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(54) Multi-function double-speed rotary hammer

(57) This tool is one of kinds of power tools, it is a multi-function double-speed rotary hammer. It includes the front and rear part; the front part includes front housing (15), base (16), transmission shaft assembly (17), impact shaft assembly (6), gear assembly (26), low-speed gear (12), high-speed gear (9), back-forward spring (11) for the gear, inner function knob, outside function knob, function-adjusting board for getting low-speed, function-adjusting board for getting high-speed, spring installed on the function-adjusting board, shaft lock assembly, etc. In this invention, just one function knob can be used for getting 5 functions, such as only chiseling, adjusting the working angel of flat chisel, drilling & chiseling, only drilling with low speed, and only drilling with high speed. In addition, it is reliable in functions, and convenient in operation and assembly. This invention has solved the present problem of the low efficiency in drilling small bores on the steel or wood.

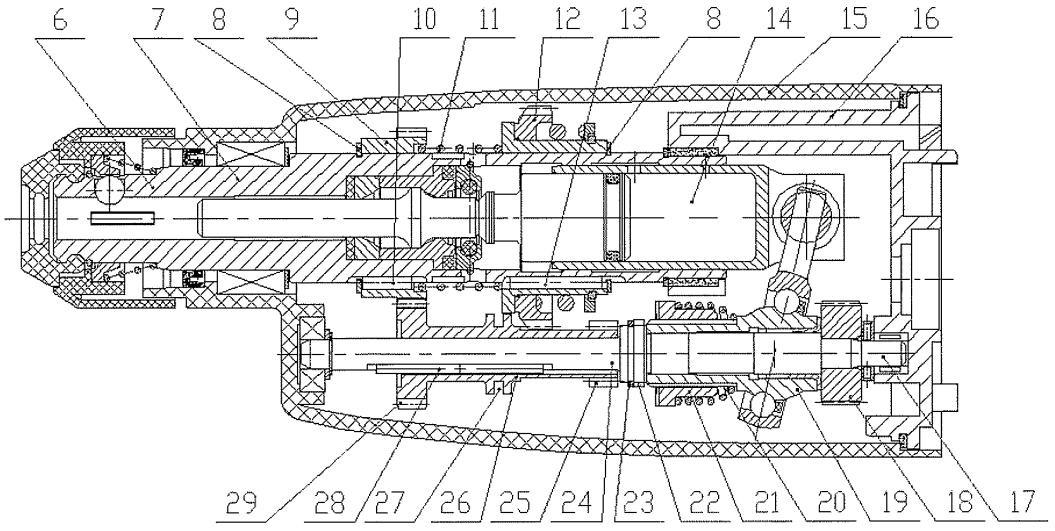

FIG 11

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Description

Brief introduction

[0001] This patent relates to a rotary hammer which is one of kinds of power tools, it uses only one function knob to realize 5 functions, such as

a. only chiseling;
b. adjusting the working angel of flat chisel;
c. drilling & chiseling
d. only drilling with low speed;
e. only drilling with high speed.

Technical background

[0002] So far, the available vary kinds of rotary hammers in market have no more than 4 functions, such as

a. only chiseling;
b. adjusting the working angel of flat chisel;
c. drill & chisel;
d. only drilling with low speed

[0003] Function a (only chiseling) is adapted for working at making wiring slot on wall which is made of concrete or brick, and removing tilt on the wall.

[0004] Function b (adjusting the working angel of flat chisel): sometimes, the end-user changes the working angel of flat chisel when working, they should set the function knob at this position, and select the proper angle, then put the function knob to the function A to work continuously.

[0005] Function c (drill & chisel): for drilling holes on the wall made of concrete or brick.

[0006] Function d (only drilling with low speed;): mainly used for drilling holes in steel or wood, when the diameter of hole is less than 10mm, but when diameter of hole is bigger than 10 mm, the drilling speed becomes lower.

[0007] To compare with the tool based on this patent and available rotary hammer in the market, this Multi-function Double-speed Rotary hammer has been added the function of only drilling with high speed (function E), it not only has a tight structure, it also can be operated simply, because it has only one knob which can conveniently achieve functions switch.

Content

[0008] For improving the drilling performance for small holes in steel or wood, this patent is related to invent one multi-function double-speed rotary hammer with single function knob to realize 5 functions such as

a. only chiseling;
b. adjusting the working angel of flat chisel;
c. drilling & chiseling
d. only drilling with low speed;
e. only drilling with high speed.

[0009] Then present invention is characterized that the tool use only one function to realize 5 functions above, especially it has the function e(only drilling with high speed).

[0010] The present invention shows how to realize the 5 functions in details:

[0011] The tool mainly includes front parts and rear part, the front part is gear system, the rear part is motor system; the front part includes gear housing 15, base 16, transmission shaft assembly 17, Impact shaft assembly 6, shaft lock assembly 44, the character is below:

[0012] Transmission shaft assembly 17 mainly includes transmission shaft 24, wobble bearing 19, and clutch 21 which can gear or ungear with transmission shaft 24, and spring 20 for clutch system.

[0013] Impact shaft assembly 6 mainly includes impact shaft 7, lock ring 8, low-speed gear 12 which in installed in the impact shaft 7 and may drive impact shaft 7, high-speed gear 9, back-forward spring 11, cylinder 14.

[0014] The tool also includes gear assembly 26 which is fixed on transmission shaft 24 and can move along with transmission shaft 24; gear assembly 26 includes a low-speed pinion 25 which gears or ungears with low-speed gear 12 in transmission shaft assembly 17 and a high-speed pinion 29 which gears with a high-speed gear 9 in transmission shaft assembly 17.

[0015] The tool also includes one function-adjusting board 34 for getting low-speed and one function-adjusting board 35 for getting high-speed, spring 41 is installed in the function-adjusting board 35 for getting high-speed; function-adjusting board 34 for getting low-speed is connected with side pin 37 and 38 which can move low-speed gear 12 and clutch 21 respectively along transmission shaft 24. The function-adjusting board 35 for getting high-speed connected with side pin 36 which may move gear assembly 26 along the direction of shaft.

[0016] The tool also has a inner function knob 32 in the base 16, outside function knob 33 is fixed with inner function knob 32 which is connected with one function-adjusting board 34 for getting low-speed which can move along transmission shaft 24 for getting low speed and a function-adjusting board 35 for getting high-speed which is fixed.

[0017] Usually, gear assembly 26 is fixed on transmission shaft 24 by a flat key 28, it only can move along with transmission shaft 24; at the two ends of gear assembly 26, it has low-speed pinion 25 and high-speed pinion 29; the slot 27 is in the middle area of gear assembly 26.

[0018] Low-speed gear 12 is fixed in the impact shaft 7 by a flat key 13, it only can axially move along with impact shaft 7. High-speed gear 9 is installed on the impact shaft 7 by key 10, it can only move along with impact shaft 7 axially. The lock ring 8 is used for stopping low-speed gear 12 and high-speed gear 9 to move axially; back-forward spring 11 is installed between low-speed gear 12 and high-speed gear 9 on the impact shaft 7.

[0019] In the middle of transmission shaft 24, there is a spline key 22 outside which may be geared with clutch 21; Lock ring 23 is fixed on transmission shaft 24, it can used for fixing clutch 21 axially.

[0020] The function-adjusting board 34 for getting low-speed is connected with side pin 37 and 38, it has one hole 50, there is teeth 49 at one side parallel with moving direction; the function-adjusting board 35 for getting high-speed is connected with side pin 36 which is fixed in the slot 27 of the sliding gear assembly 26, there is a hole 52 on the function-adjusting board 35 for getting high-speed, it has one teeth 51 in at least one side of hole 52 parallel with moving direction. Side pin 37 and 38 are perpendicular with function-adjusting board 34 for getting low-speed, side pin 37 is perpendicular with the side pin 38, and side pin 36 is perpendicular with function-adjusting board 35 for getting high-speed.

[0021] The spring 41 is installed on function-adjusting board 35 for getting high-speed; the bended bar 40 is installed in the slot 39 of the base 16. There are cylinder surface 47 and 48 in inner function knob 32, the cylinder surface 47 has several teeth 45 which can gear or ungear with teeth 49 in function-adjusting board 34 for getting low-speed. The cylinder surface 48 has several teeth 46 which can gear or ungear with teeth 51 in function-adjusting board 35 for getting high-speed.

[0022] Generally, back-forward spring 11 is used for the restoration back-forward spring 11 installed on the big gear is press spring, spring 20 installed on the clutch is press spring too, and the spring 41 installed on board is wiggly spring.

[0023] Function-adjusting board 34 for getting low-speed is installed in the slot 30 which is in the base 16 and parallel with transmission shaft 24 axially, and can slide along transmission shaft 24 axially in the groove, function-adjusting board 35 for getting high-speed is installed in the slot 31 which is in the base 16 and parallel with transmission shaft 24 axially, it can slide along transmission shaft 24 axially in the groove.

[0024] This tool can get 5-function mode by controlling the function-adjusting board 34 and 35 with outside function knob 33.

Mode 1: only chiseling

[0025] According to FIG 1, when rotating outside function knob 33 to position 1, function-adjusting board 34 for getting low-speed causes that:

1) Low-speed gear 12 ungears with low-speed pinion 25;
2) Low-speed gear 12 gears with shaft lock assembly 44 (see FIG 14);
3) The wobble bear 19 can rotate with transmission shaft 24 when clutch 21 gears with spline key 22 (see FIG 2) in transmission shaft 24;

The above 1), 2), 3) achieve the mode 1 (only chiseling)

Mode 2: Adjusting the working angel of flat chisel when rotating outside function knob 33 to position 2 shown in FIG 1, the situation of function-adjusting board 34 for getting low-speed, function-adjusting board 35 for getting high-speed, inner function knob 32 will be shown in FIG 6, at this position, low-speed gear 12 ungears with shaft lock assembly 44 (see FIG 14), it achieves the function of adjusting the working angel of flat chisel.

