones! Are you all right?

JONES: (*feeble and distant*) I — I think so, Sir Gregory.

SIR GREGORY: Well, I've just remembered. It's Wednesday today—and we don't open on Wednesdays. Come back tomorrow.



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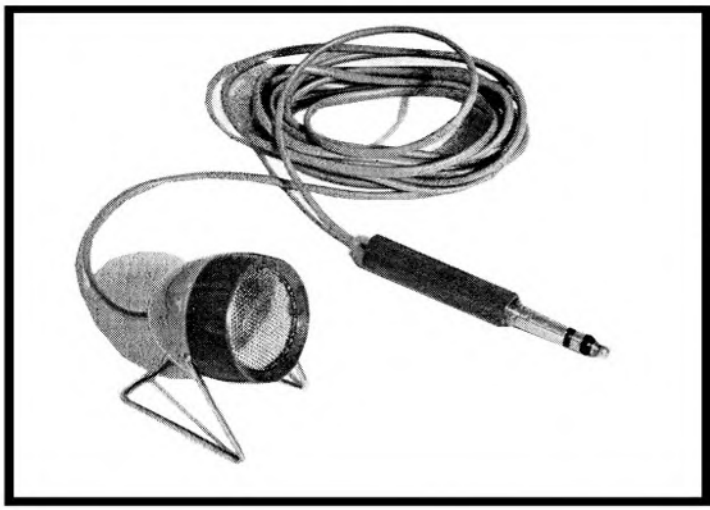

# HIGH GAIN MINIATURE TRANSISTOR MICROPHONE PREAMPLIFIER

BY G.A. STEVENS

## A USEFUL AND EASILY BUILT ACCESSORY

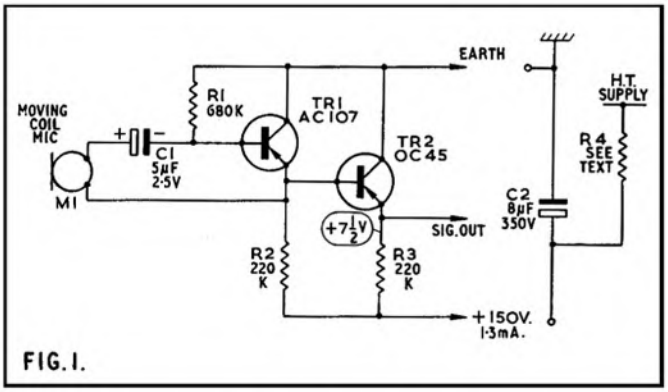

FIG. 1.

MOST commercial tape recorders available at present are supplied with a crystal microphone as standard. Whilst the output of these microphones is high (up to 100mV in some cases) their quality and frequency response are poor and sooner or later it becomes apparent to the owner of the recorder, if at all quality conscious, that a better quality dynamic (moving-coil) microphone would be a good investment. Unfortunately, the output from a dynamic microphone is much lower, and even if an expensive and bulky matching transformer is fitted, this itself may give rise to hum pick-up and distortion, whilst still leaving the input level to the recorder considerably below that needed for full modulation of the tape.

The same applies to the usual range of power amplifiers when they are pressed into service as electric guitar amplifiers, in conjunction with the usual moving-coil, or moving-iron, pickup.

The solution to this is an extra preamplifier: either valved, utilising the existing power supplies from the tape recorder or amplifier if there is a sufficient power reserve; or transistorised, with either a battery or an extra low voltage negative supply.

A transistorised amplifier has many attractions over its valve equivalent, such as low noise and hum, lightness, and low power requirements; but a conventional transistorised amplifier has drawbacks insofar as it needs a low voltage negative supply of its own, which is usually far larger and heavier than the amplifier proper.

An ideal amplifier should have the following characteristics: (1) High voltage gain. (2) Low noise. (3) Low distortion. (4) Can use existing high voltage positive power supply. (5) Low output impedance enabling long leads to be used. (6) Simple to use or remove when not needed. (7) It should not overload if subjected to a high transient (if used for guitar amplifiers). It was with these points in mind that the amplifier was designed.

As can be seen from the circuit in **fig. 1,** the amplifier consists of two transistors, the first being a low-noise type such as the AC107 or GET880. The load resistor has to be inserted in the emitter circuit due to the positive supply, and in order to avoid degeneration due to feedback across the emitter load, the microphone is connected between the base and emitter. The second stage is an emitter-follower to convert the 75K output impedance of the first stage to about 500-ohms. The two transistors are powered by a 150V supply. This value was chosen as the lowest which would be met in a normal valve power supply. Usually, of course, higher voltages would be available, excess voltage being dropped by an extra resistor and decoupled by an 8μF capacitor which are both mounted in the existing tape recorder. The value of this resistor and its required power rating may be derived from the graph given in **fig. 2.** This means that only three leads need go to the microphone with its amplifier mounted inside, so that twin screened cable may be used. Care should be taken in choosing a capacitor with an adequate voltage rating, for although it only decouples a 150V line, when the amplifier is removed it will receive the full supply voltage, which could be in the order of 350V or so.

### ORIGINAL MICROPHONE

In the original unit the microphone used was a cheap Japanese type *DM175.* This consists of a moving-coil insert feeding a 1 : 5 transformer giving an output impedance of 600-ohms (stated to be 1K by the manufacturers). This means that the insert was of about 25-ohms impedance, and since the manufacturers stated the output (with its integral transformer) was —60dB (ref. 1V), the output of the insert was—74dB. This was confirmed when the output from the amplifier and microphone was found to be about 250V when speaking about 1ft. from the unit. The space which was originally taken by the microphone transformer was used to house the amplifier, making a small and very neat unit.

Since the space is very limited it is recommended that the layout given



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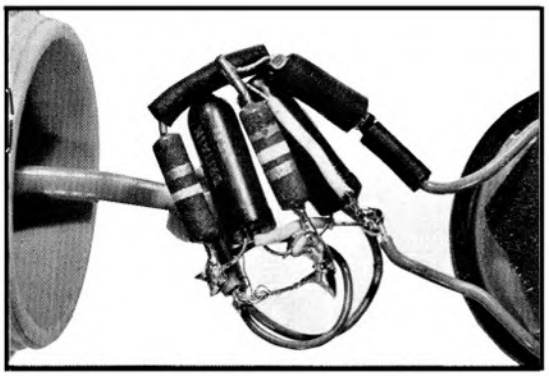


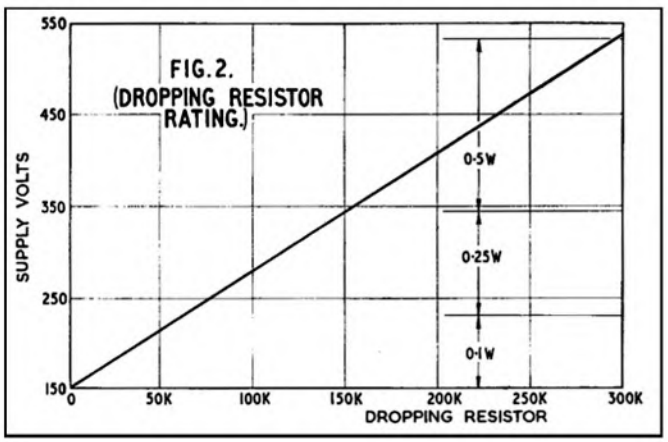
# A USEFUL AND EASILY BUILT ACCESSORY

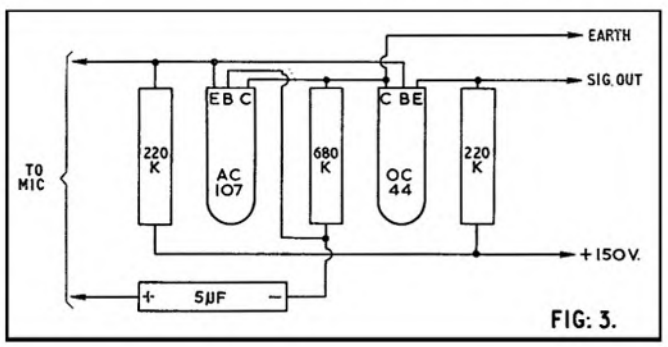
by **fig. 3** be used for the *DM* 175 microphone. Other, larger, microphones would not need such careful attention to space, and layouts could be varied to suit individual requirements.

Since the original unit was built, other microphones have been tried and the quality found to be excellent and not degraded by the circuit in any way. With the least sensitive type the output was in the order of 100mV.

The sensitivity of the various types of dynamic microphone is given typically as follows (See *Radio Designer's Handbook* by Langford Smith, Chapter 18, Section I).

| | | | | |
|---|---|---|---|---|
| Moving-Coil | —49 to —70dB | relative to 1V for 10 dyne cm² | | |
| Pressure Ribbon | —61 to —65dB | ,, | ,, | ,, |
| Velocity Ribbon | —58 to —67dB | ,, | ,, | ,, |




These sound levels correspond to a normal speaking voice 12in. from the microphone.

Since the input impedance of the microphone is about 600-ohms, a microphone with an impedance greater than this will suffer an insertion loss when connected to the amplifier. Since the higher impedance types will have a relatively higher output, this will tend to offset the initial loss, provided the ratio of the amplifier and microphone impedances is not too large. Also, since with larger input levels transistors change their input impedance, in order to avoid distortion it is usual to drive them from a high impedance source to achieve a constant current source. The higher impedance microphones achieve this, although since their output level is still relatively low, distortion would in any case be very low. From the above table it can be seen that the output from a dynamic microphone (or good quality guitar pickup) is in the order of —65dB or about 0.5mV. This means that the output from the amplifier would be about 0.5V. Now the maximum output from the amplifier into a high impedance is about 5V; at this point the transistor bottoms and flattens the output waveform. This means that there is a 20dB difference between the normal and peak outputs, which should be adequate to handle the high peak transient levels associated with guitar amplifier practice.

Whilst considering the output impedance, it should be noted that for music containing high transients it is necessary that the impedance into which the output of the amplifier is fed should not be less than 10K. This is because, although the output impedance is low, so is the current going into the output transistor, leaving little current to spare with which to drive an external load. This does not affect the capabilities of the amplifier to feed a long capacitive screened load, since at high frequencies, where capacitive losses are serious, the signal component would be low and little current would be needed to drive the stray capacities.

### SPECIFIED COMPONENTS

It is important that only the specified components are used since, as a 150V supply is used, the spreads of characteristics and high leakages associated with the cheaper transistors available would completely upset the operating points of the transistors and probably give very distorted outputs, if any at all. As stated, the input transistor can be either an AC107 or a GET880; the latter—being a closer tolerance industrial type—would be more rugged, particularly if the unit is liable to be used at higher temperatures. The input capacitor should also be checked to see that it does not have an excessive leakage current which could again upset the biasing point of the input transistor. If difficulty is experienced, a complete kit or individual items may be obtained from the supplier named at the foot of the component list.

The amplifier has now been in use for a considerable time and has given excellent quality and no trouble whatsoever, and I have now constructed several more using some expensive microphones with equal success. The only word of warning is in the choice of a plug for the unit. If a standard GPO Jack is used (as it was in one of the units which have already been built) the HT connection should be made to the *tip* of the three-way jack socket. If this is not done, the HT would be applied directly across the output transistor when the jack is half inserted. With all other types of plug no such precautions are needed, and the modern 3-pin or 5-pin Continental type plugs are ideal for this purpose.

**COMPONENTS LIST**

| | | |
|---|---|---|
| $R_1$ | 680K | 1/10W |
| $R_2$ | 220K | 1/10W |
| $R_3$ | 220K | 1/10W |
| $R_4$ | See fig. 2 | |
| $C_1$ | 5μF | 2.5V (Mullard Type C426AN/A5) |
| $C_2$ | 8μF | 350V |
| $TR_1$ | Mullard AC107 or GET880 transistor. | |
| $TR_2$ | OC44-45 transistor. | |
| $M_1$ | Dynamic microphone, DM175 in original. | |

Length of twin screened microphone cable.

