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(71) Applicant: **EMHART INC.**
Drummond Plaza Office Park, 1423, Kirkwood Highway
Newark, Delaware 19711 (US)

(72) Inventor: **Wetzel, Matthias**
Zeisselstrasse 23
W-6000 Frankfurt/Main 1 (DE)
Inventor: **Honold, Achim**
Siedler Strasse 12
W-7601 Ordenberg (DE)
Inventor: **Wirth, Christoph**
Franz-Keul-Strasse 6
W-6251 Selters 1 (DE)

(74) Representative: **Wetters, Basil David Peter et al**
Emhart Patents Department, Lyn House, 39, The Parade
Oadby, Leicester LE2 5BB (GB)

(54) **Screwing device.**

(57) A screwing device with which fixing elements having a respective generated surface, in particular polygonal nuts, can be screwed onto studs. The screwing device can be driven electrically or pneumatically and comprises an exchangeable magazine which is provided in the screw axis and from which the individual nuts can be brought to a work station by means of a tool in the form of three arms. In this position, the polygonal nut and tool are positively fixed before the rotational movement is transmitted. The force is transmitted from the motor via a driving unit to the lifting cylinder and to the mouth-piece fixed thereon.

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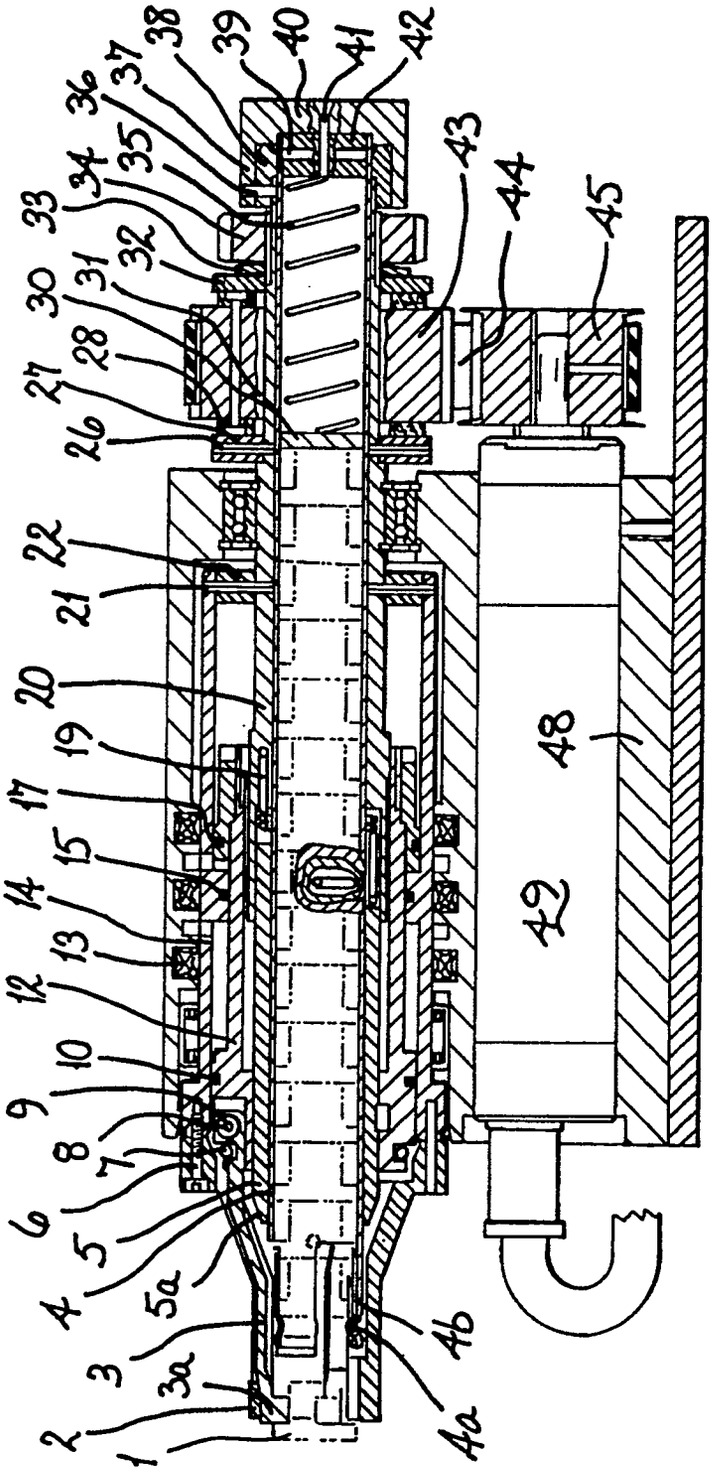
FIG. 1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The invention relates to a screwing device for screwing up fixing elements having a generated surface, in particular polygonal nuts on threaded components, having a housing for receiving a magazine, a drivring motor and a rotating tube which guides the fixing elements in the screw axis direction, wherein a mouth-piece of the housing has a claw arrangement for arresting the front fixing elements.

