(12) UK Patent Application (19) GB (11) 2 343 647 (13) A

(43) Date of A Publication 17.05.2000

(21) Application No 9916061.6

(22) Date of Filing 08.07.1999

(30) Priority Data
(31) 19831542 (32) 14.07.1998 (33) DE

(51) INT CL[7]
B24B 45/00 , B27B 5/32

(52) UK CL (Edition R)
B3D DEM D100
B5L LMB L102

(56) Documents Cited
WO 98/24589 A WO 90/00463 A

(58) Field of Search
UK CL (Edition R) B3D , B5L
INT CL[7] B24B , B27B
Online: WPI, EPODOC

(71) Applicant(s)
Robert Bosch GmbH
(Incorporated in the Federal Republic of Germany)
Wernerstrasse 1, Stuttgart-Feuerbach,
D-70442 Stuttgart, Federal Republic of Germany

(72) Inventor(s)
Albert Kleider

(74) Agent and/or Address for Service
A A Thornton & Co
235 High Holborn, LONDON, WC1V 7LE,
United Kingdom

(54) Abstract Title
Tool clamping arrangement

(57) A hand-held machine tool has a working spindle (13) which, on its free end (131), clamps a disc shaped tool (18) between a clamping flange (19) and a clamping nut. A spindle-locking system (25) has a grooved rim (27) disposed on the clamping flange (19) with at least one groove (28), and a hand lever (29) with a detent cam (32) which can be engaged in the groove (28).

The clamping flange (19), which is designed as a modified SDS click nut according to EP 0 424 388, can be slipped onto the drive shaft (13) in a non-losable, torsion-proof manner, e.g. with an internal hexagon (36) on an external hexagon 132). A spring (800) loads the grooved rim member (27) relative to a supporting ring (63) in the non-release direction.

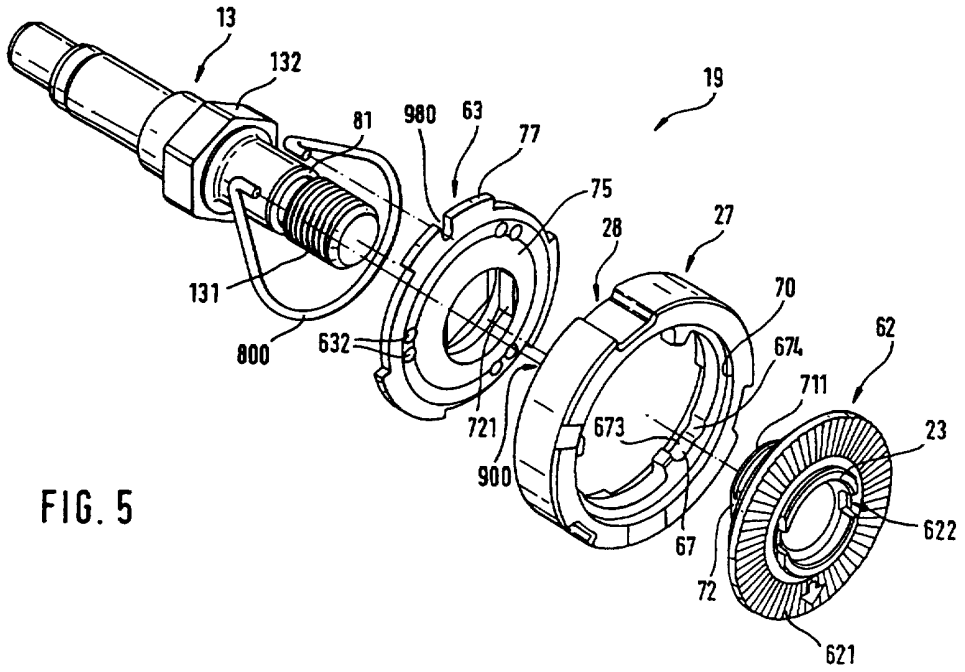


FIG. 5

GB 2 343 647 A

FIG. 1

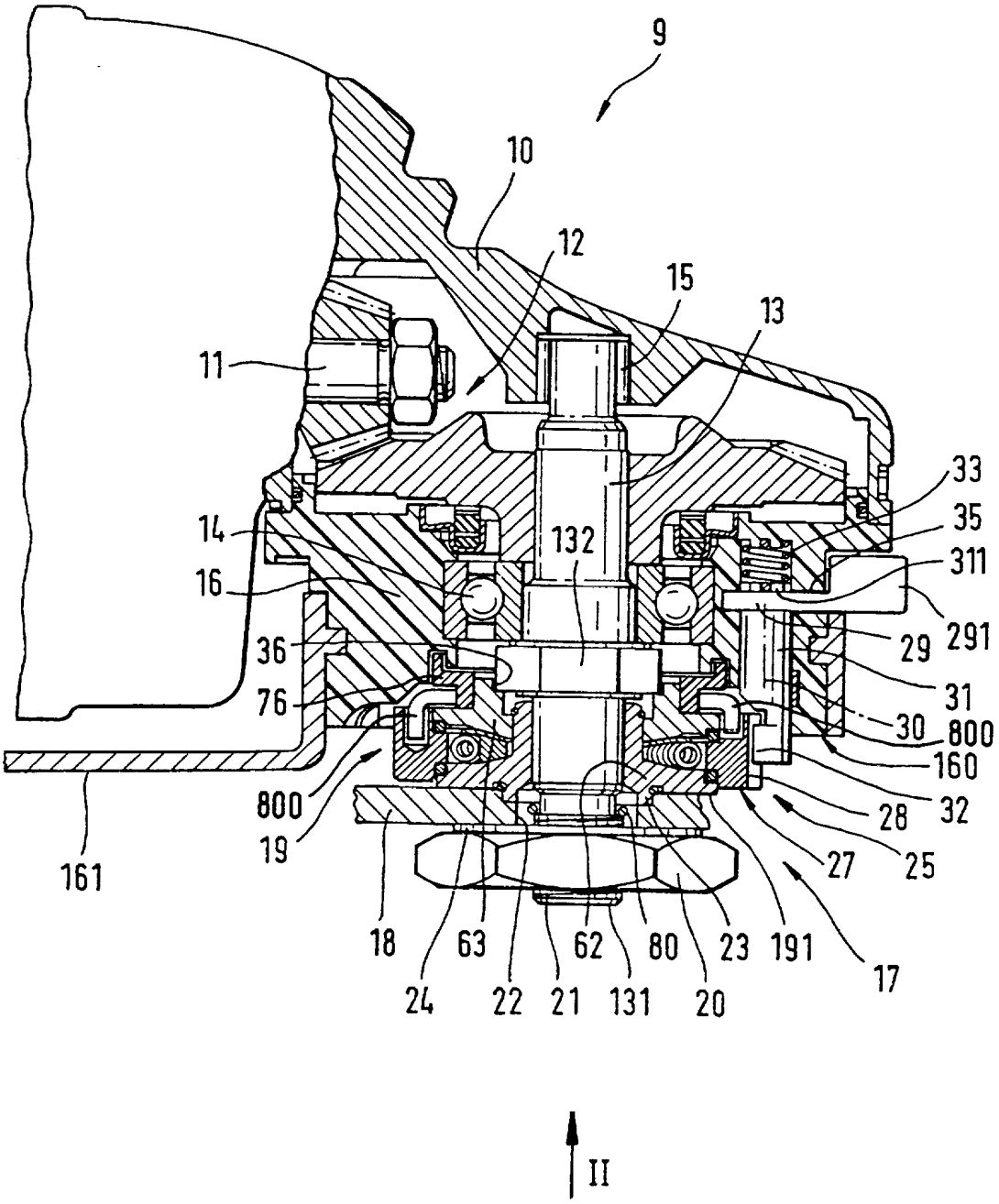

9
10
12
15
13
11
33
35
311
14
132
16
291
29
36
31
76
30
800
160
32
28
800
19
25
27
161
18
63
62
80
23
191
17
24
22
21
131
20
II