3-pin plug and socket (Continental type).

All the above components may be obtained individually or as a complete kit from:—

North Western Electronics,
283 High Street,
Berkhamsted, Herts.



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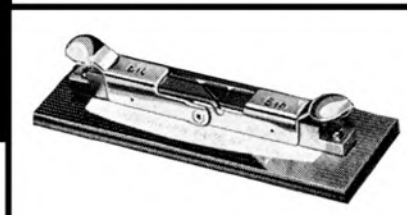

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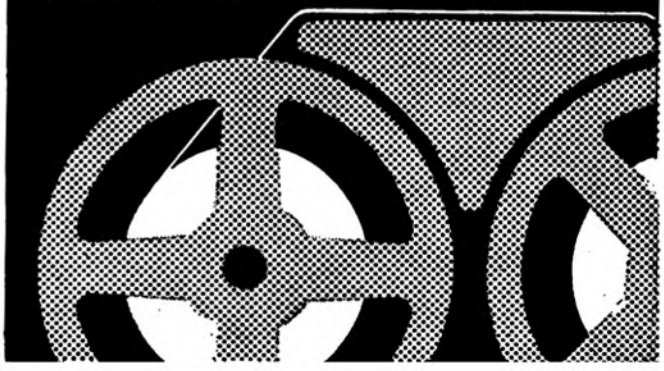

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# THE CONTRONICS CINESOUND SYNCHRONISATION SYSTEM

## EXAMINED BY RICHARD GOLDING

EIGHT millimetre sound now comes under three main headings: *Magnetic-stripe* where sound and picture are carried on the same spool of film; *Double-band* where perforated tape is run by the same motor that drives the film; and *Separate-tape* with synchronising link between tape recorder and silent projector. Strobe-control is really outdated and very few people now rely on this rather laborious method of hand control.

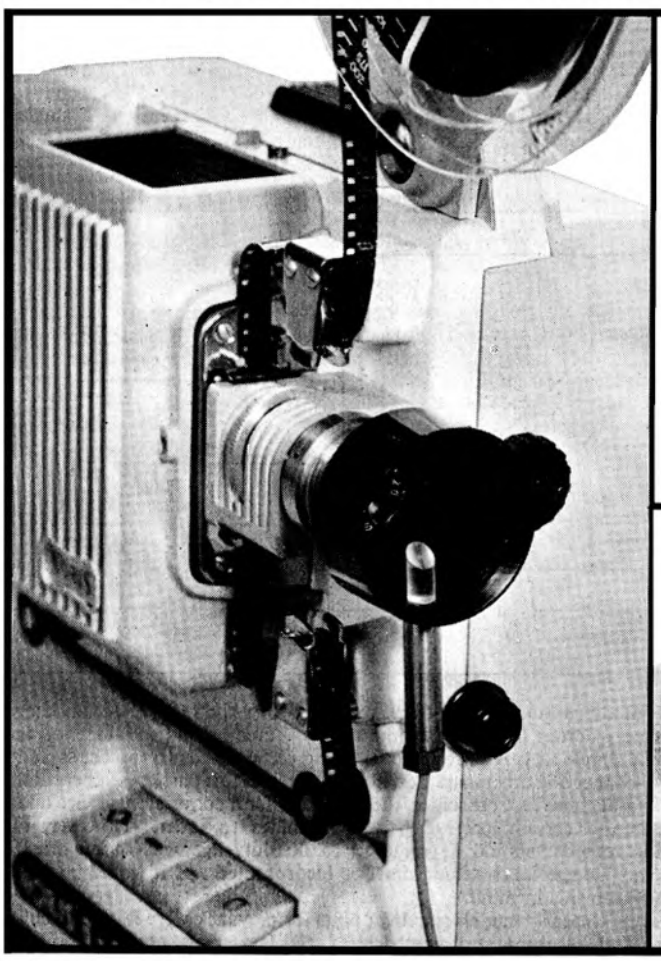
Most tape synchronisers on the market are efficient to a point and will supply satisfactory synchronisation for commentaries and music but will fall down where lip movement synchronisation is concerned. Nowadays, more than this is needed, for appetites have been sharpened by seeing what magnetic-stripe can do in this field. The separate-tape man now wants lip sync but he wants to achieve it without altering his system too drastically. To meet this need, *Contronics Ltd.*, Garth Works, Deepcut Bridge Road, Blackdown, Aldershot, Hants., have now developed an extremely efficient pulse unit—the "*Carol*" *Cinesound*—which is supplied in two different forms; a small compact control unit which can be used with an existing ¼-track tape recorder; and a ¼-track tape recorder with a built-in control unit.

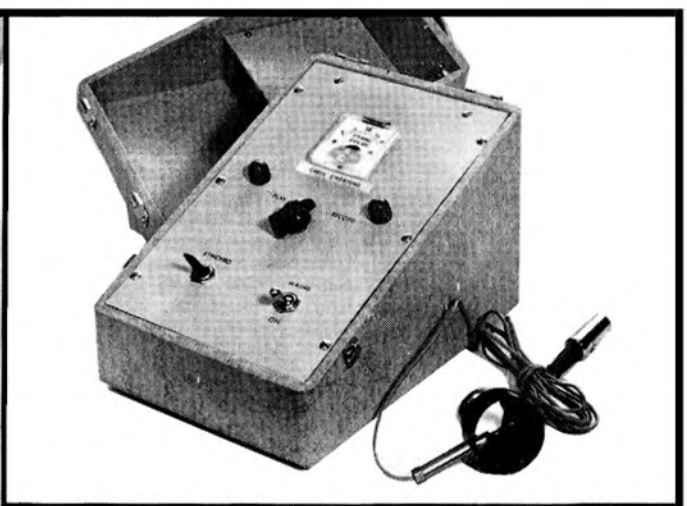
The pulse system used is not to be confused with any of the professional systems which employ once-per-frame contacts on either the camera drive or the projector drive. *It is designed for post-synchronisation only* and it works on an entirely different method by taking pulses from the moving pictures themselves. Basically this is not a new idea but it is the first time that it has been perfected and developed for amateur use.

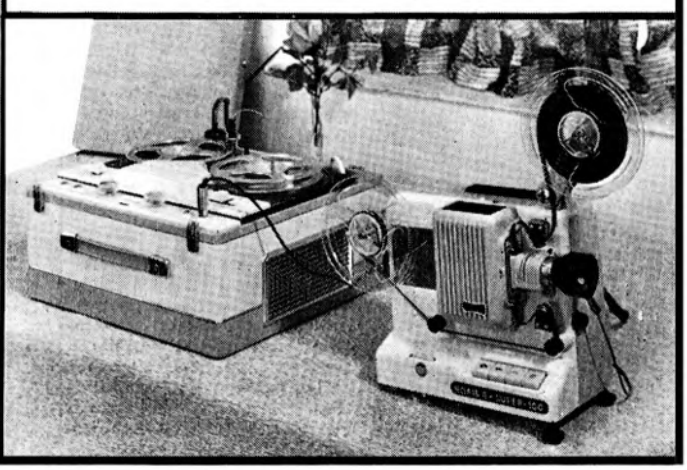
The idea is simple. As in the cine camera, the film must be pulled down to rest stationary for a fraction of a second behind the lens to record an image, so during projection the film must be pulled down in the projector gate for the same fraction of time to project the image on to the screen. The impression that the human eye retains is held for a split-second longer than the picture lasts on the screen, this impression being imposed on the following picture. This *persistence of vision* creates an illusion of constant movement although every single frame in the film is held rock-steady while a three-bladed shutter (with 16 fps) is moved across the picture to interrupt the light beam. The movement of the shutter is picked up by a photo-transistor housed in a lens-hood fitting which is clipped over the projector lens. The flickers are converted into pulses by the photo-transistor and these pulses are fed into an amplifying and pulse shaping circuit, so that despite the considerable variation in light intensity of the different frames the final output remains of the same amplitude. At the same time, these pulses also feed a tachometer circuit so that the actual speed of the projector may be read on a meter built-in to the control unit calibrated in frames-per-second.

On playback of the recorded sound, the photo-transistor pulse circuit is switched to feed a flip-flop circuit where pulses from the projector switch the projector motor off, and pulses from the tape recorder switch the motor on. The flip-flop circuit can only be in one state at any one time and if the projector motor tries to speed up then the time between the pulses decreases and the motor is momentarily switched off. Conversely, if the projector slows down the "off" pulses

(*continued overleaf*)







**Left:** *Photo-transistor hood mounted on Noris projector.*
**Top:** *Model CS/1 synchronising unit costs* £25.
**Bottom:** *The TR/7 recorder with integrated sync unit; price* £45.



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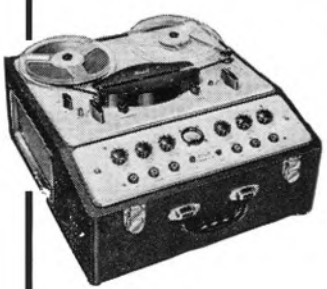

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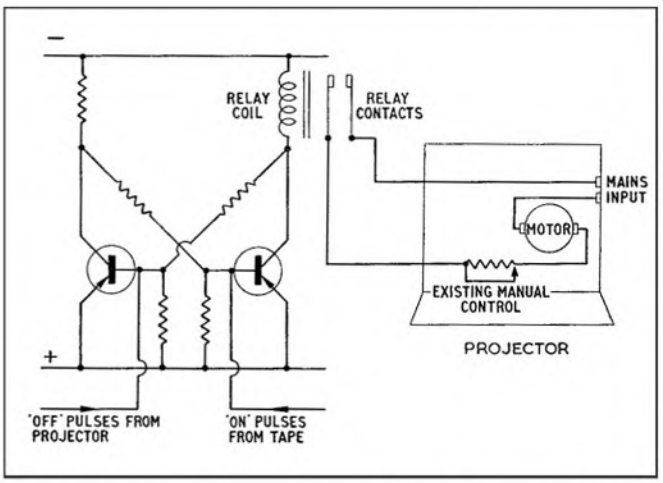
cease to function for a fraction of a second thus allowing the motor to catch up again. The whole effect is to balance the pulses from the projector precisely midway between those from the tape recorder.

In practice this does work and as the three-bladed shutter gives forty-eight periods of light and dark per second, synchronisation can be achieved to one-third of a frame.

With the Cinesound TR/7 which is a double-channel tape recorder fitted with ¼-track heads (the 'spare' head segment is connected to the built-in pulse unit) there is just a little trouble in setting up. Whereas the manufacturers state quite truthfully that there is no mechanical link, there is a small electrical modification to be made. The projector must have a variable-speed control capable of allowing the motor to run faster than 16 fps, and wires from the Cinesound must be connected into this. For most projectors this is a fairly simple job and complete instructions are issued for a number of current models. When testing, I used a *Eumig* and a *Bolex* projector and found my easiest way was to mount a lamp socket on the side of each projector so that I could plug the control in or out at will. At its worst, the whole operation should take no more than half an hour and, if a socket is mounted, each subsequent setting up should take only a few seconds.

This is not so with the other unit—the *CS*/1—which is a single control unit designed to work between a ¼-track tape recorder and the silent projector. The *CS*/1 needs the above modification and also




a modification to any ¼-track recorder other than the *TR*/6 (another tape recorder in the Contronic range). This second modification is not simple as it requires disconnecting certain leads to the heads and re-connecting others and I do not recommend this particular operation to a beginner. Contronics, themselves, offer a conversion service and can alter certain existing ¼-track machines to order. However, if the recorder should be required to do duty again as a four-track machine special switching must be incorporated and it would be well to keep this in mind.

