TAPE DECKS ANALYSED
a close look at the BSR TD10

TAPE decks come and tape decks go. Fashions change to suit market needs and to simplify mass-production. In many cases, evolution has meant improvement, though this is far from being a universal law where decks and recorders are concerned. But if the *Wearite* can claim to be the grandfather of the modern semi-professional tape recorder, the *BSR Monardeck* may make no less a claim to be the first truly domestic tape mechanism.

In many respects, the designer of a low-price medium-quality deck has greater problems with which to contend than the designer for whom price is no object. Domestic decks represent, not merely a compromise between cost and performance, but an attempt to produce a machine more reliable and versatile than a competitor can make at a similar cost. The ideal tape deck would be very accurately machined but would contain few components—something on the lines of the *Planet U.1* perhaps. A more complex design might achieve similar performance with wider machine tolerances though, in the long run, complexity serves none but the repair-man. Thus, if a golden rule exists to guide the deck designer, it is one that calls for simplicity and robust construction rather than unnecessary mechanical complication. Fortunately for Birmingham Sound Reproducers Ltd., many of their rival designers were neither fond of, nor adhered to, golden rules. In recent years this has led the one-time critics of 'over-simplicity' to favour the Monardeck as a device which, moderate as its performance may be, will run for years without fault. The Monardeck has a lifetime of some eight years to back up its theoretically slow rate of wear ; modern recorders, particularly those of Continental origin, have yet to face the test of time.

To enthusiasts interested in dissecting and studying tape mechanisms, the Monardeck is almost the only model simple enough to understand without spending long periods tracing the action of individual rods, arms and wires beneath and around a maze of components. The new *TD10* is an even more suitable instructor, since it can teach the principle of speed switching at its simplest. And it is in the respect of tape speeds that the TD10 differs from the Monardeck, apart from improved artistry above the deck. In almost every other way, the two decks are identical.

Our examination of the TD10 begins with the basic drive system. **Fig. 1** shows the layout of idlers in relation to the motor, spool turntables and capstan, omitting the brakes and the system of levers used to position the idlers and turntables for fast winding, rewinding and playing. The deck follows standard practice in driving tape from left to right, precise speed being governed by the capstan. Irregularities in the drive are ironed out, to some extent, by a heavy flywheel attached to the lower capstan spindle.

The motor is the heart of a tape deck. Many decks, for simplicity, incorporate three motors ; one for each spool turntable and one—often of superior quality to the others—to drive the capstan. It is the difficulty of transmitting drive to all three moving components that causes the complication of so many single-motor designs. BSR, however, have overcome these problems with a very straightward drive system. The motor rotates immediately the deck is switched on at a constant speed in an anti-clockwise direction (when viewed from above).

The capstan idler is tensioned against the motor and flywheel by a spring, except when changing speeds, and consequently transmits any movement of the motor spindle to the capstan. Since the capstan turns at a rate designed to pull a tape at one of the standard speeds, it follows that a tape held against the spindle by another idler—the pinch-wheel (not illustrated)—must be driven at this speed. All that is required now is a mechanism that will power the take-up spool and so wind up the tape. This is achieved by a belt-transmission from a pulley on the capstan to a larger one below the spool turntable. But since the rotation speed on the take-up spool varies with the effective diameter of the tape on it, some form of clutch must be incorporated against which the turntable may safely drag. The belt is therefore attached to a metal disc (see **fig. 2**) upon which the plastic turntable rests. The turntable thus rotates with the disc unless tension from the tape becomes greater than the grip imposed on the disc by the felt friction pad.

A less complex clutch is fitted to the feed-spool turntable, which is lightly mounted on an axle and spins fairly freely in PLAY and FAST FORWARD modes. Some back-tension is, of course, needed during both these modes—to prevent tape spillage in the former case, and to ensure an even and fairly tight wind in the latter. This tension is supplied by felt rings beneath the left-hand turntable.