In recent years, fixing elements of plastics materials have become increasingly important in assembly operations, in particular in the car industry. Such plastics fixing elements can be mounted simply and rapidly and serve, in particular, for the fixing of cables by means of clips or cable binders or for the fixing of panelling. In particular, plastics nuts are screwed onto studs to form such a fixing, the stud being welded on the body by means of a stud welding device. The thread of the plastics nuts is then screwed onto the studs.

A portable device is known from US-PS 2 256 012, with which polygonal nuts stored in a magazine can be separated and screwed onto bolts. This known arrangement comprises a two-part housing so that a drum magazine containing the polygonal nuts can be used. The nuts are pressed from a magazine tube by means of a spring arrangement and are screwed on; if this tube is empty, the drum magazine is rotated accordingly so that further nuts are available.

A device for the automatic rotation of a screw is known from DE-OS 25 43 900, in which the screws are supplied to the mouth-piece of the device via a flexible conduit. In order for the screw which is to be inserted by screwing in each case to be exactly aligned with the screwdriver, there is provided a seeker which ensures that the screw blown through the pliable supply line is invariably held in the position required for screwing it.

A chuck for the clamping of cap screws during the screwing-in process is described in DE-PS 26 21 932 and is designed such that the device can be loaded from the front with a rotating drive and the depth of insertion can be limited. Consequently, this known arrangement is not suitable for screwing polygonal nuts onto headless set screws.

A device for screwing in cap screws is described in PCT application WO 7900685, in which claws are provided for separating and conveying the individual screws and for transmitting the rotational movement to these screws. The claw is axially movable and also pivotal by contact with the stud. The device is arranged such that the claw propels the stud and transmits the rotation to the stud by positive connection.

Accordingly, it is an object of the present invention to construct a screwing device of the type outlined above such that it can be equipped in the simplest manner with fixing elements which are stored in a magazine, can be removed individually from the magazine and can be brought forcibly into the correct screwing position without the need to use technically complicated mechanisms for this purpose.

According to the invention, this object is achieved in that the magazine containing the lined up fixing elements is removably arranged in the screw axis in the housing, in that the claw arrangement consists of at least one spring-loaded arm which has an inwardly directed claw at its free end and of which the other end is articulated to a lifting mechanism movably engaging with the rotating tube, and in that the arm is forcibly guided between its blocking position holding the fixing element in its screwing position and its position in which it engages with the following fixing element.

Advantageous developments follow from the features identified by the sub-claims.

The present invention provides a screwing device with which, in particular, plastics nuts stored in a magazine can be screwed onto studs. The nuts are used as fixing elements in the car industry. A magazine with, for example, sufficient plastics nuts for a car is integrated in the screwing device according to the invention. Therefore, the worker does not have to insert each nut individually into the device and then screw it up, but merely has to position the screwing device and can screw immediately. Only one magazine per car has to be exchanged.

The magazine and the necessary locking device are produced most simply in one component as the locking device is integrated in the form of a bead into the split magazine. The magazine also has a rapid-action closure so that it can be exchanged very easily and can be reliably arrested.

Owing to the use of the screwing device and the arrangement of the magazine in the screw axis, a separate component for supplying the nuts to the tool can be dispensed with. The supply means is constructed such that the arms remove the nuts from the magazine rather than the nuts being brought into the tool in the form of arms. For this removal process, the arms are brought behind the flange of the nut by means of the lifting mechanism and the rotating tube. The arms must be adapted to open and close for this purpose. This is permitted by the rotating tube of which the movement is linked to that of the lifting piston and by a torsion spring which returns the rotating tube into its starting position. Owing to this coupling, a second drive for separating the nuts can be dispensed with, further simplifying the control and handling of the device according to the invention.

A compressed air motor is provided for driving the screwing device according to the invention so two different types of energy and two supply conduits are not required. A toothed belt drive which not only operates silently but also has only slight losses during the transmission of power is provided for torque conversion.

Torque adjustment is achieved by means of a

sliding hub with a very compact construction as, with a sliding hub, the toothed disc slides through on the drive tube, rather than two separate and therefore separately mounted shafts having to be used as with a sliding clutch. The torque is applied with the mouthpiece in which the arms are held positively. This gives rise to the substantral advantage that the torque does not have to be transmitted via the tool bearing.

In order that the present invention can be better understood, a preferred embodiment will now be described in greater detail with reference to the accompanying drawings in which:

Figure 1 shows a screwing device according to the present invention in a sectional view through the centre line,

Figures 2 to 4 show partial views of the screwing device of Figure 1 in which the arms are shown in different positions, and

Figure 5 shows a perspective view of the mouthpiece for the screwing tool shown in Figure 1.

