



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 537 955 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
08.06.2005 Bulletin 2005/23

(51) Int Cl.7: **B25D 16/00**

(21) Application number: **04257265.1**

(22) Date of filing: **23.11.2004**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LU MC NL PL PT RO SE SI SK TR**
Designated Extension States:
AL HR LT LV MK YU

(72) Inventor: **Shuhua, Sang, Positec Power Tools
Suzhou 215006 (CH)**

(74) Representative: **Stuttard, Garry Philip
Urquhart-Dykes & Lord LLP
Tower North Central
Merion Way
Leeds LS2 8PA (GB)**

(30) Priority: **02.12.2003 CH 320120216**

(71) Applicant: **Positec Power Tools (Suzhou) Co., Ltd.
Suzhou 215006 (CN)**

(54) **Hammer drill**

(57) The present invention provides a hammer drill comprising a shell (10) in which is disposed a motor (20). The motor (20) drives an intermediate shaft (30). A swing link is pivotally engaged with the intermediate shaft (30) via clutches. A cylinder (50) comprises a gear (51) which engages the intermediate shaft (30) and is

movable along its axis direction. The rotation of the cylinder (50) can drive a collet (70) so as to drive an aiguille (80). A control mechanism (100) controls the engagement/disengagement of the intermediate shaft (30) and the cylinder (50) to realize three different working modes of the hammer drill.

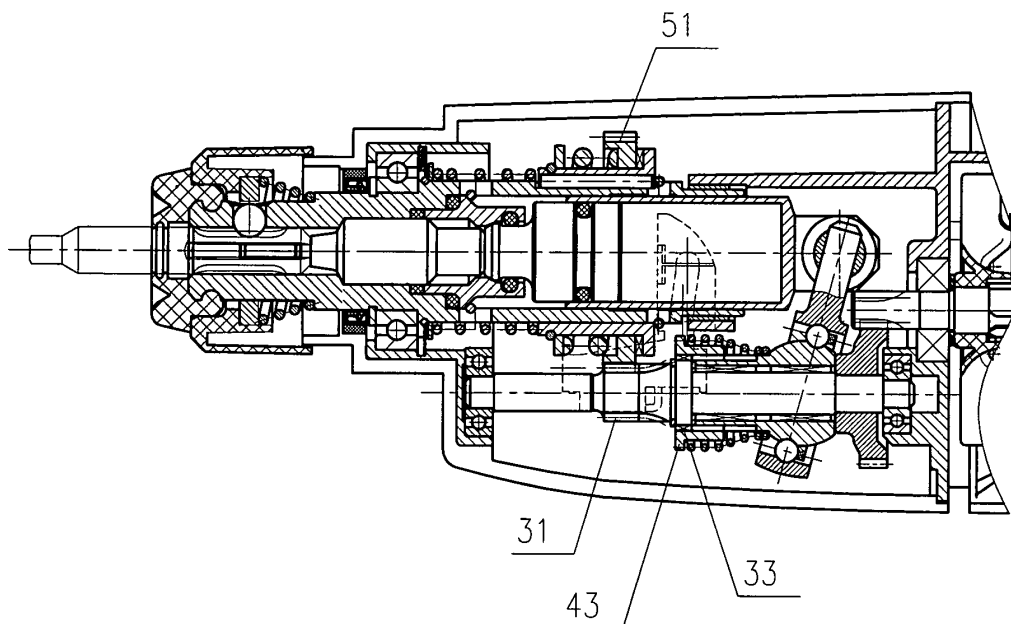


FIG. 2

EP 1 537 955 A2

Description

[0001] The present invention relates to a hammer drill, more particularly to a hammer drill which can perform three functions, namely drill, hammer and hammer/drill functions.

[0002] In building construction and other projects, there is frequently a need to drill into concrete. The hammer function of a hammer drill makes it easier to drill into hard concrete and improves the efficiency of drilling. Three-function hammer drills are known and have three different work modes: drill/ hammer/hammer drill. The operator can shift between the work modes to adapt to different working conditions. EP0775555B1 discloses a three-function hammer drill but its control mechanism for shifting between different work modes is complicated and very difficult to manufacture. There is therefore a need for a new three-function hammer drill to overcome the disadvantages of the prior art.