FIG. 2

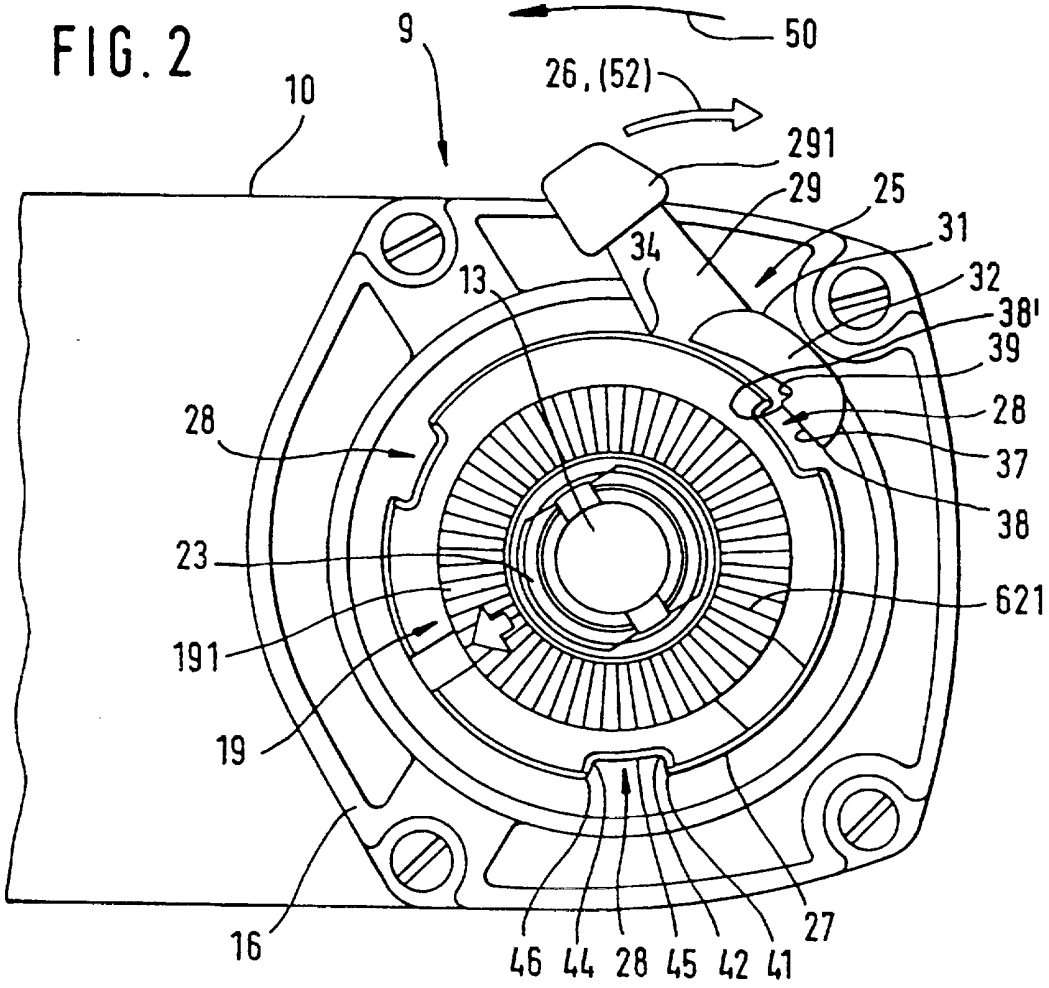
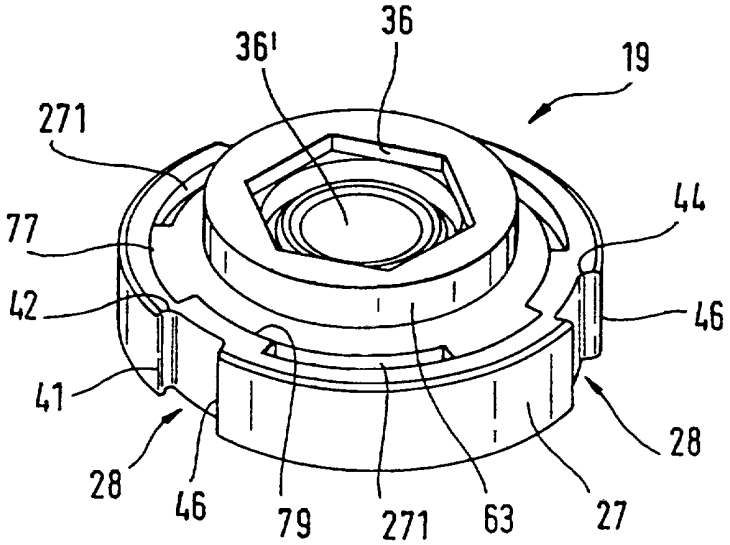

9
50
10
26, (52)
291
29
25
31
34
13
32
38'
39
28
37
38
621
23
191
19
16
46
44
28
45
42
41
27

