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(54) IMPROVEMENTS IN OR RELATING TO SCREWDRIVERS

(71) I, MICHAEL ANTHONY MUMFORD, a British subject, of 21, Helpston Road, Ailsworth, Peterborough formerly of Main Street, Ailsworth, Peterborough, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to screwdrivers in use of which a handle is rotated to drive a shaft.

Screwdrivers are known which comprise a shaft connected to a handle through a ratchet mechanism so that in one direction of rotation of the handle drive is transmitted to the shaft and in the other direction of rotation the handle moves freely angularly relative to the shaft. In such screwdrivers the ratchet mechanism can be actuated to alter the directions of drive and free movement.

Such screwdrivers have the disadvantage that a substantial free return movement of the handle relative to the shaft is required to engage the successive driving teeth of the ratchet mechanism, the movement being typically of the order of 36°.

The present invention provides a screwdriver comprising a shaft having at least two drive receiving surfaces, a handle having a cylindrical internal bore which receives the shaft, a respective rolling element located between each drive receiving surface and the internal bore of the handle, and control means engages with the rolling elements and movable relatively to the shaft between a first position and a second position, the arrangement being such that, in use, with the control means in the first position, rotation of the handle in one direction wedges each of the rolling elements between the internal bore of the handle and a first portion of the corresponding drive receiving surface to transmit drive to the shaft and rotation of the handle in the other direction is free and relative to the shaft, and that, with the control means in the second position rotation of the handle in said one direction is free and relative to the shaft and rotation in said other direction wedges each of the rolling elements between the internal bore of the handle and a second portion of the corresponding drive receiving surface.

This screwdriver has the advantage that only a small angle of free return of the handle is necessary before a further drive action can be effected. Moreover, as the drive mechanism of this screwdriver does not utilise ratchets, which tend to wear relatively quickly so that a mechanism incorporating ratchets has a relatively short working life, there is very little wear and consequently this screwdriver has a long working life. Furthermore, the drive mechanism of this screwdriver is able to stand up to torsional forces far in excess of those likely to be encountered when even a very strong man uses the screwdriver.

Preferably, two independently rotatable handle parts are provided and the shaft has at least two drive receiving surfaces associated with each handle part, each of the handle parts having a cylindrical internal bore which receives the shaft, a respective rolling element being located between each drive receiving surface and the internal bore of the corresponding handle part, the arrangement being such that, in use, when the control means is in its first position, rotation or either handle part in said one direction wedges each of the rolling elements between the internal bore of the corresponding handle part and a first portion of the corresponding drive receiving surface to transmit drive to the shaft and rotation of that handle part in said other direction is free and relative to the shaft, and that, when the control means is in its second position, rotation of either handle part in said one direction is free and relative to the shaft and rotation of that handle part in said other direction wedges each of the rolling elements between the internal bore of the corresponding handle part and a second portion of the corresponding drive receiving surface. With this screwdriver, a

continuous rotation of the shaft can be achieved by gripping one handle part with one hand and the other handle part with the other hand, by rotating one handle part in a driving direction to rotate the shaft while freely rotating the other handle part in the opposite direction and then reversing the action, and so on.

Advantageously, the control means is movable into a position intermediate the first and second positions and in which rotation of the handle or either handle part in either direction allows each of the rolling elements freedom to become wedged between the internal bore of that handle or part and the first or second portion of the corresponding drive surface to transmit drive to the shaft. This enables the screwdriver to be used as a conventional screwdriver.

Preferably, each of the rolling elements is a cylindrical roller.

The control means may include a movable cage for selectively adjusting the position of each rolling element relatively to its corresponding drive receiving surface portions. Advantageously, where the rolling elements are rollers, the cage comprises longitudinal arms for adjusting the position of each roller. Preferably, the control means comprises the cage and a hand-operated control member formed integrally therewith, in which case the control means may be a one-piece nylon moulding.

Preferably, the drive receiving surfaces are flat surfaces. In this case, the shaft may be basically cylindrical and has two flat parallel drive receiving surfaces. Alternatively, the shaft may be of square cross-section, the flat drive receiving surfaces being defined by the four surfaces of the square shaft.

Advantageously, detent means are provided for locking the control means selectively in each of its positions relatively to the shaft, and the control means is rotatable relative to the shaft so as to allow it to move between said positions.