A three-position mechanical selector governs PLAY, when pushed forward, REWIND when pushed to the left, and FAST FORWARD when located in the right-hand arm of its inverted T-slot. Rewind entails high-speed spooling of the tape from right to left-hand reels. To achieve this, the deck must be arranged in such a manner that the left-hand turntable is driven fairly quickly while the right is allowed to run free—or lightly tensioned as mentioned above. Since the motor spindle is rotating anti-clockwise barely an eighth of an inch away from the periphery of the left-hand turntable, the most economical and practical means of driving the turntable in a clockwise direction is to move it until it is locked against the spindle. And this, in fact, is just what occurs. The capstan continues to rotate during rewind, but this has no direct effect on tape speed, since the pinch-wheel is fully retracted.

The indirect effect on rewind speed, however, makes itself known through the capstan-right-hand turntable drive-belt which tries at all times to rotate the right-hand spool through the clutch. As will be seen from **fig. 1**, this attempted rotation occurs even when the machine is switched to STOP and only the brakes prevent such movement taking place. The result is that back-tension on rewind is a little greater than it should be and winding speed is nothing like as fast as that on three-motor decks. The BSR deck is by no means alone in having this 'fault', since a similar clutch and drive arrangement is used on many other single-motor machines.

Resistance from the right-hand turntable clutch is less marked on FAST FORWARD since the capstan-clutch belt is over-ridden by a separate idler giving direct transmission between motor and take-up turntable. But as the right-hand turntable rotates at a greater speed when forward winding than ever it would do during playback, the cotton pads slip in an anti-clockwise direction against the slower anti-clockwise moving clutch. The fast forward idler (so labelled in **fig. 1**) is hinged in a simple fashion between motor spindle and right-hand turntable periphery. During STOP, PLAY and REWIND, this idler is suspended limply and is free to engage either motor or the turntable, though one assumes that it remains centralised when operated in a horizontal position.

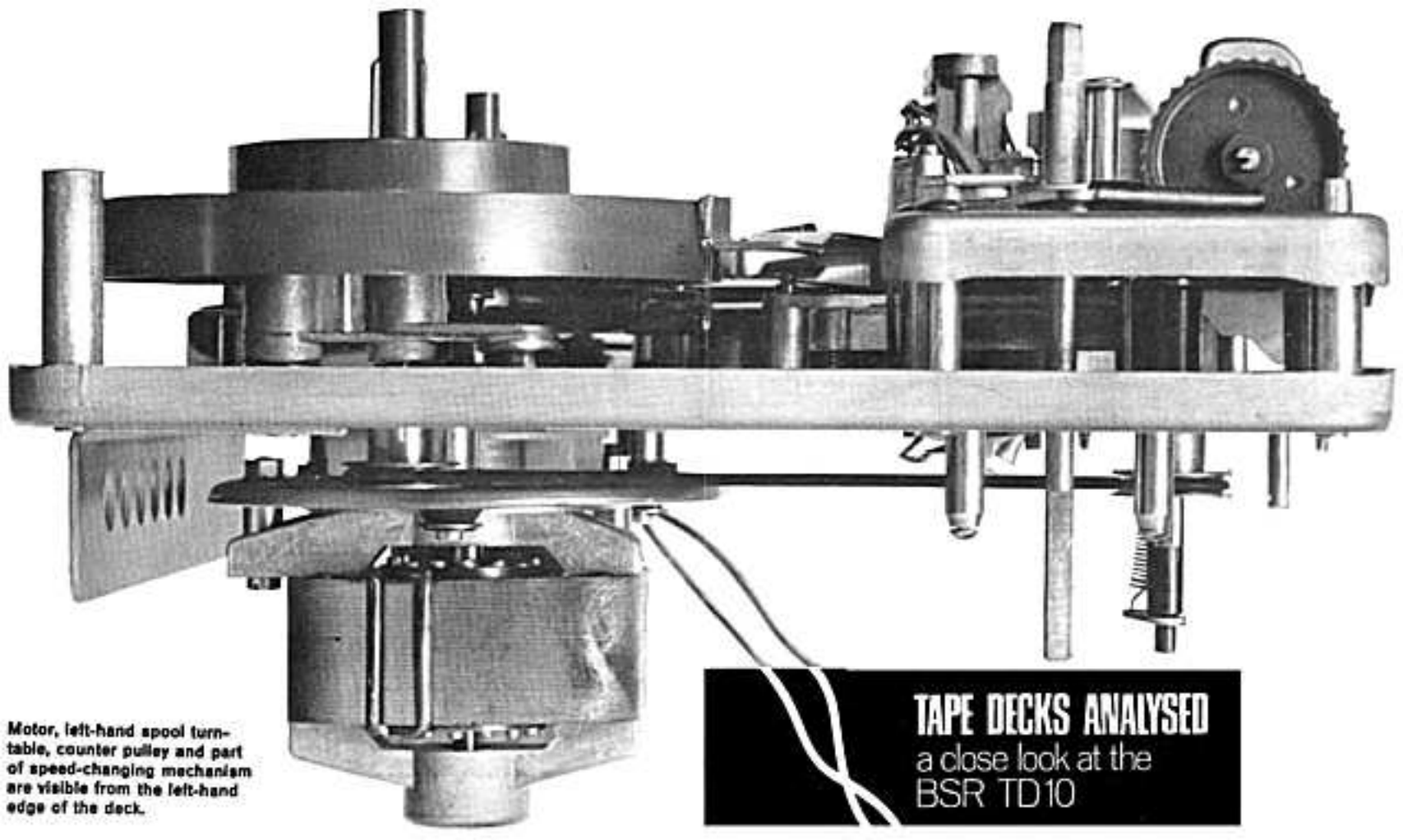
This, then, is the BSR approach to a single-motor tape drive mechanism, and in essentials that is all there is to the TD10. Rather more complicated to trace and understand are the brakes and the control mechanisms, responsible for positioning of each mechanical item. Nevertheless, their functions are simple—more so on this deck, perhaps, than on any other.