As shown in Figure 1, the screwing device, which is a manual screwing device or a mobile manual screwing device in the embodiment illustrated, comprises a housing 48 into which a central magazine 4 is inserted. A compression spring 35 is inserted in the rear part of the magazine tube in order to propel the polygonal nuts, in the form of hexagonal nuts in the embodiment illustrated, lined up in the magazine. The magazine consists of a steel tube of which the front portion consists of three resilient lips 4b. As with a crimped connection, one respective bead 4a is pressed into the ribs which lock the nuts 1 in the magazine. The nuts are permanently pressed against the beads 4a by the magazine base by means of the compression spring 35. These lips can spring back for removal of the individual nuts from the magazine.

The rear part of the magazine 4 has a handle 40 into which a rapid-action closure is integrated. This rapid-action closure contains two slots into which there is inserted a bent sring wire 37 which snaps into an annular groove of the rapid-action closure receiver when the magazine 4 is locked. The handle 40 also contains a rotation preventing means which ensures that the magazine 4 can be arrested only in a certain rotational position in the housing. The magazine is guided over its entire length in the manual screwing device, with the exception of the resilient lips 4b.

The plastics hexagonal nuts located in the magazine 4 arranged in the screw axis initially have to be separated, i.e. removed from the magazine, and then have to be supplied to the handling element. This element consists of three staggered arms 3 offset by 120°. This staggering is necessary to enable the arms to engage in the magazine without resting on the magazine wall. The arms 3 are articulated to a lifting piston 12 by means of a pin. The arms are constructed such that they can be hinged open and are axially movable so as to be able to grip behind the flange of each nut. The axial displacement is achieved by the lifting piston 12. For this purpose, a rotating tube 5, of which the movement is linked to that of the lifting piston, has an oblique face 5a which can be rotated and allows the arms to hinge open. As these arms have to be hinged so as to open and close continuously, a plastics bushing 9 has been pressed into them as a sliding bearing.

At the front end of each arm there is located a jaw in the form of a claw 3a with which the nuts can be grasped in the manner described below.

A lifting mechanism consisting of a lifting cylinder 14 and the lifting piston 12 on which the arms 3 are articulated is also provide in the housing. The lifting piston 12 performs a stroke in order to separate the nuts and bring them into the screwing position. The two piston parts are joined together by means of a locating member, which centres the two parts, and a thread. The two piston parts are also sealed from one another by this locating member and the thread. The seal between the piston 12 and the cylinder 14 is produced by means of O-rings 10, 17, the two O-rings being installed so as to float in the lifting piston.

The lifting piston has a transverse bore for receiving a steel ball which links the movement of lifting piston and rotating tube in the manner described above. The steel ball is positioned radially, lies in a guide plane of the rotating tube and produces the rotation thereof.

The lifting cylinder 14 has two transverse bores through which compressed air passes into the cylinder and transmits the torque for screwing up the individual nuts. For this purpose, a mouth-piece 2 (see also Figure 5) is fixed on the lifting cylinder by means of cylinder pins and is centred by a locating member.

The rotating tube 5 surrounded by the lifting piston 12 has the object of hinging open the arms 3 during the return travel of the lifting piston 12 and of allowing them to drop behind the flange of the first nut in the magazine 4 once they have reached their rear position. For this reason, the rotating tube 5 has, in the region of its front portion, an oblique face 5a, up which the arms 3 slide. The rotating tube 5 is also provided with three slots at this point so that the arms 3 can grip the first nut 1 through these slots.

To allow such gripping, the rotating tube 5 has to be rotated. For this purpose, the rotational movement of the rotating sleeve is linked to the movement of the lifting piston. For this purpose there is, in the rotating tube 5, a guide track in which the ball positioned in the lifting piston 12 can run. During the return travel of the lifting piston 12, the rotating tube 5 is rotated until the arms 3 fall through the slots. As the lifting piston advances, the rotating tube 5 remains in this position until the arms 3 are pushed from the rotating tube and the rotating tube is rotated back into its starting position owing to a torsion spring 19.

The rotating tube is rotatably mounted in a driving

tube 20 and axially positioned by two cylindrical pins pressed into the rotating tube 5. In the driving tube 20 there are two elongate slots into which cylindrical pins 21 extend and limit the rotational movement.

The torque is conveyed from a compressed air motor 49 via a toothed belt to a sliding hub. Below a certain screwing up torque, the sliding hub transmits the torque to the driving tube 20 which transfers it to the cylinder 14. The latter transmits the torque to the mouth-piece 2 which, in turn, positively holds the arms 3 and transfers the torque to the nut which is to be screwed up.

The sliding hub is arranged behind the lifting cylinder 14. As the direction of rotation is not reversed when using a toothed belt, the motor 49 has to rotate to the left so that the nuts 1 can be screwed onto a right-hand thread.

The sliding hub serves to adjust the torque in a given range because the same tightening moment is not requires in every application of the nut. To reduce the overall size, the driving tube 20 is integrated into the sliding hub so that the driving tube is simultaneously used as a hub. The sliding hub has two run-on discs 27 of which one is fixed to the driving tube 20 by means of two clamping sleeves. The second run-on disc is connected radially positively to the driving tube 20 and is axially positioned by three Belleville spring washers 33 and a nut with lateral notches 34 which is screwed onto the driving tube 20.