[0003] The present invention relates to a three-function hammer drill whose control mechanism for shifting between different work modes is simple.

[0004] Viewed from one aspect the present invention provides a hammer drill comprising:

a shell;

a rotary motor disposed in the shell, wherein the rotary motor comprises a rotary output shaft with a first pinion thereon;

an intermediate rotary shaft comprising a second pinion engaging the first pinion, a clutch and a third pinion;

a linear drive mechanism comprising a sleeve selectively engageable with the clutch;

a transmitting mechanism connected to the linear drive mechanism, wherein the transmitting mechanism comprises a gear selectively engageable with the third pinion;

an aiguille capable of rotary and linear movement which is engaged with the transmitting mechanism;

a control mechanism comprising:

a rotary control button pivotally mounted on the shell,

a guide device fixed on the shell and

a slide device slidably engaged with the guide device

comprising a first pushing bar and a second pushing bar; and

wherein in use the slide device is adapted to reciprocate rotary movement of the control button slidably along the guide device so as to selectively engage or disengage the gear and the third pinion or to selectively engage or disengage the clutch and the sleeve.

[0005] Compared with the prior art, the control mechanism of the present invention for shifting between different work modes is simple and straightforwardly manufactured.

[0006] In an embodiment of the invention, the transmitting mechanism transmits linear drive from the linear drive mechanism to the aiguille (ie in a hammer action). In an embodiment of the invention, the linear drive mechanism is a piston. In an embodiment of the invention, the transmitting mechanism is a cylinder.

[0007] In an embodiment of the invention, the transmitting mechanism transmits rotary drive from the intermediate rotary shaft to the aiguille (ie in a drill action).

[0008] Preferably the gear is movable along the axial direction of the transmitting mechanism.

[0009] Preferably the guide device is fixed substantially longitudinally on the shell. Preferably the guide device is a linear guide device. Preferably the guide device is elongate.

[0010] Preferably in use the slide device is adapted to linearly reciprocate rotary movement of the control button slidably along the guide device so as to selectively engage or disengage the gear and the third pinion or to selectively engage or disengage the teeth and the sleeve.

[0011] Preferably the control button further comprises:

an eccentric axle, wherein the slide device defines a slide channel for receiving the eccentric axle. Preferably the slide device defines a linear slide channel for receiving the eccentric shaft such that rotary movement of the rotary control button is translated by the eccentric shaft into linear displacement of the slide device along the guide device. Preferably the slide channel is substantially orthogonal to the guide device.

The eccentric shaft may slide axially along the slide channel in response to rotary movement of the control button so as to push the first pushing bar or the second pushing bar to selectively engage or disengage the gear and the third pinion or to selectively engage or disengage the teeth and the sleeve. The first pushing bar is operable to push the gear so as to disengage the gear and the third pinion. The second pushing bar is operable to push the sleeve so as to disengage the sleeve and the teeth.

[0012] Preferably a first resilient member (eg spring) urges the sleeve and clutch into engagement.

[0013] Preferably a second resilient member urges the gear and the third pinion into engagement.

[0014] Preferably the clutch comprises teeth.

[0015] Preferably the slide device defines an access hole through which the guide device passes as the slide device slides along the guide device.

[0016] Preferably the control button further comprises: a fastening device, wherein the shell comprises: a locking device for engaging the fastening device to lock the slide device relative to the guide device. The fastening device may be mounted substantially coaxially with the rotary control button.

[0017] Preferably a third resilient member (eg spring) is disposed between the fastening device and the rotary control button, wherein the third resilient member urges the fastening device into engagement with the locking device. Preferably the locking device comprises at least three locking channels (eg on the shell) for selectively engaging the fastening device to lock the slide device relative to the guide device in at least three positions (ie the positions corresponding to the drilling mode, the hammer mode and the drilling and hammer mode respectively).