One preferred form of detent means comprises a spring-loaded ball mounted in a recess in the control means and acting against a stop member fast to the shaft. Where this detent means is used with a shaft having two flat drive receiving surfaces, the axis of the recess in the control means is preferably parallel to the axis of the shaft and the ball can be positioned in one of three indentations formed in the adjacent surface of the stop member. Where this detent means is used with a square-section shaft, the axis of the recess may be at right-angles to the axis of the shaft with the ball acting against one of the drive receiving surfaces of the shaft.

Another preferred form of detent means comprises interlocking toothed members on the shaft and the control means.

Here, the control means may be capable of limited axial movement and may be spring biassed in such manner as to urge the toothed members into interlocking engagement, the toothed member on the shaft being fast to the shaft and the toothed member on the control means being integrally formed with the control means. In this case, a compression spring acting on the control means and backed by a member fast to the shaft may bias the toothed members into engagement.

Alternatively, the toothed member on the shaft may be capable of limited axial movement and may be spring biassed in such manner as to urge the toothed members into interlocking engagement, the toothed member on the control means being integral therewith. In this case, the toothed member on the shaft may be fastened to the shaft by an integral portion of the member which includes a bowed spring.

In each of these two forms of detent means having inter-engaging toothed members, each arm of the cage has a free end on which a tooth is formed.

In another form of detent means including interengaging toothed means, the toothed member on the shaft is fast to the shaft and the toothed member on the control means is integral therewith, the toothed member of the control means being annular, surrounding the toothed member of the shaft, and being made of resilient material.

Several forms of screwdriver each constructed in accordance with the invention will now be described, by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 is a part-sectional elevation of a first form of screwdriver;

Figs. 2*a*, 2*b* and 2*c* are sectional views taken along the line II—II of Figure 1 showing the screwdriver in three different operating positions;

Fig. 3 is a cross-section taken on the line III—III of Fig. 1;

Fig. 4 is a part-sectional elevation of part of a second form of screwdriver;

Fig. 5 is a part-sectional elevation of a third form of screwdriver;

Fig. 6 is a part-sectional elevation of a fourth form of screwdriver;

Fig. 7 is a part-sectional elevation of a fifth form of screwdriver;

Fig. 8 is a cross-section taken on the line VIII—VIII of Fig. 7;

Fig. 9 is a part-sectional elevation of a sixth form of screwdriver;

Figs. 10*a* and 10*b* are part-sectional end views of the screwdriver of Fig. 9 with its end ferrule removed for clarity, and showing

the screwdriver in two different operating positions;

Figs. 11*a* and 11*b* are cross-sections taken on the line XI—XI of Fig. 9 showing the screwdriver in its two operating positions.

Referring to the drawings, Figures 1 to 3 show a screwdriver having a handle 1 which receives a shaft 2 formed with a pair of diametrically opposed flats 3 extending along part of the length of the shaft at its inner end, the shaft being made of chrome-vanadium steel. Two pairs of rollers 4 and 5 are confined closely adjacent the flats 3 by arms 6 of an inner bifurcated part of a moulded nylon cage member 7 rotatably surrounding the shaft 2 within the handle 1 and by the inner cylindrical surface 8 of the handle. The rollers 4 and 5 are made of high-tensile steel.

The handle 1 has two aligned driving portions 9 and 10, made of a plastics material such as expanded polyurethane. The driving portions 9 and 10, receive the shaft 2 and have respective inserts 12 and 13 made of hardened high-carbon steel. The inserts 12 and 13 together coaxially surround the arms 6 of the cage member 7 and define the inner cylindrical surface 8. The cage member 7 incorporates a control member 14 for altering the direction of drive of the screwdriver. The control member 14 is provided with a longitudinal recess which receives a ball 15 backed by a compression spring 16. A Mazak (registered Trade Mark) ferrule 18 fast to the shaft provides a stop for the combined cage and control member 7, 14. This ferrule 18 is provided with three indentations 19*a*, 19*b* and 19*c* (see Fig. 3) which are shaped and sized so as to receive the ball 15 so as to lock the cage member 7 in one of three predetermined positions.

The end of the shaft 2 remote from the blade 19 is supported by a ball 20 mounted in a recess 21 in the handle portion 9. The upper end (as seen in Fig. 1) of insert 12 is closed by a nylon washer 22 backed by a spring clip 23. The washer 22 is provided with an annular shoulder 24 which engages against the inner end of the insert 12.