Two friction linings are screwed onto the belt pulley located between the two run-on discs 27,32. Into the belt pulley there is pressed a sliding bearing 31 by means of which it can slide without wear on the driving tube 20 after reaching the adjusted torque. The torque to be transmitted is adjusted by the initial tension of the Belleville spring washers by means of the nut with lateral notches. To prevent the adjusted torque from changing there are integrated into the nut 34 with lateral notches radial rotation preventing means constructed such that a respective plug of polyamide is pressed onto the thread of the driving tube 20 in two transverse bores in the notched nut 34 by means of a set screw.

The mouth-piece 2 has the object of positively holding the arms 3 so that the torque is transmitted, not via the arms and the hinge thereof but via the rigid mouth-piece 2, onto the nut which is to be screwed up.

To enable the torque to be transmitted onto the nut 1, the arms 3 are located positively in a groove N in a manner similar to a key. The groove passes into a slot S so that the arms can hinge open during the return travel of the lifting piston. The arms 3 continue to be guided in their slots or grooves (see Figure 5) throughout the entire loading process.

In the transition region from slot to groove there is located an inlet slope which ensures that the nut 1 is pressed into the correct position in the event of tilting. The arms cannot be inserted with the nut into the groove until the nut rests with its hexagonal faces on the arms.

In the mouth-piece there are provided three recesses into which the magazine lips 4b spring during removal of the nuts.

In order to store as little relative movement as possible, the entire driving unit including lifting cylinder and magazine also rotates during the screwing up process. As a result, the compressed air supply of the lifting cylinder has to be sealed in a rotational fashion.

Two bores through which the two cylinder chambers are supplied with compressed air are located in the rotating cylinder wall. To enable the compressed air to flow through these bores, two grooves into which the compressed air is conveyed when the valves are suitably adjusted are provided for this purpose at the level of the bores in the housing.

According to Figure 1, fifteen plastics nuts 1 which are pressed by the magazine base 30 and the magazine spring 35 against the beads 4a of the magazine lips 4b are located in the filled magazine. In the magazine 4, the magazine closure 42 is fixed by a clamping sleeve 39. The handle 40 is fixed on it by means of two screws 41. The magazine 4 is arrested by the snapping of the springs 37 into the rapid-action closure receiver 38. The cylindrical pin 36 pressed in the rapid-action closure receiver 38 engages into the slot of the handle to guarantee the correct rotational position of the magazine 4.

To carry out the loading process, i.e. to remove the first hexagonal nut 1 from the magazine 4 and to bring it into the screwing position, various stages of operation of the manual screwing device are shown in Figures 2, 3 and 4. Figure 1 shows the outlet position at the beginning of the loading process. The piston 12 is located in its foremost position there. The lifting piston 12 on which the arms 3 are fixed by means of the cylindrical pins 8 can be moved backwards and forwards by actuation of the valve. In the process, the compressed air flows from the valve into the respective annular groove of the housing 48 and passes through the associated bore in the cylinder wall 14 into the corresponding chamber of the cylinder. The grooves are sealed from one another by sealing rings 13. The cylinder chambers are sealed from one another and from the cylinder wall by means of the O-rings 10, 15 and 17.

During the return travel of the lifting piston according to Figure 5, the arms 3 strike the rotating tube 5. As shown in Figure 2, the arms 3 are opened by the oblique face 5a of the rotating tube 5 and are moved backwards in this state. The rotating tube 5 is rotated during the return travel by means of the ball which is located in the lifting piston 12 and runs in the guide track of the rotating tube 5. Owing to this rotation and the O-ring 7 which pulls the arms 3 together, the arms 3 pass through the slots of the rotating sleeve 5 behind the flange of the nut.

The lifting piston travels forwards owing to the changeover of the valve. In the process, the arms 3 with the flange of the nut press the magazine lips 4b open, as shown in Figure 3. As soon as the arms have pressed the flange of the nut over the bead 4a of the magazine lips 4b, the magazine lips 4b rebound immediately and therefore block the subsequent plastics nuts. As the lifting piston 12 continues advancing, the arms leave the slots of the rotating tube. The rotating tube is therefore rotated back into its starting position by the prestressed springs 19. Once the foremost position of the lifting piston has been reached (see Figure 4), the nut is located in the screwing position.

For the screwing up process, the valve (not shown) is actuated so that the torque of the compressed air motor 49 is transmitted by means of the two toothed discs 45 and 43 as well as the toothed belt 44 onto the sliding hub.

The two run-on discs 27 and 32 of the sliding hub transfer the torque by means of the two clamping sleeves 26 positively from the friction linings 28 on the toothed disc to the driving tube 20. The torque is transmitted from there via the spacer ring 22 through the two clamping sleeves 21 to the cylinder wall 14. The mouth-piece 2 is fixed on the cylinder wall by means of the three screws 6. The mouth-piece is also connected to the cylinder wall 14 by means of which the torque is transmitted. The nut is screwed onto a stud by the arms 3 held positively in the mouth-piece.