FIG. 3


36'
36
19
271
77
44
42
46
41
28
28
46
79
271
63
27

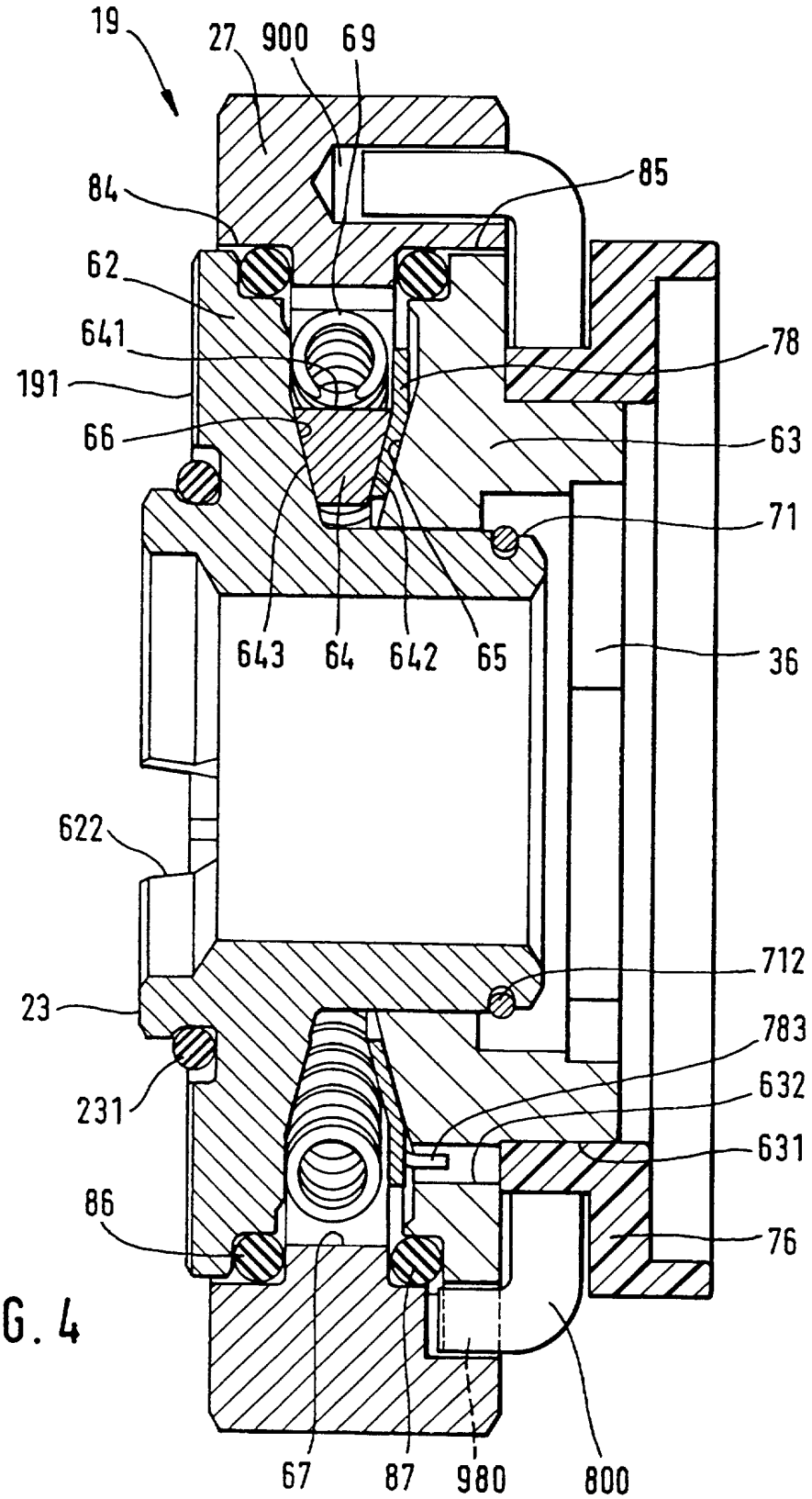

19
27
900
69
84
85
62
641
78
191
66
63
71
643
64
642
65
36
622
712
23
783
632
231
631
86
76
67
87
980
800

FIG. 4

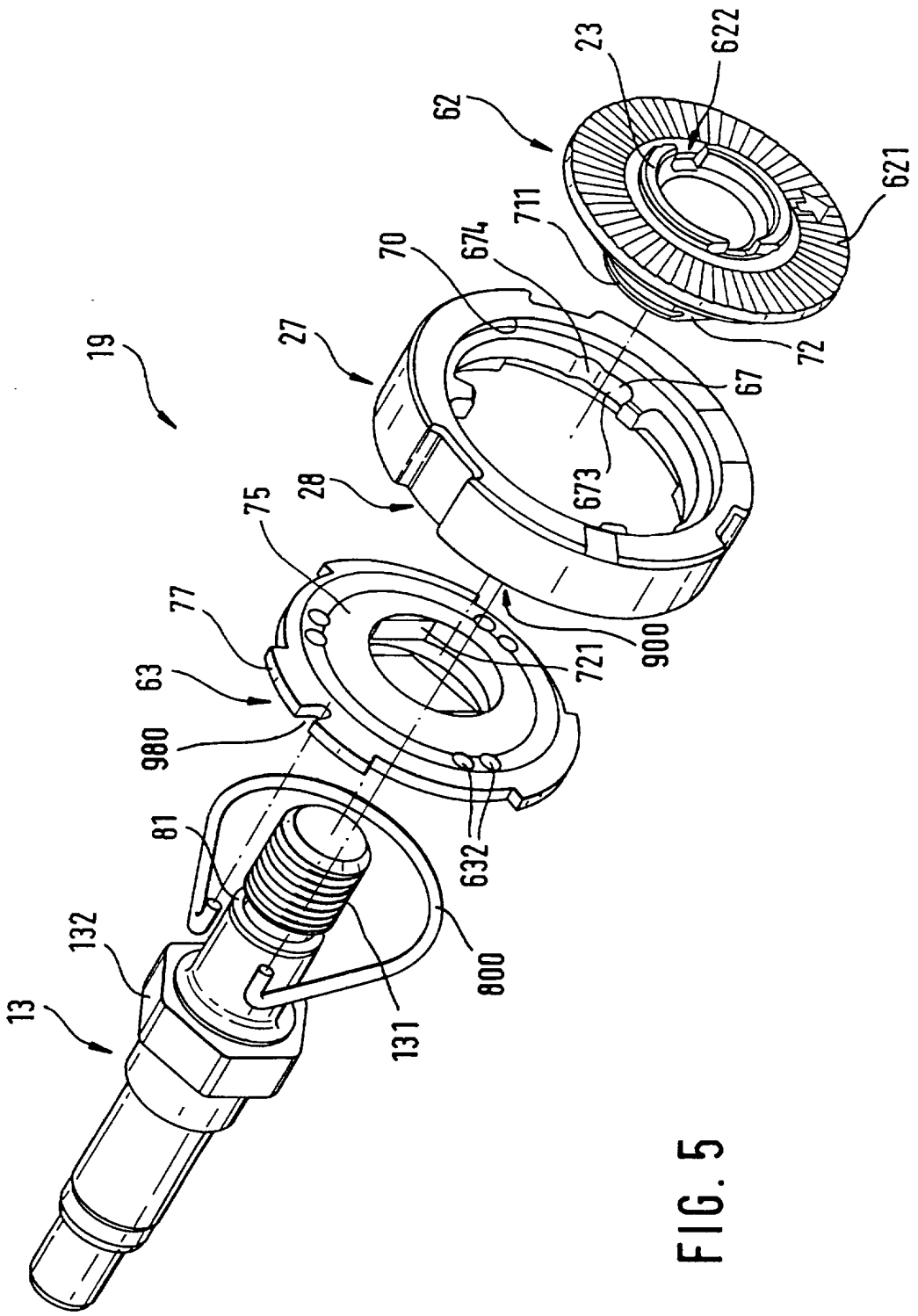

13
132
81
980
63
77
75
28
27
19
70
674
711
62
23
622
621
72
67
673
721
900
632
800
131