Mode 3: Drilling & chiseling when rotating outside function knob 33 to position 3 shown in FIG 1, the situation of function-adjusting board 34 for getting low-speed, function-adjusting board 35 for getting high-speed, inner function knob 32 will be shown in FIG 8, at this position, low-speed gear 12 gears with low-speed pinion 25, it achieves the function of Drilling & chiseling.

Mode 4: Only drilling with low speed when rotating outside function knob 33 to position 4 shown in FIG 1, the situation of function-adjusting board 34 for getting low-speed, function-adjusting board 35 for getting high-speed, inner function knob 32 will be shown in FIG 10, at this position, the clutch21 ungears with spline key 22 in transmission shaft 24, it achieves the function of Only drilling with low speed.

Mode 5: Only drilling with high speed when rotating outside function knob 33 to position 5 shown in FIG 1, the situation of function-adjusting board 34 for getting low-speed, function-adjusting board 35 for getting high-speed, inner function knob 32 will be shown in FIG 12, at this position, low-speed gear 12 ungears with low-speed pinion 25, but high-speed gear 9 gears with high-speed pinion 29.

[0026] In general, the above functions are corresponded to the following situation:

[0027] When anticlockwise rotating outside function knob 33 to position 1, function-adjusting board 34 for getting low-speed causes low-speed gear 12 ungears with low-speed pinion 25 which is included in gear assembly 26, and low-speed gear 12 gears with shaft lock assembly 44(see FIG 14); when clockwise rotating outside function knob 33 to position 2, shaft lock assembly 44 ungears with low-speed gear 12; when clockwise rotating outside function knob 33 to position 3, under the force of inner function knob 32, function-adjusting board 34 for getting low-speed causes low-speed gear 12 to gear with low-speed pinion 25 which is included in gear assembly 26; when clockwise rotating outside function knob 33 to position 4, under the force of inner function knob 32, function-adjusting board 34 for getting low-speed causes

clutch 21 to ungear with transmission shaft 24; when clockwise rotating outside function knob 33 to position 5, function-adjusting board 34 for getting low-speed doesn't move, under the force of inner function knob 32, function-adjusting board 35 for getting high-speed causes not only low-speed gear 12 to ungear with low-speed pinion 25 which is included in gear assembly 26, but also high-speed gear 9 to gear with the high-speed pinion 25 which included in gear assembly 26.

[0028] Those 5 functions are achieved by the way below:

[0029] When rotating the outside function knob 33 to position 1 in FIG 1, function-adjusting board 34 for getting low-speed helps low-speed gear 12 to ungear with low-speed pinion 25 which is included in gear assembly 26. While Low-speed gear 12 gears with shaft lock assembly 44, it achieves the function of only chiseling;

[0030] When rotating the outside function knob 33 to position 2 in FIG 1, shaft lock assembly 44 ungears with low-speed gear 12, then it achieves the function of adjusting the working angel of flat chisel;

[0031] When rotating the outside function knob 33 to position 3 in FIG 1, under the pushing of inner function knob 32, function-adjusting board 34 for getting low-speed helps low-speed gear 12 to gear with low-speed pinion 25 which is included in gear assembly 26, it achieves the function of drilling & chiseling;

[0032] When rotating the outside function knob 33 to position 4 in FIG 1, under the pushing of inner function knob 32, function-adjusting board 34 for getting low-speed helps clutch 21 to ungear with transmission shaft 24, it achieves the function of only drilling with low-speed;

[0033] When rotating the outside function knob 33 to position 5 in FIG 1, function-adjusting board 34 for getting low-speed doesn't work, under the pushing of inner function knob 32, function-adjusting board 35 for getting high-speed helps high-speed gear 9 to gear with high-speed pinion 29 which is included in gear assembly 26, it achieves the function of only drilling with high-speed.

FIG 1 shows the sequence and almost positions of 5 functions, such as

Position 1: only chiseling;
Position 2: adjusting the working angel of flat chisel;
Position 3: drilling & chiseling
Position 4: only drilling with low speed;
Position 5: only drilling with high speed.

FIG 2 shows the situation of all components in gear housing when outside function knob 33 is set at the position 1 (only chiseling);

FIG 3 is the A-A section view of FIG 2.

FIG 4 shows the situation that inner function knob 32 gears with function-adjusting board 35 for getting high-speed and function-adjusting board 34 for getting low-speed when outside function knob 33 is set at the position 1 (only chiseling).

FIG 5 shows the situation of all components in gear housing when outside function knob 33 is set at the position 2 (adjusting the working angel of flat chisel);

FIG 6 shows the situation that inner function knob 32 gears with function-adjusting board 35 for getting high-speed and function-adjusting board 34 for getting low-speed when outside function knob 33 is set at the position 2 (adjusting the working angel of flat chisel);

FIG 7 shows the situation of all components in gear housing when outside function knob 33 is set at the position 3 (drilling & chiseling);

FIG 8 shows the situation that inner function knob 32 gears with function-adjusting board 35 for getting high-speed and function-adjusting board 34 for getting low-speed when outside function knob 33 is set at the position 3 (drilling & chiseling);

FIG 9 shows the situation of all components in gear housing when outside function knob 33 is set at the position 4 (only drilling with low speed);

FIG 10 shows the situation that inner function knob 32 gears with function-adjusting board 35 for getting high-speed and function-adjusting board 34 for getting low-speed when outside function knob 33 is set at the position 4 (only drilling with low speed);

FIG 11 shows the situation of all components in gear housing when outside function knob 33 is set at the position 5 (only drilling with high speed);

FIG 12 shows the situation that inner function knob 32 gears with function-adjusting board 35 for getting high-speed and function-adjusting board 34 for getting low-speed when outside function knob 33 is set at the position 5 (only drilling with high speed);

FIG 13 is one of 3D views of all components inside gear housing of the tool.

FIG 14 is another 3D view of all components inside gear housing of the tool.

FIG 15 is the 3D view of inner function knob 32.

FIG 16 shows the relationship among inner function knob 32, function-adjusting board 35 for getting high-speed, and function-adjusting board 34 for getting low-speed.

FIG 17 shows the relationship between inner function knob 32 and function-adjusting board 35 for getting high-speed.

Actual operation mode

[0034] More description in details will be done below based on attached drawings and Figures.

[0035] The invention relates to one multi-function double-speed rotary hammer which includes front part and rear part, the front part is gear system, the rear part is motor system.

[0036] The front part includes gear housing 15 and it's inside components, such as base 16, transmission shaft assembly 17, Impact shaft assembly 6, low-speed gear 12, high-speed gear 9, back-forward spring 11, function-adjusting board 34 for getting low-speed, function-adjusting board 35 for getting high-speed, spring 41, gear assembly 26 (including low-speed pinion 25 and high-speed pinion 29) and shaft lock assembly 44.

[0037] Transmission shaft assembly 17 mainly includes transmission shaft 24, pinion 18 fixed on transmission shaft 24, wobble bearing 19, clutch 21 which can gear or ungear with transmission shaft 24, and spring 20 for clutch system; the pinion in armature will gear with the pinion 18 and drives transmission shaft 24. There is inner spline key in clutch 21; the spline key is used to gear with wobble bearing 19.

[0038] Gear assembly 26 is installed with transmission shaft 24 by a flat key 28, it only can move along transmission shaft 24 axially. Gear assembly 26 has low-speed pinion 25 and high-speed pinion 29.

[0039] There is a spline key 22 in the middle area of transmission shaft 24; spline key 22 is used to make clutch 21 to gear with transmission shaft 24. The clutch is fixed to transmission shaft 24 with one Lock ring 23. Spring 20 is used for reversing clutch 21 to gear with spline key 22 of transmission shaft 24.

[0040] Impact shaft assembly 6 mainly includes impact shaft 7, lock ring 8, back-forward spring 11 for high-speed gear 9, low-speed gear 12 which in installed in the impact shaft 7 by key 13 and may drive impact shaft 7, high-speed gear 9, cylinder 14. High-speed 9 is installed in impact shaft 7 by key 10, and it only can move along with the impact shaft 7 axially. Lock ring 8 is used to position low-speed gear 12 and high-speed gear 9. Low-speed gear 12 and high-speed gear 9 are at the two ends of back-forward spring 11.

[0041] Function-adjusting board 35 for getting high-speed is positioned in the slot 31 parallel with the axis of transmission shaft 24. and it can move back and forward along the slot 31 in base 16. Function-adjusting board 34 for getting low-speed is positioned the slot 30 parallel with the axis of transmission shaft 24, it also can move back and forward along the slot 30 in base 16.

[0042] It is characterized that function-adjusting board 34 for getting low-speed has side pin 37 and side pin 38. Side pin 37 is used to move low-speed gear 12, and side pin 38 is used to move clutch 21. There is a hole 50 in function-adjusting board 34 for getting low-speed, the side parallel with its moving direction in the hole 50 has teeth 49; it is characterized that function-adjusting board 35 for getting high-speed has side pin 36 which is inserted into the slot 27 of gear assembly 26. There is a hole 52 in function-adjusting board 35 for getting high-speed, the middle of the side parallel with its moving direction in the hole 52 has teeth 51.