On the early models starting points for playback were fairly difficult to find, resulting in a great deal of trial and error before one found sync. Now all models are fitted with an Auto-start facility, which, when momentarily depressed, sets a relay to switch off the mains from the projector. When the tape is started, the first pulse which comes along will automatically release the relay and start the projector. When making a recording it is easy to start the projector at some precise point so that the first pulse will come at the required point of the commentary. On playback, the film is laced in the projector so that the precise starting frame is in the gate. The Auto-start button is now depressed and after this the projector is switched on without it commencing to operate. The tape is now started and, with the first sound, the projector automatically starts up.

It is all fairly straightforward providing all the instructions are followed faithfully but I would hardly advise anyone to take on the job single-handed. It is a two-man operation and it needs a great deal of practice. The system can, however, produce perfect results and can allow, with the use of extra equipment, the production of complicated composite tracks to the very third of a frame.



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# recording bird song

## PART ONE
## PARABOLIC PROBLEMS

BY A. G. FIELD

THIS is the first of two articles intended for the ordinary recordist who would like to collect bird song but perhaps feels uncertain about identification and the recording method.

Much of the harshness and distortion one often hears with recorded bird song can be traced to the mis-use of a parabolic reflector. A reflector can boost high audio frequencies unduly and tends to produce an edgy sound which is just not true to nature. This may be useful for some types of sound effect but is most objectionable for bird song recordings. Such recordings are difficult to replay satisfactorily, demanding high quality equipment and wide-range tone equalisation.

It is, however, possible to overcome this vice with a minimum detraction from the reflector's many virtues.

First I shall list the three types of fault most likely to trouble the bird recordist.

*Sibilant Splash* : Cause—excessive high frequency signal reaching the recorder due to poor low frequency response of the reflector. Remedy—treat the parabola as shown in **fig. 1.** Use a good moving-coil microphone. Record at a lower level.

*Intermodulation Distortion* : This causes spurious low frequency sounds and a muddy effect; it is the most serious form of distortion. Cause—overloading the amplifier or preamplifier, or a faulty amplifier. Remedy—try recording at a lower level and if still troublesome repair amplifier.

*Electrical Motor Interference* : Cause—faulty motor or suppressor, or poor design, aggravated by under-recording. Remedy—record at a higher level. Use a microphone preamplifier such as the *Walgain*, kept well away from the recorder. Repair defective motor or suppressor.

A good recorder should have none of these troubles. It will be seen that most forms of distortion are caused by heavy modulation. In general, with most types of bird song it is not advisable to allow a VU-meter to move above half the level suggested in the instruction book. Bird song fundamentals can run up to nearly 10 Kc/s and very high notes are boosted in the recording process, so that risk of overload is considerable. It may be thought that orchestral music would be more difficult to record as frequencies run up to nearly double this figure. The very high frequencies in such music are not fundamentals but overtones and are therefore at a lower volume level and do not usually cause trouble.

The ideal machine for bird recording should be able to cope with frequencies up to 10 Kc/s at $7\frac{1}{2}$ i/s and 8 Kc/s at $3\frac{3}{4}$ i/s without audible distortion. It would, of course, be battery driven. A good quality low impedance microphone is desirable, permitting the use of long leads, but it must, of course, be made to match the recorder.

A parabolic reflector is almost essential, since it enables the recordist to keep his distance from the subject, which might easily be frightened away. This is not to say that normal microphone technique cannot be applied. Ludwig Koch, for example, a well-known broadcaster on birds and bird recording, obtained a large collection of bird song without resort to a reflector.

A diameter of 2ft. is the usual compromise between portability and reflective efficiency. The poor middle and low-frequency response, overcome to some extent with the modification already mentioned, is caused partly by the curvature of the reflector itself and partly by the wavelength of sounds at these frequencies exceeding the diameter of the reflector. It will be found very difficult to aim a reflector correctly without earphones.

I will now suggest ways in which the reflector can be improved.

First, the sight and aiming hole in the reflector should be raised by one inch (see **fig. 1**) to allow room for the microphone filter without obstructing the view of the aiming sight.

Next, we line the whole of the inside of the reflector with a green baize material such as *Con-Tact*. This baize has an adhesive plastic back and is like a very close-grained velvet. Microphone holder and stem should also be lined with the same material. The redundant viewing hole is covered with this material.

A quantity of cotton wool is dyed green and pads of three different thicknesses are made of this material by holding it together in small muslin bags. These are used one at a time as microphone filters. They are held in place by Terry Clips gripping the microphone holder stem, the base of the clip being sewn to the bag. The thin filters are

(*continued overleaf*)

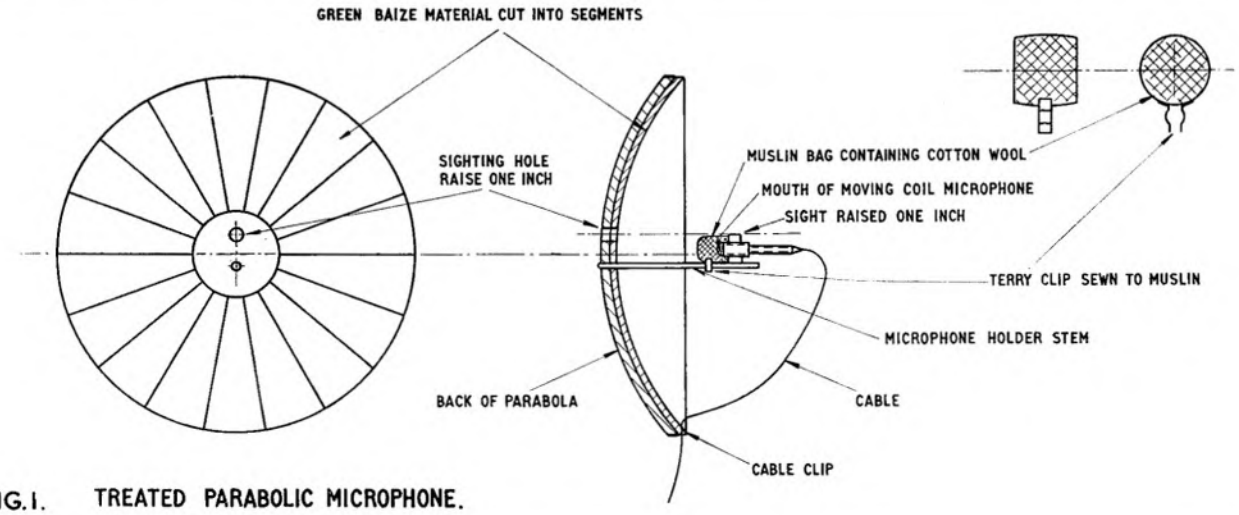


FIG. 1. TREATED PARABOLIC MICROPHONE.



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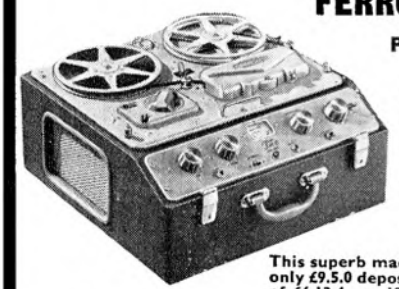

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intended for long range or indirect shots while the thick one is intended for fairly close direct shots where the bird can be plainly seen. These filters limit but not entirely suppress high frequency sound (see graphs in **fig. 2**).

Modifications made, an expedition can commence. Coming up the hill we reach a pine wood. A breeze is blowing here, making a low sighing noise in the pines. A Coal Tit sings with his needle sharp voice "if-hee . . . if-hee . . . if-hee . . ." We have little hope of success as the wind seems likely to swamp all sound. A filter is placed on the microphone; the song can now be plainly heard over the 'phones.

We move on and try to record a Skylark, but an aeroplane thwarts us. An attempt at a Willow Warbler is defeated by a flock of noisy town Sparrows.

We now come to a quiet spot where a strange bird is singing an interesting song as he flies up in the air and glides down to his perch in the top of a tree. Many good runs of song are recorded by following his flight in the parabola sights. What type of bird is this? We haven't a clue.

Arriving home, the recordings are played. Out comes a beautiful wood-wind voice—pity about the aeroplanes. Next comes the Song Thrush. This is really beautiful with the sound reflecting off the trees and adding depth and atmosphere to the recording. Pity we forgot to fade down though. Next comes the Coal Tit. The wind in the pines

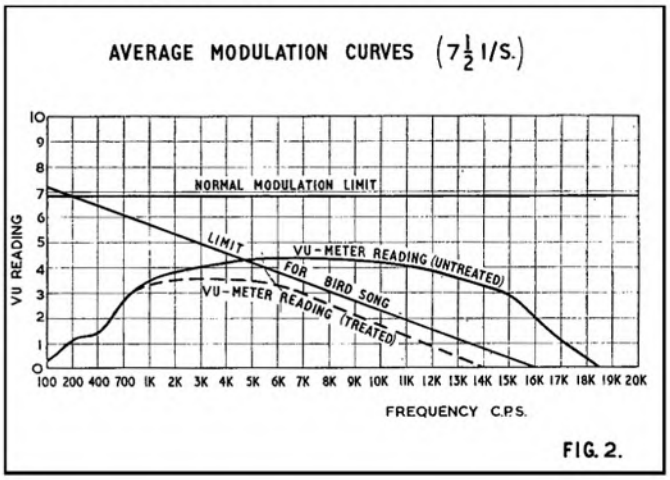


FIG. 2.

sounds quite loud but the Coal Tit's needle sharp song knifes through this, showing the value of acoustic contrast.

The two abortive attempts are followed by a strange bird. The first two runs of song are over-recorded and ruined. We have, however, six good clear runs of song. All the recordings are on one track so we can edit out the bad sections of the tape and avoid losing quality by copying. Later, on the leader tape which precedes the strange bird we are able to write "Tree Pipit" . . .

To get three good recordings in one expedition would correspond to the angler's 'good day'. Like fishing, bird recording is seasonal and has its off days and lucky days. Beginners' luck sometimes plays a hand. It should not be thought that playing back through external speakers is essential. Sometimes the internal speaker of a mains recorder gives good results. Loss of high notes with tape running at 7½ i/s is most likely due to a poor speaker. Using a good wide-range speaker with plenty of middle and top is infinitely better than treble boost. You will not capture natural beauty with unnatural volume. A powerful amplifier is for low distortion not high volume where bird song is concerned. Always record on one track only, edit the tape ruthlessly and have leader tape between items, with the item number and subject inscribed thereon. Keep an ordered index of the subjects showing 'What, Where and When' together with any remarks.

Perhaps you wish to record doves and cooing pigeons. Maybe you wish also to record a 'dawn chorus'. A parabola is unlikely to be useful here, as in the first instance it will give little gain to these very low pitched sounds, and would not capture a large enough spread of sound.

(*continued on page* 132)



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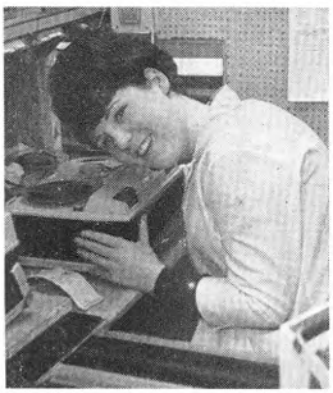
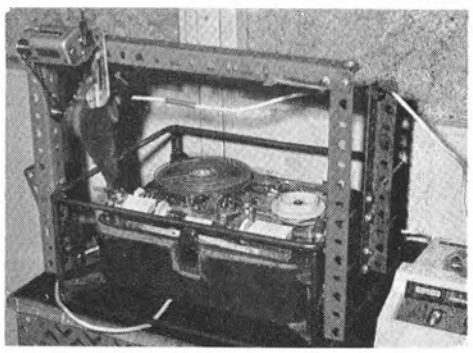
# The Grundig method



## CONTINENTAL TAPE PRODUCTION IN NORTHERN IRELAND

**Left:** *Ten transformer bobbins wound in one operation.* **Centre:** *Listening for noise in sound-proofed booth.* **Lower right:** *Start and stop controls are depressed up to* 20,000 *times on this test rig.*

TWENTY years have passed since the allied armies met in the centre of Germany at the end of the second world war, and although the technique of recording magnetically on oxide-coated plastic tape has since spread in all directions, these two decades have not dislodged the inventors from a position of considerable importance in the tape recording industry. Superb professional machines are made in Switzerland, Japan, Scandinavia, U.S.A. and Britain ; the Dutch and others can mass-produce high quality domestic models for a wide market; plenty of manufacturers at all points of the compass make recorders ranging from good to cheap-and-nasty; but the West Germans still seem to have that little extra something when it comes to combining streamlined modern factory techniques with a popular precision product.