[0018] The present invention will now be described in a non-limitative sense with reference to the accompanying Figures in which:

Fig. 1 shows a cross-sectional view of a hammer drill in accordance with an embodiment of the present invention;

Fig. 2 shows a partial cross-sectional view of the hammer drill in accordance with an embodiment of the present invention in hammer/drill mode;

Fig. 3 shows a cross-sectional view of the control mechanism of the hammer drill of Fig. 2;

Fig. 4 shows a partial cross-sectional view of the hammer drill in accordance with an embodiment of the present invention in hammer mode;

Fig. 5 shows a cross-sectional view of the control mechanism of the hammer drill of Fig. 4;

Fig. 6 shows a partial cross-sectional view of the hammer drill in accordance with an embodiment of the present invention in drill mode;

Fig. 7 shows a cross-sectional view of the control mechanism of the hammer drill of Fig. 6; and

Fig. 8 shows a cross-sectional view of Fig. 1 along A-A.

[0019] Fig. 1 shows a hammer drill in accordance with an embodiment of the invention comprising a shell 10 and a motor 20 disposed in the shell 10. The motor 20 comprises an output rotary shaft 21 with a first pinion 22 thereon. An intermediate rotary shaft 30 is disposed parallel to the output rotary shaft 20 and comprises a sec-

ond pinion 32 engaged with the first pinion 22 to transmit rotary power from the output rotary shaft 20 to the intermediate rotary shaft 30 and to a third pinion 31.

[0020] A swing link comprises a bearing 40 having a sleeve 43 engaged with teeth 33 on the intermediate rotary shaft 30 and a connecting bar 41 connected to a piston 60. A first spring 42 is interposed between the bearing 40 and the intermediate rotary shaft 30 to urge the sleeve 43 and the teeth 33 into engagement so that the teeth 33 and the sleeve 43 perform a clutch function.

[0021] A cylinder 50 covers the piston 60 and comprises a gear 51 engaged with the third pinion 31. The gear 51 can move along the axis of the cylinder 50. A second spring 52 is disposed on one side of the gear 51 to bring the gear 51 and the third pinion 31 into engagement so as to transmit rotary power from the intermediate rotary shaft 30 to the cylinder 50. The cylinder 50 is driven linearly by the piston 60. A collet 70 is mounted on one end of the cylinder 50 and an aiguille 80 is gripped in the collet 70.

[0022] The hammer drill further comprises a control mechanism 100 which is shown in outline in Figures 2, 4 and 6, in cross-section in Figures 3, 5 and 7 and *in situ* in Figure 8. The control mechanism 100 itself comprises a rotary control button 110, a guide device 120 and a slide device 130. The rotary control button 110 has an eccentric shaft 111 parallel to its rotary axis. The slide device 130 defines a slide channel 131 which receives the eccentric shaft 111 and an access hole 132 through which the guide device 120 passes. The eccentric shaft 111 translates rotary motion of the rotary control button 110 into a linear displacement of the slide device 130 along the guide device 120. The slide device 130 also comprises a first pushing bar 133 and a second pushing bar 134. By rotating the control button 110, the eccentric shaft 111 rotates eccentrically and is displaced in a relative horizontal direction. The first pushing bar 133 and the second pushing bar 134 move to push the gear 51 and sleeve 43 respectively and this serves to disengage the gear 51 from the third pinion 31 and the teeth 33 from the sleeve 43.

[0023] Referring to Figs. 2 and 3, when the slide device 130 is in the middle position, the first pushing bar 133 and the second pushing bar 134 do not push the gear 51 and the sleeve 43. Power is transmitted to the cylinder 50 and the swing link 40 respectively via the engagement of the gear 51 with the third pinion 31 and the sleeve 43 with the teeth 33 so that the cylinder 50 makes the aiguille 80 drill via the collet 70 and the swing link 40 drives the piston 60 to make the aiguille 80 hammer (*ie* the hammer drill mode).

[0024] Referring to Figs. 4 and 5, the control button 110 is rotated to move the slide device 130 to the left. The first pushing bar 133 moves to push the gear 51 which disengages the third pinion 31. The cylinder 50 loses rotary power and the aiguille 80 cannot drill. The sleeve 43 and the teeth 33 remain engaged so the aiguille 80 can hammer (*ie* the hammer mode).