[0043] According to FIG 7 and FIG 14, the spring 41 is installed in the function-adjusting board 35 for getting high-speed. The bended bar 40 for spring 41 is installed in the slot 39 of base 16. The spring 41 can move the function-adjusting board 35 for getting high-speed and have teeth 51 in function-adjusting board 35 for getting high-speed and teeth 45 in inner function knob 32 to gear with each other.

[0044] Inner function knob 32 is positioned in one hole of base 16, it is characterized that there are cylinder surface 47 and 48 in inner function knob 32. There are several teeth 45 in cylinder surface 47 and several teeth 46 in cylinder surface 48. Teeth 45 can gear or ungear with teeth 49 in function-adjusting board 34 for getting low-speed. Teeth 46 can gear or ungear with teeth 51 in function-adjusting board 35 for getting high speed. Outside function knob 33 is connected with inner function knob 32. When outside function knob 33 is rotated, the function-adjusting board 34 and 35 can move axially along with transmission shaft 24 or keep still (see FIG 15, FIG 16, FIG 17).

[0045] The ways below show how to achieve 5 functions in details.

[0046] Remark: the original position is from position 1; we will rotate outside function knob 33 from it to the 5th position.

Position 1: only chiseling (see FIG 2, FIG 4)

[0047] When outside function knob 33 is at the position 1 shown in FIG 1, teeth 51 of function-adjusting board 35 for getting high-speed ungears with teeth 46 of inner function knob 32; high-speed pinion 29 ungears with high-speed gear 9 by the force from function-adjusting board 35 for getting high-speed. The teeth 49 of function-adjusting board 34 for getting low-speed gears with teeth 45 of inner function knob 32. Under the supporting by side pin 37 in function-adjusting board 34 for getting low-speed gear 12 ungears with low-speed pinion 25 of gear assembly 26, low-speed gear 12 gears with shaft lock assembly 44, the impact shaft 6 can not be rotated in this situation. Under the help of back-forward spring 20, clutch 21 gears with spline key 22 of transmission shaft 24. And the wobble bearing can rotate axially with transmission shaft 24. It helps to achieve the function of "only chiseling".

Position 2: adjusting the working angel of flat chisel (see FIG 5, FIG 6)

[0048] When outside function knob 33 is rotated from position 1 to the position 2 shown in FIG 2, teeth 51 of function-adjusting board 35 for getting high-speed still ungears with teeth 46 of inner function knob 32, function-adjusting board 35 for getting high-speed doesn't move. Function-adjusting board 34 for getting low-speed is pushed forward by force from teeth 45 of inner function knob 32, low-speed gear 12 ungears with shaft lock assembly 44 under the help of back-forward spring 11, while low-speed gear 12 still doesn't gear with low-speed pinion 25, the other components don't move or change their position, then it achieves the function of adjusting the working angel of flat chisel. (see FIG 5, 6)

Position 3: drilling & chiseling

[0049] When rotating outside function knob 33 from position 2 to the position 3 shown in FIG 2, teeth 51 of function-adjusting board 35 for getting high-speed still doesn't gear with the teeth 46 of inner function knob 32, function-adjusting board 35 for getting high-speed doesn't move.

[0050] Function-adjusting board 34 for getting low-speed is pushed forward by force from teeth 45 of inner function knob 32, low-speed gear 12 gears with low-speed pinion 25 under the help of back-forward spring 11, the other components don't move or change their position. Now it achieves the function of Drilling & chiseling. (see FIG 7, 8)

Position 4: only drilling with low speed

[0051] When rotating outside function knob 33 from position 3 to the position 4 shown in FIG 2, teeth 51 of function-adjusting board 35 for getting high-speed still doesn't gear with the teeth 46 of inner function knob 32, function-adjusting board 35 for getting high-speed doesn't move. Function-adjusting board 34 for getting low-speed is pushed forward by the force from teeth 45 of inner function knob 32, side pin 38 of function-adjusting board 34 for getting low-speed presses down clutch 21, and this causes clutch 21 to ungear with spline key 22 in transmission shaft 24, wobble bearing 19 doesn't work, the back-forward spring 8 not only stops low-speed gear 12 to slide axially, but also helps low-speed gear 12 to gear with low-speed pinion 25, the other components don't move, then it achieves the function of Only drilling with low speed. (see FIG 9, 10)

Position 5: only drilling with high speed

[0052] When rotation outside function knob 33 from position 4 to the position 5 shown in FIG 2, teeth 49 of function-adjusting board 34 for getting low-speed ungears with teeth 45 of inner function knob 32, function-adjusting board 34 for getting low-speed doesn't move. Teeth 51 of function-adjusting board 35 for getting high-speed gears with teeth 45 of inner function knob 32 by the force of the spring 41 installed on the function-adjusting board 35, function-adjusting board 35 for getting high-speed moves under the force from inner function knob 32, this causes not only low-speed gear 12 to ungear with low-speed pinion 25 included in gear assembly 26, but also high-speed gear 9 to gear with the high-speed pinion 25 which is included in gear assembly 26, the other components don't move, now it achieves the function of only drilling with high speed. (see FIG 11, 12).

List of Reference Signs

[0053]

6	impact shaft assembly
7	impact shaft
8	lock ring
9	high-speed gear
10	the key
11	back-forward spring
12	low-speed gear
13	key
14	cylinder
15	gear housing
16	base
17	transmission shaft assembly
18	pinion
19	wobble bearing
20	spring
21	clutch
22	spline key
23	lock ring
24	transmission shaft
25	low-speed pinion
26	gear assembly
27	the slot
28	the flat key
29	high-speed pinion
30	the slot
31	the slot
32	inner function knob
33	outside function knob
34	function-adjusting board 34 for getting low-speed
35	function-adjusting board 35 for getting high-speed
36	side pin
37	side pin
38	side pin
39	the slot
40	the bended bar
41	spring
44	shaft lock assembly
45	teeth
46	teeth
47	cylinder
48	cylinder

49 teeth
50 hole
51 teeth
52 hole

Claims

1. A tool such as a multi-function double-speed rotary hammer, having 5 functions of

- only chiseling,
- adjusting the working angel of flat chisel,
- drilling & chiseling,
- only drilling with low-speed, and
- the function of only drilling with high-speed,

whereby all 5 functions are achieved by using only one function knob.

2. The tool according to claim 1, including front parts which is gear system, rear parts which is engine system, whereby the front parts at least include a gear housing 15, a base 16, a transmission shaft assembly 17, an impact shaft assembly 6, and a shaft lock assembly 44 **characterized in that**:

- the transmission shaft assembly 17, mainly includes a transmission shaft 24 connected with an engine system, a wobble bearing 19, a clutch 21, which is installed on the transmission shaft 24 and can slide axially for gearing and ungearing with the transmission shaft 24, and a spring 20 which is installed on the clutch 21;
- the impact shaft assembly 6 mainly includes an impact shaft 7, a lock ring 8, a low-speed gear 12 and a high-speed gear 9 which are installed on the impact shaft 7 and can slide axially for driving the impact shaft 7, a back-forward spring 11 which is installed on the gear and a piston 14 which is used for driving the drill bit inserted into impact shaft 7 to work axially;
- the front parts also include gear assembly 26 which is installed on the transmission shaft 24 and can slide axially, whereby the gear assembly 26 includes a low-speed pinion 25 which can gear or ungear with the low-speed gear 12 and a high-speed pinion 29 which can gear or ungear with the high-speed gear 9;
- the front parts include a function-adjusting board 34 for getting low-speed and a function-adjusting board 35 for getting high-speed which can slide along the transmission shaft 24 axially, whereby a spring 41 is installed on function-adjusting board 35 for getting high-speed, the function-adjusting board 34 for getting low-speed, has a side pin 37 and 38 used for respectively pulling low-speed gear 12 and clutch 21 axially and the function-adjusting board 35 for getting-high-speed, has a side pin 36 used for pulling gear assembly 26 axially; and
- the front parts, also include an inner function knob 32, which is fixed in a hole on the base 16, whereby an outside function 33 is installed on the inner function knob 32 which is connected with function-adjusting board 34 for getting low-speed and function-adjusting board 35 for getting high-speed, and they can slide along transmission shaft 24 axially or keep still.

3. The tool according to claim 1 and 2, wherein said 5 functions of only chiseling, Adjusting the working angel of flat chisel, Drilling & Chiseling, Only drilling with low-speed and Only drilling with high-speed are achieved:

- when rotating the outside function knob 33 to a position 1, the function-adjusting board 34 for getting low-speed helps low-speed gear 12 to ungear with low-speed pinion 25 which is included in gear assembly 26, while low-speed gear 12 gears with shaft lock assembly 44, thereby achieving the function of only chiseling;
- when rotating the outside function knob 33 to a position 2, shaft lock assembly 44 ungears with low-speed gear 12, thereby achieving the function of adjusting the working angel of flat chisel;
- when rotating the outside function knob 33 to a position 3, under the pushing of inner function knob 32, the function-adjusting board 34 for getting low-speed helps low-speed gear 12 to gear with low-speed pinion 25 which is included in gear assembly 26, thereby achieving the function of drilling & chiseling;
- when rotating the outside function knob 33 to a position 4, under the pushing of inner function knob 32, the function-adjusting board 34 for getting low-speed helps clutch 21 to ungear with transmission shaft 24, thereby achieving the function of only drilling with low-speed;
- when rotating the outside function knob 33 to a position 5, the function-adjusting board 34 for getting low-speed is not working and under the pushing of inner function knob 32, the function-adjusting board 35 for getting high-speed helps high-speed gear 9 to gear with high-speed pinion 29 which is included in gear assembly 26, thereby achieving the function of only drilling with high-speed.

