No. 665,993. Patented Jan. 15, 1901.

N. A. CHRISTENSEN.

FLUID PRESSURE HOIST.

(Application filed June 18, 1900.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

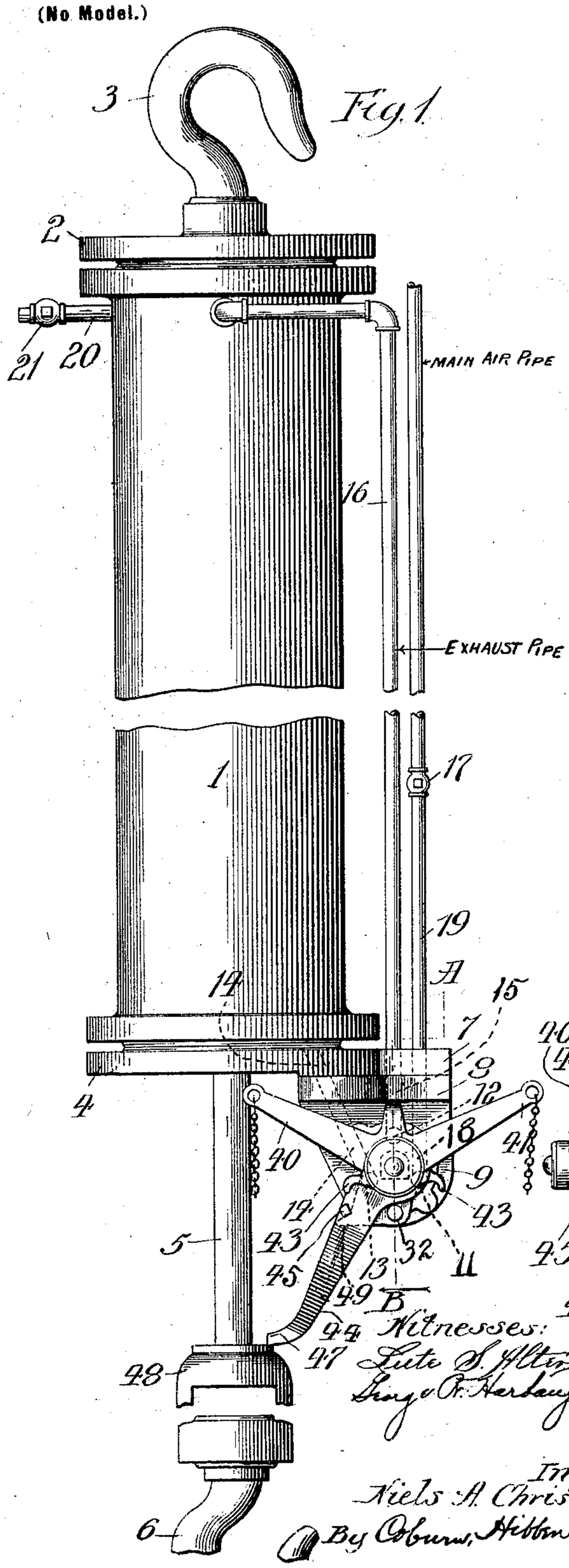
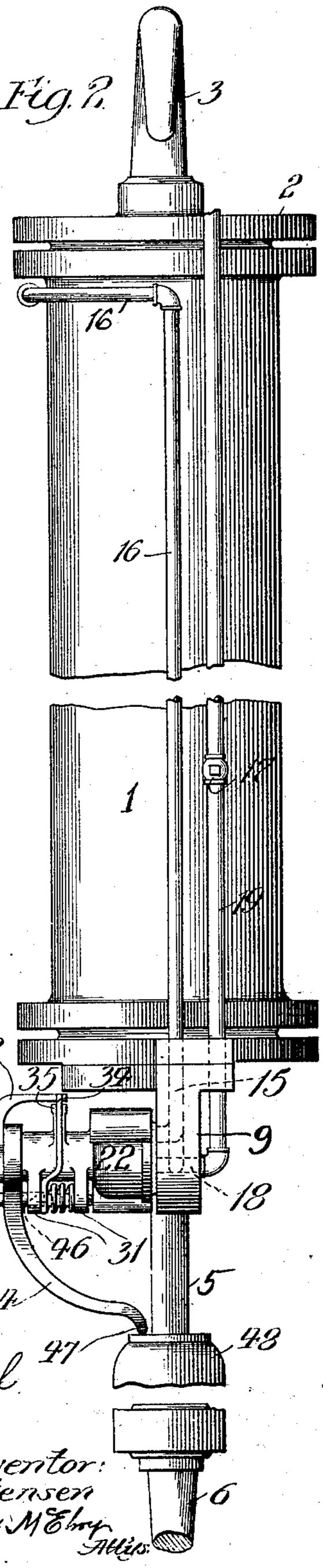


Fig. 2.