FIG. 5

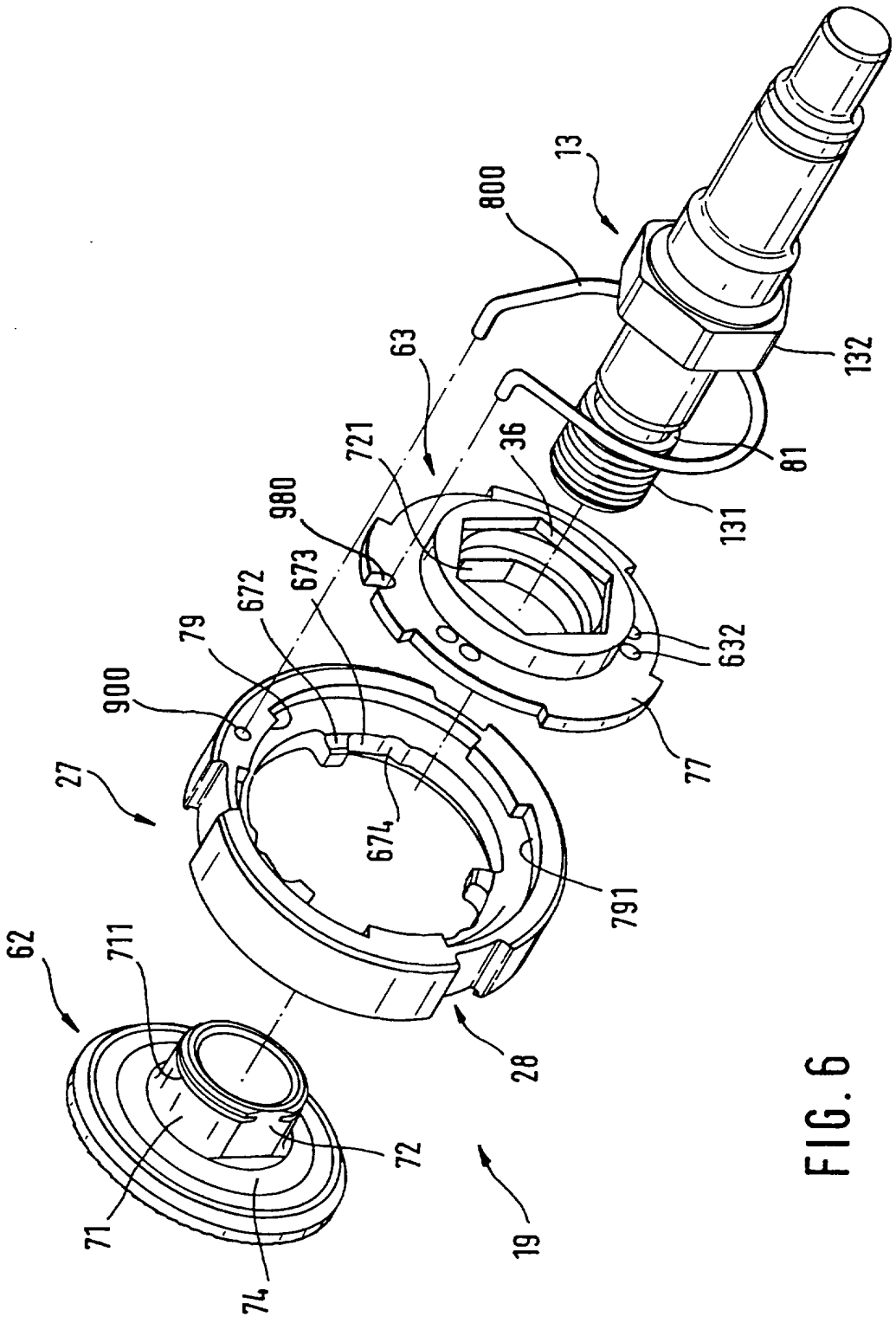

13
800
63
132
721
36
81
980
131
673
672
632
79
900
77
27
674
791
62
711
28
72
71
19
74

FIG. 6

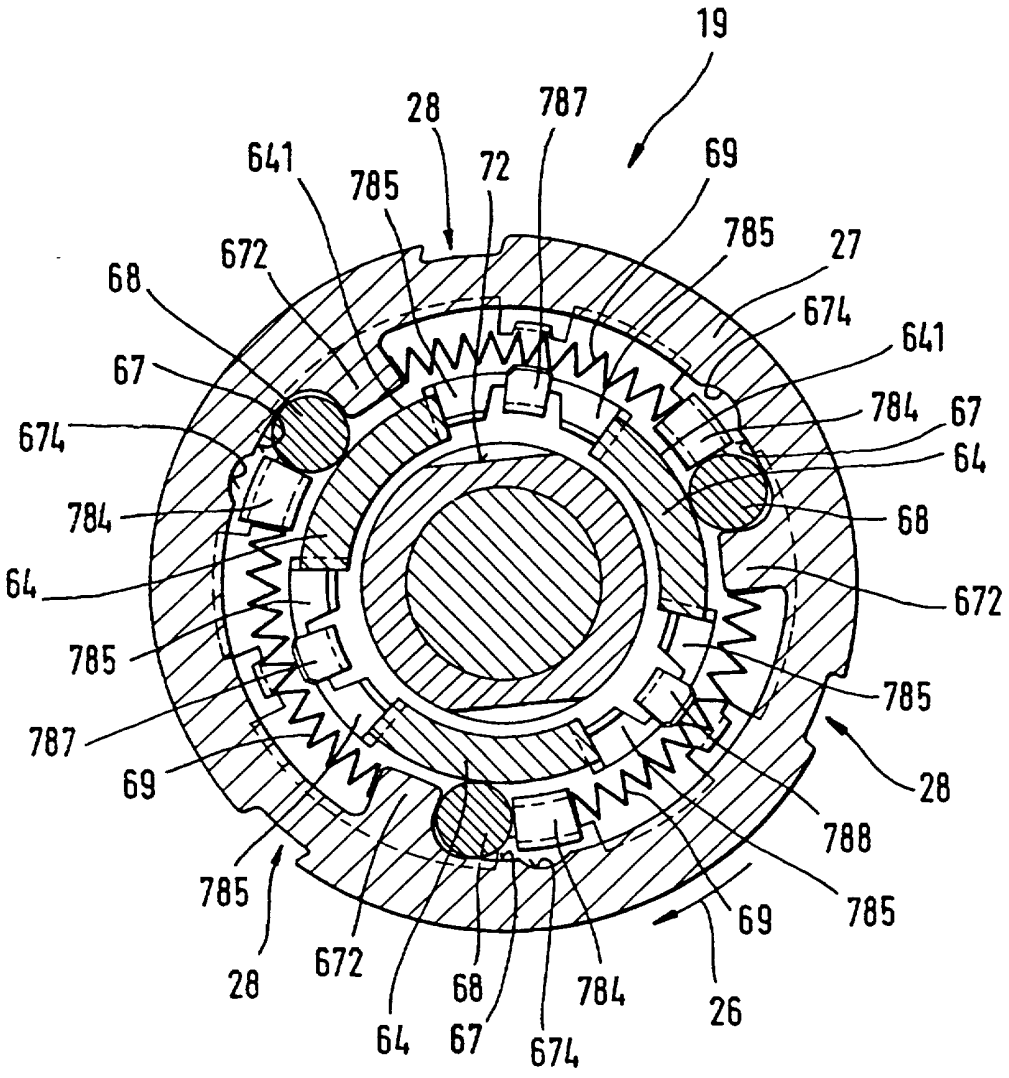

19
28
787
641
785
72
69
672
785
27
68
674
641
67
784
67
674
64
784
68
64
672
785
785
787
69
28
788
785
69
785
28
672
68
784
26
64
67
674