4. The tool according to claim 2, **characterized in that** the gear assembly 26 is installed and slide along on the transmission shaft 24, whereby are connected by a key 28.

5. The tool according to claim 2, **characterized in that**

the gear assembly 26 embodies the low-speed pinion 25 and the high-speed pinion 29, and there is a slot 27 in the middle area of gear assembly 26.

6. The tool according to claim 2, **characterized in that** the low-speed gear 12 is installed in the impact shaft 7 by a flat key 13, such that it only can axially move along with impact shaft 7, the high-speed gear 9 is installed on the impact shaft 7 by the key 10, such that it can only move along with impact shaft 7 axially, and a lock ring 8 is provided which is used for positioning low-speed gear 12 and high-speed gear 9 axially, whereby a back-forward spring 11 is installed between low-speed gear 12 and high-speed gear 9 on the impact shaft 7.

7. The tool according to claim 2, **characterized in that** there is a spline key 22 in the middle area of the transmission shaft 24, the spline key 22 is used to make clutch 21 to gear with transmission shaft 24, whereby a lock ring 23 for positioning clutch 21 axially is covered on the transmission shaft 24.

8. The tool according to claim 2, **characterized in that** there is a hole 50 on the function-adjusting board 34 for getting low-speed, whereby teeth 49 are arranged on one side of the hole 50.

9. The tool according to claim 2, **characterized in that** the function-adjusting board 35 for getting high-speed has side pin 36 which is inserted into the slot 27 of the gear assembly 26, whereby there is a hole 52 in function-adjusting board 35 for getting high-speed and teeth 51 are arranged in the hole 52 in the middle of the side which is parallel with its moving direction.

10. The tool according to claim 2, **characterized in that** the spring 41 is installed in the function-adjusting board 35 for getting high-speed, whereby a bended bar 40 for the spring 41 is installed in the slot 39 of base 16 and/or whereby the spring 41 works as a torsion spring.

11. The tool according to claim 2, **characterized in that** the side pins 37 and 38 are perpendicular to the function-adjusting board 34 for getting low-speed and side pin 37 is perpendicular to the side pin 38 and/or side pin 36 is perpendicular to the function-adjusting board 35 for getting high-speed.

12. The tool according to claim 2, **characterized in that** there are cylinder surfaces 47 and 48 on inner function knob 32, whereby on cylinder surface 47, there are several teeth 45 which can gear and ungear with the teeth 49 of function-adjusting board 34 for getting low-speed and on cylinder surface 48, there are several teeth 46 which can gear and ungear with the teeth 51 of the function-adjusting board 35 for getting high-speed.

13. The tool according to claim 2, **characterized in that** a back-forward spring 11 is installed on the gear or a spring 20 is installed on the clutch 21, whereby the back-forward spring 11 or the spring 20 work as a pressure spring.

14. The tool according to claim 2, **characterized in that** function-adjusting board 34 for getting low-speed is installed into the slot 30 of the base 16, the slot 30 is axially parallel with transmission shaft 24, and the function-adjusting board 34 for getting low-speed can axially slide along transmission shaft 24 in the slot 30.

15. The tool according to claim 2, **characterized in that** the function-adjusting board 35 for getting high-speed is installed into slot 31 of the base 16, the slot 31 is axially parallel with transmission shaft 24, and the function-adjusting board 35 for getting high-speed can axially slide along transmission shaft 24 in the slot 31.

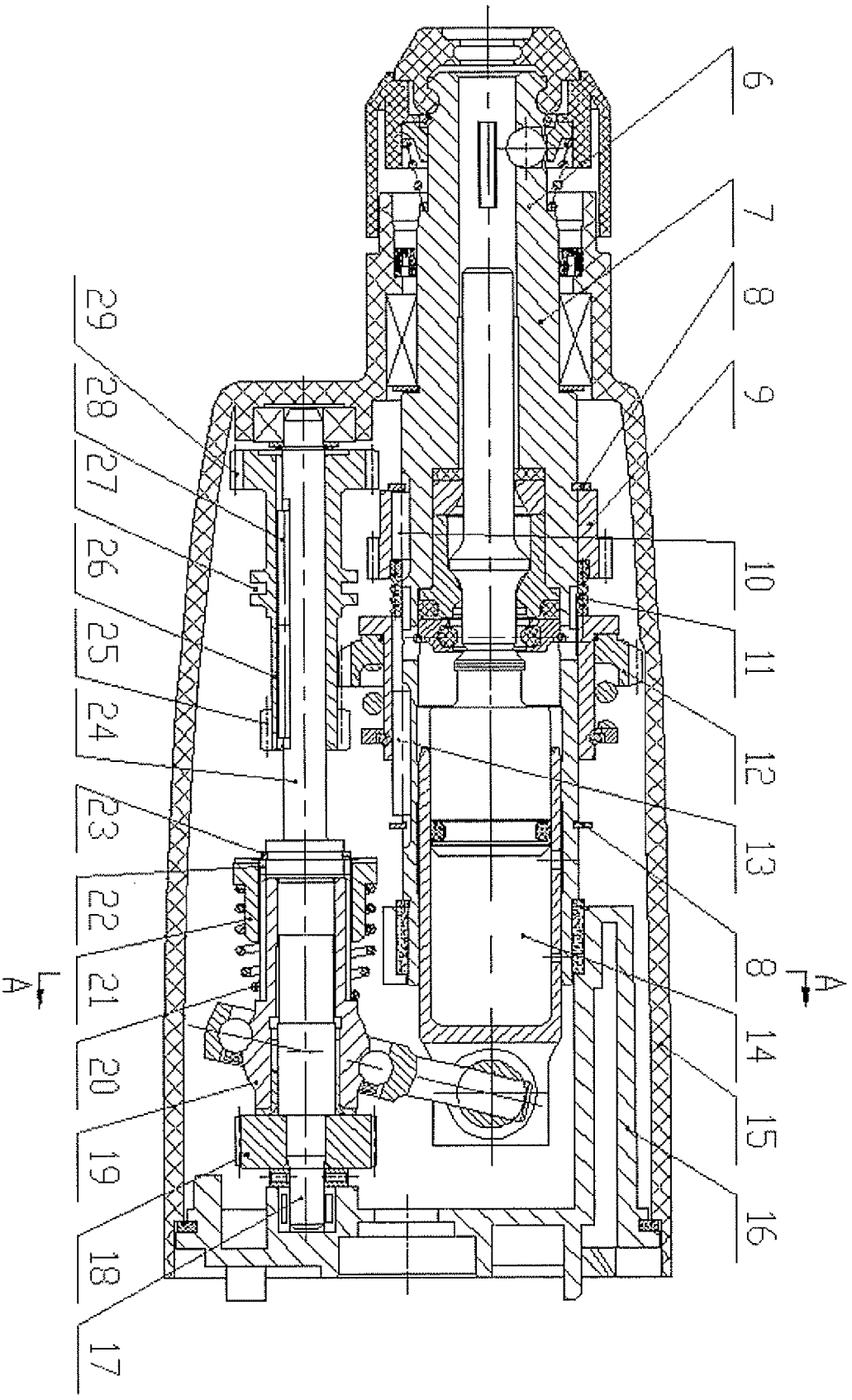


FIG 2

FIG 1

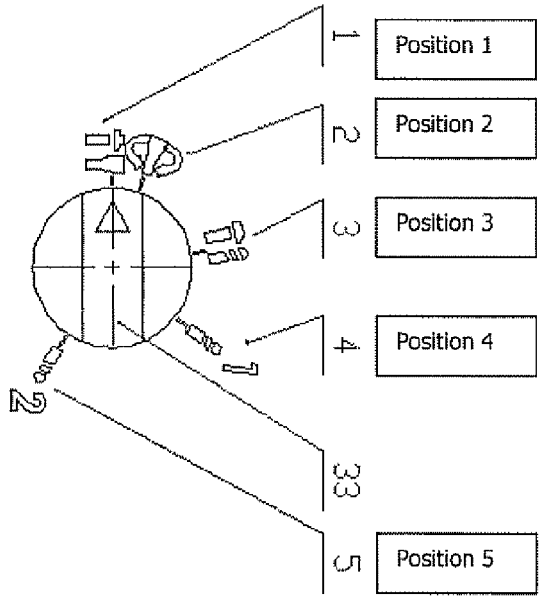


FIG 3

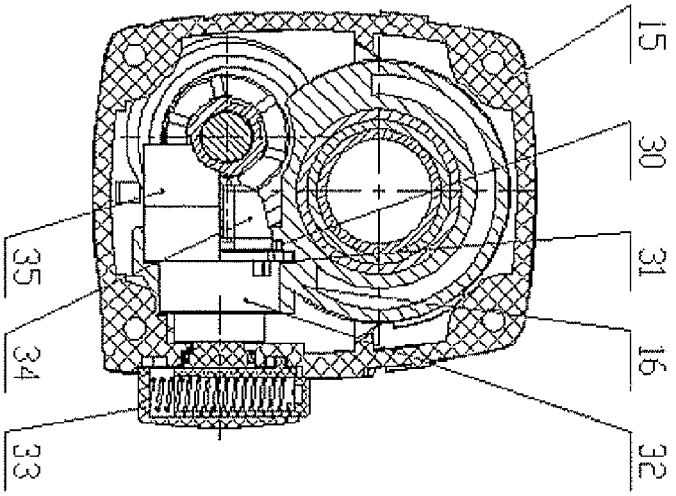
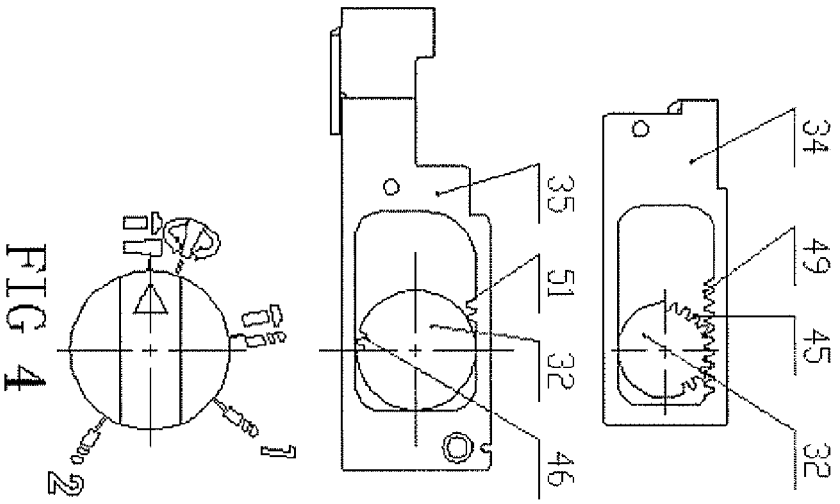


