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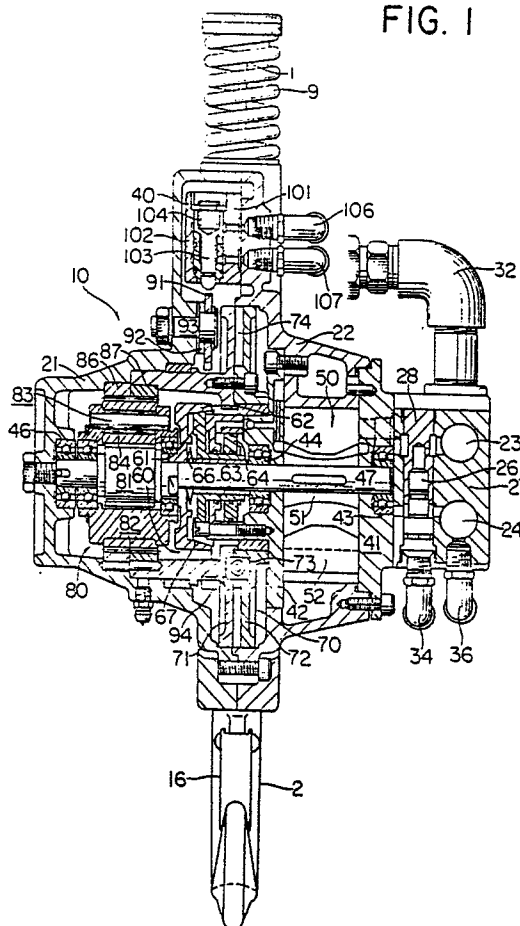
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London, EC4A 1PL(GB)(54) **Hoist.**

(57) A hoist which reads out the amount of reverse rotation of a drum and stops a drive source based on the read-out result to control the quantity of wire rope (1) wound on or released from the drum to be a predetermined length.

FIG. 1



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HOIST

Technical Field:

The present invention relates to a hoist which is used to lift a cargo hanged on a hook, move to a desired position and lower there.

Attention is directed to European Application 83900736.6 (Publication No. 0 101 743) from which this application is divided.

Background Art:

There are known various types of hoist, for example, electric hoist and air hoist, adapted for different purposes. These conventional hoists have a common problem. That is, when the hook is lowered to hang the cargo thereon, operation time of the driving source has to be controlled accurately, otherwise the hoisting wire would be re-wound on the drum after completely unwound from the drum. Conventionally, the operator actuates a switch to lower the hook for unwinding the wire and stops actuation of the switch at an appropriate time to stop lowering of the hook.

However, it is not easy without a great deal of experience to judge correctly as to what extent or length the wire is unwound corresponds to the lowest position of the hook. In practice therefore, almost all of the operators have to lower the hook step by step, but this leads to considerable time-consuming. For this reason, a hoist which can easily control altitude of a hook, has been a long-felt want.

Disclosure of Invention:

The object of the present invention is to solve the problem involved in the prior art, that is, to provide a hoist which can set the hook at most desirable altitude by controlling the amount of rotation of a drum in unwinding direction. To attain the abovementioned object, the hoist of the present invention is provided with means for reading the amount of rotation of the drum in the unwinding or backward direction, and means for stopping the driving source in response to a signal from said reading means.

Brief Description of Drawings:

Fig. 1 is a cross-sectional view showing an embodiment of the invention where the present invention is applied to an air hoist (the upper part of the hoist is omitted);

Fig. 2 is a side view thereof partially cross-sectioned (partly omitted);

Fig. 3 is a similar side view showing the partly omitted from Fig. 1;

Fig. 4 is a pneumatic pressure circuit diagram of the embodiment; and

Fig. 5 is a detailed view of the index geared wheel (91) used in the embodiment.

Best Mode for Carrying Out the Invention:

An embodiment of the present invention will be explained with reference to the drawings. Referring to Figs. 1, 2 and 3 the main body of an air hoist is generally designated by 10. A wire-rope 1 extends upwardly from the main body 10. A hanger or hook 2 is fixed to the lower end of the main body. As shown in Fig. 3, the loop portion 3 is connected with the lower end of a swivel holder 5 the upper end of which is connected with a swivel 4. Horizontally mounted on the holder 5 is a nipple 6 with an elbow 7 at one end and a cap 8 at the other end. A spirally coiled vinyl tube 9 is disposed between the nipple 6 and the loop portion 3.