Advantageous alterations to the described embodiment can be made without departing from the scope of the invention.

Claims

1. Screwing device for the screwing up of fixing elements having a respective generated surface, in particular polygonal nuts onto threaded components, with a housing for receiving a magazine, a driving motor and a rotating tube which guides the fixing elements in the screw axis direction, characterised in that a mouth-piece of the housing has a claw arrangement for arresting the front fixing element, wherein the magazine (4) containing the lined-up fixing elements (1) is removably arranged in the screw axis in the housing (48), in that the claw arrangement consists of at least one spring-loaded arm (3) which has an inwardly directed claw (3a) at its free end and is articulated by its other end to a lifting mechanism (12) which engages movably with the rotating tube (5) and in that the arm is forcibly guided between its blocking position holding the fixing element (1) in its screwing position and its position in which it engages with the following fixing element.

2. Screwing device according to claim 1, wherein the magazine (4) has, in the region of its outlet end, a holding stop (4a) for the respective front fixing element (1) and axial recesses which are restricted by resilient lips (46).

3. Screwing device according to claim 1, wherein the claw arrangement has three arms (3).

4. Screwing device according to claim 1, wherein the portion of the rotating tube (5) directed toward the mouth-piece has a conical generated surface (5a) as well as axial slots, the number of which corresponds to the number of arms (3).

5. Screwing device according to claim 1, wherein the movement of the rotating tube (5) is forcibly linked to the axial movement of the lifting mechanism during axial movement of the lifting mechanism (12).

6. Screwing device according to claim 5, wherein the lifting mechanism is a lifting cylinder (14) with a piston (12) axially movable therein and in that in the generated surface of the rotating tube (5) there is located a guide track for a ball which is fixed on the internal periphery of the piston (12) and allows for the rotation of the rotating tube (5).

7. Screwing device according to claim 1, wherein each arm (3) is angled between its ends.

8. Screwing device according to claim 1, wherein the mouth-piece (2) is fixed on the lifting cylinder (14) and, in the region of its front cylindrical portion, has grooves for the positive guidance of the arms (3) and in that each groove passes inwardly into an axial slot for the passage of a corresponding arm (3).

9. Screwing device according to claim 8, wherein in the internal wall of the mouth-piece (2) there are provided recesses into which the resilient lips (4b) of the magazine (4) can be spread apart.

10. Screwing device according to any one of the proceeding claims, wherein it is arranged such that the torque can be transmitted from the driving motor (49) via a driving tube (20) to the wall of the lifting cylinder (14), from there to the mouth-piece (2) and radially to the claws (3a) of the arms (3) and therefore to the generated surface of the fixing element (1).

11. Screwing device according to claims 1 or 10, wherein the axial length of the claws (3a) of the arms (3) is selected such that they can be pivoted into the magazine (4) and between the two front fixing elements.

12. Screwing device according to claim 1 or 10, wherein the arms (3) holding the fixing element in the screwing-up position are pressed radially toward one another by the mouth-piece (2).

FIG. 1

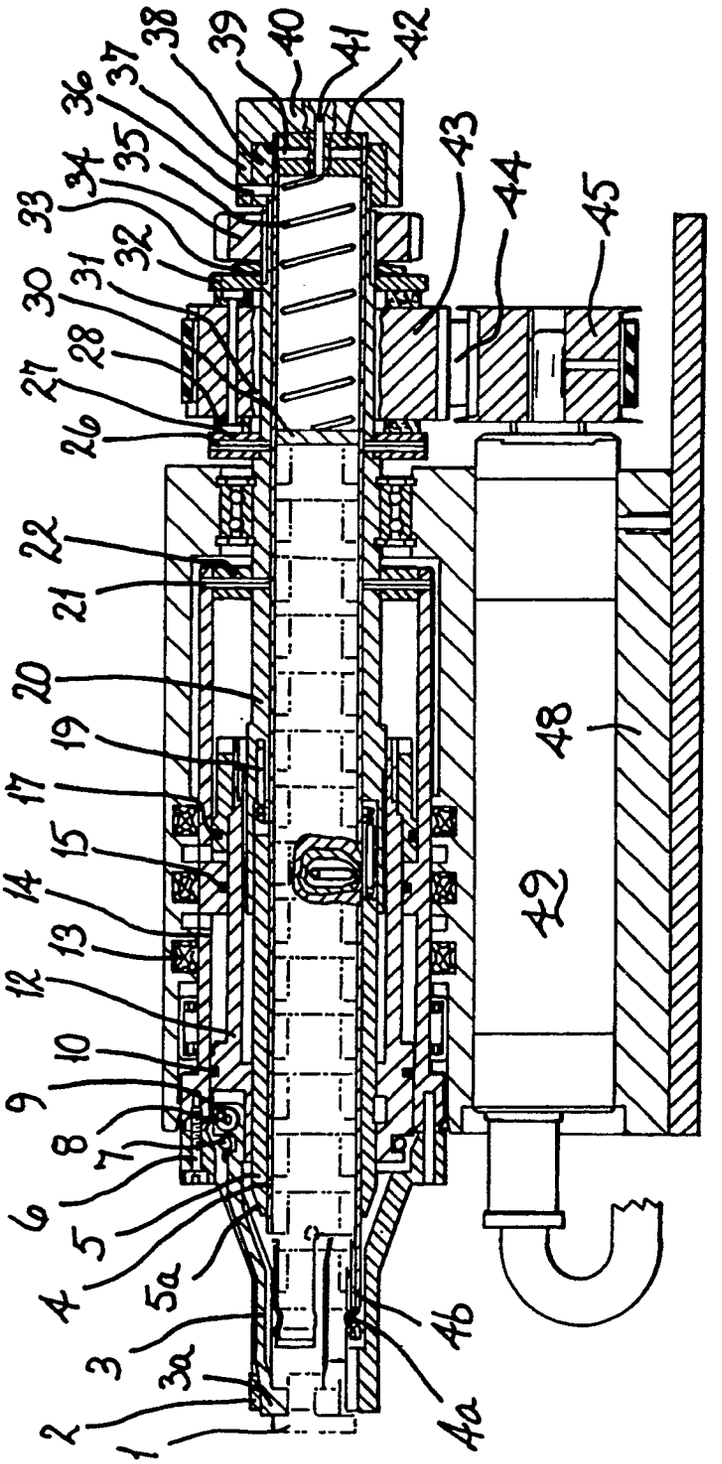
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FIG.2