FIG. 7

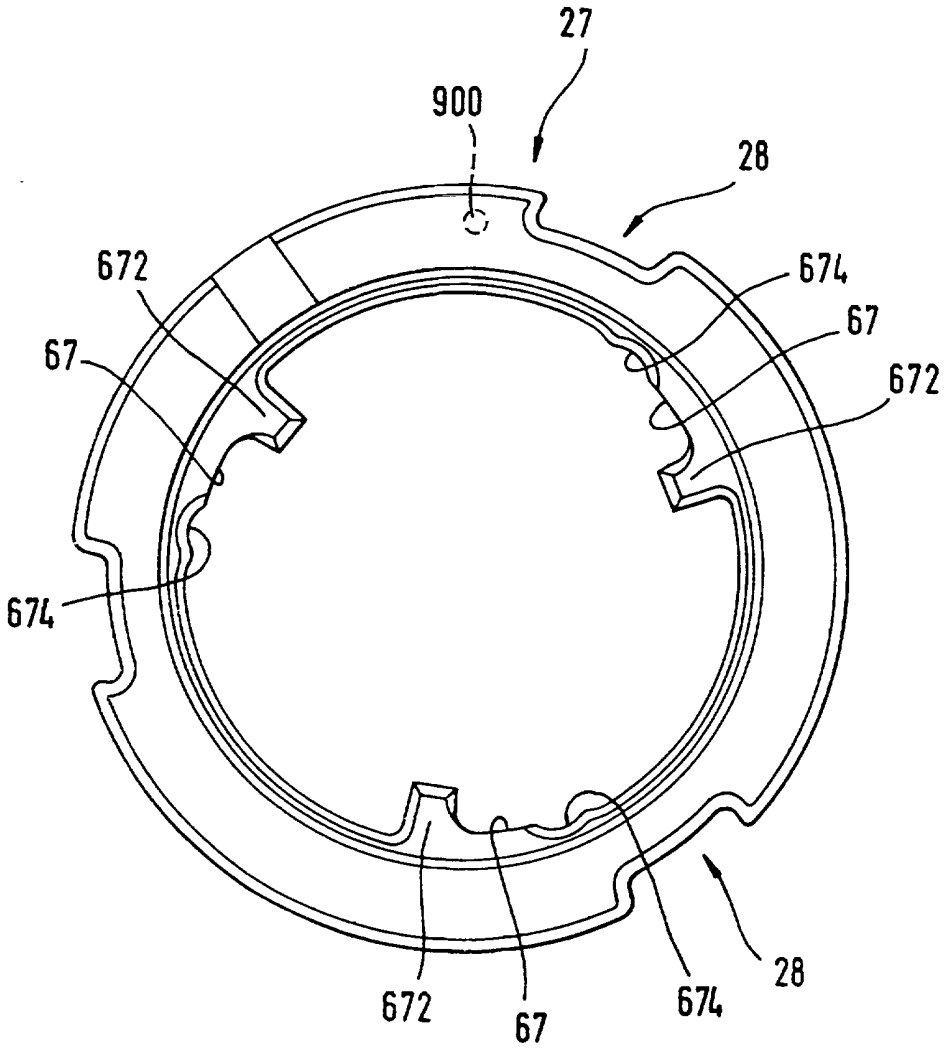


FIG. 8

Hand-held machine tool

Prior art

The starting point of the invention is a hand-held machine tool, for example an angle grinder, hand-held circular saw or the like, of the kind in claim 1.

A hand-held machine tool with an arrangement for releasably clamping a disc-shaped tool seated on a working spindle is known from EP 0 339 027. During the releasing thereof, the initial tension on the tool and thereby on a clamping nut screwed onto the working spindle on the opposite side can be reduced to such an extent that the said clamping nut can be easily released by hand. In this arrangement, incorrect actuation when the machine is still running cannot be ruled out, following which the disc-shaped tool may jump in an unintended manner off the spindle which is still rotating - with corresponding risks to persons and objects located nearby.

According to EP 0 424 388, an SDS click nut is known, which can be used for hand-held machine tools with disc-shaped tools, it being possible for the said nut to be screwed externally onto the free end of the working spindle carrying the disc-shaped tool and to be shifted by hand, for tool-changing purposes, in the direction of release by a short turning stroke, under which circumstances the clamping pressure on the disc-shaped tool is released and the SDS click nut can be easily unscrewed by hand.

Furthermore, a generic hand-held machine tool is known from PCT/DE 95/01083, the spindle-locking system of which can be activated via a pivot bolt which is actuatable by a hand lever, a detent cam disposed on the pivot bolt having a semi-circular cross-section. The detent cam is intended to enter opposed semicircular grooves in the grooved rim of a clamping flange. The detent cam enters or leaves these semicircular grooves in a smooth-running manner when the hand lever is actuated. As a result of this it is possible, in the event of inadvertent actuation of the spindle-locking system when the machine is running, for the detent cam to engage in, or disengage from, the grooves in an unhindered manner, under which circumstances troublesome vibrations occur.

Advantages of the invention

In contrast to this, the hand-held machine tool according to the invention with the characterising features of claim 1 has the advantage that the solution constituted by the SDS click-type clamping nut, which, in itself, is advantageous, is now secured in a non-losable manner on the working spindle on the machine side and can be triggered, in advantageous manner, by means of a specially designed spindle-locking system - in a manner which is secure against incorrect operation - the spindle being, in addition, automatically lockable, when the said clamping arrangement is actuated, in the direction of clamping of the conventional clamping nut, which can be screwed on from outside. Because of the shallow mode of construction of the new clamping arrangement, the working spindle is able to retain a length which is unchanged - compared with conventional clamping arrangements - because the bearing load is low, likewise in an unchanged manner, as a consequence of the constant axial distance of the tool from the bearing of the hand-held machine tool.

Moreover, in the event of incorrect operation, the detent cam allows only minimal force to pass from the hand lever to the clamping flange via the said detent cam. There is therefore no danger of the detent cam or the grooves becoming deformed in the event of incorrect operation of the spindle-locking system, for example when the machine is running.

Through the fact that a separate spring supports the switching ring-like grooved rim, in relation to the supporting ring of the clamping flange, in the neutral position in an elastically pre-tensioned manner, a pressure point is formed between the grooved rim and the supporting ring. As a result of this, the clamping flange cannot be triggered unintentionally in the event of inadvertent actuation of the spindle-locking system. Release of the tool from the working spindle while the latter is still rotating is thereby as good as ruled out and considerable risks to the operator of the hand-held tool are avoided.

As a result of the separate spring between the grooved rim and the supporting ring, the said grooved rim can be configured in a simpler manner and be manufactured from less expensive material. Moreover, the restoring action or switching-back force on the grooved rim after its actuation is distinctly reinforced as a result.

Convenient, safe operability by means of the spindle-locking system permits particularly rapid changing of the tool and safe, convenient re-clamping of the changed tool.

Drawings

The invention is explained in greater detail in the following description with the aid of an exemplified embodiment represented in the drawings, in which:

figure 1 shows a partial longitudinal section through an angle grinding machine according to the invention,

figure 2 shows a plan view (from underneath) of the angle grinding machine in accordance with the arrow II in figure 1, without the clamping nut, grinding disc and protective hood,

figure 3 shows a three-dimensional rear view of the clamping flange,

figure 4 shows the clamping flange in longitudinal section,

figures 5 and 6 shows an exploded representation of the working spindle with the essential parts of the clamping flange, from the rear and from the front,

figure 7 shows a plan view of the cross-section through the clamping flange, from the front, and

figure 8 shows the grooved rim as an individual part, in plan view.

Description of the exemplified embodiment

The angle grinder 9 represented in longitudinal section in figure 1 has a housing 10 which receives an electric drive motor, not represented, with a drive shaft 11, an angular gear unit 12 and a working spindle 13. The working spindle 13 is rotatably mounted in a ball bearing 14 and a needle bearing 15, both of which are constructed as radial bearings. The needle bearing 15 is received by the machine housing 10, and the ball bearing 14 by a bearing flange 16 manufactured from plastic. The said bearing flange 16 is flanged onto the machine housing 10 and an angle grinder protective hood 161 is seated on its outer periphery, which is designated as the neck 160.

With its free end 131, the working spindle 13 projects axially beyond the bearing flange 16. Seated on the said free end 131 is a clamping device 17 which receives a tool 18 in the form of a cutting-off or grinding disc.

The clamping device 17 comprises a clamping flange 19, which is slipped onto the free end 131 of the working spindle 13 and connected to the latter in a non-rotatable and radially and axially non-displaceable manner, and a clamping nut 20. The clamping nut 20 can be screwed onto a threaded section 21 of the free end 131 of the working spindle. With the aid of a median centring hole 22, the tool 18 can be placed, in a form-locking manner, on a receiving journal 23 constructed on the front end of the clamping flange 19, and can be pressed against the annular end face 191 of the clamping flange 19 in a force-locking manner by means of the clamping nut 20. A plain washer 24 is fitted between the clamping nut 20 and the tool 18.