FIG 4



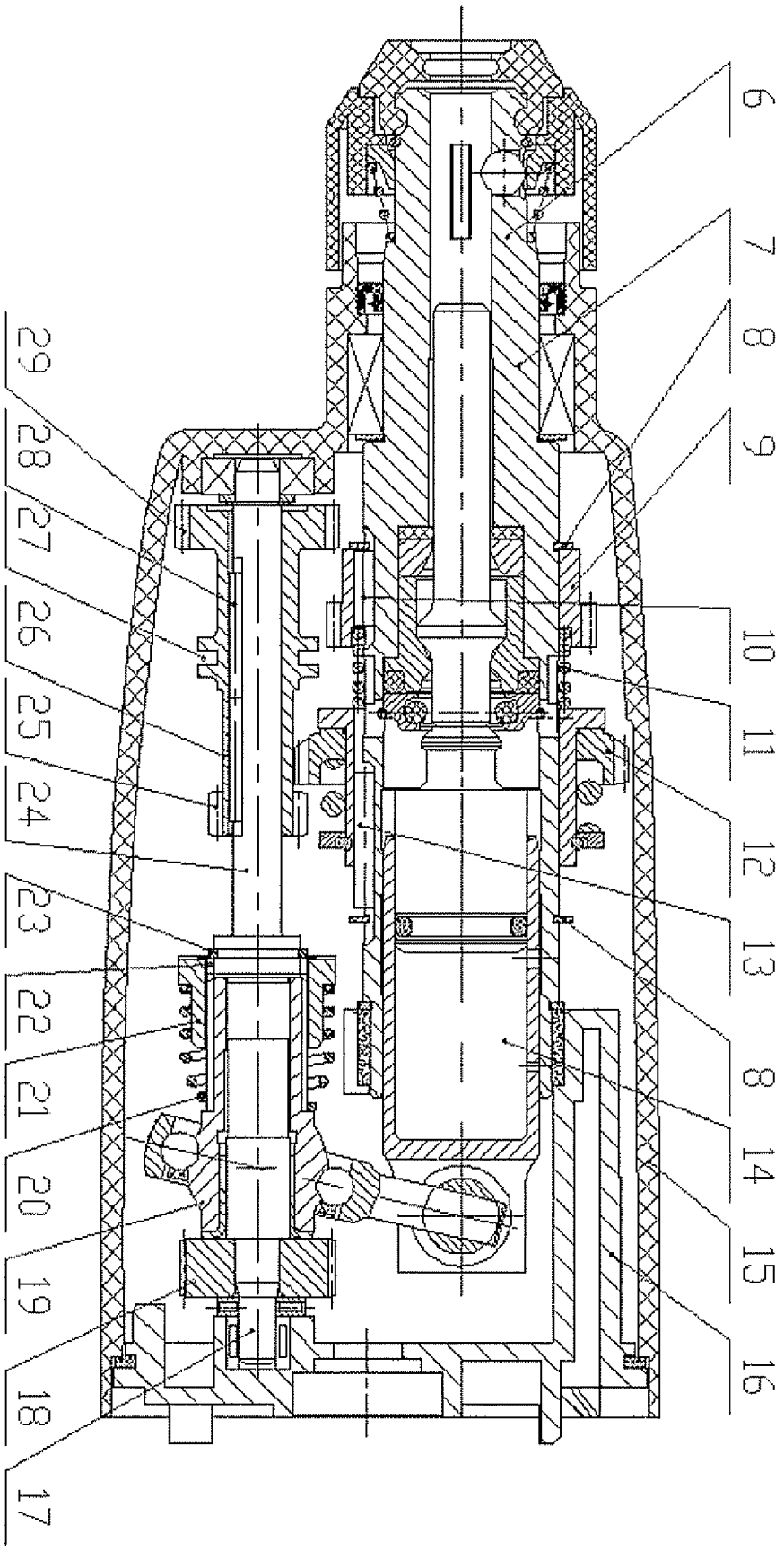


FIG 5

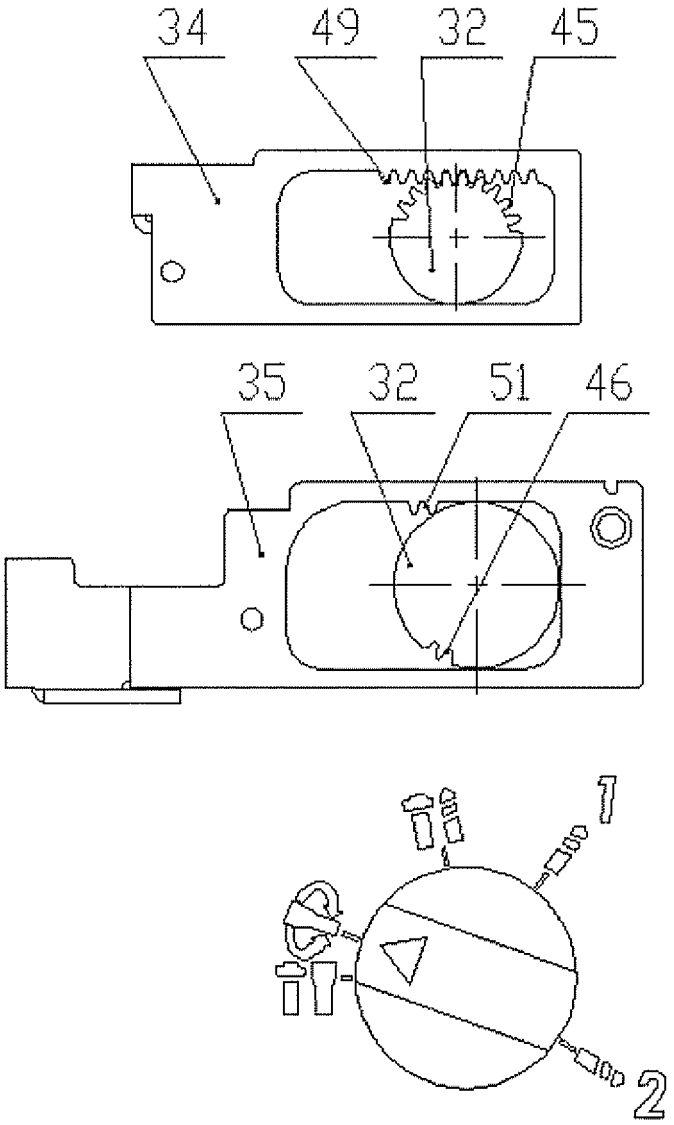


FIG 6