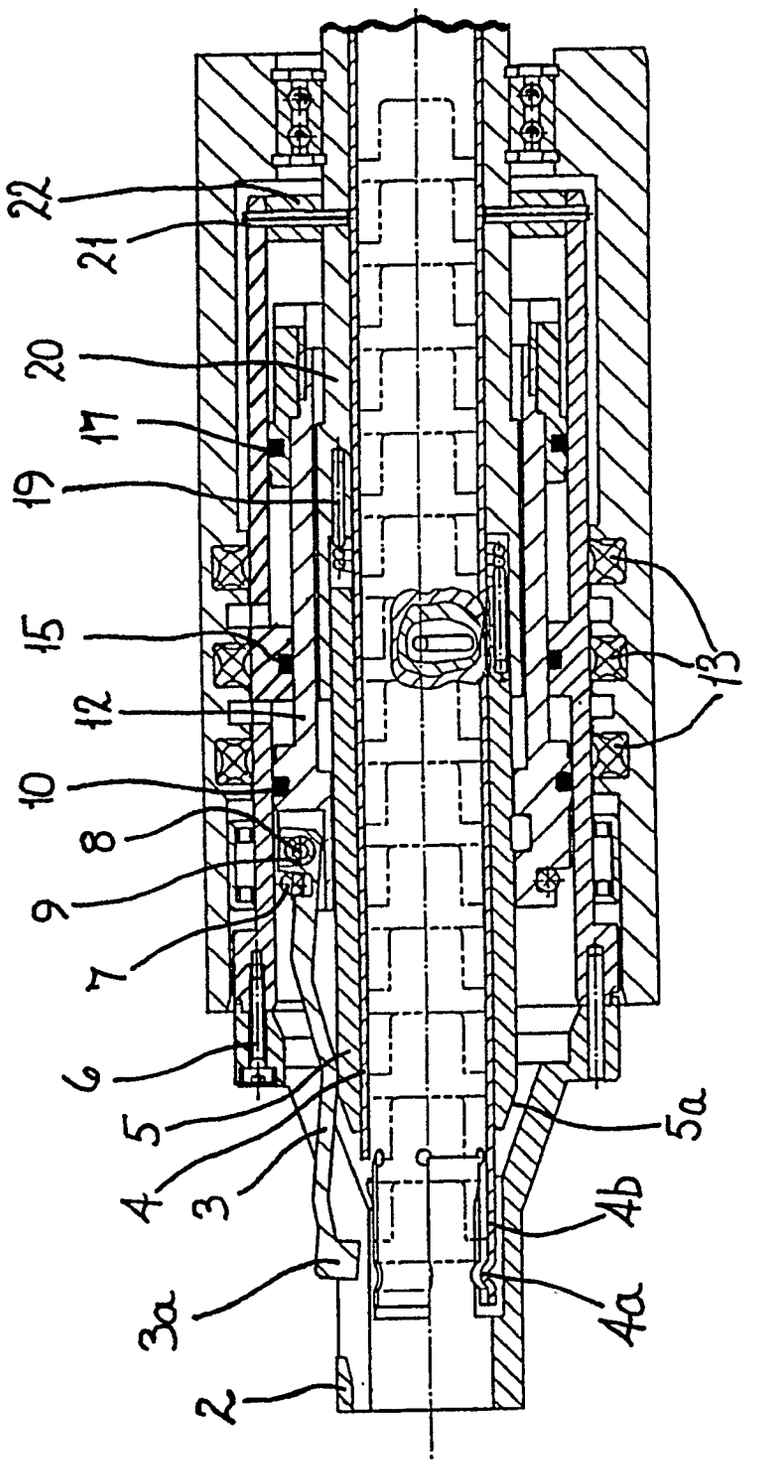


FIG.3