In the rest of Europe the most famous name from this source in the field of domestic tape recording is probably *Grundig*, and in Britain machines carrying this label certainly account for a sizeable fraction of the market. Actually, the bulk of Grundig tape recorders sold in the UK are *made* in the UK, at Dunmurry in N. Ireland. While the more elaborate models (*TK* 40, 41, 46 and the *TR* 6 battery portable) are imported from Germany, all the popular machines are made just across the Irish Sea, a few miles from Belfast. We were recently invited to Dunmurry (a day trip, twelve hours London-to-London!) to see how an offshoot of central European enterprise fares in this gently undulating corner of the British Isles.

Opened in the winter of 1960/61, the Grundig factory occupies a floor space of 110,000 sq. ft. and provides work for a thousand people (very important in N. Ireland, where the Government welcomes and encourages any investment which creates employment). Already the largest tape recorder factory in the UK, a further extension is planned for opening this year, giving another 50,000 sq. ft. The factory is very light, clean and pleasant, with a grassy inner courtyard and all mod-cons for the employees—including spacious cloakrooms and a magnificent dining room which is also used for social events (including a fashion show!).

Although this establishment functions to reduce the numbers of Grundig machines coming to Britain from the Continent, one very important item is exported from Germany lock-stock-and-barrel. This is the actual production *system*. Grundig do not employ 350 design and research engineers for nothing; every detail of a tape recorder's growth, each stage of production, the types of machinery and test gear—all are the subject of thorough investigation before a complete production scheme is evolved. Having devised such a scheme, it is available for use elsewhere, and the system which we saw in operation at Dunmurry was in all essentials conceived in Germany. Despite the changed locale and personnel, it certainly seems to work with high efficiency.

Grundig are just launching four new models, comprising the *Luxus* range, details of which are given on page 127. We visited the factory during the early stages of a production run on these new machines, but already everything was buzzing away happily—no doubt because of the pre-conceived production plan. Indeed, things were so well thought-out that an array of labelled warning lights on the factory manager's desk gave immediate indication of a hold-up at any point in the system. With approximately 500 machines passing through the system every day, *any* delay is very expensive.

The Grundig machines are made on a rationalised sub-assembly system, the chassis and its wide rim forming the basic frame on which everything else is mounted; in one sense the chassis/frame *is* the tape recorder, housing both mechanics and electronics in a fashion poles apart from the deck-plus-chassis-plus-box approach. This production system may be likened to a river with many tributaries : each little stream (sub-assembly) feeds in its essential part, all the contributions being integrated with the main flow (chassis) at appropriate points. Finally, when each part has joined the river, the water (complete recorder) must flow through a large net (test and alignment) before moving out to sea (loading bay). We were able to follow many of the sub-assemblies through most of the way, but as it would require a whole month's issue of *Tape Recorder* to give every detail, we shall just pick out a few highlights.

Very rare of its kind was a massive electro-plating bath, with a moving belt carrying chassis around and lifting them up and down automatically from one solution to another according to an accurately timed schedule. One interesting feature here was a special hot-oil dip which removes microphonic peaks and dips from tin-plated surfaces, thus reducing the risk of corrosion.

Many components which other manufacturers would think twice about producing for themselves are made as a matter of course at Dunmurry. This includes mains transformers, wound ten at a time with insulating paper fed in between layers at lightning speed. The complete set of ten windings on its single long 'bobbin' is sliced up by a



(*Continued on page* 121)

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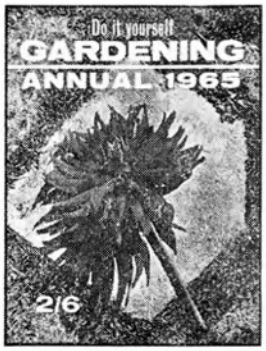


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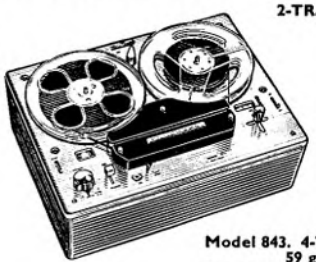

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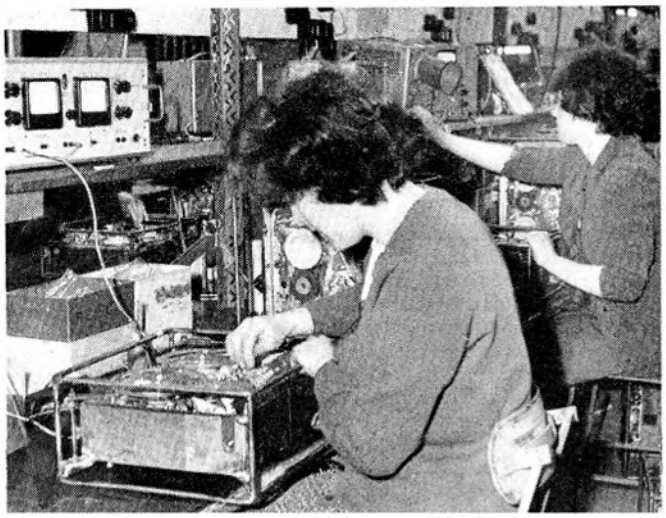

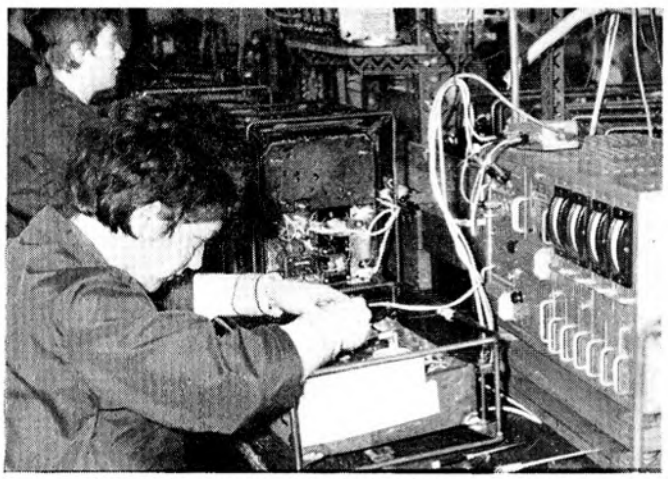

**Above :** *Two views of the electrical alignment bench.*

multi-bladed saw, lead-out wires are terminated, iron cores fitted—all in a routine matter-of-fact way which makes a complex operation seem almost as simple as plugging in a valve.

Perhaps the most impressive things we saw were the huge injection-moulding machines used to produce the plastic deck-top, case parts, spools and other bits and pieces. It is rather awe-inspiring to see one of these monsters at its silent work, creating as one piece in a matter of seconds a beautifully finished rigid case with every detail, all from a sticky, shapeless lump of plastic. The largest machine was working continuously, twenty-four hours a day, seven days a week, paying for a capital expenditure of about £25,000. These injection moulders do not demand much attention when working smoothly: a blind man was operating one, and during the fifty seconds in every minute not needed by another, its operator was adding a decorative finish to mouldings. Incidentally, another finishing touch added by an intriguing method was the application of aluminium lettering by pressing a plastic-backed metal tape on to a surface by means of a heated mould carrying the necessary lettering. The aluminium adheres in the shape of letters and the rest is brushed away.

A multitude of sub-assemblies, both mechanical and electrical, find their way eventually to the final assembly line. Here, because everything fits together accurately and is fed through in a logical order, a mere thirty operatives are able to assemble about 250 samples of a particular model per day. To walk around this line and watch a tape recorder grow from a lump of metal into a complex machine is quite fascinating, for the rate of growth seems phenomenal due to the very complete sub-assembly scheme.

After assembly the recorders are tested and aligned, a unified test gear being set-up to perform all the basic electronic measurements in quick succession. Frequency response, magic-eye setting, noise-level and output power are all covered by the one instrument. Occasional models are taken from the production run for checking in the factory laboratory, where heat-life-tests and other trials are conducted. One item in this section is a device for operating the STOP and START buttons up to 20,000 times, with the spools starting up and turning back endlessly.

Finally, a series of little booths house girls who subject every recorder to an operational test. All the controls are used, and as these young ladies know their models almost by instinct any departure from the 'norm' is soon discovered. The tests include listening for above average motor noise, judging musical quality, and generally putting the machines through their paces. Because they tend to become ultra-sensitive to particular deficiencies, these girls have nickname—we met 'Miss Noise' and 'Miss Clutch' amongst others!

So there, briefly, is Grundig at Dunmurry. The new recorders which we saw are now pouring across the Irish Sea and if they perform as well as they are produced they should be very successful.

# our readers write . . .

### . . . about stirring the customers

**From: Martin York, 64 Porthkerry Road, Barry, Glamorganshire.**

DEAR SIR, My article, *Some Thoughts on Guarantees* (December 1964) seems to have had the desired effect of stirring up the customers and I am glad to see that the concensus of opinion is sufficiently adult to take account of the Dealer's position.

Mr. Hellyer's suggestion (February) definitely qualifies him as a founder member of the Martin York Fan Club. I love the idea of charging the customer and letting him claim from the manufacturer. It will be interesting to observe whether any bright young P.R.O. dares to defend his employers in your columns, against this proposal.

As for Mr. McLaren's doubts (February), I agree wholeheartedly that this "paragon of a dealer" is a very rare bird. I cannot waste valuable space in defence of my veracity, so I ask you, Mr. McLaren, to accept my word that the circumstances which made the incident possible were regrettably exceptional. If only they were the rule!

As a tailpiece to the original article, I had hoped to reveal the name of the machine which finally gave satisfaction to 'Adam Bryant'; the makers would surely have found some way to express their gratitude for the advertisement. But it was not to be.

Scarcely had the ink dried on the December issue than Adam was again weeping on my shoulder. This time, it was the fault of the recording head—an expensive Continental component, for which the manufacturers of the machine could hardly be blamed.

Adam's nerve failed him. He could not face the dealer yet again and was on the brink of selling up and taking to chess. I have, however, persuaded him to take up the matter with the manufacturers,

I hope they are following this correspondence, for though we may appear to treat the subject lightly, there is a growing amount of very real dissatisfaction which will, in the long run, affect their business and which can only be made right by their action.

*Yours faithfully.*

### . . . about guarantees and the specialist

**From : Colin Braddock, Tape Recorder Centre (Blackpool) Ltd., 266 Waterloo Road, Blackpool, Lancs.**

DEAR SIR, We are all guilty of hypocrisy at some time in our lives and I should like to join the fray in the field of Guarantees in the hope of retouching the picture of disreputability and inefficiency presented by recent articles and letters in this journal.

I speak not just as a dealer in the highly specialised field of tape recording, but as an enthusiast, importer and distributor of tape equipment. In common with several other small dealers, I am my own service agent and salesman and, in fact, I live the business. Though I could easily do so, I refrain from selling 'cheap and nasty' products, keeping to reliable brands of my own choice.

Regarding Martin York and his imaginary customer—we have all heard of such cases. Perhaps if the 'imaginary dealer' had been able to tell us, the story would have sounded slightly different.