Fig. 3 provides a bird's-eye view of the head block and its connection to the mechanical controls. All three controls on the TD10 are illustrated, though the speed switch is represented, for the moment, merely as a vertical metal bar protruding through a slot in the chassis. All these components are mounted on a platform raised from the base of the deck to the same level as the base of the spool turntables. Drive transmission and control levers all operate in the space of about ¼in. between this raised plate and the base. The three-way lever shown in **fig. 3** and **fig. 4** is without doubt the most complicated single item on the deck. It is best described as a meeting place of levers. **Fig. 4** shows the levers in 'exploded' form. Uppermost of the four levers is that shown in **fig. 3**. The entire 'arm' is hinged about a point just left of the erase head and is held taut by a spring forward and to the right of the spindle. The spindle is mounted to the lowest of the four levers and is free to move forwards to PLAY, back again to STOP, right to FAST FORWARD and back left through STOP to REWIND. Each action, into or out of a mode, is resisted by an ingenious yet simple spring arrangement which, once the spindle has passed the half-way mark in its channel, reverses its action and forces the spindle into its destination The spring is responsible for the very positive action of the switch and is a strengthened version of that used on early Monardecks.

The positioning of pinch wheel, pressure pads and record interlock catch are all governed by this, the uppermost lever. The action is simple enough. Pushing the control spindle to the left or right has no effect on the lever, other than a slight oscillation towards the heads as the spindle is drawn straight across the W-shaped mechanical lock. This W arrangement assists the spring in retaining the spindle when in a STOP position.

The second of the four levers, situated just below the raised chassis plate, operates a lock across the RECORD switch, preventing the latter from being switched into position during fast forward or rewind. The original Monardeck did not have this facility, and thus this new arrangement eliminates a fault—or useful feature, depending on how one looks at it—common to many machines which used the single-speed deck. On some single-speed BSR-decked recorders, high speed

(*continued overleaf*)



Motor, left-hand spool turntable, counter pulley and part of speed-changing mechanism are visible from the left-hand edge of the deck.