[0025] Referring to Figs. 6 and 7 (*ie* the drill mode), the control button 110 is rotated to move the slide device 130 to the right. The second pushing bar 134 moves to push the sleeve 43 which disengages the teeth 33. The swing link 40 loses power and the aiguille 80 can not hammer. The gear 51 and the third pinion 31 remain engaged so the aiguille 80 can drill.

[0026] Referring to Fig. 8, the rotary control button 110 pivotally engages the shell 10 via an axial bolt 112. The shell 10 comprises three locking devices 11 to engage a fastening device 113 in three different positions respectively. A third spring 114 is disposed between the fastening device 113 and the rotary control button 110. Each of the locking devices 11 defines a groove for receiving the fastening device 113. When the rotary control button 110 is in one of the drill/hammer/drill and hammer positions, the fastening device 113 is urged into engagement with a corresponding one of the locking devices 11 by the third spring 114. When it is desired to shift the working mode, the fastening device 113 is pushed downwardly to disengage the locking device 11 so that the rotary control button 110 can rotate freely.

Claims

1. A hammer drill comprising:

a shell 10;

a rotary motor 20 disposed in the shell 10, wherein the rotary motor 20 comprises a rotary output shaft 21 with a first pinion 22 thereon;

an intermediate rotary shaft 30 comprising a second pinion 22 engaging the first pinion 22, a clutch 33 and a third pinion 31;

a linear drive mechanism 40 comprising a sleeve 43 selectively engageable with the clutch 33;

a transmitting mechanism 50 connected to the linear drive mechanism 40, wherein the transmitting mechanism 50 comprises a gear 51 selectively engageable with the third pinion 31;

an aiguille 80 capable of rotary and linear movement which is engaged with the transmitting mechanism 50;

a control mechanism 100 comprising:

a rotary control button 110 pivotally mounted on the shell 10,

a guide device 120 fixed on the shell 10 and

a slide device 130 slidably engaged with the guide device 120 comprising a first pushing bar 133 and a second pushing bar 134; and

wherein in use the slide device 130 is adapted to reciprocate rotary movement of the rotary control button 110 slidably along the guide device 20 so as to selectively engage or disengage the gear 51 and the third pinion 31 or to selectively engage or disengage the teeth 33 and the sleeve 43.

2. A hammer drill as claimed in claim 1 wherein the control button 110 further comprises:

an eccentric shaft 111, wherein the slide device 130 defines a slide channel 131 for receiving the eccentric shaft 111 such that rotary movement of the rotary control button 110 is translated by the eccentric shaft 111 into linear displacement of the slide device 130 along the guide device 120.

3. A hammer drill as claimed in claim 1 or 2, wherein the slide device 130 defines an access hole 132 through which the guide device 120 passes as the slide device 130 slides along the guide device 120.