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No. 665,993. Patented Jan. 15, 1901.

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(No Model.) 3 Sheets—Sheet 2.

Fig. 3.

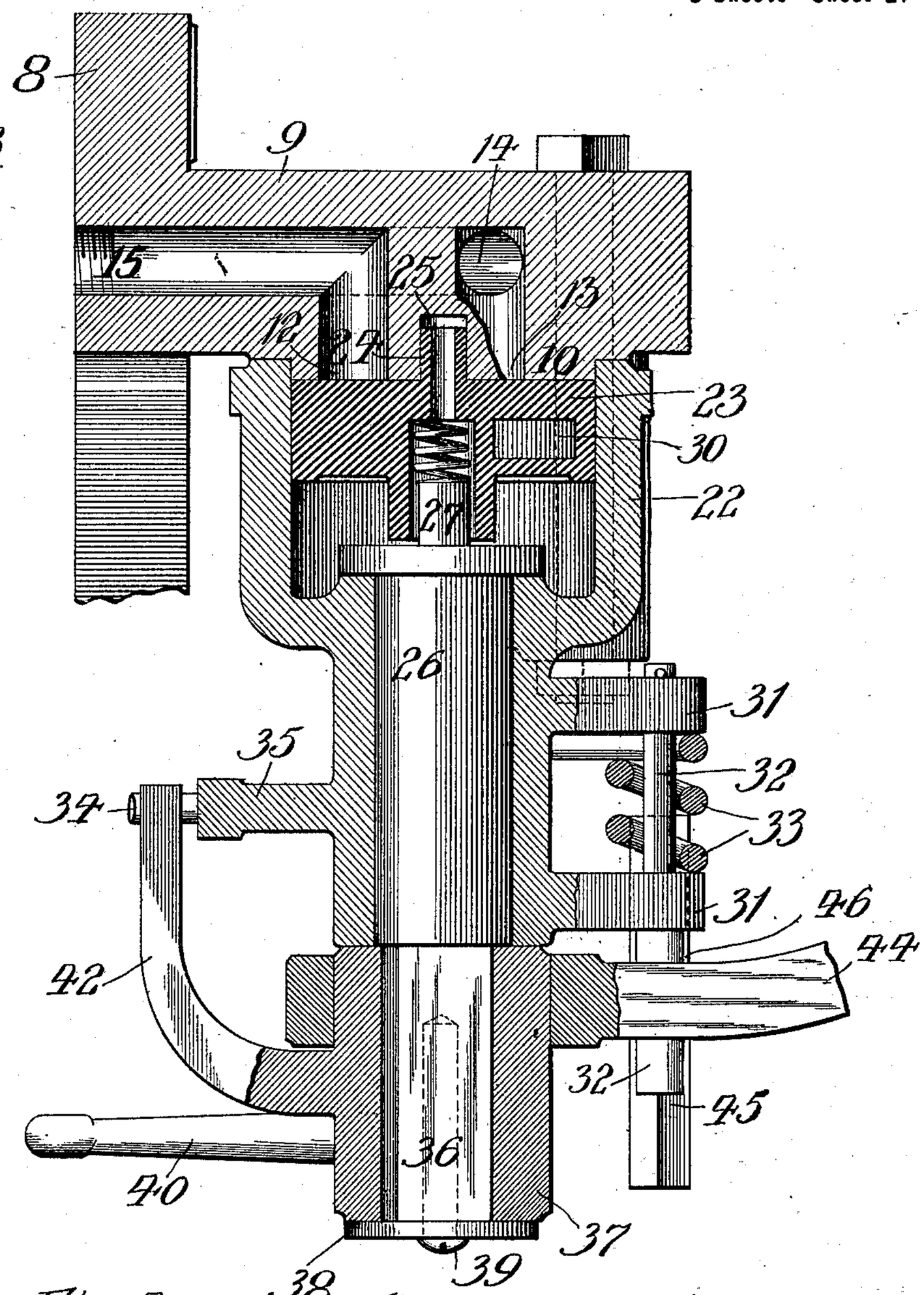


Fig. 4.