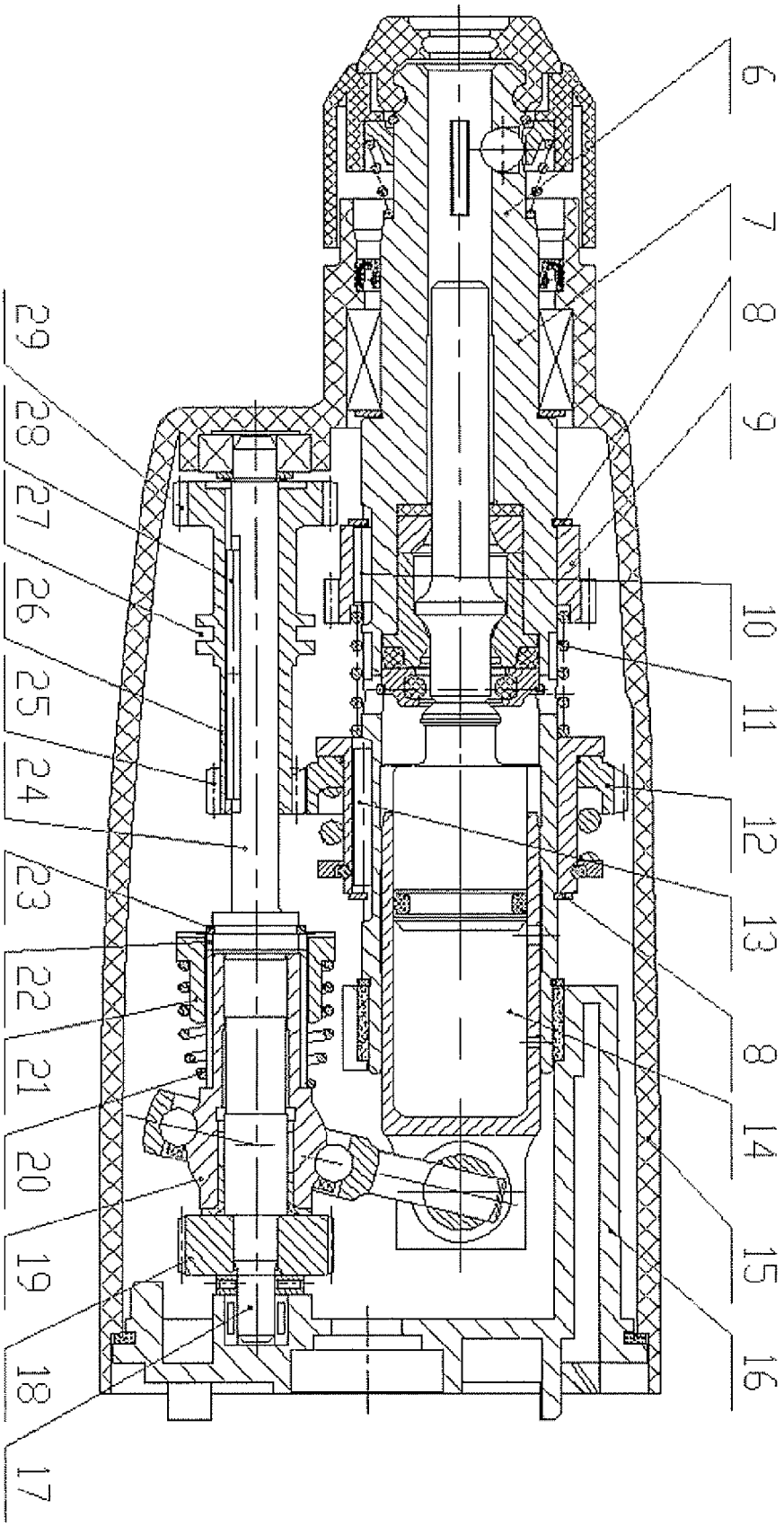


FIG 7

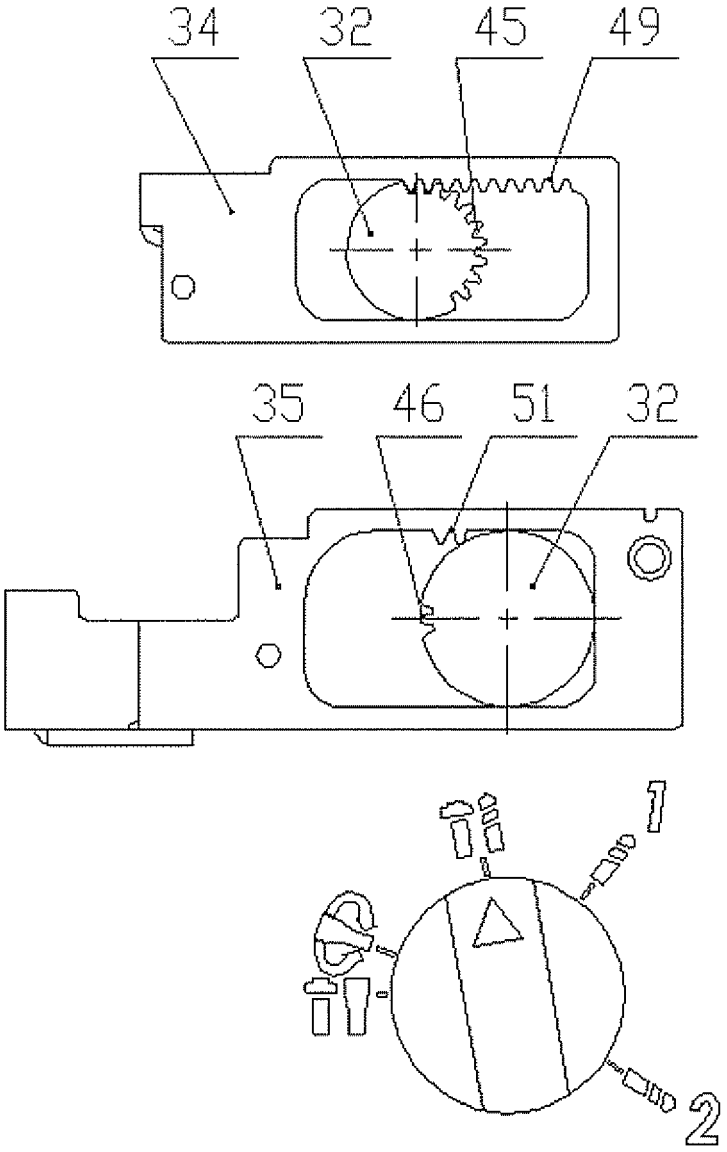
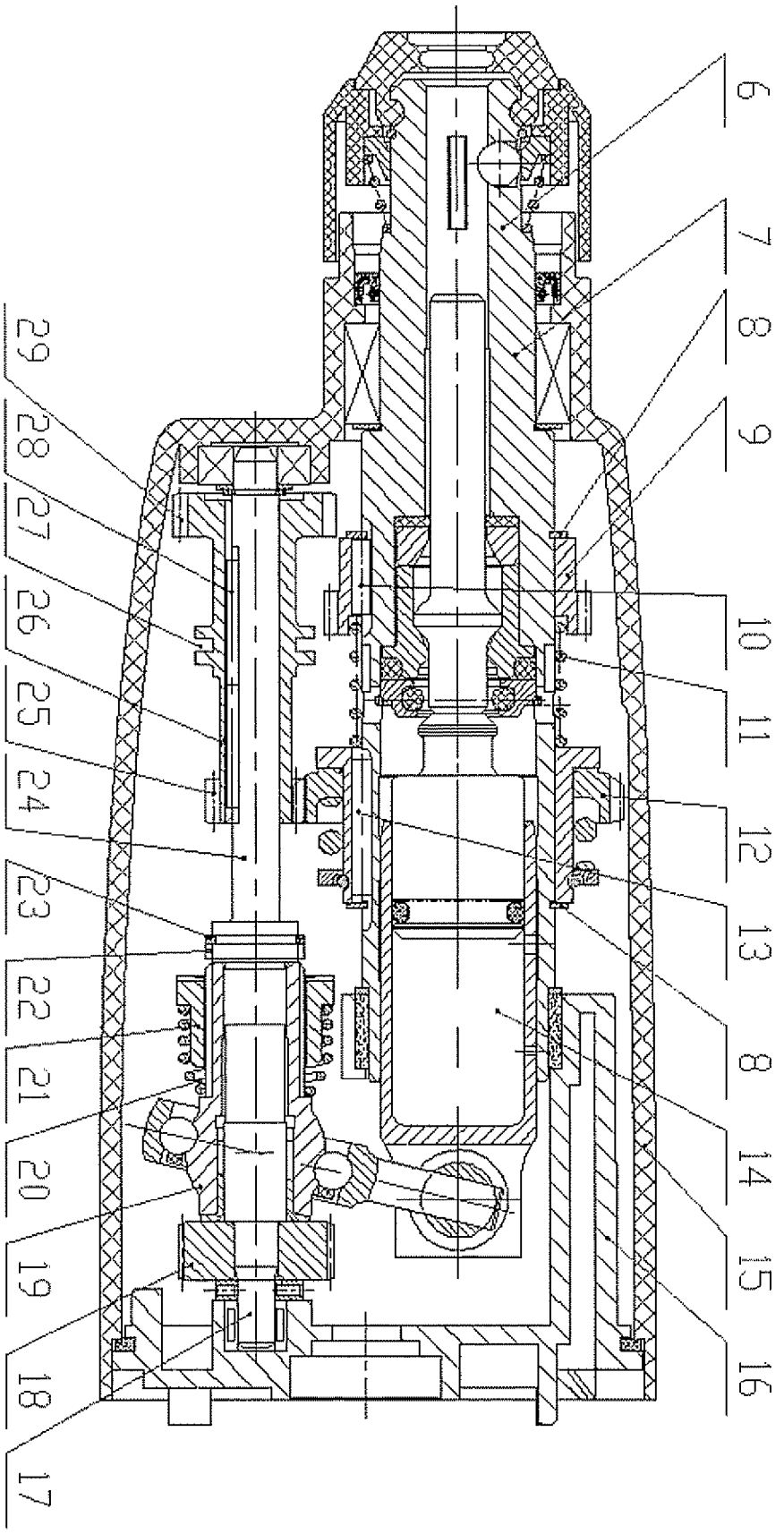