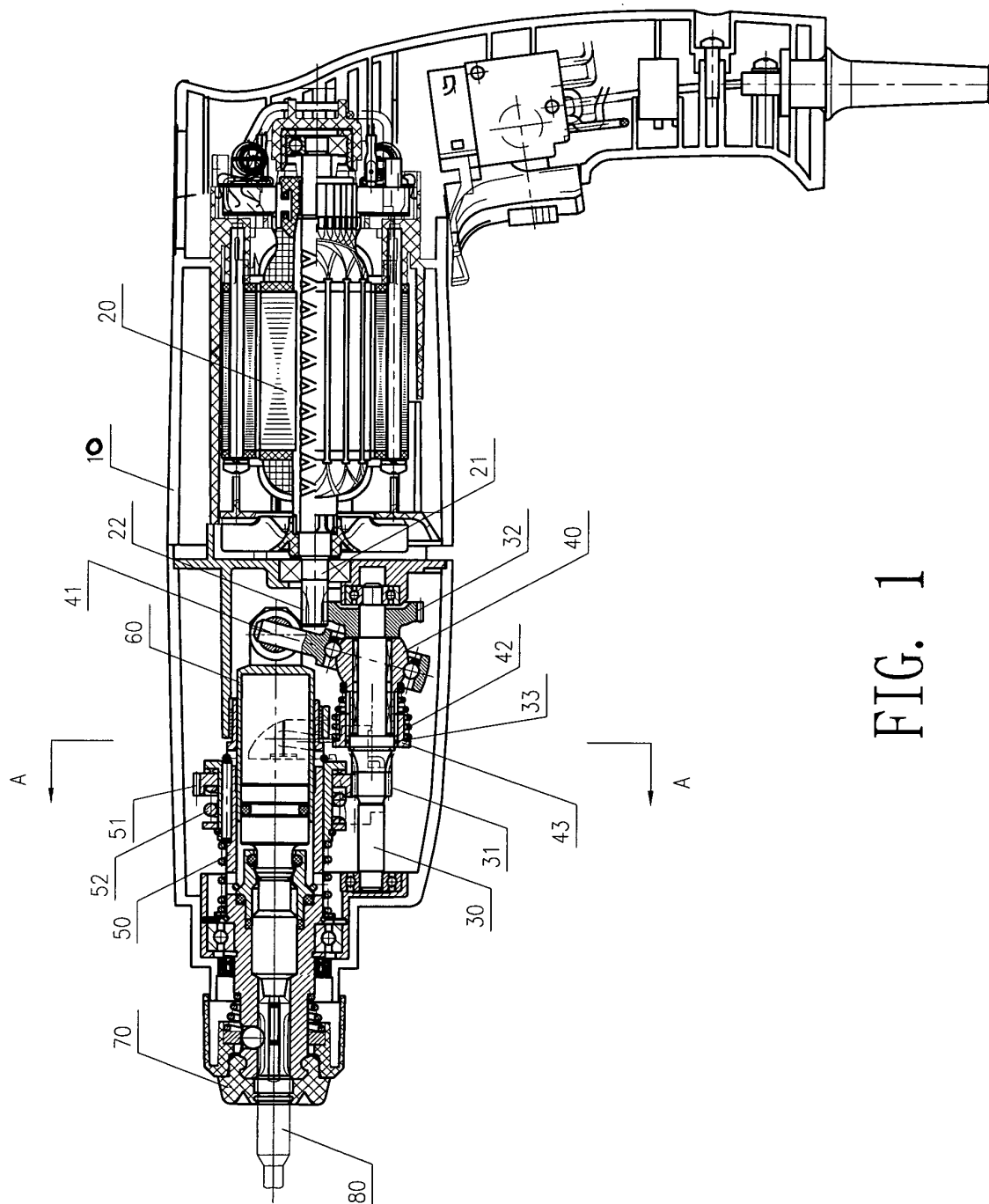
4. A hammer drill as claimed in claim 1, 2 or 3 wherein the control button 110 further comprises:

a fastening device 113,

wherein the shell 10 comprises:

a locking device 11 for engaging the fastening device 113 to lock the slide device 130 relative to the guide device 120.

5. A hammer drill as claimed in claim 4 wherein a spring 114 is disposed between the fastening device 113 and the rotary control button 110 and the locking device 11 comprises at least three locking channels for selectively engaging the fastening device 113 to lock the slide device 130 relative to the guide device 120 in at least three positions.