The screwdriver is assembled as follows. The cage/control member 7, 14 (with the ball 15 and spring 16 already in place) is pushed over the shaft 2 until the front end of the member 14 rests against the ferrule 18 and the ball 15 mates with one of the indentations 19*a*, 19*b* or 19*c*. The rollers 4 and 5 and the inserts 12 and 13 are then positioned around the flats 3, the handle portion 10 having been previously force-fitted to the insert 13. The washer 22 is then forced over and down the inner end of the shaft 2 until its shoulder 24 is hard against the inner end of the insert 12. The spring clip 23 is then clipped to the shaft 2 to hold the whole assembly together. Finally, the handle portion 9 is force-fitted to the insert 12 to give a completely sealed unit.

With the screwdriver parts in the relative positions shown in Figure 2*a*, the shaft 2 is arranged to drive in the direction shown by the arrow, that is to say in an unscrewing direction. The cage arms 6 hold the rollers 4 and 5 in the position illustrated between the flats 3 and the inner surface 8 f the handle.

Referring to Figure 2*a*, rotation of either handle portion 9 or 10 anti-clockwise in the direction of the arrow wedges each of its associated rollers 4 and 5 between one portion of its respective flat 3 and the inner surface 8 and drive is transmitted from that handle portion through the rollers to the shaft 2. Rotation of that handle portion 9 or 10 in a clockwise direction releases the wedging engagement and that handle portion rotates freely relative to the shaft 2 and to the cage 7, which is held against rotation by the interengagement of the ball 15 and the indentation 19*a*.

With the above-described screwdriver a continuous rotation of the shaft 2 can be achieved by gripping handle portion 9 with one hand and handle portion 10 with the other hand and rotating one portion (say 9) in a driving direction to rotate the shaft while freely rotating the handle portion 10 in the opposite direction and then reversing the action, and so on.

To change from an unscrewing action to one for screwing, the handle 1 is gripped and the control member 14 rotated relative to the handle, clockwise as viewed in Figures 2*a* and 3. The relative movement of the handle and control member reverse the action of the flats 3 and the inner surface 8. Rotation of the control member 14 forces the ball 15 out of the indentation 19*a*, and into the indentation 19*c*. Further rotation of the member 14 in the same direction forces the ball 15 out of indentation 19*c* and into indentation 19*b*. The screwdriver is then in position for screwing (see Fig. 2*b*). In this position, rotation of either handle portion 9 or 10 in a clockwise direction, shown by the arrow, will drive the shaft 2 and anti-clockwise rotation of that handle portion will be free. In this case, the rollers are wedged against a second portion of the respective flats 3.

When the ball 15 is in the indentation 19*c* (see Fig. 2*c*) i.e. the intermediate position, each of the rollers 4 and 5 becomes wedged between one or other of the portions of its respective flat 3 and the inner surface 8 whichever direction either handle portion 9 or 10 is rotated. Thus, the screwdriver acts as a conventional screwdriver. There is some slight relative movement between shaft 2 and handle 1 before wedging occurs and that movement is sufficient to permit rotation of member 14 relative to handle 1

when it is desired to operate the screwdriver in the manner described above with reference to Fig 2*a* or Fig. 2*b*.

Fig. 4 shows a screwdriver which is the same as that shown in Figs. 1 to 3 except that it only has one handle part 109 and some parts of the cage (107) are not shown (reference numerals used in this embodiment are the same as those used in the embodiment of Figs. 1 to 3 for similar parts but increased by 100) and consequently only one pair of rollers 104 and 105. The control member 114 of this screwdriver has a splined outer surface to facilitate rotation thereof. This screwdriver is assembled in a similar manner to that of Figs. 1 to 3 in that the entire mechanism, apart from the handle 109, is assembled to the shaft 102. The handle 109 is then force-fitted to the insert 112.

Fig. 5 shows a "chubby" screwdriver having a handle 201, made of a plastics material, which handle receives a chrome-vanadium steel shaft 202 formed with a pair of diametrically opposed flats (not shown but similar to the flats 3 of the screwdriver of Figs. 1 to 3). A pair of rollers 204 and 205 are confined closely adjacent the flats by the two arms 206 of a nylon cage member 207 rotatably surrounding the shaft 202 within the handle 201, and by the inner cylindrical surface 208 of an insert 212. The rollers 204 and 205 are made of high-tensile steel and the insert 212 of hardened high-carbon steel.