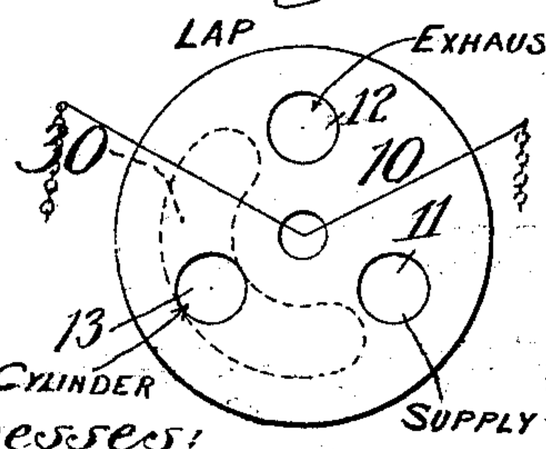


Fig. 5.

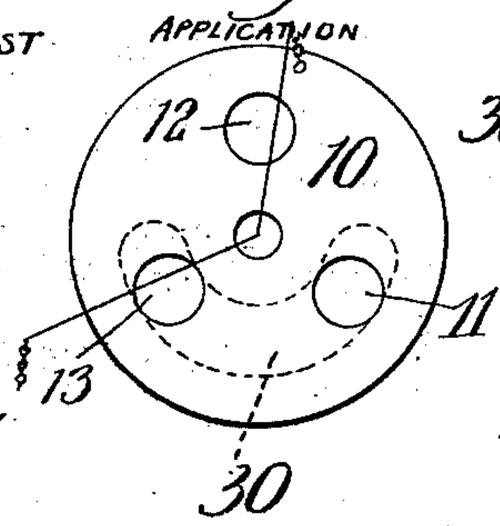
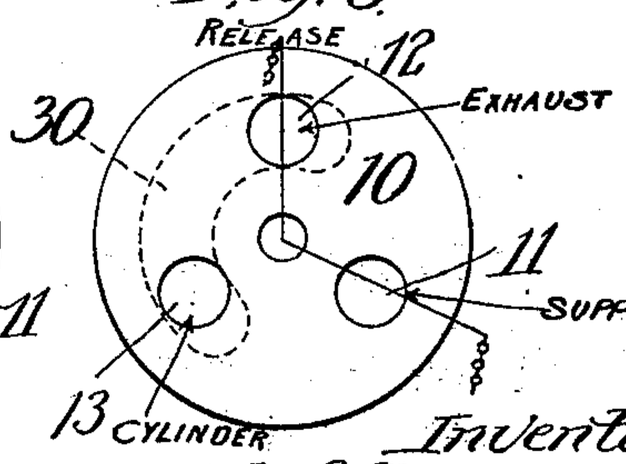


Fig. 6.



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No. 665,993. Patented Jan. 15, 1901.

N. A. CHRISTENSEN

FLUID PRESSURE HOIST.

(Application filed June 18, 1900.)

(No Model.) 3 Sheets—Sheet 3.