*(continued overleaf)*



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We all know that unscrupulous retailers exist; we also know that today the public at large have more money and consequently a poorer sense of values than they did. Yet a customer demanding lower prices, greater discounts *and the same service* would scream blue murder if he was forced to work harder for the same wages. The abolition of RPM suggests that retailers should work harder for *less* profit. Hypocrisy! When, as sometimes happens, I find myself in front of, rather than behind, the counter, intending to purchase an expensive item, I do not instinctively look for the fellow with the lowest price—I want service after sales.

Another point the customer tends to forget is that the steady fall in price of electronic equipment means a similar reduction in profit for the retailer, who has to sell more and increase his efficiency in order to keep the same profit margin from year to year.

As to the point regarding manufacturers and payment for work done under guarantee, again this is a two-edged blade. Some manufacturers will provide free service for genuine faults but there are customers and even (so-called) dealers who return equipment to the manufacturer for reasons which an idiot could undertake to repair.

Transport is itself one of the major causes of mechanical faults. To quote one case to you, and here I am soul seeking to find the exact truth, we sold a machine to a dealer in May last year carrying a six months guarantee. This machine was returned to us, without notice, in December with a request for free repair under the guarantee. On inspection it was found to be a very minor fault which could and should have been serviced by the dealer, who was entitled to charge for time. Apart from this, packing instructions had not been followed—resulting in internal damage to the machine. A nominal charge was made for this repair with a letter why it was made and how the machine should be packed. A shirty letter was promptly returned by a 'white collar' director more or less telling us that we had supplied it in the first case and were therefore married to it for life; this very same fiasco was repeated shortly after. The retailer receives a trade discount for stocking, selling and caring for the machine, especially when out of guarantee. He should follow this; far too few do.

It may sound stupid, but we have had portable machines returned with the complaint 'Won't work' and found the reason to be—no batteries!

*Yours faithfully*

## . . . about more accurate pictures

**From: E. R. Chilton, General Sales Manager, Reditune Ltd., Grosvenor House, 125 High Street, Croydon, Surrey.**

DEAR SIR, There are certain aspects of the article about our company's activities (*Endless Music*, February) which I should like to clarify, in order to give a more accurate picture of our operation.

Firstly, your reference to Copyright charges being paid by us on behalf of subscribers using our music is misleading, since it is in fact the Performing Right Society's fees which we pay for them—in order to spare subscribers from the complications of this most complex fee system.

Secondly, I would hate to leave your readers with the impression that we record unpopular music. Your reference to our practice of taking a further copy of the master "which is subsequently filed in the hope that its contents return to popularity at a later date", refers, I take it, to the protection copy which we make and store to guard our very valuable masters against accidental loss or damage.

Elsewhere in the article you describe our splice-finder as a "bad-splice finder". The essential function of this machine is to find all splices, in order that: (a) If it is necessary to cut the tape this can be done at the splice and (b) If we need to check the tension this can best be done at the point of splice where the tensioning was originally carried out.

Other points of detail which I should like to correct are: (1) Subscribers are supplied with a float of five programme cassettes (not four) any two of which can be exchanged as often as required. (2) Our "Slave" deck was designed and built in Croydon, not Jersey; only our tape players are made in Jersey, by an associated company.

*Yours faithfully*

**Editor's Note:** We are glad to publish these small corrections, but must point out that we were originally told that subscribers are supplied with *three* cassettes, later modified to *four*, and now to *five* !



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# tape reviews

CLASSICS **GEORGE GOODALL**
JAZZ & FOLK **TONY FARSKY**
SPOKEN WORD **MAURICE PODBREY**

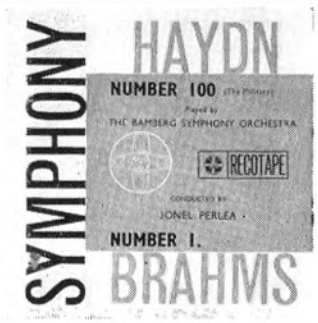

**SONNY TERRY & BROWNIE McGHEE.** Twelve items including Treated Wrong, Southern Train, Gone But Not Forgotten. **World Record Club TT379,** 3¾ i/s twin-track mono. 29s.

IT is difficult to believe that less than ten years ago recordings of such blues artists as Sonny Terry and Brownie McGhee were just not available in this country. Today, the catalogues contain a wealth of rich material by Blues singers. Whole companies of these artists arrive regularly from the States, to tour Britain. All of which has had a revolutionary effect on the sounds being produced by our own groups.

With this greatly changed position since the first records were issued here in 1958, followed by many visits, it is not surprising that some people do not rate Brownie and Sonny as highly now as they once did. It is possible that popularity and world touring may have led this vocal-harmonica-guitar-duo to become rather more polished, but the music is nonetheless still a very fine example of the idiom.

The combination, on this recording, of voice, guitar and harmonica, with the driving rhythm provided by Brownie's guitar, is a unique sound which embodies the very essence of the blues.

There are twelve numbers on this tape, many of them original compositions. The recording was made in Britain during one of their many visits. Several items have our own Dave Lee added, who plays some fine, earthy, primitive piano blues which fit in remarkably well with this great combination. **T.F.**




**HAYDN/BRAHMS** Symphony No. 100, Symphony No. 1. Bamberg Symphony Orchestra conducted by Jonel Perlea. **Recotape RML 507.** 3¾ i/s twin-track mono. 50s.

AT first sight the choice of programme on this record may seem casual. In fact I am sure that it is not, for Haydn represents the beginnings of classical symphonic composition whilst Brahms's symphonies represent perhaps the fullest development of the form. Brahms is sometimes described as a classicist living in a romantic era, and the purely classical elements of his writing seem to be made more apparent when heard after the Haydn symphony. The harmonies may be richer (for want of a better word) but the roots of the symphonic form are obvious. In fact, on the occasions that I have played this tape right through, I am sure I have enjoyed the Brahms symphony more for having just heard the Haydn.

The Bamberg Symphony Orchestra is either out in full force, or else the recorded acoustic makes the orchestra sound bigger than it really is. This suits the Brahms symphony well, I feel, but makes the performance of the Haydn sound rather heavy-handed. In the minuet, in particular, there seemed to me to be a lack of stateliness and delicacy. Small points these, though, for it is an enjoyable performance.

On wide-range equipment the review copy sounded rather bass-heavy with somewhat hard sounding string tone. Using the tape recorder's small internal speaker, however, these defects were less apparent. Some may prefer the resultant added richness. **G.G.**

**SHAKESPEARE.** (Scenes and Speeches.) Vol. 2. Hamlet, Julius Caesar, A Midsummer Night's Dream, Twelfth Night, As You Like It, Much Ado About Nothing. Narrator: Michael Howley; director: Denis Comper. Dramatised by a team of sixteen actors. **HMV TA-CLP 1739 (Laureate Series).** 3¾ i/s mono. twin track. 35s.

AFTER the lively and spirited reading on the first volume I admit to a little disappointment here. The selections seem presented as items alone, as set pieces, and curiously removed from the passion and context of the play. Even the dialogues do not really engage and score off each other.

Robert Hardy gives us the soliloquy from *Hamlet* "To be or not to be, that is the question" and the "advice to the players" speech. They are intelligently and clearly spoken but from the first I missed the agate edge of Hamlet's searching, questioning mind working its way towards and away from suicide, and from the second sheer pleasure and relish with which the prince talks to the players—his special guests and friends. *Julius Caesar* fares less well. George Baker is helped little by the three voices trying to simulate a crowd effect but as Mark Antony, his funeral oration speeches before the Roman Forum do not add up to the fantastic piece of mob incitement and opportunism that cleft the Roman state in twain. And the conspirators Brutus and Cassius arguing in the camp near Sardis are just not the political heavyweights we have watched drag down "the greatest Roman of them all".

The comedy selections are happier. Lewis Jones giving us Jaques' "All the world's a stage" from *As you Like it*, and *Much Ado About Nothing* is nicely served with two scenes of confusion soon to be righted. This play has great vivacity and characterisation and the actors catch it well. The Titania/Oberon encounter in *A Midsummer Night's Dream* is most charmingly spoken by Anna Massey and Redvers Kyle in the style of high comedy. The *Twelfth Night* scene in Olivia's garden where the unfortunate Malvolio is gulled into the wearing of yellow and cross-garters is not altogether successful in bringing the humour to life, but Roger Liversey's Sir Toby Belch complete with throaty scurrilousness is great fun. **M.P.**

WHEN listening to the powerful and relentless intensity of *Mars* from Holst's *Planets*, it is difficult to imagine the composer as a man who began his more academic musical career as the music master of a girls' school. *Mars* was, in fact, the first of the movements to be written and was composed in the year 1914, at the beginning of the Great War. The work was completed in 1917, and the events of the period doubtless influence much of the music's atmosphere, though of course it is the *Mars* movement that is the really warlike one.

At one time it was difficult for Holst to get a conductor to perform this work (I believe Sir Adrian Boult gave it its first performance),


**THE PLANETS** (Holst), BBC Symphony Orchestra conducted by Sir Malcolm Sargent. **HMV TA-ALP 1600.** 3¾ i/s twin-track mono. 40s.

but these days it is considered quite a normal part of concert repertoire. On this tape record Sir Malcolm Sargent shows no hesitancy in piloting us through our space journey, and the BBC Symphony orchestra sounds very well. The contrasting moods reflected in the astrological symbolism come over clearly. The quality of the recording, though restricted in frequency range, is satisfactory except for a small patch of drop-out appearing at the beginning of Track One on the review copy. **G.G.**



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# TAPE RECORDER SERVICE

## NUMBER FORTY · RECAP ON PHILIPS BY H. W. HELLYER

THREE previous articles of this series have dealt with *Philips* and their associated companies' tape recorders. These appeared in May and June 1962 and in May 1963. Necessarily, the treatment had to be perfunctory. This company is nothing if not prolific.

My postbag since then has proved that there were a number of small points requiring further explanation. This is aggravated by the difficulty the layman has of getting service information on certain machines. Mainly, the queries have been about small adjustments, the 'correct' setting of the transport system, clutches, brakes and switches. But also there is a little confusion about the model differences, and the accessories that are available.

The confusion begins with the *EL*3541, now five years old, and overtaken by the 'upright' revolution, and the 'square-button' models of more recent times—about which, more later. This machine was similar to the *Stella* 454 and the *Cossor CR*1602, except for small styling differences. But hard on its heels came the 3541/15*B*, which, though mechanically similar, is quite a different machine.

Main differences were the layout of the electrical section and the switches. These last were not only mounted differently, but used a slightly changed contact sequence, with a printed circuit slider, and those readers who wished to modify the 3541 to later, improved versions, may be disappointed.

The changes bring in rather more complicated feedback circuits between second and third stages, and allow for the physical changes of the printed circuit boards. Certainly, they give more elbow-room, and the 15*B* is a much easier machine to service. The sub-panel on which the two variable capacitors are mounted is now easily reached for a quick check if oscillations cease. Often, a slight movement of one or other of these, depending on the track being used, is sufficient to clear what may seem to be a deep and difficult fault. The physical construction of the Philips concentric trimmers is such that a very delicate electrical change can be effected by a small movement of the upper section on the threaded spindle. But with these capacitors, when the two sections have to interleave concentrically, and where the thread on the spindle is fairly coarse for its diameter, any wear—generally, to be honest, due to rough treatment!—results in intermittent short-circuits, and a consequent intermittent bias.

### MODIFIED TONE CONTROL

The tone control is now in the grid circuit of the triode section of the ECL82, the third stage, and not, as previously, the feedback over the output stage. The oscillator coil is different, which precludes adapting the 3541 to 15B circuitry, as part of the difference includes the superimposing switch circuitry. But the problem that is more realistic, and can be overcome, is to alter the 15B superimpose circuit to the later, 15K, parallel track circuit, and to adapt the stereo socket for feeding an external amplifier, such as the Philips 3774. More about this later.