The cage member 207 incorporates a control member 214 for altering the direction of drive of the screwdriver. The end of the control member 214 remote from the arms 206 is hollow and contains a compression spring 216 backed by a ferrule 218 fast to the shaft 202. The free ends of the arms 206 of the cage 207 are each provided with a pointed tooth 215 which cooperates with similar pointed teeth 219 on a nylon washer 222 held to the shaft 202 by a spring clip 223.

This screwdriver has only two operating modes, namely those corresponding to the modes shown in Figs. 2*a* and 2*b* for the first form of screwdriver. Thus, the screwdriver shown in Fig. 5 is in the position for unscrewing action (that is to say the rollers 204 and 205 are positioned as are the rollers 4 and 5 in Fig. 2*a*). To change from unscrewing action to one for screwing, the control member 214 is rotated in an anticlockwise direction (when looking in the direction away from the blade of the screwdriver). This forces the teeth 215 up one side of their respective teeth 219 which forces the cage 207 outwardly against the force of the spring 216. As the tips of the teeth 215 pass over the tips of the teeth 219, they rapidly ride down the other sides of the teeth 219 and knock the rollers 204 and 205 out of wedging engagement and into a position identical with that occupied by the rollers 4 and 5 in Fig. 2*b*. The screwdriver is then in position for screwing. Obviously, it would also be possible to arrange for this screwdriver to act as a conventional screwdriver, for example by providing further teeth 219 in a different arrangement on the washer 222 to provide an intermediate position.

Fig. 6 shows another screwdriver which is very similar to that shown in Fig. 4 except that it incorporates a different mechanism for changing the direction of drive. Consequently, only this mechanism will be described, the reference numerals used being the same as those used in the embodiment of Figs. 1 to 3 for similar by acting parts but increased by 300. Here, the free end of each arm 306 or the cage 307 is provided with a pointed tooth 315. A nylon washer 322 is fastened to the shaft 302 by a spring clip 323. This washer 322 includes a serrated collar 325 and a bowed spring portion 326, these portions both being formed integrally with the washer. The collar 325 is provided with two sets of serrations (only one of which is visible in Fig. 6), one for each tooth 315. Each set of serrations defines three indentations 319*a*, 319*b* and 319*c* for locking the screwdriver in drive positions equivalent to those shown in Figs. 2*a* 2*b* and 2*c*. Change over from position to position is effected in a similar manner to that described above with reference to Fig. 5, that is to say, the control member 314 is rotated and the teeth 315 ride up and over the serrations of the collar 325.

Figs. 7 and 8 shows yet another screwdriver which is similar to those described above, apart from the incorporation of yet another different change-over mechanism. Here again, therefore, only this mechanism will be described. This change-over mechanism is housed in the ferrule 418 and comprises a flange 422 formed intergrally with the ferrule and fast to the shaft 402, this flange being provided with two sets of serrations. Each set of serrations defines three indentations 419*a*, 419*b* and 419*c* and cooperates with a respective pointed tooth 415 formed on the interior of an annular collar 426 formed integrally with the control member 414 and joined thereto by two bridging portions 427. As the collar 426 is made of a resilient material, its shape can be distorted slightly as it is rotated to change the operating mode of the screwdriver. Here again, the indentations 419*a*, 419*b* and 419*c* are equivalent to the indentations 19*a*, 19*b* and 19*c* and so give rise to the three operating positions equivalent to those shown in Figs. 2*a*, 2*b* and 2*c*.

Figs. 9 to 11 show a further screwdriver

which is generally similar to those described above and the same reference numerals are used as in the embodiment of Figs. 1 to 3 for similar parts but increased by 500. In this embodiment the shaft 502 has a square cross-section (and so there are four rollers 504) and there is only one handle 501 having a cylindrical metal part 512, defining the inner cylindrical surface 508, and a plastics part. The cage 507 has an inner cylindrical portion 507*a* and arms 506 extending longitudinally and integral with the control member 514 rotatably mounted on the shaft 502. The cage 507 is a sliding fit within the metal handle part 512. The ferrule (or end plug) 518 is non-rotatably mounted on the shaft 502 and fits within a recess 528 in the control member 514 and retains a ball 515 biassed by a spring 516 into engagement with the shaft. The ball 515 and the spring 516 are, for clarity, shown in full in Fig. 9. The ferrule 518 permits limited rotational movement of the control member 514 between two extreme positions.