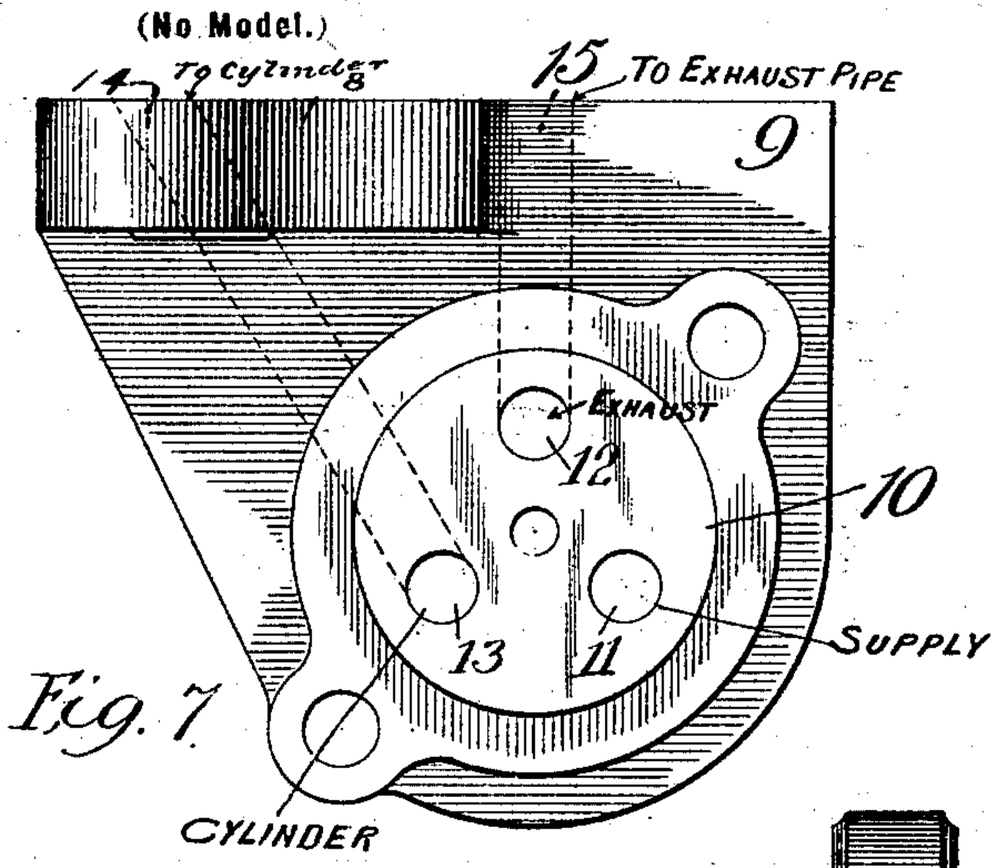


Fig. 7.

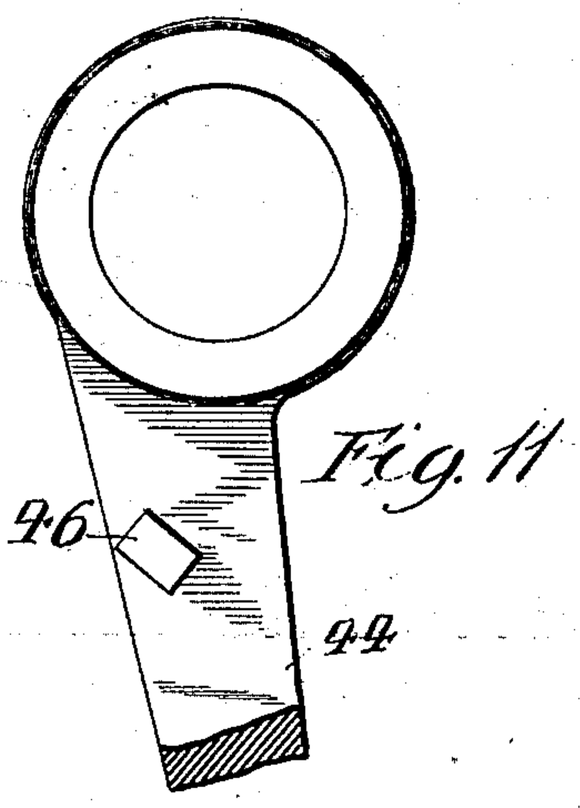


Fig. 11.

Fig. 8.