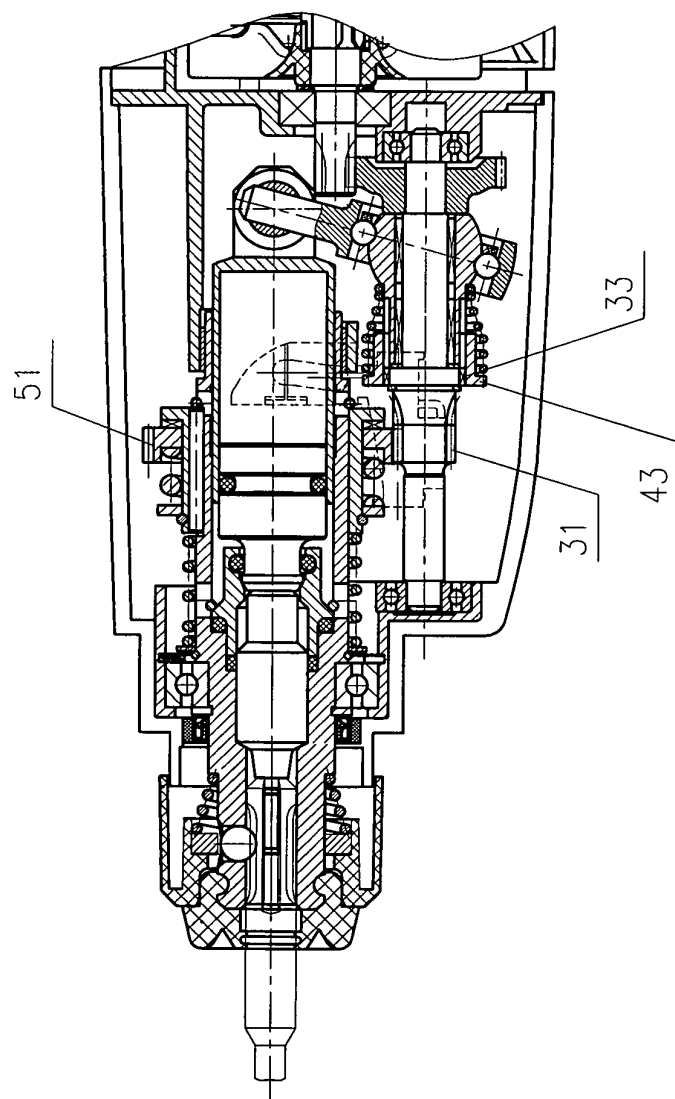


FIG. 2

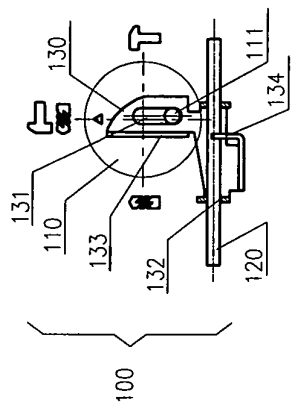


FIG. 3