As seen best from Fig. 2, the hoist main body 10 has a rope entrance opening around which there are provided a damper spring 11, a rope guide 12, damper rubber 13, rope stoppers 14, 15 etc. On the other hand, the hanger 2 has a check plate 16 disposed to close the open mouth of the hook. The check plate 16 is rotatable about a pin 17 and is normally biased by a spring 18 which intends to rotate the check plate 16 clockwise (as viewed in the drawing of Fig. 2).

On the whole, the main body 10 is composed of a pair of casing members 21 and 22. In the space defined by the casing members 21 and 22 there are provided an air motor 50, a drum 70, a brake unit 60, a planet gear mechanism 80 etc. of which a further detailed description will be made later.

On one side of the main body 10 (on the right-hand side as viewed in Fig. 1) there are mounted two valve shafts 23 and 24 horizontally movable and spaced from each other, and also a valve 26 which is vertically movable. The valve shafts 23 and 24 are received in a valve cylinder 27 whereas the valve shaft 26 is received in a valve cylinder

28. The valve cylinder 27 is secured to the valve cylinder 28 which in turn is secured to a motor cover 41 described later. The valve shaft 23 is biased by a valve spring 31 in one direction - (rightward as viewed in Fig. 2). This is the same for the valve shaft 24. An air-feeding pipe line 32 is connected to the valve cylinder 27. Pipe lines 34 and 36 are connected to the valve cylinders 27 and 28 respectively.

The motor covers 41, 42 and the other casing member 21 support a rotary shaft 47 through ball bearings 43, 44 and 46. On the rotary shaft 47 the aforementioned air motor 50, brake unit 60 and planet gear mechanism 80 are mounted. The air motor 50 is between the motor covers 41 and 42 and has a rotor 51 and vanes 52. By the force of air supplied through the valve cylinders 27 and 28, the rotor 51 is rotated to rotate the rotary shaft 47.

The brake unit 60 comprises a brake cone 61 and brake ring 62 mounted on the rotary shaft 47, and a brake cylinder 63 and a brake piston 64 on the brake cone 61. The brake cylinder 63 and the motor cover 42 are united together with a communication bore and a valve therebetween. The brake cone 61 is biased leftwards (as viewed in Fig. 1) by a spring (not shown). Further, a spring 66 is disposed between the brake cone 61 and the brake ring 62 with the biasing force intending to move the cone and ring away from each other. A conical friction surface 67 is formed on the brake cone 61.

A hoisting drum 70 is composed of a pair of drum members 71 and 72 with a slit-like space 74 therebetween. The base end of the rope is connected with the drum 70 by a lock member 73. With the rotation of the drum 70, the hoisting rope 1 is taken up in the space 74 around the drum.

The rotary shaft 47 has a gear portion 81 formed at one end thereof (at the left-hand end as viewed in Fig. 2). A planet gear 84 is in mesh with the gear portion 81 of the rotary shaft 47. The planet gear 84 is rotatable about a shaft 83 supported by a gear disc 82 which, in turn, is rotatably supported on the rotary shaft 47. Also, in mesh with the planet gear 84 there are a pair of internal gears 86 and 87 fixed to one casing member 21 and one drum member 71 respectively. The internal gears 86 and 87 are different in the number of teeth from each other. The internal gear 86 is fixed to the one casing member 21.

On the one casing member 21 and at the portion near the outer circumference of the drum 70 there is mounted an index wheel 91 by a bolt 93 through a lining 92. The index wheel 91 is mounted for rotation. On the index wheel 91 there are formed a plural number of teeth 91a and a single projection 91b which is higher than the teeth 91a. The drum 70 has a stud pin 94 engageable with these teeth and projection.

Above the index wheel 91 and disposed within valve case 101 and valve seat 102 is a valve shaft 103 which is downward biased by a spring 104. The shaft 103 is engageable with the projection 91b of the index wheel 91. When the shaft 103 is engaged with the projection 91b of the wheel 91, the shaft 103 is elevated and the air fed through the pipe line 106 is allowed to be discharged through the pipe line 107. The valve shaft 103 is not engageable with the remaining portion of the wheel 91, and therefore when the shaft 103 is opposed to the remaining portion of the wheel 91, the shaft 103 is in its lowered position by the spring 104 to disconnect between the pipe lines 106 and 107.