FIG 8

FIG 9



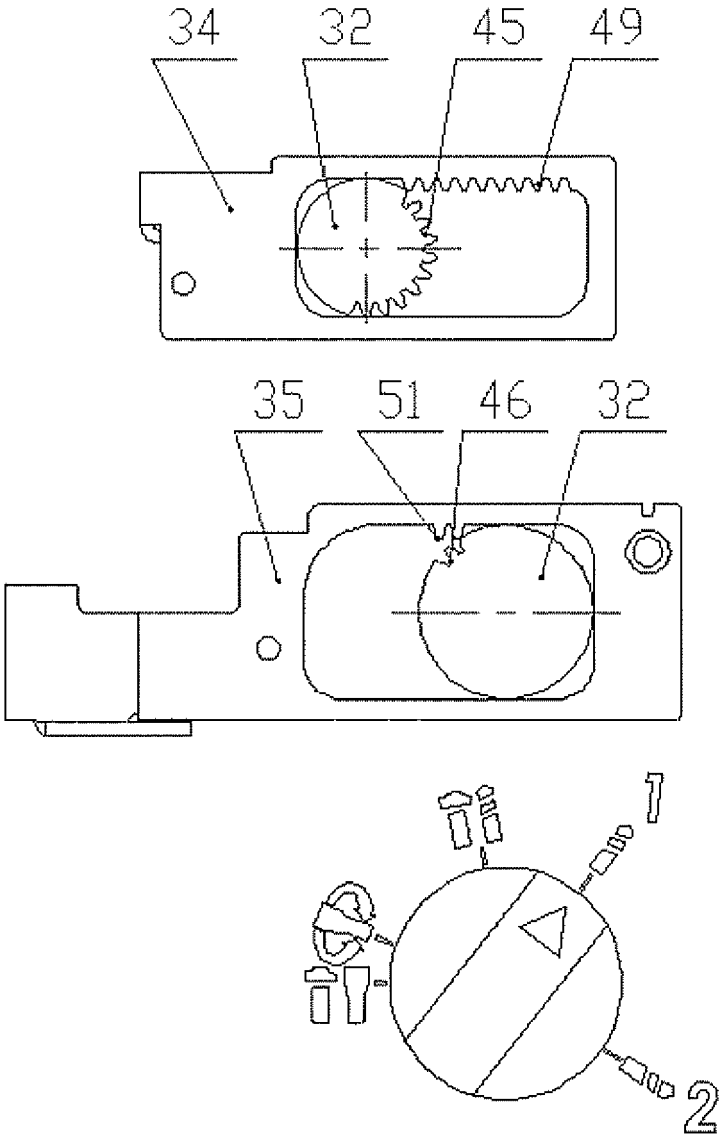


FIG 10

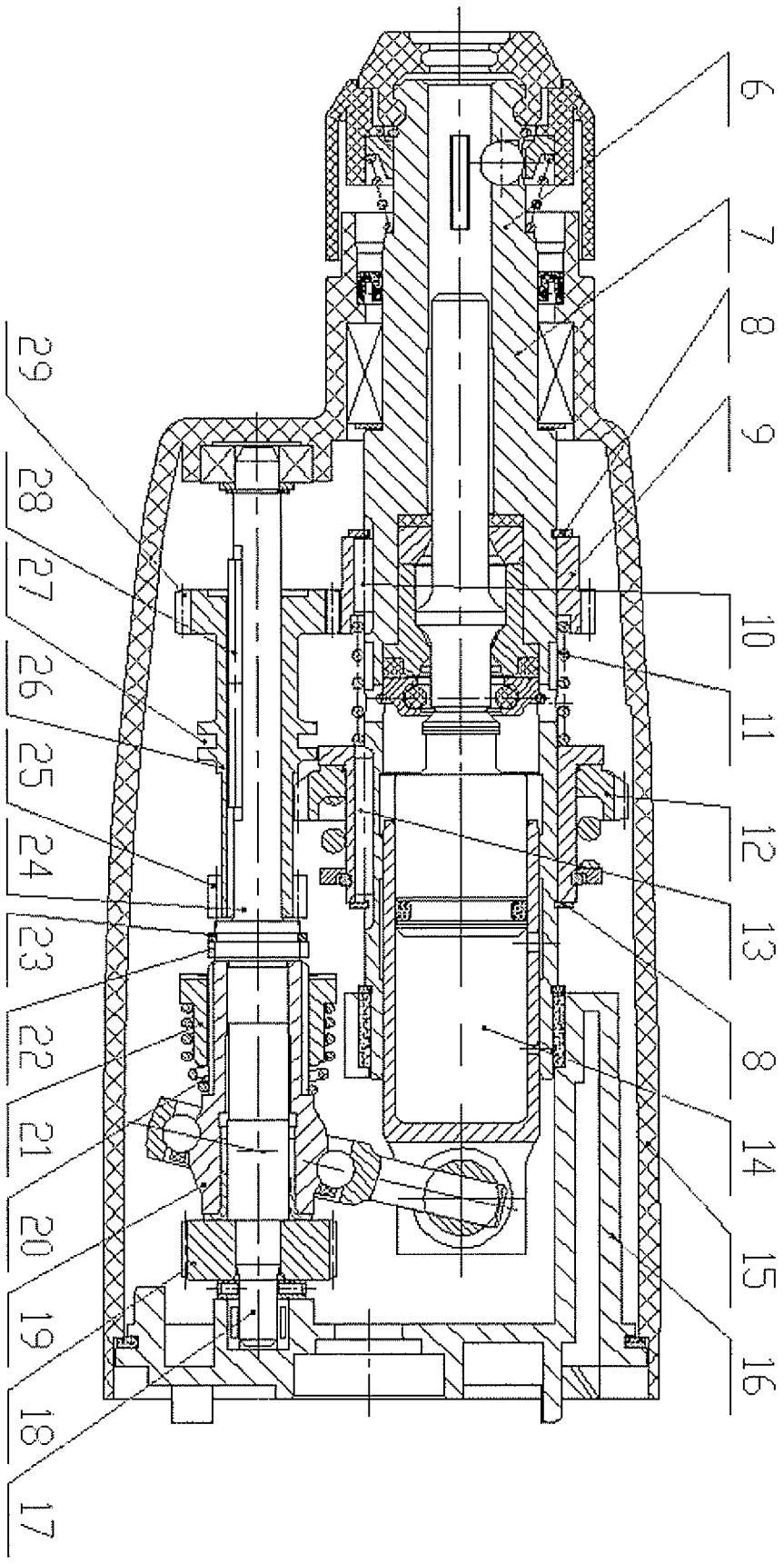


FIG 11

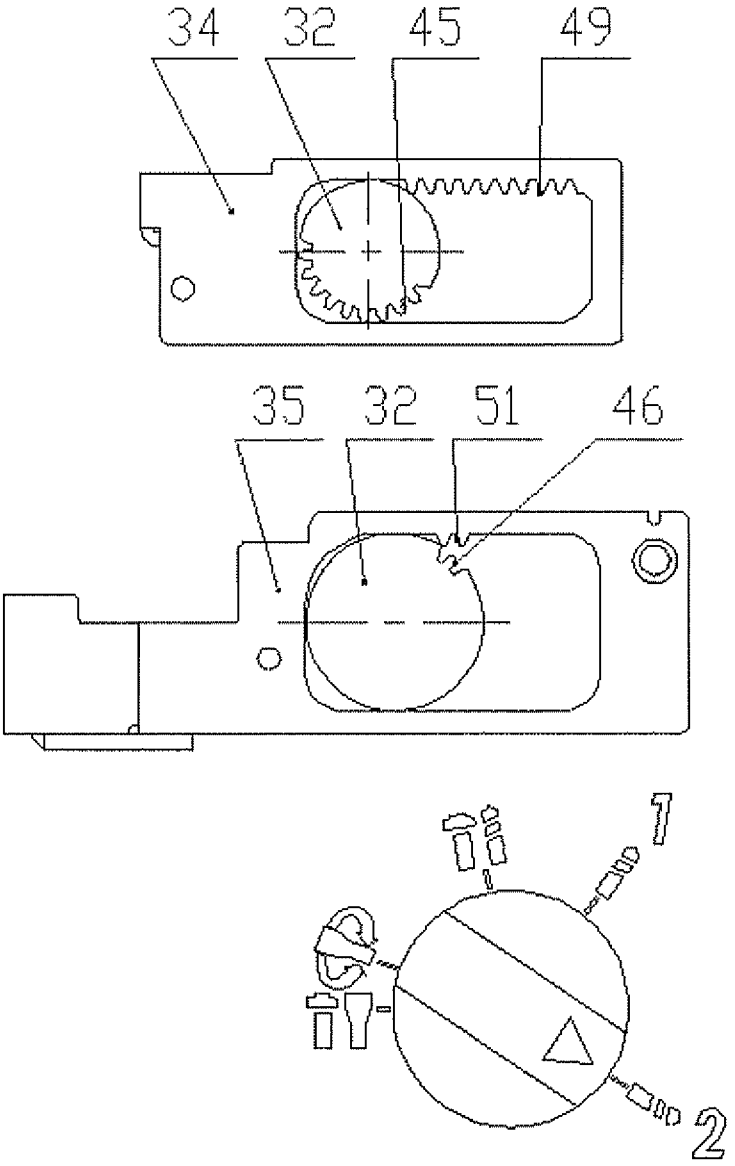


FIG 12

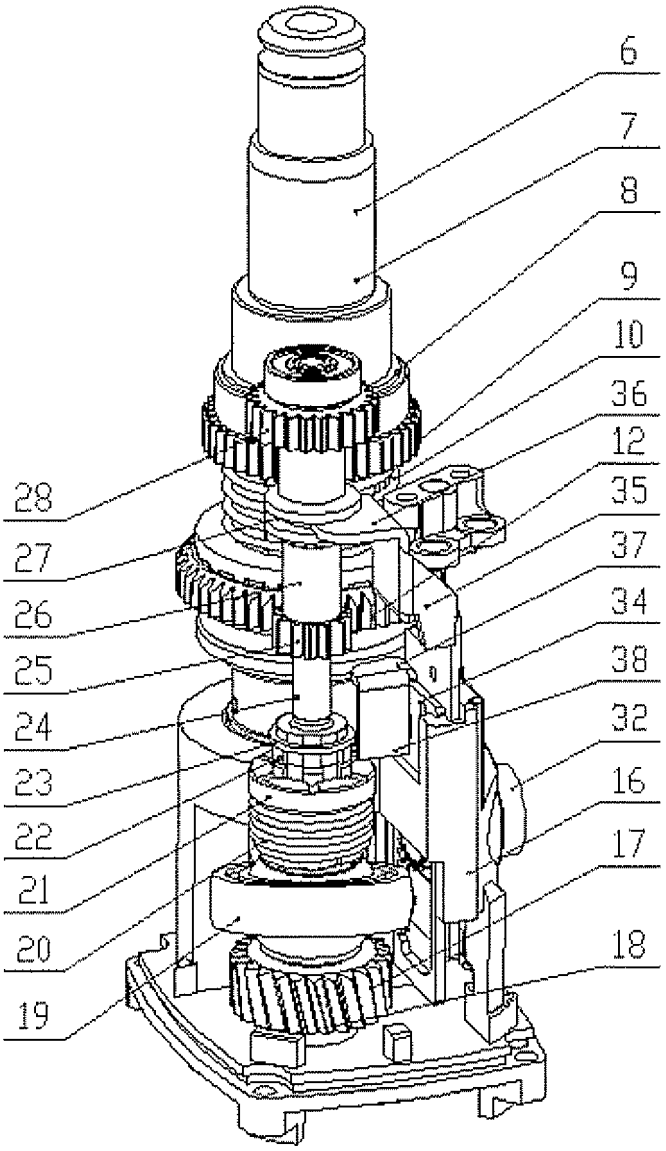


FIG 13

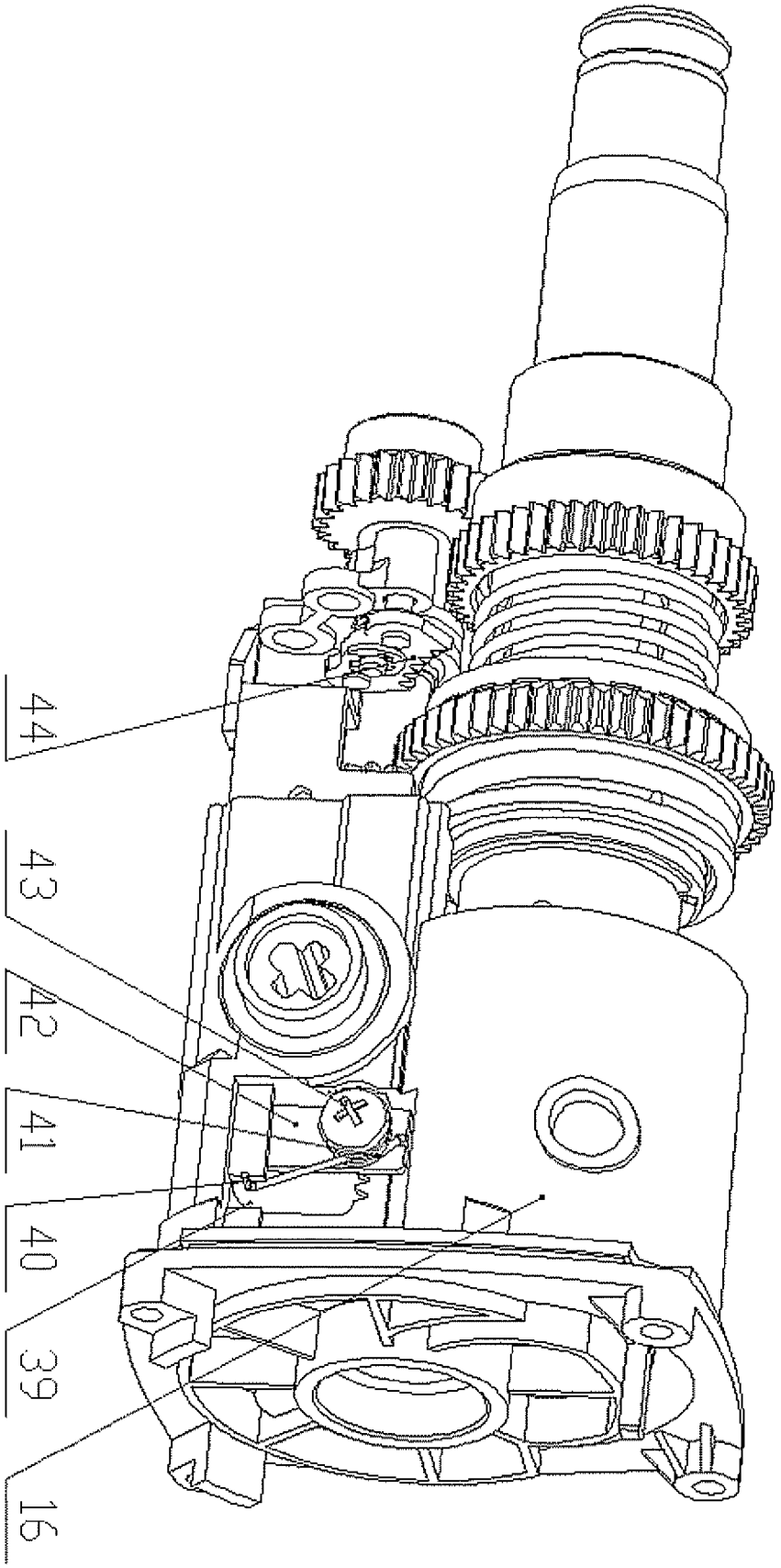


FIG 14

FIG 15

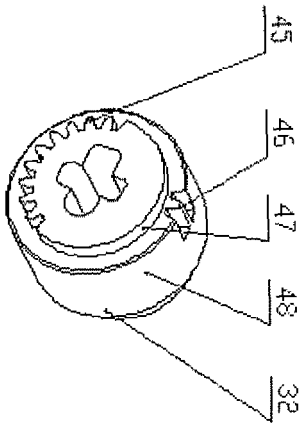


FIG 16

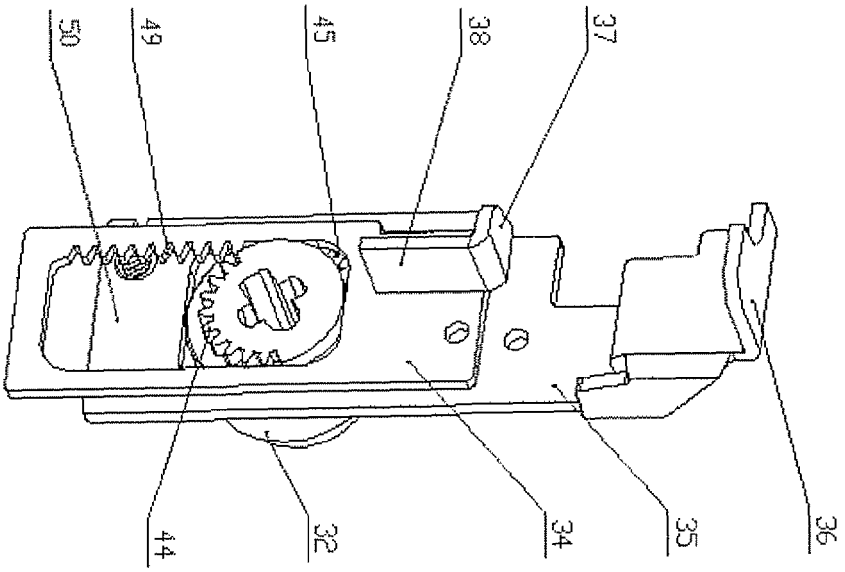
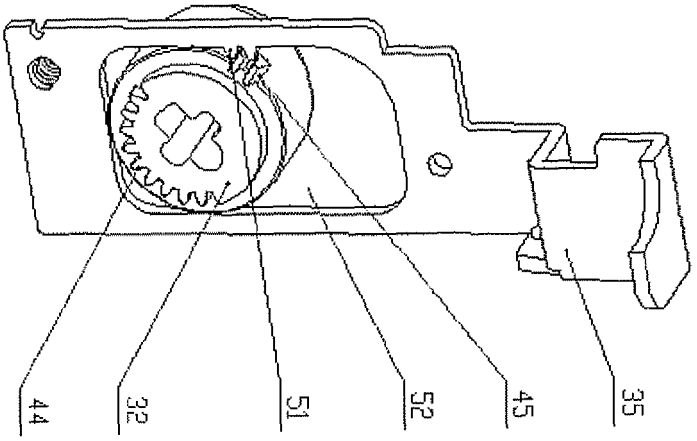


FIG 17



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EUROPEAN SEARCH REPORT

Application Number
EP 08 16 7598

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
P,X	WO 2008/000545 A (BOSCH GMBH ROBERT [DE]; SAUR DIETMAR [DE]) 3 January 2008 (2008-01-03) * page 4, line 20 - page 10, line 10; figures 1-7 *	1	INV. B25D16/00
P,X	WO 2008/080658 A (BOSCH GMBH ROBERT [DE]; SAUR DIETMAR [DE]; HERR TOBIAS [DE]) 10 July 2008 (2008-07-10) * page 5, line 26 - page 11, line 34; figures 1a-6 *	1	
A	DE 93 07 523 U1 (BOSCH GMBH ROBERT [DE]) 29 September 1994 (1994-09-29) * the whole document *	1	
A	US 2005/224242 A1 (BRITZ RORY [DE] ET AL) 13 October 2005 (2005-10-13) * paragraphs [0035] - [0056]; figures 1-9 *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			B25D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4 February 2009	Lorence, Xavier

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