The clamping flange 19 consists of an outer grooved rim 27 which serves as a switching ring and engages round a supporting ring 63, and also a clamping plate 62, in an externally twistable manner, the grooved rim 27 being coupled to the supporting ring 63 in a torsionally elastic manner via a spring 800.

When a hand lever 29 belonging to a spindle-locking system 25 is actuated, the working spindle 13 can be locked in a torsion-proof manner. To that end, the spindle-locking system 25 has the grooved rim 27, which is seated externally on the clamping flange 19 and has a multiplicity of radial grooves 28 with a rectangular cross-section which are offset in relation to one another at equal angular intervals of rotation, and the said spindle-locking system also has a detent cam 32 which interacts with the grooved rim 27 and has a hook-shaped contour on the end face 37 of the said cam (figure 2). The contour of the grooves 28 and the profile of the detent cam 32 are coordinated with one another in such a way that, when it engages in the groove 28 with the working spindle 13 at rest or rotating only at low speed, that is to say under desirable circumstances, the detent cam 32 arrests the clamping flange 19 and, with it, the working spindle 13, and under undesirable circumstances, that is to say when the spindle-locking system is

actuated with the motor running, the said detent cam 32 is repulsed by the grooved rim 27 with minimal dynamic effect and with little vibration, and is unable to arrest the working spindle 13. This coordination is the result of the low difference, of only about 1 mm, in the breadth of the supporting face 37 of the cam in relation to the breadth of the groove 28. As a result of this, the detent cam 32 has too little time to penetrate, when the working spindle 13 is turning in the direction of rotation for working purposes and when the hand lever 29 is actuated, sufficiently far towards the bottom 45 of the groove to be able to engage in the groove 28 in an arresting manner and to bring the grooved rim 27, together with the working shaft 13, to a standstill.

The grooves 28 in the grooved rim 27 have essentially parallel flanks 42, 44, which are oblique in relation to an imaginary radial passing, as illustrated in figure 2, through the centre of the working spindle 13, and an essentially flat groove bottom 45. The flanks 42, 44 are inclined towards the right in the direction of viewing, that is to say in the opposite direction to the arrow 50 indicating the direction of rotation, and are inclined in relation to a radial passing through the middle of the working spindle 13 (figure 2).

The detent cam 32 is constructed on the free end of a pivot bolt 31 which is rotatably mounted in the bearing flange 16. The axis of rotation 30 of the pivot bolt 31 extends parallel to the working spindle 13. A hand lever 29 jutting out at right angles is connected to the pivot bolt 31 in a torsion-proof manner, the said hand lever 29 consisting of sheet steel and the pivot bolt 31 and detent cam 32 consisting, in one piece, of sintered steel.

The hand lever 29 is disposed near that end of the pivot bolt 31 which faces away from the detent cam 32, a front-end section 311 of the said pivot bolt continuing axially beyond the hand lever 29 and being mounted in the bearing flange 16.

There is pushed onto the front-end section 311 of the pivot bolt, a restoring spring 33 which is constructed as a torsion spring and of which one end is immobilised on the bearing flange 16 and the other on the pivot bolt 31.

The restoring spring 33 is designed in such a way that it endeavours to turn the pivot bolt into a basic position in which the detent cam 32 is pivoted completely out of the groove 28 and is located directly in front of, and at a distance from the grooved rim 27 on the clamping flange 19. This basic position of the pivot bolt 31 or detent cam 32 is predetermined by a stop 34 which is constructed on the clamping flange 16 and against which the hand lever 29 is applied (figure 2). The hand lever 29 protrudes radially through an opening 35 in the bearing flange 16, slightly beyond the said flange, and carries a gripping plate 291 on one side.

With the aid of a plan view of the angle grinder 9 - from the same side as the clamping flange 19 - figure 2 shows the detent cam 32 as an elongated lever arm with a contour which is straight or rounded on the radially outer side facing away from the clamping flange 19 and which merges in a beak-like manner, on the radially inner side remote from the hand lever 29 and facing towards the clamping flange 19, via an end edge 38 rounded with a small radius of curvature, into a flattened end face 37 of the cam which is preferably curved in a concave manner with the same radius of curvature as the grooved rim 27 and has a rear end edge 38' and also merges, at that point, into a V-shaped recess 39. The recess 39 essentially conforms to the contour of the left-hand flank 42 of the groove 28 in the region of an acute-angled retaining edge 41 which is formed from the transition of the groove flank 42 into the peripheral curvature of the grooved rim 27.

The clamping plate 62 has an end face 621 which is preferably radially fluted. The fluted face 621 serves to arrest the clamped-on, disc-shaped tool 18 with the aid of high surface pressure.

If the tool is to be changed, it is first necessary to release the clamping nut 20 by means of a spanner, not represented. In order to stop the working spindle 13 for that purpose, the operator places one finger on the gripping plate 291 of the hand lever 29 and pivots the latter in the direction of the arrow 29 as illustrated in figure 2. By this means, the pivot bolt 31 is turned in the clockwise direction against the force of the restoring spring 33. In the process, the detent cam 32 pivots into one of the grooves 28 in the grooved rim 27 and the rounded end edge 38 of the detent cam 32 is supported against the right-hand groove flank 44 or its rounded portion 46 on the clamping flange 19. The rounded portion 46 and the end edge 38 are so dimensioned that the detent cam 32 is all the more arrested on the flank 44, the greater the loosening moment at the clamping nut 20 becomes.

When the hand lever 29 is arrested, the clamping flange 19 and, with it, the operating spindle 13 are locked in a torsion-proof manner via the form-locking connection between the groove 28 and the detent cam 32. The clamping nut 20 can now be released by hand or, if the said clamping nut has rusted tight, by means of a spanner, without any problems.

After the changing of the tool 18, actuation of the spindle-locking system 25 is also advantageous when tightening the clamping nut 20. For the purpose of tightening the clamping nut 20, the hand lever 29 has to be pivoted in the direction of the arrow 26 indicating actuation. If the clamping nut 20 is now turned in the direction of clamping, that is to say against the direction of rotation for working purposes, in relation to the working spindle 13, it entrains the latter in rotation, with distinct slip. As a result of this, the grooved rim 27 turns, together with the

groove 28, in relation to the detent cam 32 in such a way that the end face 37 of the cam engages over the retaining edge 41 with the aid of the recess 39. The clamping flange 20 and, with it, the working spindle 13 are thereby arrested, against the direction of clamping of the clamping nut 20. In other words, the rear end edge 38' of the end face 37 of the cam arrests the retaining edge 41 in a hook-like manner.

If the hand lever 29 is released after the tightening of the clamping nut 20, the restoring spring 33 turns the pivot bolt illustrated in figure 2 in the counter-clockwise direction or against the direction of the arrow 26, until the hand lever 29 strikes against the stop 34 on the bearing neck 16. During this rotational movement of the pivot bolt 31, the detent cam 32 is completely pivoted out of the groove 28 in a reliable manner and the clamping flange 19 is able to rotate freely.

The clamping flange 19, which is shown in a three-dimensional view from the rear in figure 3, has a pass-through opening 36' designed as an internal hexagon, for the free end 131 of the working spindle 13 to engage over in a torsion-proof manner, which free end is provided with a matching external hexagon 132. Also visible are the design of the grooves 28 with a contour which is rounded as a whole, the disposition of the groove flanks 42, 44, the rounded portion 46 and the retaining edge 41. In addition, it is possible to make out, radially on the inside between the grooved rim 27 and the supporting disc 63, three guide slots 271 which merge into three radial cams 79 which are uniformly spaced apart and point radially inwards and which come into abutment, in a rotation limiting manner, against radial cams 77 guided in the guide slot 271 and belonging to the support ring 63, which is shown clearly in Figure 8.