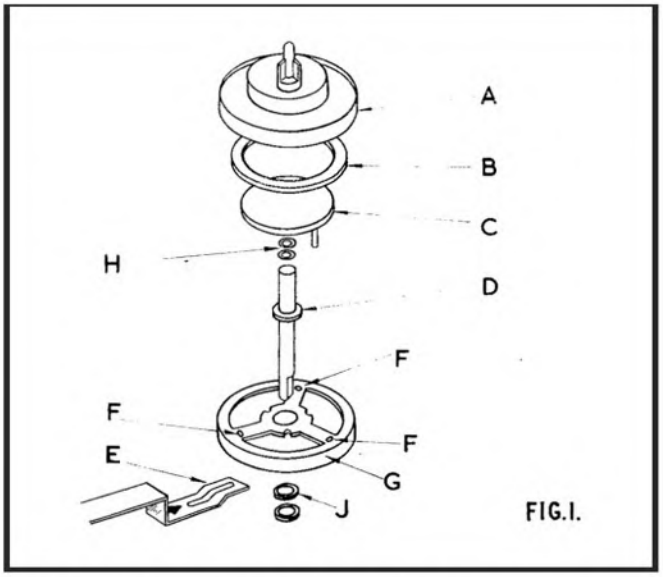

FIG.I.

Before getting involved in the electronics, let us look at some of the mechanical features, common to the various machines, which give the most worry.

Clutches: the system was described in the previous articles, but will bear repeating, and would be better illustrated by the exploded drawing of **fig. 1,** which the restriction on space squeezed out of the former servicing pages. The spool carrier **A** has an inset felt ring **B** which rests on the plastic disc **C** to allow a slipping torque for take-up. The disc **C,** during RECORD or PLAY, is held up by the collar on the spindle **D,** so that it is clear of the clutch drum but still held in place by the spigot.

The height of the plastic disc is determined by the raising of the spindle, whose flatted lower end sits in a slot of the angle arm **E.** This arm has a 'set' in its end of about two millimetres. It is not —repeat not—a solution to clutch troubles to bend this arm for more upward movement. The usual trouble is that the turntable sits too low and tends to rub on the Vulcanan pads **F** which are inset in the clutch drum **G.** This action is invoked during fast forward wind, when the movement of the arm **E** in the direction of the arrow allows the spindle to sit lower and makes the turntable and the clutch drum into a composite piece of winding mechanism.

### IMPORTANT PARTS

The important parts are the washers **H** and **J.** The upper pair **H** are to adjust the height of the turntable, relative to the spindle, while the lower washers adjust the height of the clutch drums. Method of adjustment is first to check that the turntables are correctly positioned so that the tape runs straight and true between the spool flanges, and is square to the guides, by adding or subtracting the plastic washers beneath the disc. These small washers are supplied as spares by Philips dealers, and require a small amount of lubrication. After regular use they tend to dry out, crack and disintegrate. It is possible, as a temporary cure, to make replacements from thin polythene, if you have a steady hand and a wife with a suitable pair of manicure scissors.

The above depends on one thing—that the guides themselves have not been altered. They are too temptingly easy to maladjust. Correct positioning is when the space from the lower side of the left



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mounting bracket to the deck-plate (the sub-plate, to be more accurate), is 16.3 millimetres. And the distance from the lower side of the forked piece of the right guide bracket should be 16.5mm. Note that these guides are mounted on screws which insert from beneath the plate, and are locknutted and spring mounted so that adjustment needs only slight movement of the upper nut.

Returning to the clutch drum; this important item should be at such a height that the tops of the Vulcanan plugs are between 0.8 and 1.2mm. from the underside of the turntables. Slowing down as a full spool is approached when fast winding usually indicates that this clearance is too great, either due to wear of the plugs, or incorrect positioning of the spool on its bearing, which again needs packing with washers and slight lubrication at this point. Too much enthusiasm here, or a hardened felt ring in the underside of the turntable, will cause snatch during take-up. The felt should be degreased regularly, as should the feed spool felt, with methylated spirit or carbon tetrachloride.

Brake adjustment has been dealt with before, and should need no repeating. On these machines, the setting of the peripheral brake pads is self-evident. Allowance for wear can be made by feeding the cork or composition parts further through the bent clips.

Head adjustment has also been covered before, but as there have been so many queries that obviously stem from a belief that heads cannot be adjusted for optimum results without a battery of meters and a Physics Laboratory sub-standard generator, it is worth a brief precis of the information that was given on page 164 of the May 1962 issue.

### TWO-FOLD DIFFICULTIES

The difficulties are twofold; achieving correct alignment for four-track response, and preventing erase heads from either obliterating a wanted track or failing to clean off an unwanted one. The two things go hand in hand, but a sequence of operations must be followed to get any sort of acceptable results without the aid of test gear.

First need is for a reliable source of playback signal. If no test tape is available, a good pre-recorded tape, such as one of the better Record Club offerings, is as good a source as will be required. One thing is certain—the tracks will be in the right place! To adjust a record playback head it is thus only necessary to play back this tape and align the head for maximum output.

The snag arises from the reluctance of the human ear to indicate small changes in output level, as compared with the accuracy that can be obtained with even a moderately specified meter. There are two schools of thought about this method of aural adjustment. My own favour is for headphone listening and null point adjustment. This relies on the fact that it is easier to detect the absence of sound than distinguish between small changes in sound level. So we play back the pre-recorded tape, turn the gain control to a minimum, until the signal can just be heard. Then, the azimuth adjustment is made, very slowly and carefully, adjusting the gain control to keep the sound right down to the merest whisper. Eventually, a position will be found where the sound can only just be heard, but any alteration of the azimuth screws will silence the whisper.

Given that the guides are correctly adjusted, as outlined before, and that enough time and trouble is taken with this setting, the azimuth alignment of the combined Record/Play head can be made with some precision. For ¼-track heads, which are a little more difficult to align in this way as azimuth discrepancies do not have such a great effect upon output, it is advisable to align on track 3 (numbering 1 to 4, top to bottom). When the best possible setting has been found, repeat the alignment on track 1, when it should only be necessary to check the exact height of the head. This applies particularly to heads using three and four screw fixing, but seldom to the two-screw mounted head.

### A TRICK IN THIS

Having done all this, remove the test tape and check the recording and erasure. There is a trick in this: for normal machines, erasure takes place prior to recording, and a good deal of care is needed to distinguish between the signal that has been partially erased by incorrect erase head setting, and that which is not being recorded at an incorrect level. So we put the erase head out of action (using the super-imposition facility, if fitted), or remove the tape from the immediate vicinity of the erase head. A thin piece of plastic, such as the tongue of one type of ladies' comb, or the handle of one of the manicure implements in the kit you borrowed previously from her ladyship, does this very nicely.

---

Make sure your tape is magnetically 'clean'. Bulk erase, or use new tape. Record a signal on Track 1, wind back and re-record a similar signal on Track 3. If you have some sort of constant sound available—even the whine of a vacuum cleaner, with the gain setting at the same level each time, and the position of the microphone unaltered, has been known to provide a fair measure of sound balance. Play back the two tracks, now parallel on the tape. Note that the sound level on each is similar. If not, you probably have the head too high, and had better check the original alignment.

Once this is right, and you are satisfied with the two tracks of equal sound intensity, invert the tape, and between these two sounds, apply the erase field. Simply remove the erase blanking and record with no input, on Track 2. Turn the tape over again and replay those two recorded tracks, listening carefully for any diminishing of output on either. If Track 1 has been impaired, the erase head setting was too low; if Track 3 is weaker, the head was too high. Repeat this operation several times, using cleaned-off tape each time, or a further portion of new tape, until no difference between the two tracks can be discerned.

Still on the subject of heads and erasure, we come to the difference between the 15B and 15K. This consists of changes in switch connections to convert the superimposition facility of the 15B to a parallel play facility, and also to bring out to the stereo replay socket a 16V supply to power a preamplifier. **Fig. 2** shows the circuit used in the later model. The only additional components needed will be two resistors, 6.8K and 47K respectively, for the feed to the stereo socket. The top of the 47K is taken to a convenient point on the HT line. The connection from pin 3 of the stereo socket will have to be taken from the connection on the track switch which goes back to the bottom tag of the erase head via the track switch. See fig. 3. This point is then taken to the junction of the two resistors. *(continued overleaf)*



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The parallel effect switch is added between the track switch tag to which the 56K resistor is connected, and the tag on the PLAY switch which is second from the end of the board. Although the actual switch supplied by the makers is a lockable type, with spring loaded spindle, this only requires a single-pole, single-throw switch, and any convenient toggle switch could be used. The superimposing switch will have to be disconnected, making a permanent connection to the commoned erase head connection.

Other changes that came with later models were to fit a 5-pin DIN socket for Diode input and a 5-connection I.E.C. socket in place of the 2-pin radio socket, with a 100K resistor as matching grid load for the high-level input pre-amp stage (ECC83).

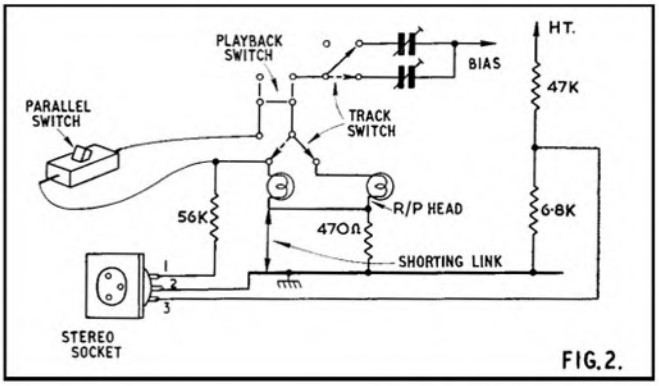

FIG. 2.

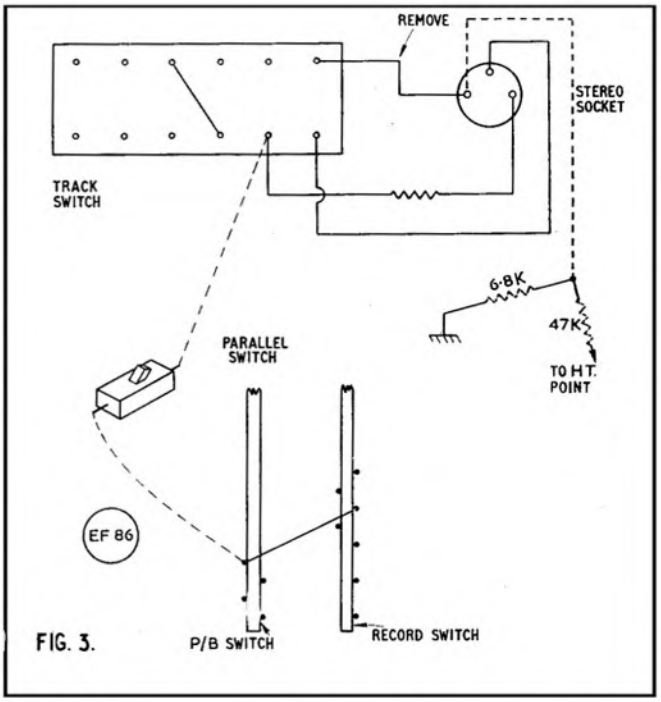

FIG. 3.

The type of preamplifier used with these models is the EL3774, a three-transistor job, using an OC44 and two OC75s. The frequency response from the 1 volt output socket (150k matching) used to power the main amplifier, is from 60 c/s to 10 Kc/s, while from the 2-pole socket with 200mV output across 1,000 ohms, the top response is 4.5 Kc/s.