The screwdriver is illustrated in Figs. 9, 10*b* and 11*a* with its parts in position for driving the shaft 502 clockwise as viewed from the handle 501. In this case the control member 514 is in one extreme position and the ball 515 is biassed into engagement with the shaft 502 as seen in Fig. 10*b* to resist clockwise movement of the shaft relative to the control member. The arms 506 are in the positions illustrated in Fig. 11*a* holding the rollers 504 in close proximity to the adjacent face of the shaft 502 so that clockwise rotation of the handle 501 in the direction of the arrow wedges the rollers between the inner surface 508 and the shaft, drive being transmitted through the rollers to the shaft. Rotation of the handle 501 in the direction opposite to the arrows releases the wedging engagement and permits free rotation of the handle, the cage 507 being prevented from moving with the handle by the engagement of the ball 515 with the shaft 502.

The direction of drive is altered by rotating the control member 514 relative to the handle 501 in an anti-clockwise direction as viewed from the blade along the shaft in Fig. 9. The handle 501 tends to hold the rollers 504 in engagement with the shaft 502 permitting ball 515 to ride over the adjacent corner of the shaft to the position shown in Fig. 10*a*.

It will be appreciated that in each of the above-described embodiments the angle of free return movement of the handle necessary before a further drive action can be effected is very small. In known ratchet screwdrivers a handle return movement of about 36° is required for the next tooth to be engaged so that a further driving action can take place.

Moreover, although the above-described screwdrivers are shown with two or four flats on the shafts, any number of flats and corresponding rollers can be used. For example, three rollers could be used with a hexagonal shaft. The advantage of using a larger number of rollers than two, is that the load is transmitted more evenly from the handle to the shaft and so there is less chance of the metal inserts in the handle distorting.

In the embodiment of Figs. 1 to 3, it is possible to use one pair of rollers 4 and 5 instead of two pairs of rollers. In this case, each roller cooperates with each of the inserts 12 and 13.

Furthermore, it is not essential that the "flats" are exactly planar. Thus, they could be slightly convex. This is particularly useful for very small screwdrivers where there is a tendency for insufficient wedging to occur for the intermediate position if the "flats" are actually planar.

It is also possible to use balls instead of rollers, though this is not very practical as the load transmission is much lower and Brinelling tends to occur. The use of tapered rollers is also a possibility, though this would entail "tapering flats" on the screwdriver shaft which would be more difficult to form than the parallel flats used with cylindrical rollers.

WHAT I CLAIM IS:—

1. A screwdriver comprising a shaft having at least two drive receiving surfaces, a handle having a cylindrical internal bore which receives the shaft, a respective rolling element located between each drive receiving surface and the internal bore of the handle, and control means engageable with the rolling elements and movable relatively to the shaft between a first position and a second position, the arrangement being such that, in use, with the control means in the first position, rotation of the handle in one direction wedges each of the rolling elements between the internal bore of the handle and a first portion of the corresponding drive receiving surface to transmit drive to the shaft and rotation of the handle in the other direction is free and relative to the shaft, and that, with the control means in the second position, rotation of the handle in said one direction is free and relative to the shaft and rotation in said other direction wedges each of the rolling elements between the internal bore of the handle and a second portion of the corresponding drive receiving surface.

2. A screwdriver as claimed in claim 1, wherein two independently rotatable handle parts are provided and the shaft has at least two drive receiving surfaces associated with each part, each of the handle parts having a cylindrical internal bore which receives the

which is generally similar to those described above and the same reference numerals are used as in the embodiment of Figs. 1 to 3 for similar parts but increased by 500. In this embodiment the shaft 502 has a square cross-section (and so there are four rollers 504) and there is only one handle 501 having a cylindrical metal part 512, defining the inner cylindrical surface 508, and a plastics part. The cage 507 has an inner cylindrical portion 507*a* and arms 506 extending longitudinally and integral with the control member 514 rotatably mounted on the shaft 502. The cage 507 is a sliding fit within the metal handle part 512. The ferrule (or end plug) 518 is non-rotatably mounted on the shaft 502 and fits within a recess 528 in the control member 514 and retains a ball 515 biassed by a spring 516 into engagement with the shaft. The ball 515 and the spring 516 are, for clarity, shown in full in Fig. 9. The ferrule 518 permits limited rotational movement of the control member 514 between two extreme positions.