In Fig. 4, the arrangement described above is diagrammatically shown as a pneumatic pressure circuit. In all of the Figures 1 to 4, like reference numerals represent the same or corresponding members.

The manner of operation of the above shown embodiment is as follows:

After the hoisting rope 1 has been paid out and when the hoist main body 10 is in its lowered position, the operator hangs a cargo to be hoisted on the hanger 2. Compressed air is supplied into an air cylinder 25 (which corresponds to an upperhalf of the cylinder 27 shown in Fig. 1) through the nipple 6, extended vinyl tube 9 and elbow 32 - (Fig. 2). Therefore, when the operator operates the lever 112 to move the valve shaft 23, the cylinder 25 is changed over from II to I (Fig. 4) and air is supplied to the motor 50 from the air source 113. Thus, the air motor 50 and the gear 81 integrally formed therewith are rotated. However since, as previously noted, the gear 86 is fixed to the case member 21 and the gears 86 and 87 are different from each other in the number of teeth, the gear 86 does not rotate. Only the gear 87 rotates with the reduction ratio. Together with the rotation of the gear 87, the hoisting drum 70 also rotates to take up the rope 1 around the drum. The main body 10 moves upwardly.

A portion of the compressed air supplied to the elbow 32 is branched into the air cylinder 35 - (which corresponds to the cylinder 28 shown in Fig. 1). By the pilot pressure the shaft 26 is moved to change over the cylinder 35 from II to I. At this time, an air cylinder 30 (which corresponds to a lower half of the cylinder 27 shown in Fig. 1) remains in the position II because the shaft 24 is in the position moved rightward in Fig. 2. Consequently, the air is allowed to come out from the pipe line 36 of the air cylinders 30, 27 after passing through the air cylinder 35, 28.

During the rotation of the drum 70, the stud pin 94 on the drum comes into engagement with one of the teeth 91a of the index wheel 91 at every rotation. Thereby the index wheel 91 is rotated counter-clockwise (as viewed in Fig. 4) a determined rotational angle per drum rotation. Since the pipe lines 36 and 106 are in communication to each other, the exhaust air from the air cylinder 30 (lower portion of 27) is allowed to enter the air cylinder 40. However, the shaft 103 is in its lowered-position under the action of the spring 104 (the air cylinder 40 is in the position II), and therefore, the air can not pass through the cylinder 40 at this time.

When the winding operation comes near the end, the operator stops operating the lever 112. Thereby the air cylinder 25 is changed over to II to stop the air supply to the motor 50. Thus, the motor stops at this time point.

To start the operation for lowering the hoist, the operator operates the lever 116 for the air cylinder 30. By this lever operation, the cylinder 30 is changed over from II to I. Now the compressed air is introduced into the air motor 50 through the air cylinder 35 which is in the position I at that time. The motor starts to rotate in the direction opposite to the above, and the rope 1 is unwound from the drum 70 rotating in the opposite direction. Thus, the hoist main body 10 begins to move downwardly. During the rotation of the drum in the opposite direction, the index wheel 91 is rotated stepwise in the same manner as above but in the opposite direction to above (clockwise as viewed in Fig. 4). When the amount of the rotation of the index wheel 91 reaches a determined value, the projection 91b of the wheel comes into contact with the valve shaft 103 and moves it (pushes the shaft up). Thereby the air cylinder 40 is shifted to I. Now the air is allowed to flow passing through the air cylinder 40. Since the pipe lines 107 and 34 are in communication with each other, the exhaust air from the air cylinder 40 pushes up the valve shaft 26 of the air cylinder 35 so that the air cylinder 35 is changed over from I to II to block the flow of air through it. Thus, the motor 50 is stopped automatically to stop lowering the hoist.

In this manner, according to the shown embodiment of invention, the index wheel 91 is rotated together with the drum 70 but with a predetermined reduction ratio. When the amount of the rotation of the index wheel reaches a certain determined value, its projection 91b changes over the air cylinder 40 to change over the air cylinder 35 for stopping the motor 50. Therefore, it is no longer necessary for the operator to delicately control the lowering time of the hoist or hook. The problem involved in the prior art hoists such as overshooting is completely solved by the present invention.