But the question most frequently asked is not about the preamp itself, or the later type 3787, which matches the Philips *EL*3549, Cossor 1604 and 1605 and the Stella 458 and 459 and is a much more comprehensive job, but about the various interconnecting leads that can be used. In the next article, these will be drawn and described in full.



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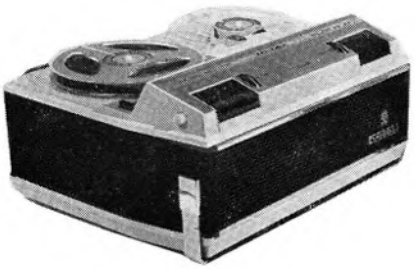
## FOUR NEW GRUNDIG RECORDERS



FOUR new recorders have been added to the *Grundig* range—Models *Luxus TK* 14*L*, *TK* 17*L*, *TK* 18*L* and *TK* 23*L*. Common specificational points are tape speed - 3¾i/s; frequency response - 40 c/s to 12 Kc/s ±4dB; wow and flutter - ±0.2%; output power - 2.5W; dimensions - 13¼ x 10½ x 6¾in.; weight - 22lb. All four incorporate high impedance and external speaker outlets and all are mains powered.

The TK 14L and 18L are ¼-track machines, having 48dB signal-to-noise ratio, input sockets for high impedance microphone and pickup, with tape counter, speaker switch, pause control and tape jointing channel. Prices are £38 17s. and £43 1s. for the TK 14L and its auto-gain equivalent, the TK 18L, respectively.

Quarter-track operation, with 45dB signal-to-noise ratio, is offered by the TK 17L and TK 23L. The latter model features manual and automatic gain control, while both have three input sockets and headphone monitoring facilities. The TK 17L costs £45 3s. and the TK 23L - £51 9s.

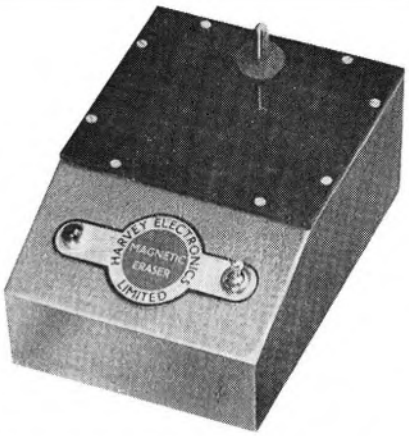
**Manufacturer : Grundig (Great Britain), Newlands Park, Sydenham, London, S.E.26.**

## BAIRD VARSITY 101 THREE SPEED TAPE RECORDER

DOUBLE-track playback and inter-track recording are incorporated on the *Varsity* 101 tape recorder recently announced by *Baird*. A BSR TD10 tape deck gives three speeds of 7½, 3¾ and 1⅞ i/s, 7in. spool capacity and 2½ minutes rewind time per 850 ft. reel. Internal mixing of high impedance microphone and GRAM inputs and separate bass and treble controls are also featured. The ¼-track recorder provides outputs for external amplifier and speaker with facilities for muting the internal 8 x 5in. unit. Gain level is indicated by magic-eye and cabinet dimensions are 16 x 16½ x 8in. The price, including crystal microphone and accessories, is £34 13s.

**Manufacturer: Baird TV Distributors Ltd., Empire House, 414 High Road, Chiswick, London, W.4.**

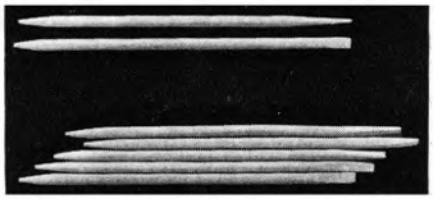
## HARVEY BULK ERASERS




VARYING in price from £6 5s. to £15 10s., a new production of Harvey Erasers was recently announced. Twelve models are now obtainable, to handle spools of up to 12in. diameter and tape widths up to 1in. The units can also be used to demagnetise small metal objects such as watches and tape heads. In the latter case, care should be taken to protect loudspeakers magnets.

**Manufacturer: Harvey Electronics Ltd., Farnborough Road, Farnborough, Hants.**

## HEAD CLEANING STICKS



EASY access to tape heads and head channel is provided by the 4in. wooden sticks sold by *DEYM*. *Cleanheads* are available in packets of eight costing 1s. (or 1s. 4d. by post) and should be used with small pieces of cotton wool soaked in methylated spirits.

**Manufacturer: DEYM Products, 73 Wadbrough Road, Sheffield.**

## BEYER MICROPHONES

FOUR new microphones have been added to the *Beyer* range : Models *M*55, *M*80, *M*110 and *M*610. The M55 is housed in a die-cast zinc casing and has a frequency response from 70 c/s to 16 Kc/s ±2dB and omni-directional pickup pattern. Output impedance is 200 ohms or 80K and the microphone costs £6 17s. including stand and cable.

Price £12 18s., the M 80 cardioid microphone has a frequency range from 50 c/s to 16 Kc/s and is also available with 200 and 80K impedances.

The Beyer M 110, is suitable for use as a lavalier microphone for reporting and in general applications requiring some degree of portability. Frequency range and output impedance are 60 c/s to 12 Kc/s and 200 ohms respectively; retail price is £28 11s.

Model M 610, pictured on the right, has a built-in music/speech (bass attenuation) and on/off switch and a cardioid pickup pattern. Nominal impedance is 200 ohms but an external matching transformer is available for 50K ohm impedance requirements. A 37.5 ohm balanced line version is also available for public address applications. Price is from £22 to £26 12s. depending on impedance.

**Distributor: Fi-Cord International, 40a Dover Street, London, W.1.**



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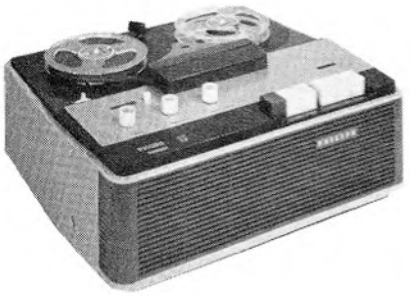
# equipment reviews

PHILIPS
EL3548



**MANUFACTURER'S SPECIFICATION :** Quarter-track two-speed domestic recorder. **Frequency response:** 60 c/s to 10 Kc/s at 1⅞ i/s; 60 c/s to 13 Kc/s at 3¾ i/s, ±3dB. **Signal-to-noise ratio:** 40dB. **Spool Capacity:** 7in. **Power Output:** 2.2W. **Wow and flutter:** 0.6% peak-to-peak at 3¾ i/s. **Fast wind:** 1800ft. in two minutes. Tone control operative on replay. Tape pause button, with connection for foot-switch. **Facilities:** Mixing of microphone and high-level inputs. Parallel-track playback. Stereo replay and inter-track recording using EL3787 pre-amplifier. **Inputs:** Diode, Gram and Microphone. **Outputs:** Diode, External speaker, Headphones and Stereo. **Power requirements:** 50W approx. from 110, 127, 200-250V AC 50 c/s (60 c/s conversion). **Dimensions:** 15¾ x 13¾ x 6¾in. **Weight:** 18lb. **Price:** £40 19s. **Manufacturer: Philips Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2.**

A RECORDER for home and family pleasure, economical in tape and reasonable in price, backed by name and know-how . . . Tape without tears, in fact . . . this is a fair description of the *Philips EL3548*, such as its own advertisers might use. Perfectionists and other (hi-) fry need not apply—it does not record stereo, and needs extras to replay it; the machine has no 7½ i/s nor will it follow CCIR or any other characteristic with bloodhound accuracy; its output will not shake floors unaided, neither will it enjoy internal tinkering.

It *does* offer: ease in setting up; real simplicity and versatility in use; smart modern design with performance and facilities to match. The makers have kept size and weight down, but unlike other slow-speed models the spools are not thereby limited to 5¾in. or less; 7in. diameters are accommodated, giving really long uninterrupted runs.

### TRANSISTOR PREAMPLIFIER

The circuit is a marriage of solid-state early stages with an ECL82 valve output and EM87 magic-eye—perhaps the best of both worlds at present. The mains-transformer and single motor with their hum-fields are located as far to the rear as possible, and a close-fitting shield is brought up to the record/playback head outside the pressure-pad; one might expect a higher signal-to-noise ratio than the 40dB claimed: measurement gave 39dB at 1⅞, 42dB at 3¾ i/s.

Performance at either speed can be assessed by taking figs 1 (a) and (b) in conjunction; extending measurements rather beyond audibility in (b) points the causes of the somewhat restricted response from tape (a). Normally one would expect a test-tape (replay only) at the higher speed to give the best showing; the dotted curve obtained in this way is in fact the least extended, the overall record-play curves being better at both speeds—3¾ i/s the solid-line, 1⅞ i/s the circles.

### STRAIGHT-THROUGH RESPONSE

After checking azimuth and possible errors I attacked the anomaly by plotting straight-through response in the record and play modes, with results shown in **fig. 1 (b)**. The lower curve shows recording gain with frequency, test oscillator feeding the diode socket (input pin) and valve-voltmeter across the monitoring headphone sockets, with resistive load. This curve divides into two steep treble-peaks at 17 Kc/s (3¾) or 11½ Kc/s set to 1⅞ i/s, the LF performance being unaffected. The upper replay-curve also divides in the treble for each speed, and was obtained by matching the generator in place of the tape-head and measuring at the diode output.

The picture now clears—best slope of the replay curve is less than the desired 6dB per octave, being 5dB per octave around 500 c/s and 2.5dB or less per octave below 200 c/s. At the treble end, lift does not begin in earnest until 10 Kc/s and upwards, except for the record equalisation at 1⅞ i/s whose effect is mirrored in the flattening at "F" of the circled record/replay curve before its final demise. At each speed the bass end of the overall curve in **fig. 1 (a)** is 3-4dB up on test-tape, showing the effect of bass emphasis in recording.

### LISTENER'S TOTAL

What does all this add up to for the listener? There will of course be a scarcity of true bass, replaced by 'middle-bass', but if driving a fairly large extension-speaker in open cabinet, with bass resonances around 100 c/s—not uncommon in a domestic set-up—the response makes best use of available output by minimising overload and cross-modulation from the true-bass end, and may even be turned to advantage—shades of 'tailored response'. Likewise, any treble shrillness will be much less obtrusive, especially as the microphone knob becomes an unusually smooth treble-cut tone control on replay via speaker—not on the diode output, leaving the pre-amp user free to make up treble and bass as desired. The smooth declines of the test-tape curve make feasible a close approximation to flat response into an external power-amplifier by these methods, for replaying, say, 3¾ i/s pre-recorded tapes.

### CONTINUOUS-RUNNING CAPSTAN

The EL3548 uses a continuous-running capstan with wide flywheel, belt-driven from alternative pulleys for speed-change, and I would expect rather better wow and flutter figures than those claimed in the specification. In fact the *Kalee meter* showed (RMS): total waver at 3¾ i/s - 0.25% (flutter 0.2%, wow 0.15%); at 1⅞ i/s - total 0.3% rising in slow cycle to 0.4%, flutter component again 0.2%, wow now 0.25% (0.2% RMS = 0.56 peak-to-peak). Use of pre-recorded known low-wow tape on the machine showed a slight audible improvement, but as the measured figures are not far off the spec. I suppose we must be satisfied. However, even these low figures are perceptible to a sensitive ear, and I did find a rubber inter-wheel driving take-up clutch with noticeable tyre-eccentricity and warp; also, grinder-marks are to be seen on the capstan-shaft.

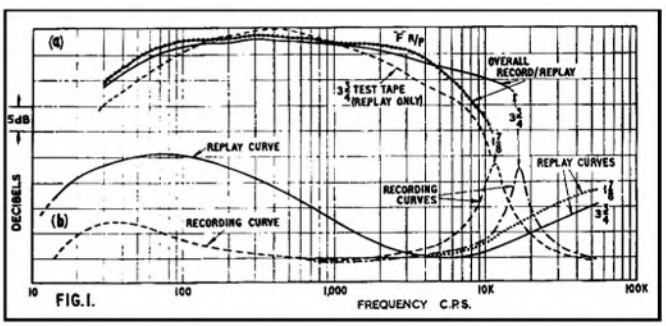


FIG. 1.