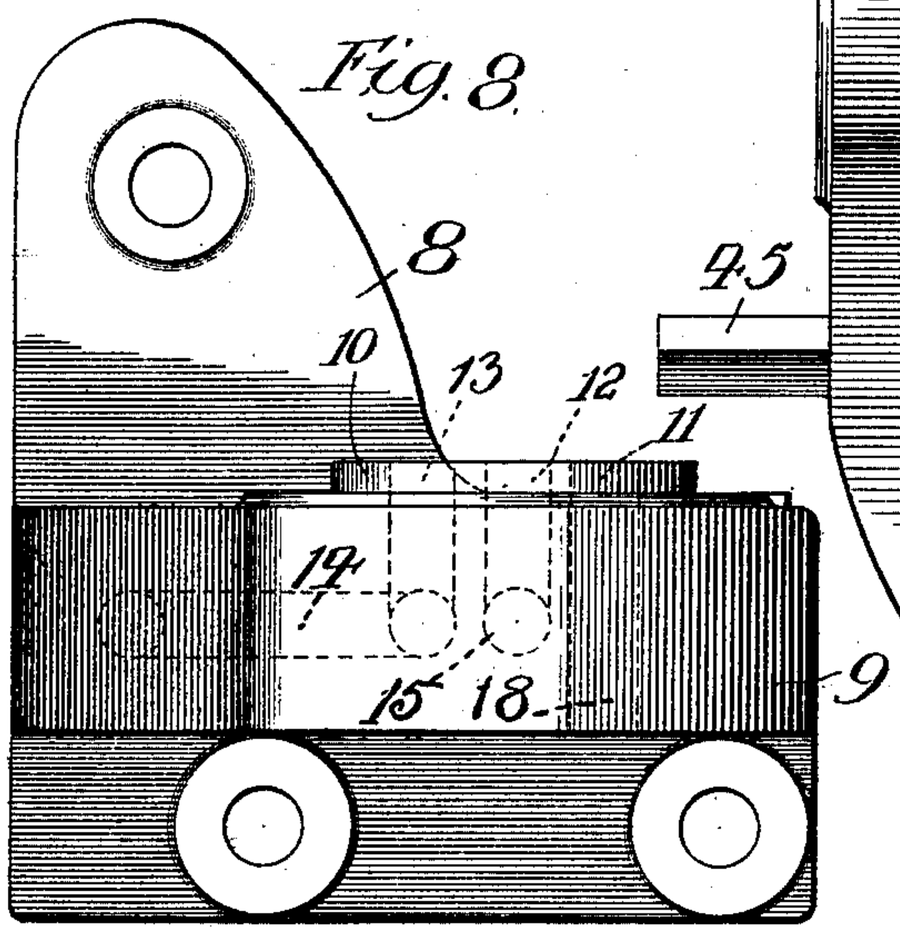


Fig. 10.

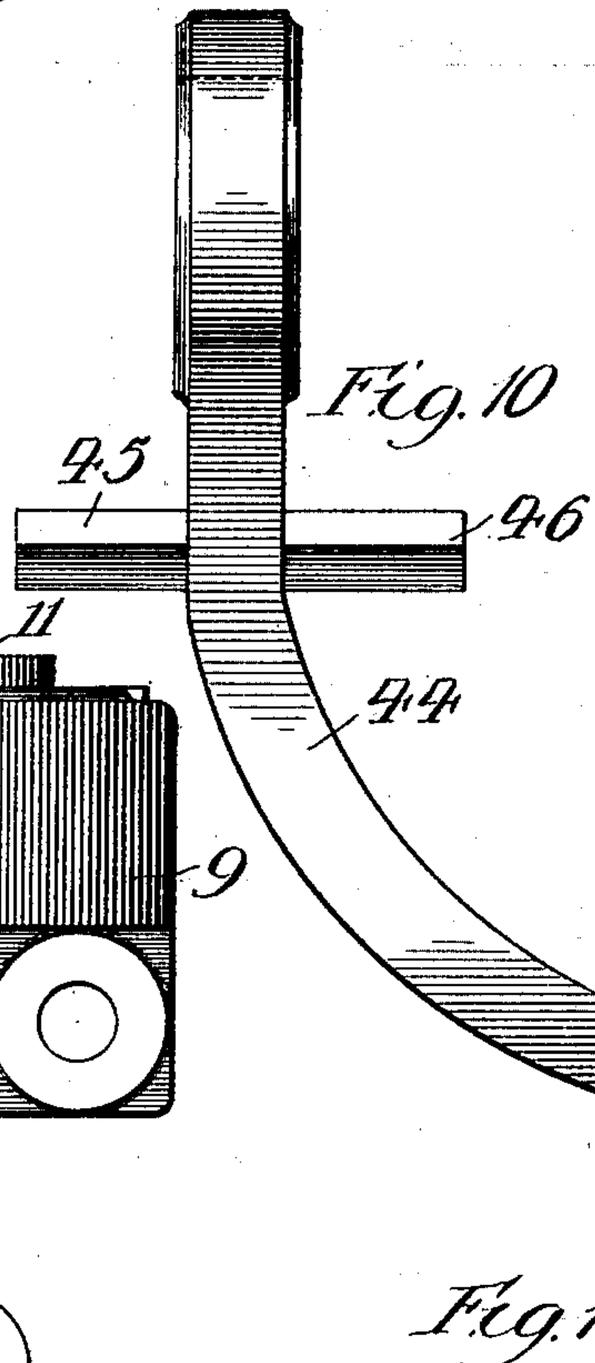


Fig. 12.