The brake unit 60 operates in the following manner:

When the hoist is not operating, the valve cone 61 is in contact with the brake ring 62 and therefore the brake is effective. During the winding - (lifting) operation and the pay-out (lowering) operation, the compressed air passed through the air motor 50 is allowed to enter the brake unit through the air passages and valves. Then, the valve cylinder 64 and the valve cone 61 are moved together rightward (as viewed in Fig. 1) by the air pressure. As the cone 61 moves away from the brake ring 62, the braking is released.

While the present invention has been particularly shown and described with reference to an embodiment thereof, it is to be understood that various modifications and changes are possible in the light of the above teachings. For example, the present invention is applicable to other types of hoist than air hoist particularly shown in the above, such as electric hoist and hoists of the type in which the main body is stationary and a hoisting rope with a hanger hook at its lower end can be pulled out from the stationary main body.

Industrial Applicability;

According to the invention the hook is automatically and always correctly set to the desired lowest position. It is not required for the operator to delicately control the position of the hook in lowering it. Therefore, any unskilled operators can operate the hoist without danger and time loss. A substantial speed-up of the work is attained as compared with the prior art ones.

Claims

1. A pneumatically operable hoist for use with a pneumatic source (113) and comprising:
 - a pneumatically operable motor (50);
 - a drum (70) rotatable by said motor for winding and unwinding a wire (1) about said drum;
 - a first conduit for supplying fluid from said source to said motor to thereby rotate said motor in a wire winding direction;
 - a manually controllable valve means (25) for controlling the supply of fluid through said first conduit;
 - a second conduit for supplying fluid from said source to said motor to thereby rotate said drum in a wire unwinding direction;
 - a second manually controllable valve means (30) for controlling the supply of fluid through said second conduit;
 - a third valve means (35) in said second conduit downstream of said second valve means;

a third conduit branched from said second conduit between said third valve means and said second valve means and operatively connected to said third valve means;

fourth valve means (40) in said third conduit and pneumatically associated with said third valve means;

an indexing wheel means (91) intermittently rotatable as said drum rotates and arranged to act on said fourth valve means;

the arrangement being such that when said indexing wheel means is rotated by a predetermined angle in a condition in which said second valve means is manually operated to an open position allowing the flow of fluid therethrough, said fourth valve means is brought into an open position by said indexing wheel means to allow the flow of fluid through said third conduit, thereby causing said third valve means being brought into a closed position interrupting the flow of fluid through said second conduit to stop said motor in said wire unwinding direction.

2. In a hoist in which a wire rope (1) is wound or unwound by rotating a drum (70) in forward or backward direction by a driving source (50) the improvement comprising:

a reading means (40) for reading the amount of rotation of said drum in the backward direction; and a stopping means (35) actuated to stop said driving source in response to a signal from said reading means.

3. A hoist as set forth in claim 2, wherein said reading means comprises an indexing wheel (91) to be rotated by the backward rotation of said drum at a reduced rotational speed, and a first valve means to be operated by said indexing wheel.

4. A hoist as set forth in claim 3, wherein said stopping means comprises a second valve means operable in association with said first valve means.