Figure 4 shows, in a longitudinal section through the clamping flange 19, the circular ring 712 on the cylindrical stub 71 of the clamping plate 62, which

secures the individual parts of the clamping flange 19 in position axially in relation to one another, ready for operation. Also shown, in a manner differing from the preceding figures, are a plastic labyrinth ring 76 seated on the clamping flange 19 on a cylindrical collar 631 belonging to the supporting ring 63, and the springs 69 which, after the releasing stroke of the grooved rim 27, move the latter and the rolling bodies 68 illustrated in figure 7 back into their starting position for abutment against the stops 672, so that the clamping flange 19 is ready for a new clamping operation, for example when the angle grinder 9 is equipped with a tool 18.

The clamping plate 62 can be supported axially in relation to the supporting ring 63 in order to absorb the axial clamping pressure directed against the tool 18 by the clamping nut 20. The clamping plate 62 is connected, together with the supporting ring 63, to the working spindle 13 in an axially displaceable and non-rotatable manner.

Supporting bodies 64, which are wedge-shaped in cross-section and are designed as a circular ring segment, are disposed axially between the conical front ends 65, 66 of the clamping plate 62 and of the supporting ring 63 in a supporting manner, so that an annular groove is formed between the clamping plate 62 and the supporting ring 63.

Axially disposed, as an actuating member, between the clamping plate 62 and the supporting ring 63, so as to engage radially over them, is the grooved rim 27 which engages, with an upper annular collar 70, over the clamping plate 62 in the axial direction, while leaving clearance for movement. The annular collar 70 terminates axially almost flush with the contour of the end face 191 of the clamping plate 62. The grooved rim 27 is seated axially, with clearance for

movement, between the clamping plate 62 and the supporting ring 63, and is disposed so as to be rotatable relative to both.

The grooved rim 27 contains, radially on the inside, the detent race 67 which may, for example, be cylindrical. A corresponding counter-race 641 extends on the radially outer peripheral face of the supporting body 64, at a radial distance, in relation to the detent race 67, that approximately corresponds to the diameter of the rolling bodies 68. The supporting bodies 64 are acted upon radially by means of the rolling bodies 68 (figure 7) in the form of cylinders, which are guided on, and roll along on the races 67 and 641.

Engaging in an axial bore 900 in the grooved rim 27 is a first leg, which is bent over by about 90°, of the annular spring 800, the second leg of the latter engaging in an axial bore 980 in the supporting ring 63. As a result, the grooved rim 27 is supported so as to be elastically pre-tensioned in rotation in relation to the supporting ring 63.

In figures 5 and 6, an exploded representation shows the working spindle 13, which carries an external hexagon 132, with the main parts of the clamping flange 19, the supporting ring 63, the grooved rim 27 and the clamping plate 62. The supporting ring 63 can be slipped onto the external hexagon 132 of the working spindle 13 by its internal hexagon 36 in a torsion-proof manner. In the fitted position, it is supported axially on the grooved rim 27, the latter being capable of being twisted, in a limited manner, in relation to the supporting ring 63, and engaging radially over the latter. The supporting ring 63 carries, in a manner axially adjacent to the internal hexagon 36, an internal structure with two flats 721 which engages round the external structure with two flats 72 on the clamping plate 62 in a torsion-proof but axially displaceable manner. Disposed radially on the outside of the supporting ring 63 at regular intervals from one another are cams 77

which interact, as rotation-limiting stops, with the counter-cams 79 disposed radially on the inside of the collar 791 of the grooved rim 27. The cams and counter-cams 77, 79 form, together with the collar 791, the slot 271 (figure 3) which permits limited twisting of the said parts in relation to one another. In the event of incorrect operation of the spindle-locking system 25, the limiting of rotation prevents over-rotation of the grooved rim 27 in relation to the supporting ring 63, and thereby destruction of the parts or operating faces disposed in the interior of the clamping flange 19.

On its free end 131, the working spindle 13 carries an annular groove 81 for the insertion of a circular ring 80 (figure 1) which arrests the clamping flange 19 on the working spindle 13 with axial clearance but in a manner secured against loss.

It is possible to make out, on the grooved rim 27, the three radially internal detent tracks 67 which merge evenly from a stop 672, in each case, which protrudes radially inwards in a tooth-like manner, into a clearance 674, in each case, which leads radially outwards. The three rolling bodies 68 illustrated in figure 7 are intended to move aside radially into these when the clamping flange 19 is put into its releasing position by rotation of the grooved rim 27.

It is possible to clearly make out, on the clamping plate 62, the fluting 621, which retains the disc-shaped tool in a torsion-proof manner after the fashion of claws, and the receiving journal 23 for centring the tool.

Figure 6 clearly shows, on the left in the direction of viewing, the clamping plate 62 from the rear, its cylindrical central stub 71, which has a structure 72 with two flats and also an annular groove 711 at the outermost end, being visible. The annular groove 711 serves for the engagement of a circular ring 712 (figure 4) which fixes the clamping flange 19 axially in position in such a way that the

individual parts of the latter which are disposed in its interior and which are shown in the subsequent figures, are arrested axially in relation to one another in a non-losable manner, together with the grooved rim 27 and the supporting ring 63.

The spring 800 shown in figures 5 and 6 engages, with one leg which is bent over approximately at right angles, in an external radial recess 980 in the supporting ring 63 and, with the other leg, in an axial bore 900 in the grooved rim 27. In this way, the grooved rim 27 and the supporting ring 63 are coupled to one another in a torsionally elastic manner. Through the fact that the spring 800 is pre-tensioned, twisting of the grooved rim 27 in relation to the supporting ring 63 is possible only against a distinct resistance. In this way, a pressure point is defined which makes inadvertent releasing of the clamping flange 19 considerably more difficult and thereby prevents the rotating tool from jumping off the working spindle.

Figure 7 shows a cross-section through the clamping flange 19 with three rolling bodies 68 which are disposed at approximately equal angular intervals from one another and are guided on tracks 67, 641 concentric with the central axis and which, under these circumstances, are in contact with the supporting bodies 64 on the one hand and with the grooved rim 27 on the other. The grooved rim 27 is radially supported in a rolling manner, via the rolling bodies 68, in relation to the clamping plate 62 and also the supporting ring 63, a cam ring 78 stamped out of sheet metal being anchored, with the aid of a region which is bent out in a barb-like manner, in an axial recess 632 in the supporting ring 63. The cam ring 78 forms a receptacle for the springs 69 and also a holder and a stop face for the rolling bodies 68.

When the grooved rim 27 is turned towards the right, in the direction of viewing, in a manner corresponding to the arrow 26 indicating motion, the rolling bodies 68 are rolled along towards the right on the supporting bodies 64, the grooved rim 27

forcing the rolling bodies 68 to roll along without climbing into a clearance 674 in the detent track 67. As a result of the initial tension on the spring 800 (figures 1 to 6), a pressure point is set up which is relatively difficult to overcome and which prevents unintentional releasing of the clamping position of the clamping flange 19 as a result of incorrect operation of the spindle-locking system 25. The releasing position of the clamping flange 19 when the hand lever 29 of the spindle-locking system 25 is actuated can thus be set only in a non-dangerous, low rotational speed range. In this position, the rolling bodies 68 have reached the clearance 674 into which they pass radially outwards, so that the supporting bodies 64, which are clamped-in between the front ends 65, 66 of the supporting ring 63 and clamping plate 62 in a wedge-shaped manner are likewise able to move radially outwards, liberated from the radial clamping pressure of the rolling bodies 68. As a result of this, the clamping plate 62 and the supporting ring 63 are able to move axially up to one another. This sequence of movements and the design of the operating parts in the interior of the clamping flange 19 essentially correspond to the circumstances described in Patent Specification EP 0 424 388.