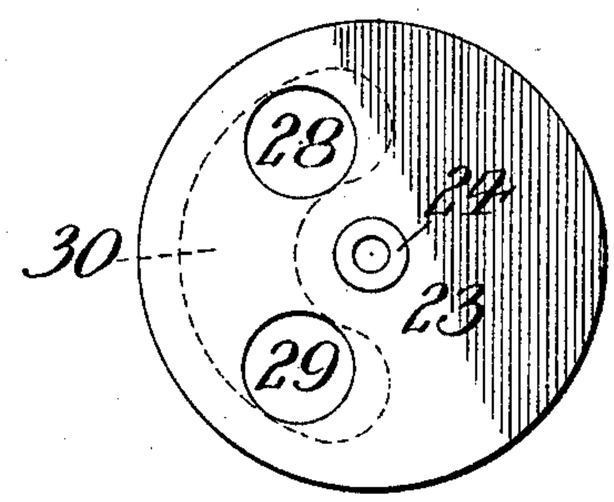


Fig. 9.

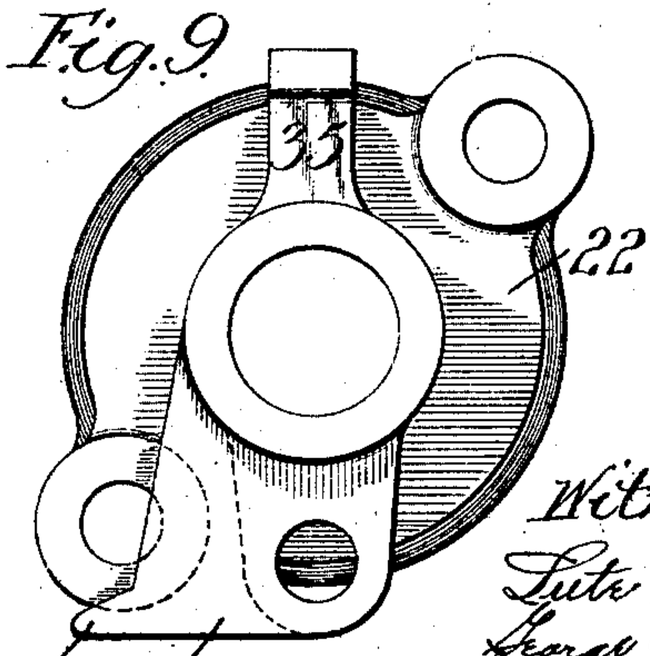
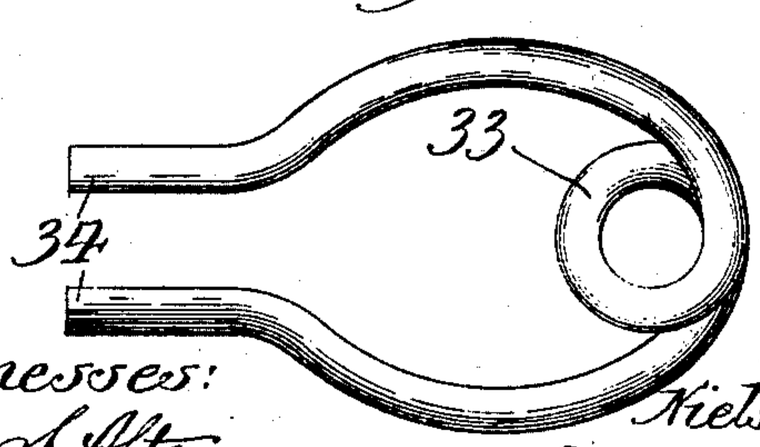


Fig. 13.



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UNITED STATES PATENT OFFICE.

NIELS ANTON CHRISTENSEN, OF MILWAUKEE, WISCONSIN.

FLUID-PRESSURE HOIST.

SPECIFICATION forming part of Letters Patent No. 665,993, dated January 15, 1901.

Application filed June 18, 1900. Serial No. 20,719. (No model.)

To all whom it may concern:

Be it known that I, NIELS ANTON CHRISTENSEN, a resident of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Fluid-Pressure Hoists, of which the following is a specification.

My invention pertains to hoists; and its object is to provide a simple and efficient valve device for controlling the fluid-pressure to and from the cylinder and also to provide means for automatically maintaining the valve in a normal lapped position, and in addition means are preferably provided for preventing overcharging of the cylinder with fluid-pressure.