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FIG. 1

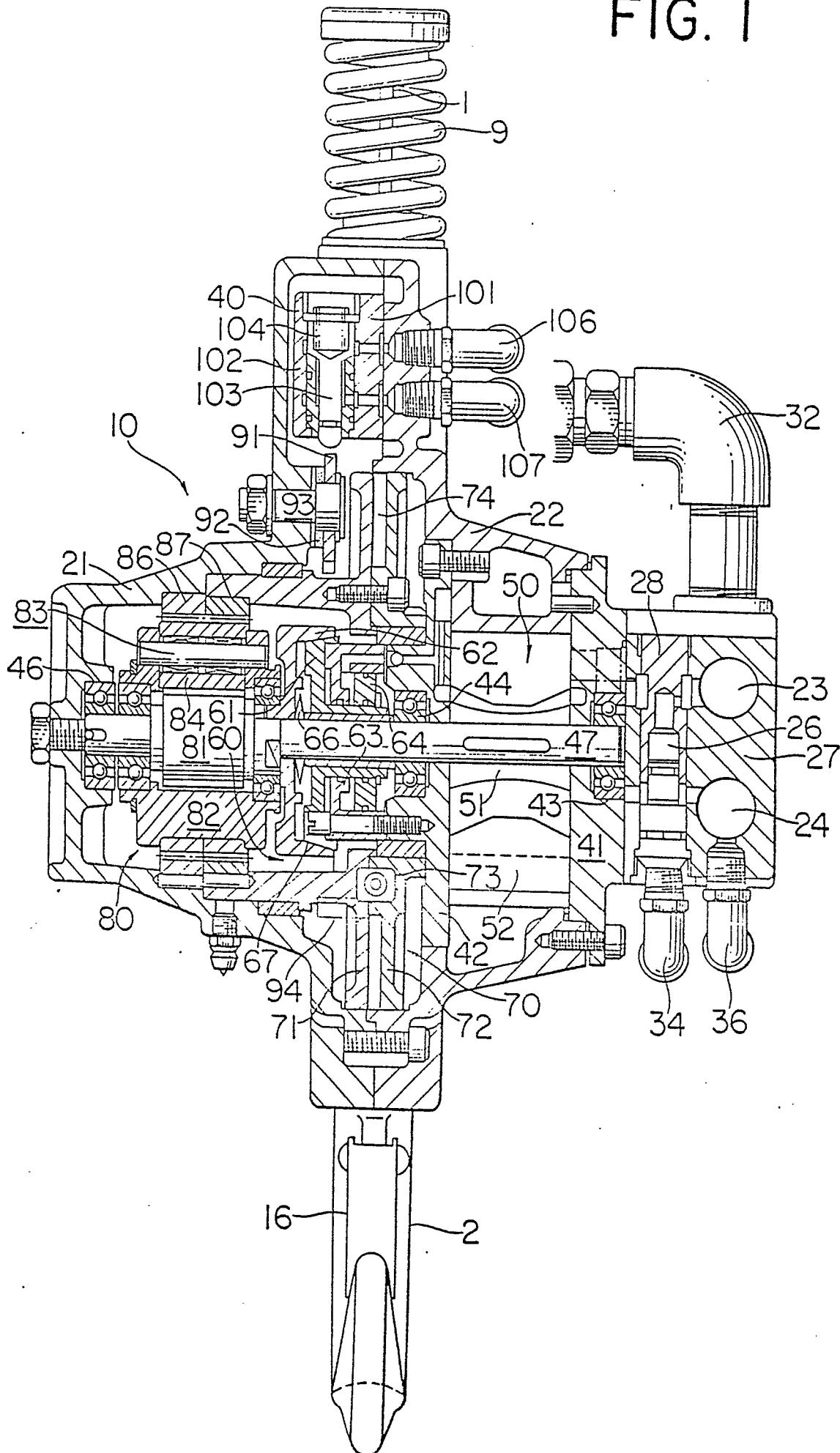