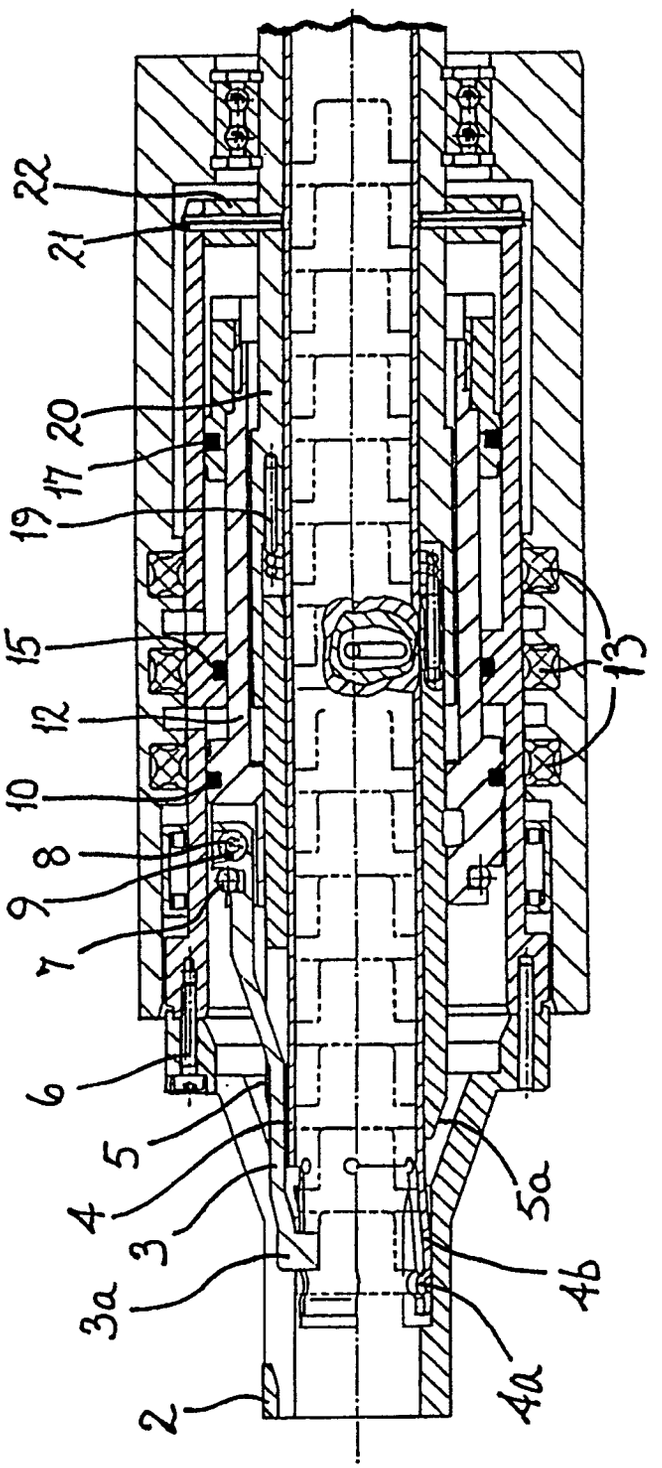
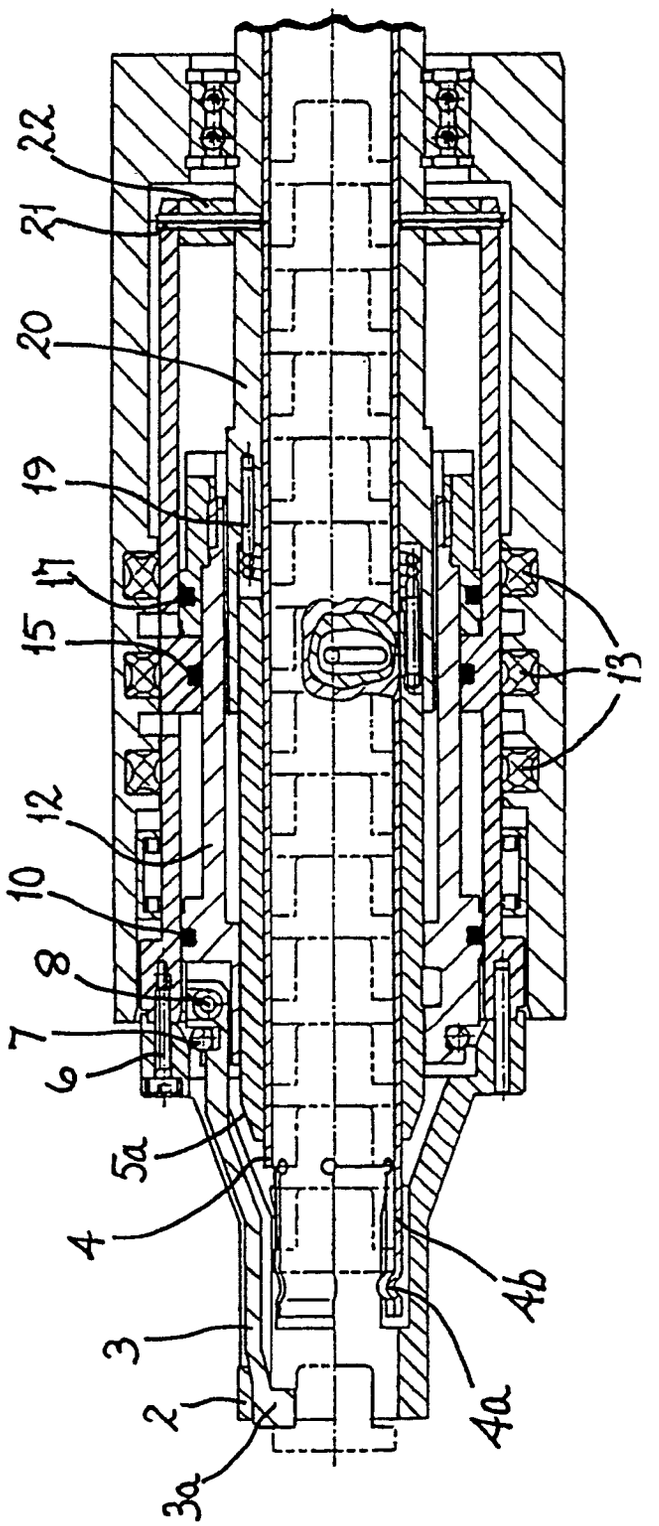