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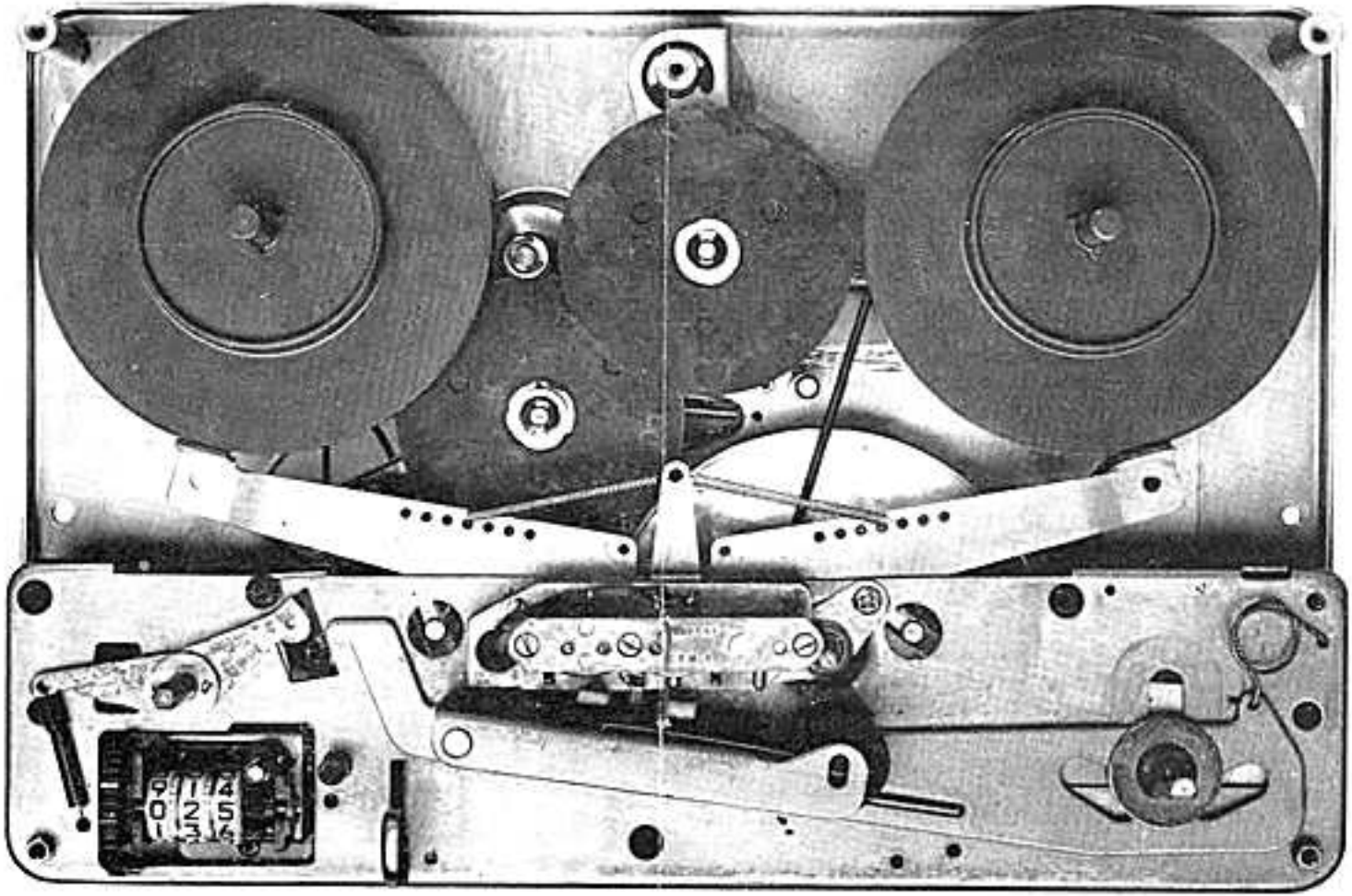
Removal of five screws and two control knobs gives access to the heads, brakes and idlers.