Another feature of my invention consists in exhausting the fluid-pressure into the cylinder above the piston instead of exhausting the same directly to the atmosphere.

In the drawings, Figure 1 is an elevation of my hoist; Fig. 2, a side elevation of the hoist as shown in Fig. 1; Fig. 3, a full-size section of the valve device, taken on line A B of Fig. 1, but on a larger scale than that used in Fig. 1; Figs. 4, 5, and 6, face views of the valve-seat with the valve-ports and passage in dotted lines to indicate different positions of the valve, Fig. 4 indicating lap position of the valve, Fig. 5, application position, and Fig. 6 release position; Fig. 7, an elevation of the valve-base and its seat; Fig. 8, an edge view of the valve-seat proper; Fig. 9, a plan of the valve-casing alone; Fig. 10, a full-size elevation of the depending arm; Fig. 11, a side elevation of the upper portion of said arm; Fig. 12, a face view of the valve, and Fig. 13 a detail view of the spring for normally maintaining lap position of the valve.

The cylinder 1 has a top head or cap 2, with its suspending-hook 3, and a bottom head 4. The cylinder also has the usual piston, (not shown,) provided with the piston-rod 5, which carries at its lower end the usual swiveled lifting-hook 6. The bottom head has a laterally-extended portion 7, to which is bolted or otherwise secured the base for the regulating-valve, to be described. This valve-base comprises a horizontal portion 8, resting flat against the bottom head, and also a vertical portion 9, on which is formed a valve-seat 10. This valve-seat has a supply or feed port 11 communicating with any main reservoir containing fluid-pressure or with any other suitable source of supply and also has an exhaust-port 12 and a cylinder-port 13. The cylinder-port communicates with a passage 14, leading through the base and through the bottom head into the cylinder below the piston. The main air-pipe 19, which is connected with the main reservoir and has a check-valve 17, communicates with a horizontal passage 18, which terminates on the valve-seat in the supply-port 11. The exhaust-port 12 communicates with a passage 15, leading horizontally and then upwardly through the base and through the extended portion of the bottom head, where it connects with an exhaust-pipe 16, extending upwardly and entering the cylinder near the top. This exhaust-pipe thus connects the exhaust-port of the valve device with an inlet-port into the cylinder, near the top end thereof. An outlet-pipe 20, having a check-valve 21, also communicates with the cylinder, near the upper end thereof. The object of such location of the inlet from pipe 16 and outlet through pipe 20 is to provide a cushioning-space for the piston in its upward travel. Just before the piston has made its full upward travel it passes by and closes said inlet and outlet near the top of the cylinder, and the air so trapped forms a cushion, preventing violent contact of the piston against the top cap or end of the cylinder.

The controlling-valve device consists of a bonnet or casing 22, secured to the base and within which is a rotary disk valve 23. This valve has a central stem 24, fitting in a socket 25 in the portion 9 and is partially rotated by an operating-stem 26, whose inner end 27 is operatively connected to such valve. The valve is provided on its face which fits on the valve-seat with two ports 28 and 29, connected by an internal recess 30, although it is evident that a recess in the face of the valve might be used. These ports in the valve are adapted to connect the ports on the valve-seat in different positions of the valve.

Upon the lower side of the casing are arranged lugs 31, through which passes a pin or bolt 32, forming a pivot for the coiled portion 33 of a spring, whose free ends 34 extend around on either side of the casing and lie on either side and slightly beyond a lug 35, lo-

cated on the casing substantially diametrically opposite the lugs 31.

The valve-stem 26 may be rotated by the usual hand chains or ropes, and for this purpose the stem has an angular outer end 36 extending outside the valve-casing. This outer end of the stem is received in the corresponding angular hole of a hub 37, which is held in place on the stem by a washer 38 and a screw 39. The hub is provided with the diverging operating arms or levers 40 and 41 and to whose ends the operating cords or chains are connected. The hub also has a curved arm or horn 42, arranged centrally with respect to the levers and extending above the lug 35 and between the ends 34 of the spring. Hook-shaped arms 43 are also provided on the hub to contact the pivot-pin 32, whereby a stop is provided for the extreme movements of the levers in the two directions.