The screwdriver is illustrated in Figs. 9, 10*b* and 11*a* with its parts in position for driving the shaft 502 clockwise as viewed from the handle 501. In this case the control member 514 is in one extreme position and the ball 515 is biassed into engagement with the shaft 502 as seen in Fig. 10*b* to resist clockwise movement of the shaft relative to the control member. The arms 506 are in the positions illustrated in Fig. 11*a* holding the rollers 504 in close proximity to the adjacent face of the shaft 502 so that clockwise rotation of the handle 501 in the direction of the arrow wedges the rollers between the inner surface 508 and the shaft, drive being transmitted through the rollers to the shaft. Rotation of the handle 501 in the direction opposite to the arrows releases the wedging engagement and permits free rotation of the handle, the cage 507 being prevented from moving with the handle by the engagement of the ball 515 with the shaft 502.

The direction of drive is altered by rotating the control member 514 relative to the handle 501 in an anti-clockwise direction as viewed from the blade along the shaft in Fig. 9. The handle 501 tends to hold the rollers 504 in engagement with the shaft 502 permitting ball 515 to ride over the adjacent corner of the shaft to the position shown in Fig. 10*a*.

It will be appreciated that in each of the above-described embodiments the angle of free return movement of the handle necessary before a further drive action can be effected is very small. In known ratchet screwdrivers a handle return movement of about 36° is required for the next tooth to be engaged so that a further driving action can take place.

Moreover, although the above-described screwdrivers are shown with two or four flats on the shafts, any number of flats and corresponding rollers can be used. For example, three rollers could be used with a hexagonal shaft. The advantage of using a larger number of rollers than two, is that the load is transmitted more evenly from the handle to the shaft and so there is less chance of the metal inserts in the handle distorting.

In the embodiment of Figs. 1 to 3, it is possible to use one pair of rollers 4 and 5 instead of two pairs of rollers. In this case, each roller cooperates with each of the inserts 12 and 13.

Furthermore, it is not essential that the "flats" are exactly planar. Thus, they could be slightly convex. This is particularly useful for very small screwdrivers where there is a tendency for insufficient wedging to occur for the intermediate position if the "flats" are actually planar.

It is also possible to use balls instead of rollers, though this is not very practical as the load transmission is much lower and Brinelling tends to occur. The use of tapered rollers is also a possibility, though this would entail "tapering flats" on the screwdriver shaft which would be more difficult to form than the parallel flats used with cylindrical rollers.

WHAT I CLAIM IS:—

1. A screwdriver comprising a shaft having at least two drive receiving surfaces, a handle having a cylindrical internal bore which receives the shaft, a respective rolling element located between each drive receiving surface and the internal bore of the handle, and control means engageable with the rolling elements and movable relatively to the shaft between a first position and a second position, the arrangement being such that, in use, with the control means in the first position, rotation of the handle in one direction wedges each of the rolling elements between the internal bore of the handle and a first portion of the corresponding drive receiving surface to transmit drive to the shaft and rotation of the handle in the other direction is free and relative to the shaft, and that, with the control means in the second position, rotation of the handle in said one direction is free and relative to the shaft and rotation in said other direction wedges each of the rolling elements between the internal bore of the handle and a second portion of the corresponding drive receiving surface.

2. A screwdriver as claimed in claim 1, wherein two independently rotatable handle parts are provided and the shaft has at least two drive receiving surfaces associated with each part, each of the handle parts having a cylindrical internal bore which receives the

shaft, a respective rolling element being located between each drive receiving surface and the internal bore of the corresponding handle part, the arrangement being such that, in use, when the control means is in its first position, rotation of either handle part in said one direction wedges each of the rolling elements between the internal bore of the corresponding handle part and a first portion of the corresponding drive receiving surface to transmit drive to the shaft and rotation of that handle part in said other direction is free and relative to the shaft, and that, when the control means is in its second position, rotation of either handle part in said one direction is free and relative to the shaft and rotation of that handle part in said other direction wedges each of the rolling elements between the internal bore of the corresponding handle part and a second portion of the corresponding drive receiving surface.