FIG. 2

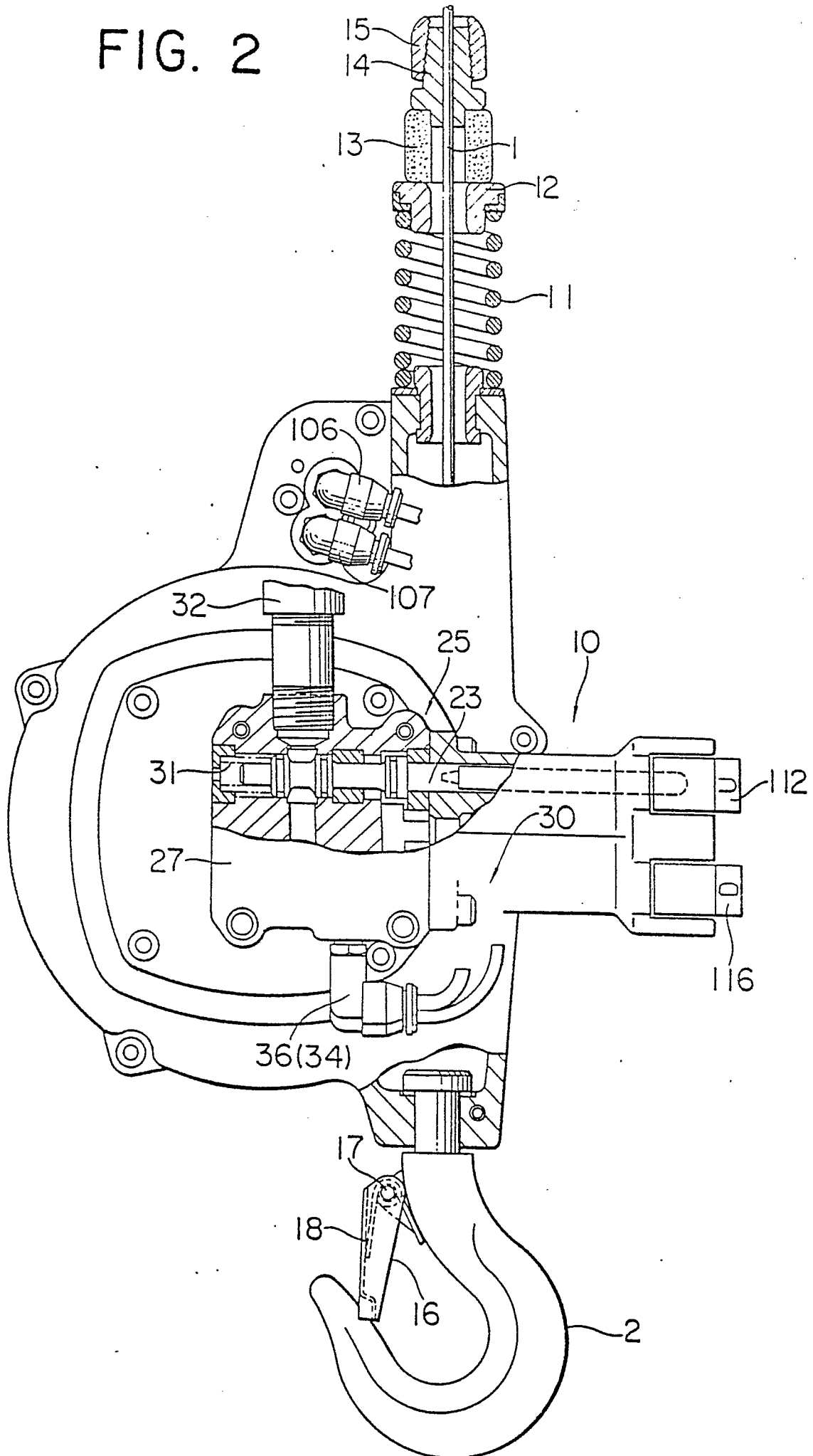


FIG. 3