To check on the possibility that the machine was not standard, I unobtrusively tried a 3 Kc/s good tape on another 3548 in the local dealer's and it sounded much better. Regret no fluttergrams—difficult to take under the circumstances, and it was Christmas-crowded too . . .

A fair review must mention also that rewind is rather slow—the 1200ft. 5¾in. tape supplied took 2½ minutes to wind on to similar spool (tight wind) and 2¾ minutes on rewind (one packslip). The rotation

(*continued on page* 131)



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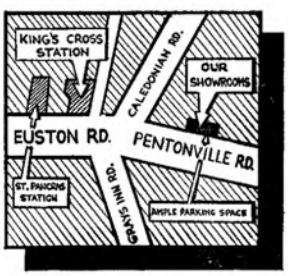


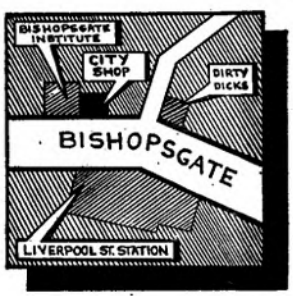


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counter is four-figure, instant reset, and showed an error of only three final digits over the distance. But bearing in mind the recorder's purpose, may one also give due weight to the following:

The placing and marking of controls in three groups of three, six large tablets and three knobs for everything, make operating simple and easily learned. The left-hand knob switches on, and the red left-end RECORD tablet is pressed; advancing remaining knobs shows the incoming signals on magic-eye—microphone on right-hand knob and mixing in radio/gram or another recorder by the centre knob. The transparent red centre-clip on the eye simplifies level-setting; signals can be heard at any convenient volume by advancing the combined on/off switch and gain control and this is also the straight-through amplifier mode. Three-finger control on either group of tabs from now on—to record, still listening, press the outer tabs together in the left-hand group (RECORD and PLAY). Pressing PLAY alone releases the red tab, as a safeguard against accidental erasure.

### PAUSE CONTROL

The centre tab of this trio (PAUSE) gives temporary stop and may be held or locked down without scraping of oxide against the capstan; the tape-angles prevent this in play while offering a straight drop-in slot when loading. Pause action is duplicated by an optional foot-control, a non-electrical Bowden-cable action which screws in at the rear. The run completed, tape can be fast-wound either way—without necessarily stopping—by three-finger control of the right-hand group of tabs: REWIND at the left, fast forward WIND to the extreme right and STOP in between, which cancels all. WIND and REWIND cancel RECORD/PLAY instantly, without smearing the recording at the reversal point, and tape-wind can be reversed at will for inching by alternating pressure on the outer pair. Hardly any single-motor machines have had this feature to date; interlocks are usually arranged to prevent one operation running into the next, operation of the stop-button being mandatory each time.

### EASY EDITING

For editing, chinagraph-pencil marking is made easy by a lid on the front head-cover which slides forward and unclips. One screw releases the back section for cleaning heads, etc. Four more screws are removed for internal attention, one behind each spool and one each side, and I have never seen a domestic machine whose 'works' can be uncovered so elegantly. Instead of a drop-in chassis, top-plate and sides of the cabinet are integral, and once the knobs are pulled off the complete 'overcoat' lifts away. The carrying-handle slides away through the socket cut-out at the right to ease the unveiling.

To replace the output valve or the fuse beside it is even simpler: the plastic bottom-plate only is removed (four bolts in the feet) and this carries a rubber-beading all round its edge to engage plastic finger-mouldings on the cabinet-sides when replaced, eliminating cabinet-buzz at high volume.

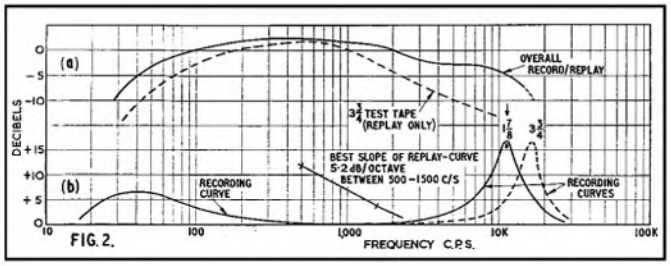

FIG. 2.

Many electrical devices in one-room flats, etc., are used from bayonet-adaptors or other two-pin sources, and Philips provide *twin* mains lead (no earth-wire)—hum-loops at least are unlikely with the arrangement, and earthing, if required, can be taken to the lower wander-plug (headphones); the socket is marked with the earth symbol, and makes through to chassis. There is no exposed metal apart from sockets, and their mounting-plate is shielded by an engraved plastic facia.

(*continued overleaf*)


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A final point—do not press WIND and REWIND together; the interlocks are ingenious, but not that clever, and the motor will promptly stall, stretching the unfortunate tape in the process!

### POSTSCRIPT

Further to feelings that the specimen I tested might possibly be an unlucky one, I was glad to have the opportunity of testing another sample kindly provided by Philips. The procedure was to take another series of measurements for the more interesting parameters and replot them, and of course, to measure the wow figures again of depending on aural assessment.

The differences found were no more than might be attributed to the normal spread of tolerances in production. In **fig. 2** (a) the same test-tape failed once again to give as wide or even response as the overall record/play results, for the same reasons of pre-emphasis already discussed in the body of the article, and visible in the new version of **fig. 2** (b) curves. The straight portion of the replay-response is also shown, and its slope of 5.2dB per octave is only marginally better than the 5dB/oct. of the original.

### BETTER APPEARANCE

The appearance of the salient parts of the tape-transport was much better, and the wow figures showed an improvement. They are RMS in all cases: $3\frac{3}{4}$ i/s, flutter 0.16%, wow 0.15%, total 0.2% to 0.25%; $1\frac{7}{8}$ i/s, flutter 0.2%, wow 0.25%, total 0.25% to 0.35%. The values for total waver again showed the same slow cycling between the figures given, as various components came in and out of step.

Remaining impressions were substantially the same, except for two very small faults. Pressure of the PLAY tab to its bed while using the diode socket to feed external systems on replay caused disappearance of the external signal—without, however, affecting sound from the internal loudspeaker. Also, it is not advisable to snap home the cover to the mains-cable stowage compartment, relying on the locking spring to latch home with a click; it flew off with a snap, owing to the plastic pips which secure it shearing off. Am hopeful of what *Araldite* may do . . .

**B. R. J. Plumtree.**



The answer is a microphone preamplifier. Gain may have to be reduced somewhat with an attenuator if it is a general purpose type such as a Walgain.

A long length of cable, say 100ft., is used with the preamplifier near the microphone. If an attenuator is used this should be near the recorder.

Every bit of the microphone circuit must be screened, and waterproof as dawns are usually damp.

The reason for having the preamplifier near the microphone is that 100ft. of cable generates noise. This noise would be amplified if the preamplifier were near the recorder.

Recording shy birds with this technique is very like fishing. You place your microphone in a likely spot, keep out of sight and wait.

A dawn chorus requires some consideration. Do not place your microphone in the woodland but to one side of it, say 100ft. or perhaps a bit more. Do not place it in a tree either or you may find some Blackcap doing his little black nut about two feet away from the microphone and overloading your equipment. In the second place, pigeons bumbling in the tree top will transmit sound through the tree to your microphone. The resultant effect is rather like moving furniture upstairs.

Bird song commences in January and a dawn chorus will be at its peak in May at about 4 a.m. If you are after a dawn chorus put everything ready to snatch up or you will never make it in time. The best time for skylarks is about one hour *before* the dawn chorus, so if you want the rising lark in June you had better stay up all night. Next month we will take a look at the individual birds in greater detail.



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Replies to Box Nos. should be addressed to the Advertisement Manager, Tape Recorder, Link House, Dingwall Avenue, Croydon, Surrey, and the box no. quoted on the outside of the envelope. The district after box no. indicates its locality.

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*continued on page* 134

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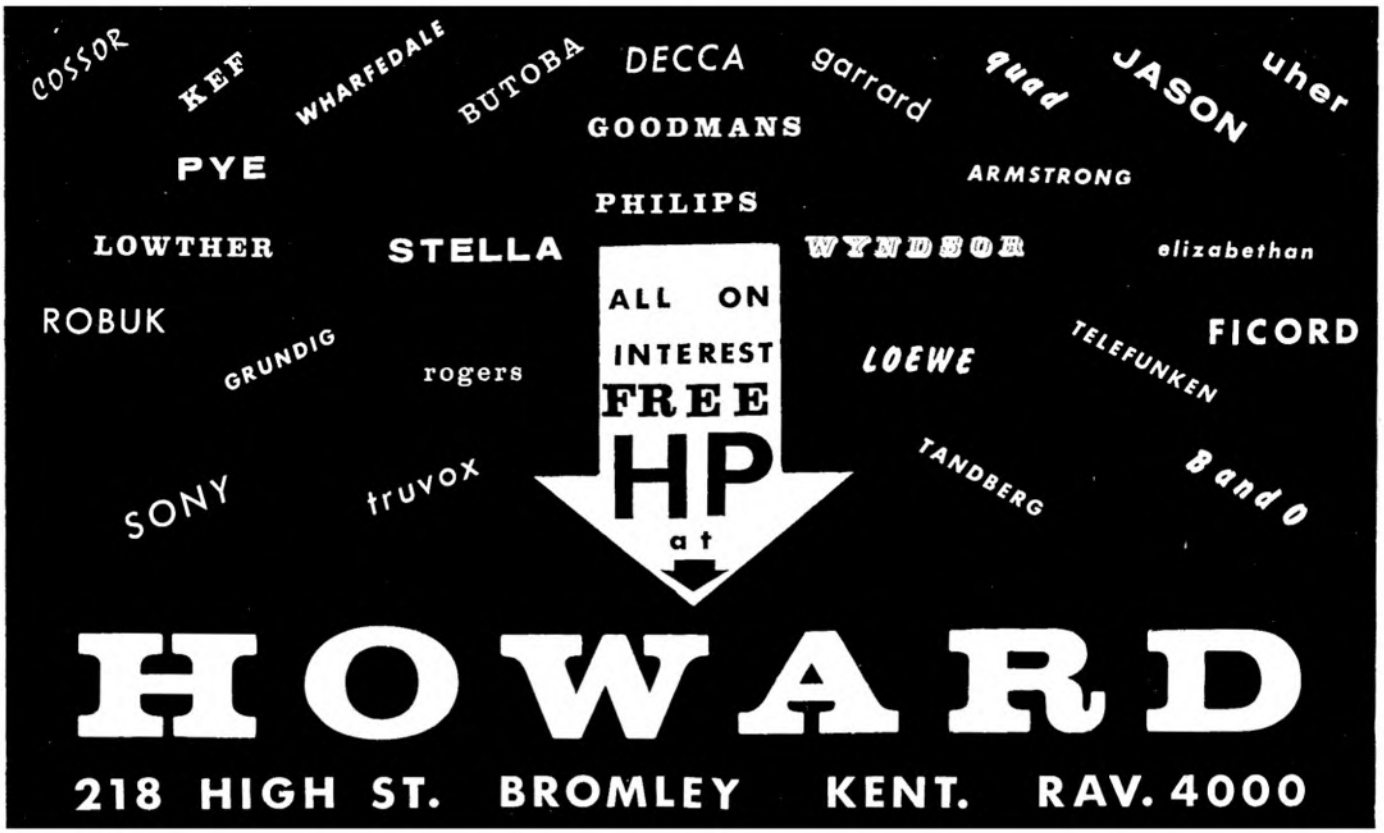


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