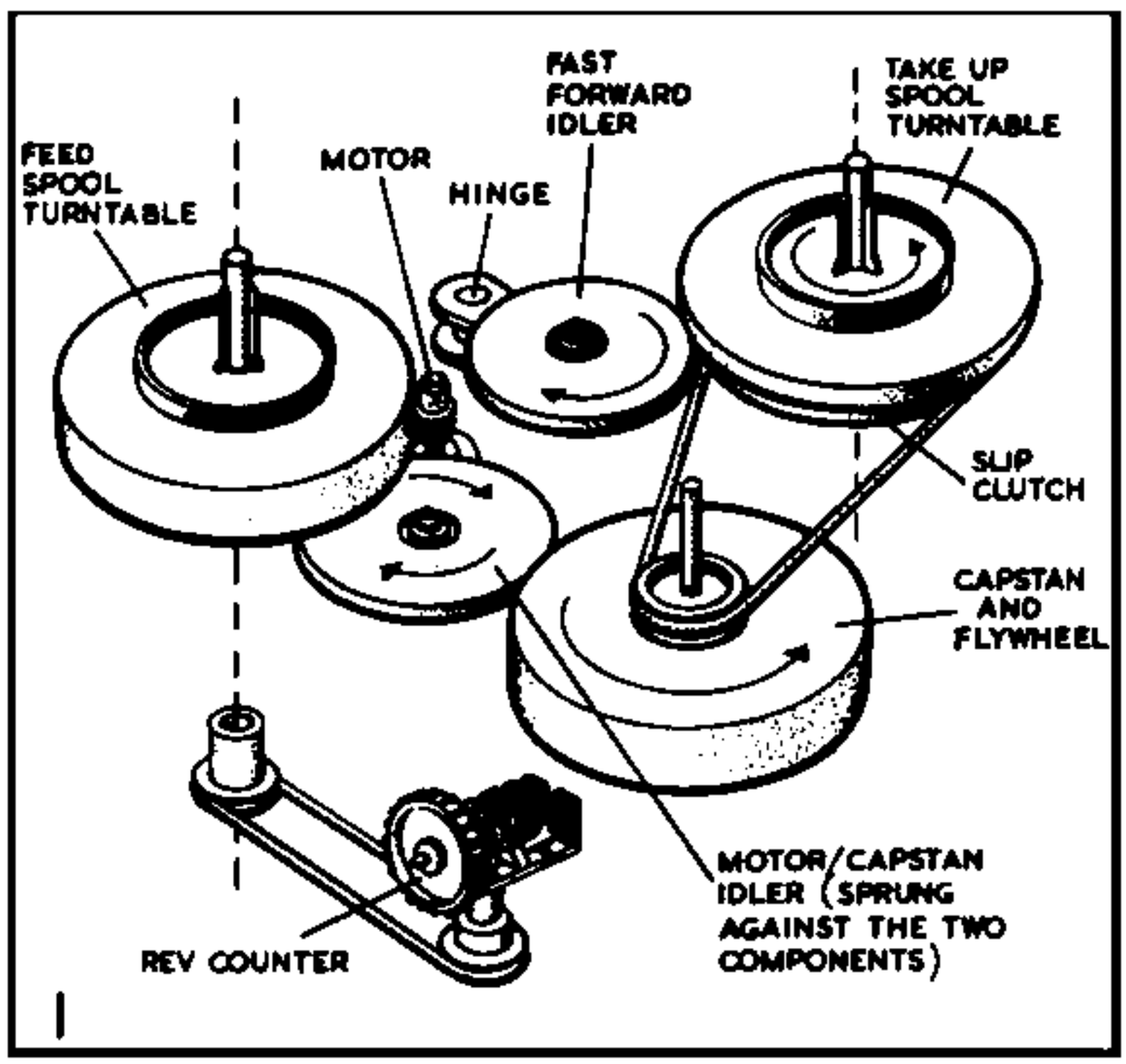
erasure of a tape could be accomplished merely by fast winding the tape and at the same time holding the record interlock in the ON position.