In the region of the detent track 67 for each rolling body 68, figure 7 shows a clearance 674 which is associated with the said rolling body. This clearance consists, in each case, of a radial, cylindrical pocket in the detent track 67, which pocket is recessed towards the outside and open towards the centre. Under these circumstances, each clearance 674 is provided in such a way that the rolling bodies 68 travel radially outwards when they roll along and reach the respective associated clearance. This results in the aforesaid relieving of the radial load on the supporting bodies 64 and, in consequence thereof, the relieving of the axial load between the clamping plate 62 and supporting ring 63. Under these circumstances, it is sufficient if at least one of the two front ends 65, 66, between which the supporting bodies 64 of wedge-shaped cross-section are axially

disposed, are constructed with annular faces 65, 66 extending parallel to the lateral faces of the supporting bodies 64. The conical annular faces 65, 66 (figure 4) endeavour to press the supporting bodies 64 radially outwards as a result of the pre-tensioning by the clamping nut 20. The supporting bodies 64 have, both on the axial side which faces towards the annular face 65 and on the opposite axial side, support faces 642 and 643 of congruent cross-section which correspond to the course of the respective annular face 65 or 66. As a result of this, the supporting bodies 64 follow the rolling bodies 68 radially outwards as soon as the latter engage in the clearances 674. As soon as the clamping plate 62 and supporting ring 63 have moved up to one another axially, the clamping pressure of the clamping flange 19 in relation to the clamped tool 18 is reduced in such a way that the clamping screw or clamping nut 20 can be easily released from the working spindle 13 by hand.

From figure 7 it is possible to make out the three circular ring segment-shaped supporting bodies 64 which are spaced apart from one another at approximately equal peripheral angles. Under these circumstances, gaps into which stops 785 on the sheet metal cam 78 which are approximately axially parallel protrude, are left between the supporting bodies 64 in each case. The said stops 785 are located outside the rolling region of the rolling bodies 68, so that they do not hinder the rolling movement of the said rolling bodies between the tracks 641, 67. The stops 785 position the supporting bodies 64 in the peripheral direction and secure them in their position.

For each rolling body 68, the grooved rim 27 carries a cam-like stop 672 which protrudes radially inwards, in a tooth-like manner, into the track of the particular rolling body 68 mounted in front of it, and forms a form-locking abutment face for the said body.

The grooved rim 27, which is constructed as a sintered part, carries circumferential, cylindrical upper and lower annular collars 84, 85 on its front ends. The upper annular collar 84 radially engages, at least partially, over the clamping plate 62, and the lower annular collar 85 radially engages, at least partially, over the supporting ring 63. A sealing ring 86, 87 is disposed, in each case, between the annular collars 84, 85 and the clamping plate 62 or supporting ring 63 respectively. The sealing rings 86, 87 serve to seal off the inner compartment of the clamping flange 19, which is bounded by the supporting ring 63, the clamping plate 62 and the grooved rim 27. They also retain the grooved rim 27 at least axially in its position in relation to the supporting ring 63. On the outer rim and on the inner faces which face towards one another, the supporting ring 63 and clamping plate 62 have offset shoulders which form step-shaped annular receptacles for the sealing rings 86, 87 at that point.

On that side which faces towards the tool 18, the clamping plate 62 is provided with an axially projecting receiving journal 23 on which the disc-shaped tool 18 can be centred. Crossing the receiving journal 23 is a transverse slot 622, through which a fitting tool for demounting the guard ring 80 in the annular groove 81 in the working spindle 13 can be released in order to remove the clamping flange 19. Engaging round the receiving journal 23 on the outside is a circular ring 231 made of rubber, which serves to clamp the tool 18 in a slip-proof manner.

The cam ring 78 formed from sheet metal as a lining part is fitted between the clamping plate 62 and the supporting ring 63. The cam ring 78 consists of a sheet-metal ring which is at least partially flat and rests, in an axially supported manner, on the annular end face 65 of the supporting ring 63.

Figure 8 shows the grooved rim 27 as an individual item, it being possible to make out the contour of the detent track 67 with the entraining stops 672, which are

disposed in a three-fold manner in each case, the concentrically extending sections of the detent tracks 67, the clearances 674 and the bore 900 for receiving one end of the spring 800. Because of the action of the spring 800, the disposition of gradients in the detent tracks 67 for generating a pressure point between the grooved rim 27 and the rolling bodies 68 is superfluous. As a result of this, it is possible to use inexpensive sintered metal instead of extruded steel for the grooved rim 27. A grooved rim 27 made of sintered metal with gradients in the detent tracks 67 would be exposed to an excessively high radial pressure from the rolling bodies 68 and would not be safe enough because of its relatively low impact strength.

Moreover, because of the spring 800 on the clamping flange 19, the switching-back force of the latter is distinctly higher, compared with an exemplified embodiment without such a spring or with gradients in the detent tracks, the surface pressure between the grooved rim 27 and the rolling bodies 68 being kept low.

Claims

1. Hand-held machine tool with a disc-shaped tool (18) and with a machine housing (10) which receives a working spindle (13) which, on its free end (131), clamps the tool (18) between a clamping flange (19) forming a clamping device (17) with one direction of release and a clamping nut (20), and with a spindle-locking system (25) for immobilising the working spindle (13) against rotation, which spindle-locking system has a grooved rim (27) disposed on the clamping flange (19) and having at least one groove (28) with groove flanks (42, 44), and has a hand lever (29) with a detent cam (32) which is disposed on the said hand lever and can be engaged in the groove (28), of which there is at least one, characterised in that
an, in particular thread-less, special nut, in particular an SDS click nut according to EP 0 424 388, is constructed as a clamping flange (19) on the machine housing, which flange can be slipped onto the working spindle (13), in particular in a non-losable, torsion-proof manner, preferably with an internal hexagon (36) on an external hexagon 132), a grooved rim (27), which serves as a switching ring, and a supporting ring (63) being coupled to one another via spring means (800) in a torsionally elastic manner and in a manner pre-tensioned against the direction of release, so that a pressure point is formed when the grooved rim (27) is twisted in the direction of release in relation to the supporting ring (63).

2. Machine according to claim 1, characterised in that the grooved rim (27) consists of sintered metal.

3. Machine according to claim 2, characterised in that the spring (800) is designed as a ring-like bow spring.

4. Machine according to claim 3, characterised in that the spring (800) consists of, in particular round, wire.

5. Machine according to claim 4, characterised in that the spring (800) is designed as a ring which is not closed and the ends of which are bent over so as to extend essentially at right angles, parallel to the axis of the ring, and engage in a recess (980, 900), in each case, in the supporting ring (63) and the grooved rim (27).

6. A hand-held machine tool substantially as herein described with reference to the accompanying drawings.

The Patent Office

INVESTOR IN PEOPLE

20

Application No: GB 9916061.6 **Examiner:** Dave Butters
Claims searched: 1-6 **Date of search:** 13 March 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): B3D, B5L

Int Cl (Ed.7): B24B,B27B

Other: Online: WPI, EPODOC

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	WO 98/24589 A (BOSCH)	
A	WO 90/00463 A (BOSCH)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.