FIG.4



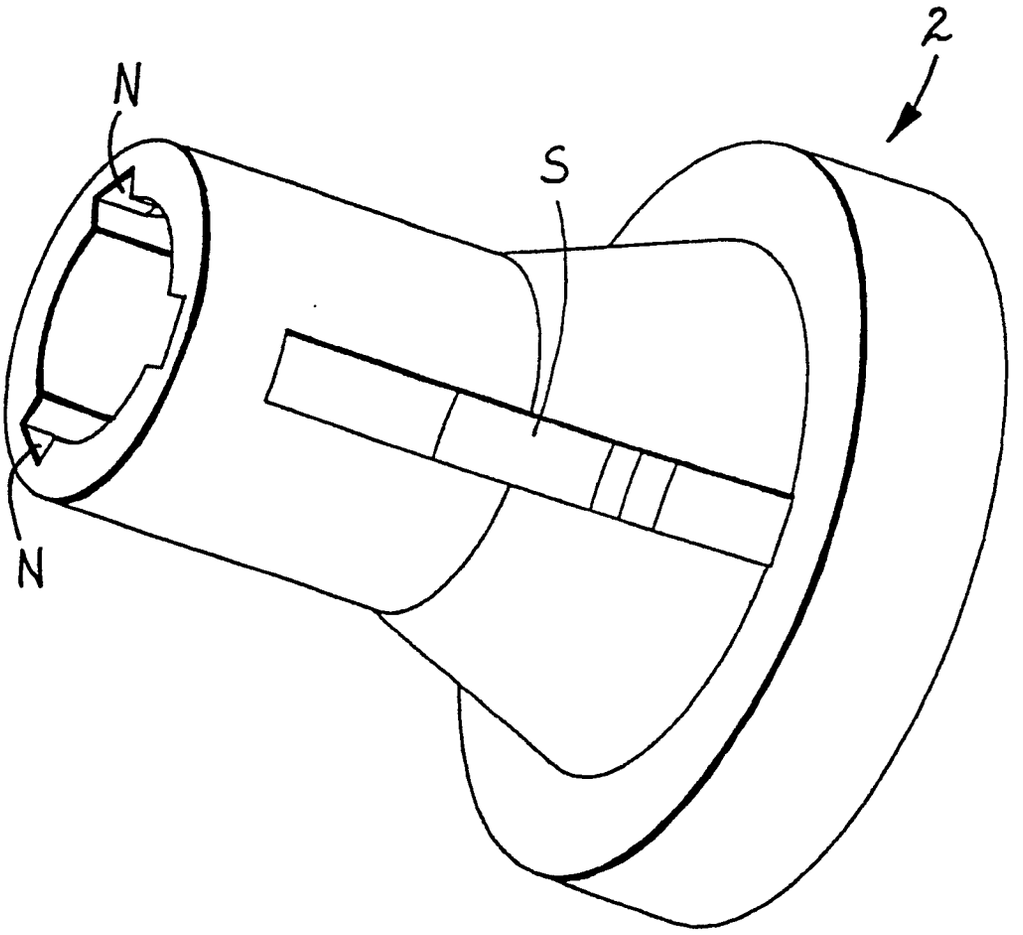


FIG. 5