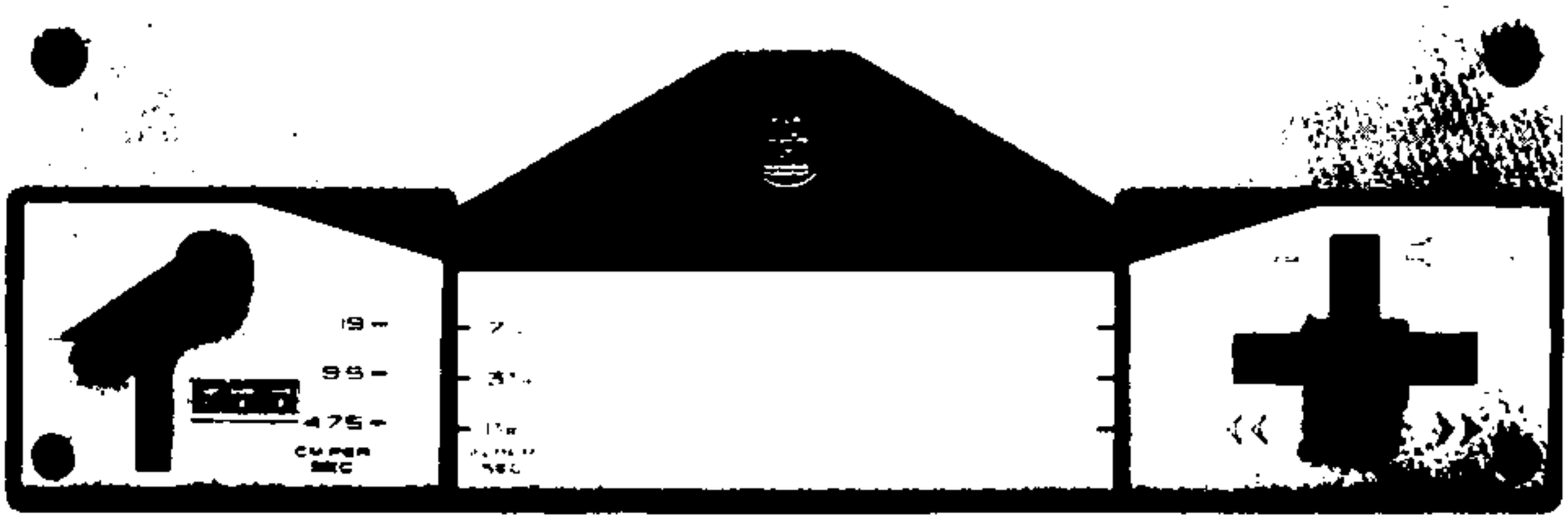
Third in the line of levers is the brake lever. This is presented to the selector switch as an inverted V-shape, the lever being pushed forward about its pivot whether the switch is moved to the left, right or straight forward. A protrusion from the lever passes the motion to the brakes which, in turn, swing about a pivot. The brakes are held against the two spool turntables by a pair of springs until the control lever forces them out.

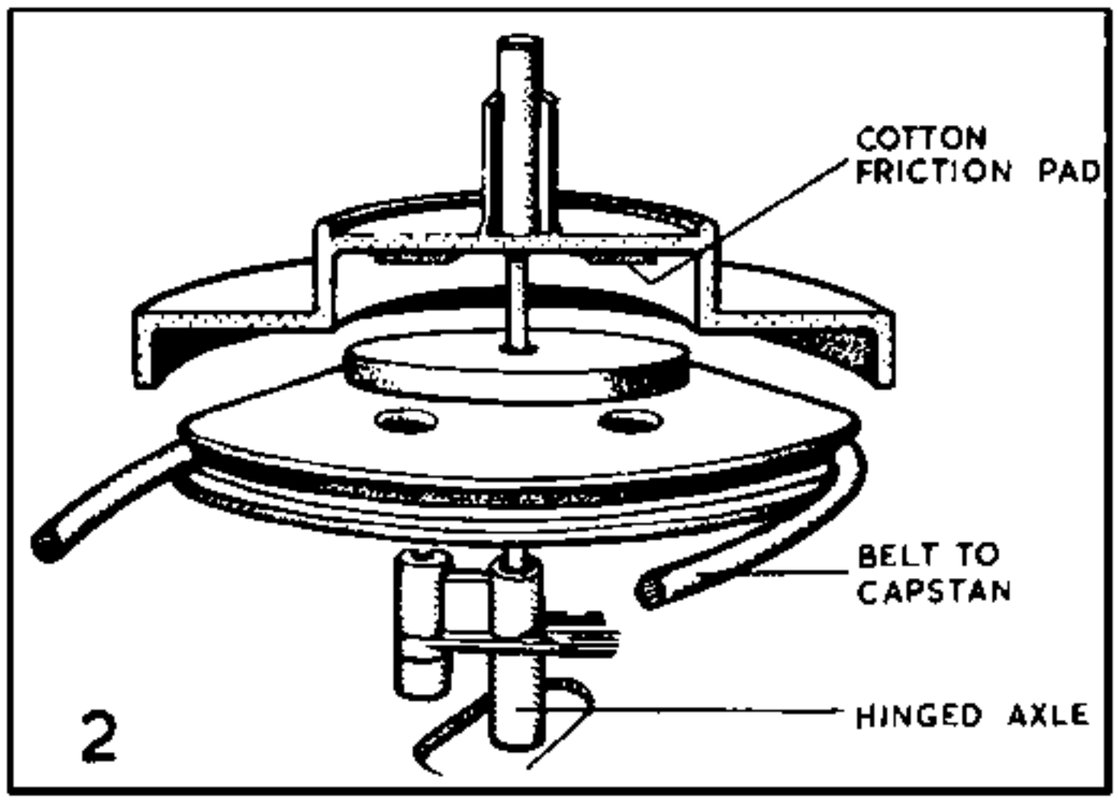
Most complex of the four levers is that at the bottom of the three-way switch. Again illustrated in fig. 4, this lever operates through 90° to move the spool turntables against the motor spindle. Pushing the switch to the right causes both turntables to move left, the right-hand one against a jockey pulley and hence the motor spindle. The movement of the left-hand turntable, in this case, is incidental and serves no real purpose. Pulling the switch into the left channel moves the two turntables to the right, the left-hand one direct against the motor spindle. At the point which engages the left-hand turntable, the spindle is tyred with rubber. The two idlers operate against metal.