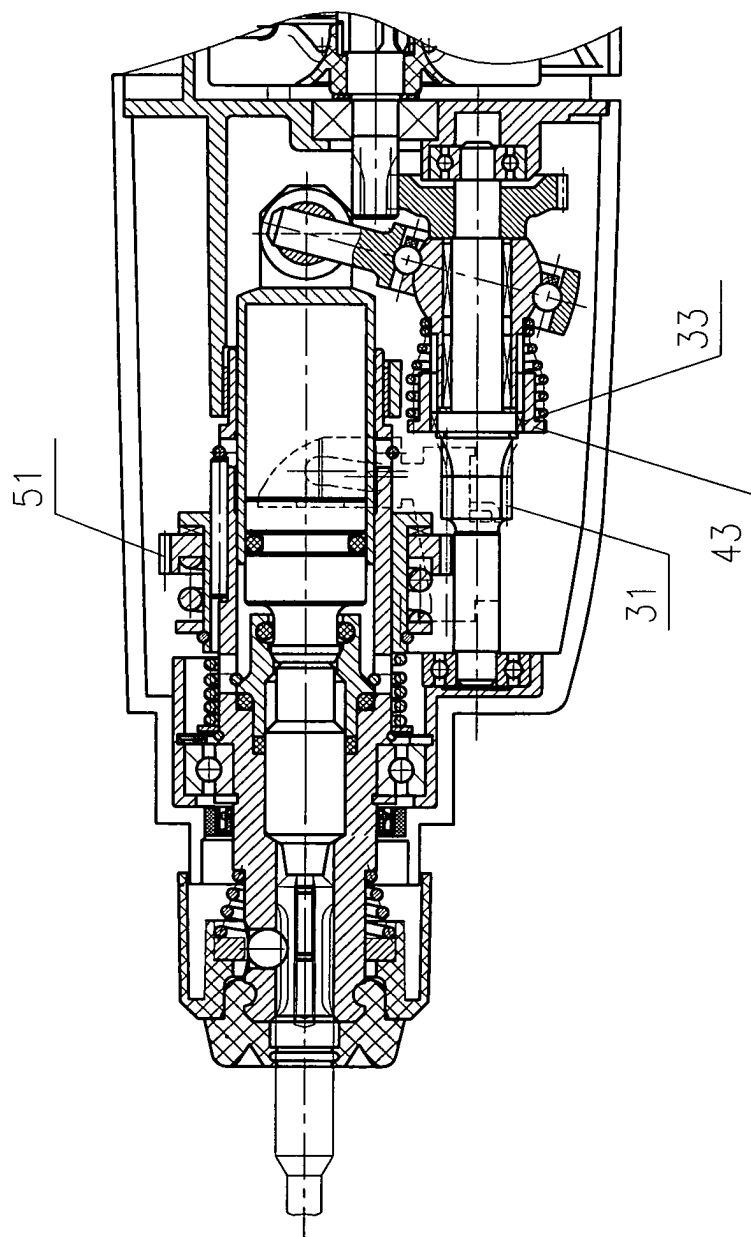


FIG. 4

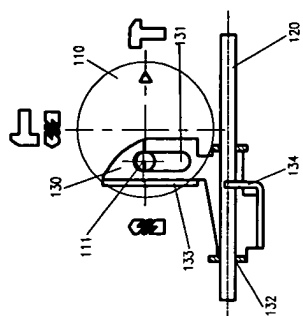


FIG. 5

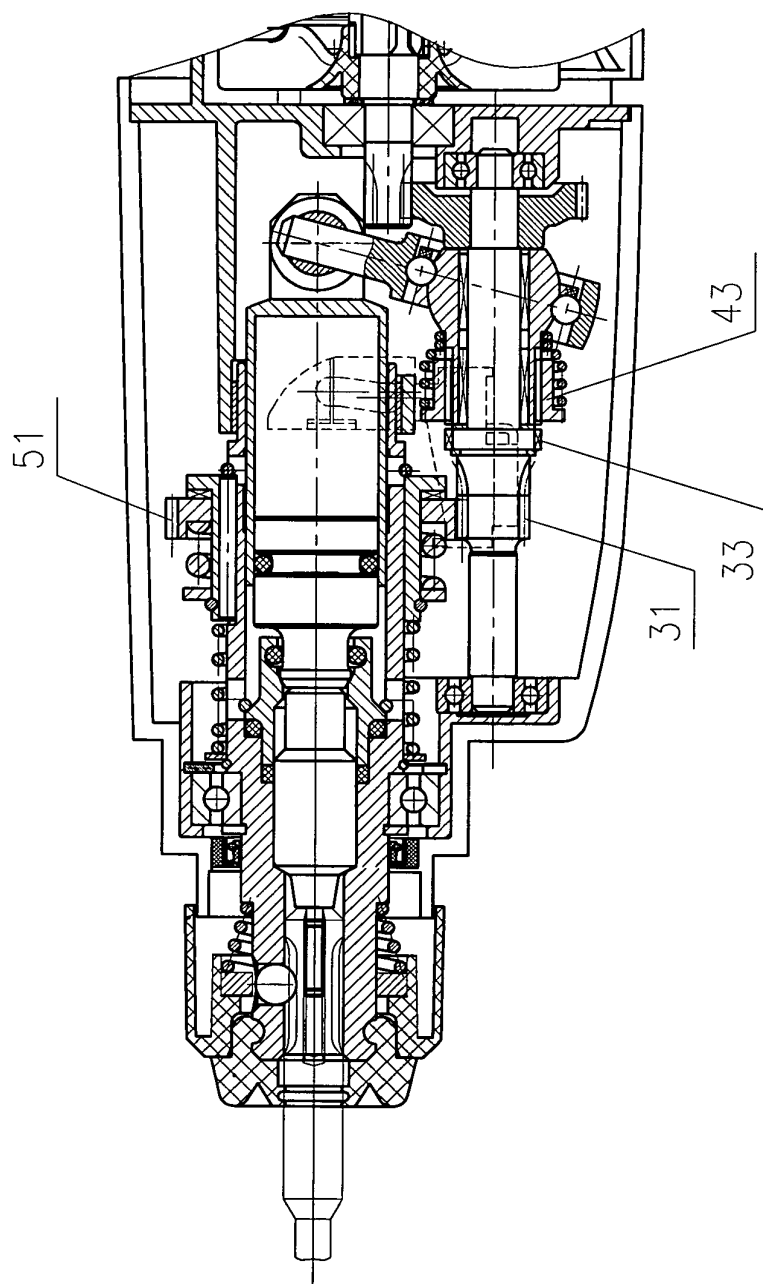