3. A screwdriver as claimed in claim 1 or claim 2, wherein the control means is movable into a position intermediate the first and second positions and in which rotation of the handle or either handle part in either direction allows each of the rolling elements freedom to become wedged between the internal bore of that handle or part and the first or second portion of the corresponding drive receiving surface to transmit drive to the shaft.

4. A screwdriver as claimed in any one of claims 1 to 3, wherein each of the rolling elements is a cylindrical roller.

5. A screwdriver as claimed in any one of claims 1 to 4, wherein the control means includes a movable cage for selectively adjusting the position of each rolling element relatively to its corresponding drive receiving surface portions.

6. A screwdriver as claimed in claim 5 when appendant to claim 4, wherein the cage comprises longitudinal arms for adjusting the position of each roller.

7. A screwdriver as claimed in claim 5, or claim 6, wherein the control means comprises the cage and a hand-operation control member formed integrally therewith.

8. A screwdriver as claimed in claim 7, wherein the control means is a one-piece nylon moulding.

9. A screwdriver as claimed in any one of claims 1 to 8, wherein the drive receiving surfaces are flat surfaces.

10. A screwdriver as claimed in claim 9, wherein the shaft is basically cylindrical and has two flat parallel drive receiving surfaces.

11. A screwdriver as claimed in claim 8, wherein the shaft is of square cross-section, the flat drive receiving surfaces being defined by the four surfaces of the square shaft.

12. A screwdriver as claimed in any one of claims 1 to 11, wherein detent means are provided for locking the control means selectively in each of its positions relatively to the shaft.

13. A screwdriver as claimed in claim 12, wherein the control means is rotatably relative to the shaft so as to allow it to move between said positions.

14. A screwdriver as claimed in claim 13, wherein the detent means comprises a spring-loaded ball mounted in a recess in the control means and acting against a stop member fast to the shaft.

15. A screwdriver as claimed in claim 14, when appendant to claim 3, wherein the axis of the recess in the control means is parallel to the axis of the shaft and the ball can be positioned in one of three indentations formed in the adjacent surface of the stop member.

16. A screwdriver as claimed in claim 13, when appendent to claim 11, wherein the detent means comprises a spring-loaded ball mounted in a recess in the control means, the axis of the recess being at right angles to the axis of the shaft and the ball acting against one of the drive receiving surfaces of the shaft.

17. A screwdriver as claimed in claim 13, wherein the detent means comprises interlocking toothed members on the shaft and the control means.

18. A screwdriver as claimed in claim 17, wherein the control means is capable of limited axial movement and is spring biassed in such manner as to urge the toothed members into interlocking engagement, the toothed member on the shaft being fast to the shaft and the toothed member on the control means being integrally formed with the control means.

19. A screwdriver as claimed in claim 18, wherein a compression spring acting on the control means and backed by a member fast to the shaft biasses the toothed members into engagement.

20. A screwdriver as claimed in claim 17, wherein the toothed member on the shaft is capable of limited axial movement relative to the shaft and is spring biassed in such manner as to urge the toothed members into interlocking engagement, the toothed member on the control means being integral therewith.

21. A screwdriver as claimed in claim 20, wherein the toothed member on the shaft is fastened to the shaft by an integral portion of the member which includes a bowed spring.

22. A screwdriver as claimed in any one of claims 17 to 21 when appended to claim 6, wherein each arm of the cage has a free end on which a tooth is formed.

23. A screwdriver as claimed in claim 17, wherein the toothed member on the shaft is fast to the shaft and the toothed member on

the control means is integral therewith, and wherein the toothed member of the control means is annular, surrounds the toothed member of the shaft, and is made of resilient material.

24. A screwdriver as claimed in any one of claims 1 to 23, wherein that part of the handle or each handle part defining the inner cylindrical bore thereof is made of high-tensile steel, the remainder of the handle being made of plastics material.

25. A screwdriver as claimed in any one of claims 1 to 24, wherein the rolling elements are made of hardened high-carbon steel.

26. A screwdriver as claimed in any one of claims 1 to 25, wherein the shaft is made of chrome-vanadium steel.

27. A screwdriver substantially as hereinbefore described with reference to, and as shown by, Figs. 1 to 3, Fig. 4, Fig. 5, Fig. 6, Fig. 7 and Fig. 8 or Figs. 9 to 11.

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