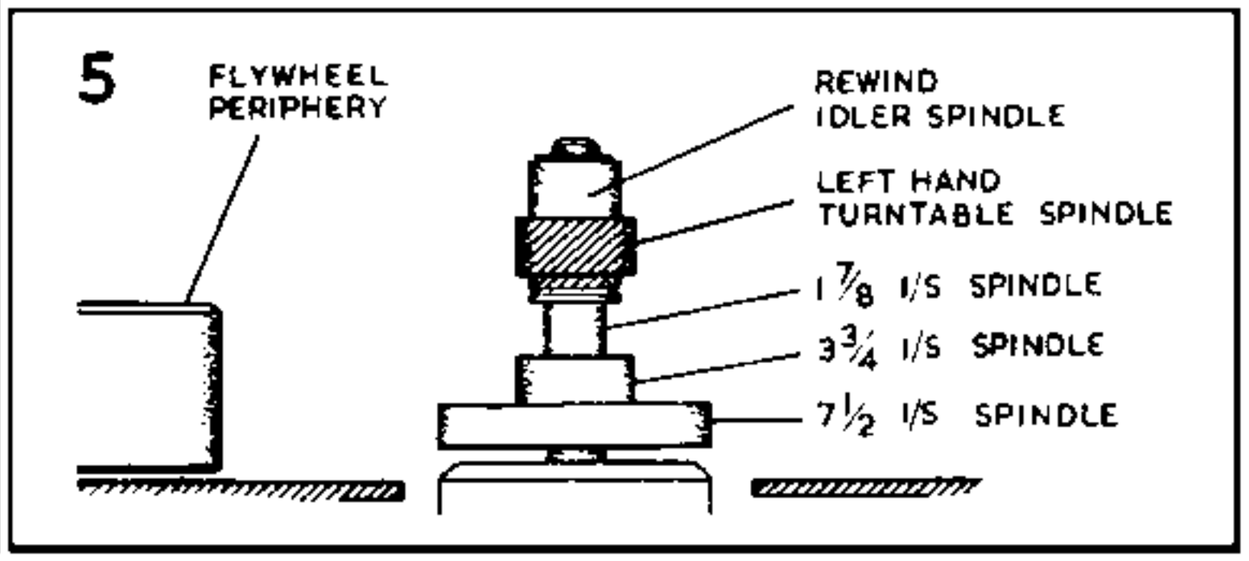
Fig. 5 shows the rubber tyre and also the stepped spindle, doubling in diameter to give 1¾ and 3¾ i/s, and further doubling to rotate the capstan, via the rubber idler, for a 7½ i/s tape speed. This brings us to the speed selecting mechanism. This is about as simple as it is possible to make a speed selector, though nevertheless fully effective. Fig. 5 shows the relationship between motor spindle and periphery of the capstan flywheel. It should be clear from the illustration that, since the motor turns at a constant rate, the speed of the idler, and hence capstan rotation, will depend solely on the vertical positioning of the idler in relation to the various steps. An 'exploded' view of the idler retracting and vertical positioning levers is given in fig. 6. As shown, this is set to the 7½ i/s tape speed, and pushing the control forward (in the direction of the arrow) causes the entire idler and supporting frame to move downwards. A peg, protruding from the frame into the stepped cutout on the sliding control, is supported against the steps by a spring which connects the bottom of the plastic support bar to the deck. The drop between each step in the cutout metal control slopes at about 45°, and slight friction between slope and peg as the control is pushed forward from slow to faster speed results in the entire idler bracket retracting for an instant from the motor spindle. This friction does not occur when changing down in speed, though it is not necessary for the idler to retract—it merely jumps straight down from wide to narrow spindle periphery. Absurdly simple, but foolproof and reliable.