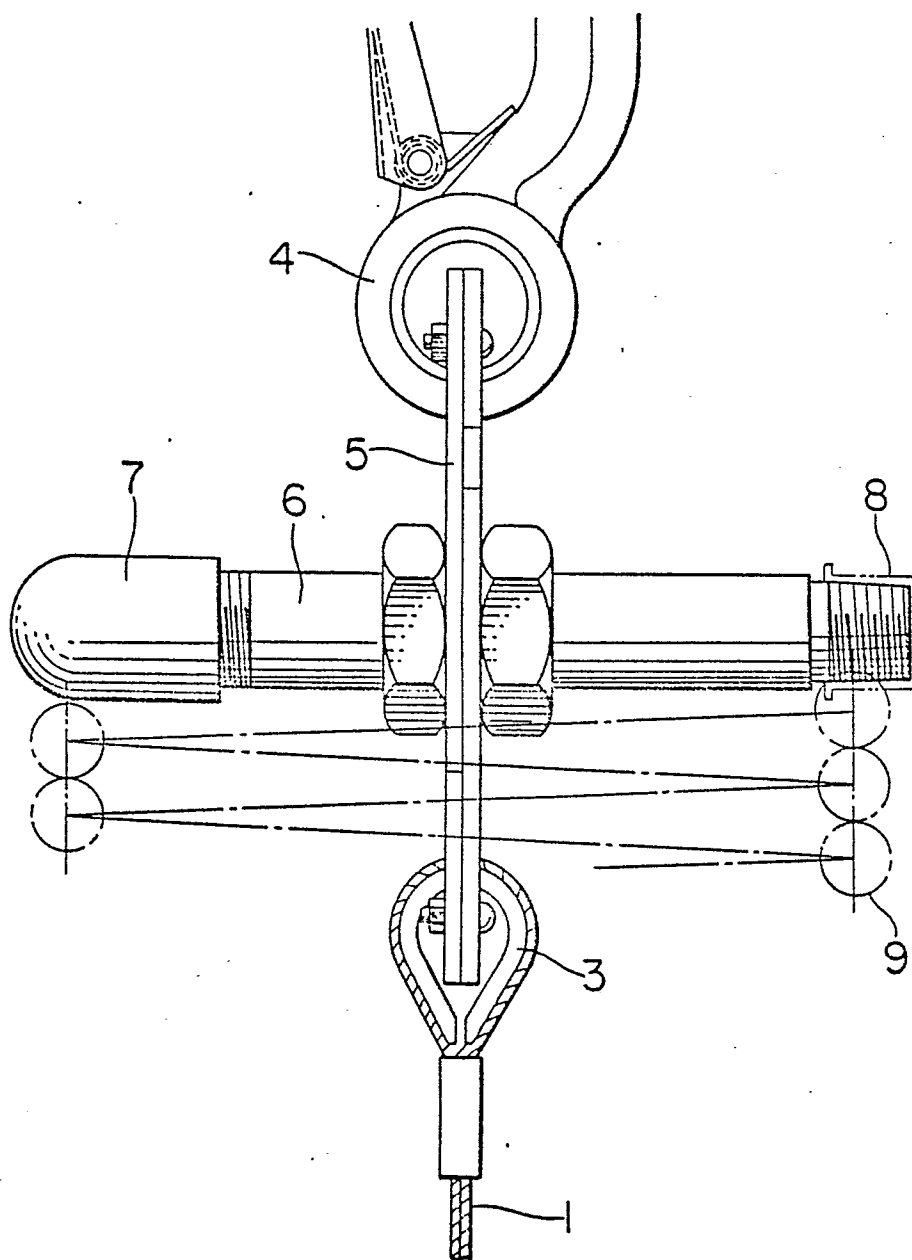


FIG. 4

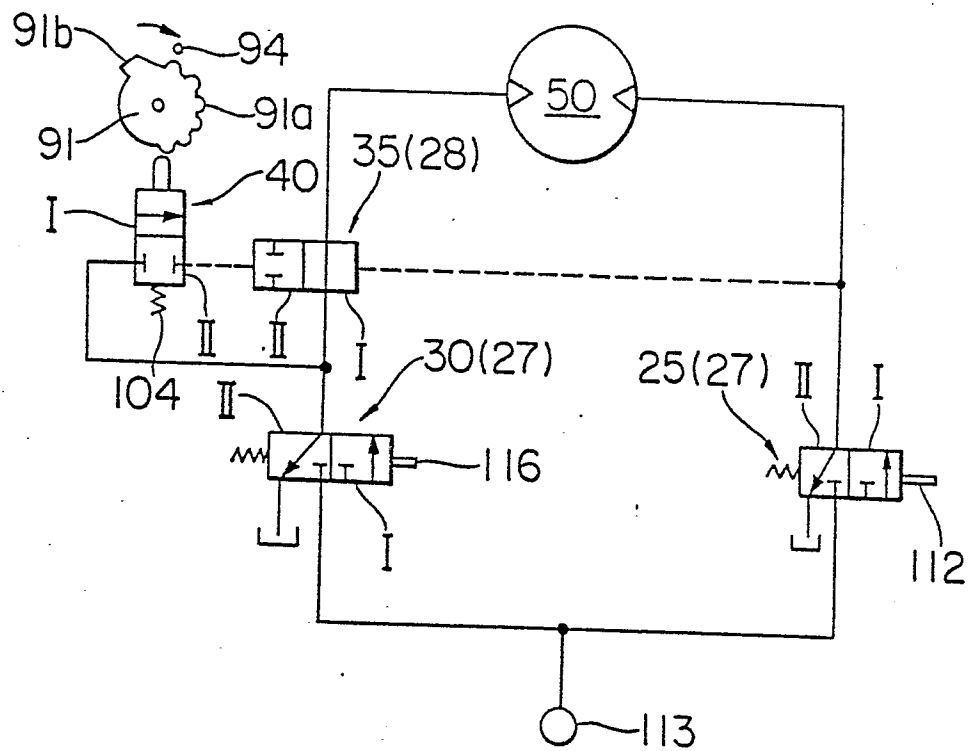


FIG. 5