FIG. 6

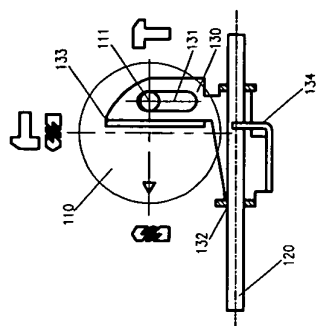


FIG. 7

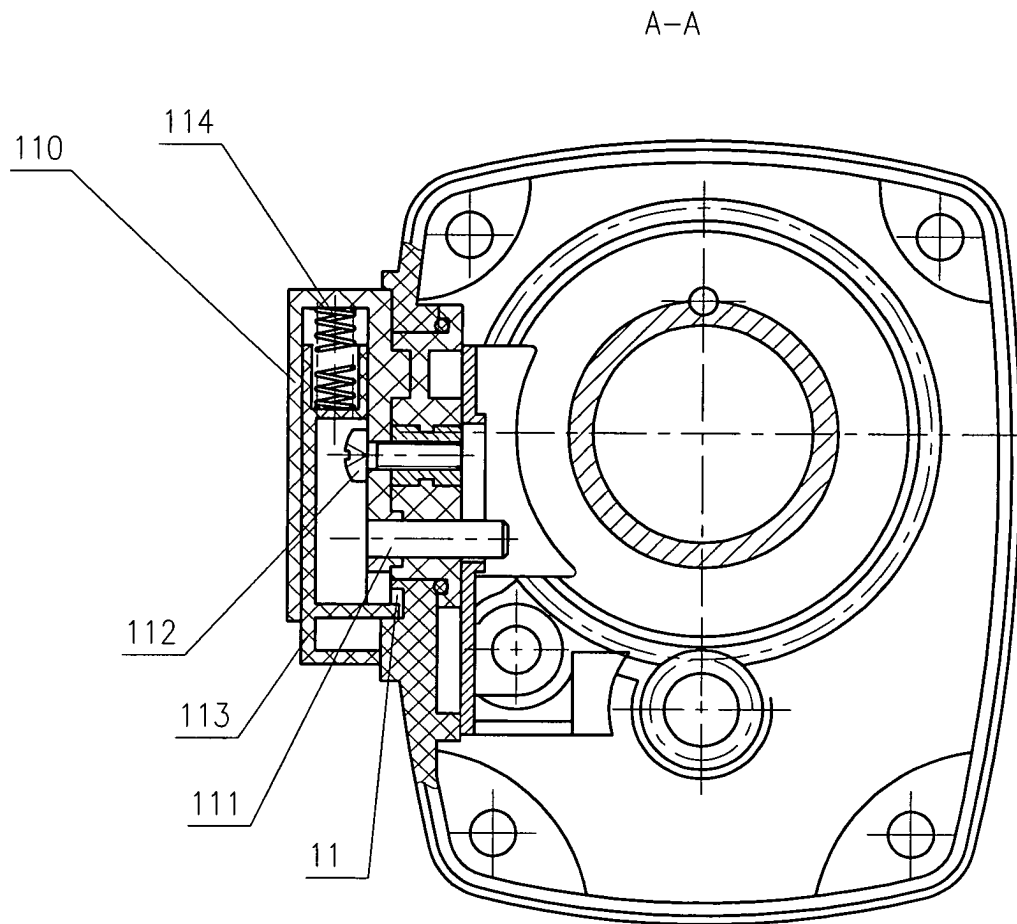


FIG. 8