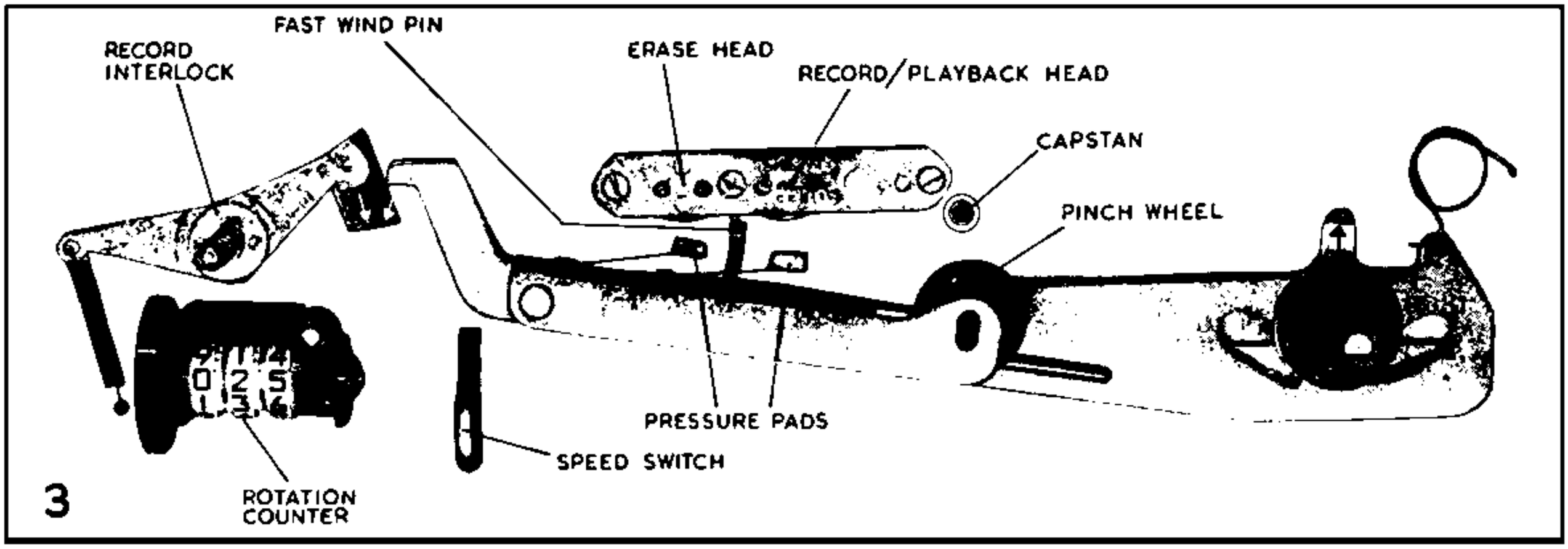
In closing, it might be of interest to note that of the deck's total retail price (£14 in ¼-track form), some £5 is devoted to the erase and record/playback heads, while the motor costs a little over £2 10s. Out of the remaining £6 10s., BSR have built a deck as rugged and reliable as it is possible to buy. The reader may not own a Monardeck or TD10 himself but, even if not the 'peering under decks' type, he might find it worthwhile and interesting to examine his machine and determine the similarities, the better points, the worse; such a study can only result in a better understanding of the machine, which in turn will simplify the task, and increase the followers, of 'do-it-yourself servicing'.











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