A depending arm 44, which is curved, as shown in the drawings, is swiveled, preferably, though not necessarily, upon the hub 37. Obviously any other way of mounting this arm so that it will perform its proper functions may be adopted. This arm has two opposite and lateral lugs 45 and 46, and its extreme end 47 is arranged in the path of travel of the projection 48 on the piston-rod, which projection contacts such end 47 toward the completion of the upward stroke of the piston. Contact of lug 46 on the projecting portion or lug 49 of the outermost one of the lugs 31 limits the downward movement of the arm 44.

The normal or lap position of the disk valve is maintained by the spring 33, whose free ends keep the horn 42 directly beyond and in line with the lug 35. At this time all the ports are closed, as is illustrated in Fig. 4 of the drawings, and the valve is said to be on lap. Movement of the valve in either direction is consequently against the tension of the spring, which tends to automatically return the valve to lap position after any movement in either direction. The particular construction shown is of advantage not only because the lap position is automatically maintained, but also because such lap position is definite, owing to the practical absence of play of the horn between the ends of the spring, which prevents any movement of the valve except the pull exerted by the operator.

When the lever 40 is pulled down by the operator, the valve is partially rotated, so that its ports 28 and 29 will connect the feed-port 11 and cylinder-port 13, as shown in Fig. 5, whereupon fluid under pressure will enter the cylinder and operate the piston in the usual manner. Upon a release of the pull chain or cord the valve will be automatically returned to lap position by the spring and the pressure will be held in the cylinder. The check-valve 17 permits the passage of fluid-pressure to the valve device, but prevents its return. This check-valve is of great advantage, inasmuch as the fluid-pressure can be kept in the cylinder to hold the load in case of a rupture or other accident to the main air-pipe, even though the valve is in a position to admit pressure to the cylinder.

In case the operator should keep the valve open when the piston is approaching completion of its upward stroke the projection 48 will contact the depending arm 44, will raise the same, and finally cause its lug 45 to contact arm 40 to thereby positively and automatically return the valve to lap position against any pull exerted by the operator.

To release the pressure from the cylinder, the lever 41 is pulled downward, whereupon ports 28 and 29 will connect cylinder-port 13 and exhaust-port 12 and the depending arm will thereupon drop down in normal position, with its lug 46 resting on the projection 49. Instead of exhausting direct to atmosphere the pressure flows through the exhaust-pipe 16 and enters the cylinder on the top side of the piston, from whence it finally escapes through pipe 20, the check-valve 21 preventing the outside air from entering the cylinder. By this arrangement the ordinary outside air is not introduced into the cylinder at any time, but an equalization of pressure is effected on both sides of the piston, so that the fluid under pressure must always pass through the space above the piston in order to escape to the atmosphere. The check-valve in the outlet-pipe 20 is, therefore, useful in absolutely preventing the entrance of the outside air, the hoist being so constructed that all of the air entering the cylinder above the piston comes through the operating-valve, so as to prevent the entrance of dust and dirt or other objectionable matter into the hoist-cylinder. The check-valve opens outwardly and closes against any admission of air through the pipe 20. As a general thing compressed air is comparatively pure and clean, inasmuch as the air is taken from a clean source and generally strained before being compressed. Consequently practically pure air only is allowed to enter the hoist-cylinder on either side of its piston.

By means of the depending arm the operating-lever is positively returned to normal position in an automatic manner by the travel of the piston itself and against any pull exerted by the operator, thereby avoiding the possibility of an overcharge of fluid-pressure in the hoist. In other words, the hoist when having the full upward stroke cannot consume any more fluid-pressure than that which is required to lift the load, thereby effecting an economy in the consumption of pressure. Were it not for this provision of closing the valve the careless operator might hold the valve open a sufficient length of time after the piston had reached its stop stroke to fully charge the hoist with main-reservoir pressure, thereby introducing some seventy to ninety pounds pressure per square inch where it might not be necessary to introduce more than ten to twenty pounds to lift the load.

While I have herein shown my invention as applied to vertical hoists, it will be understood that it is applicable to other kinds of hoists or fluid-pressure mechanism, and consequently I contemplate using my invention wherever applicable.

I claim—

1. In a hoist, the combination with a cylinder having a piston traveling therein which is actuated by the admission of a fresh supply of fluid-pressure at each lifting operation, of means for admitting such fluid-pressure into the cylinder against one side of the piston and discharging all the exhaust into the cylinder on the other side of the piston but at a point below the end of the cylinder, such cylinder having a separate inlet and outlet for said exhaust.

2. In a hoist, the combination with a cylinder having a piston traveling therein, of a valve device for controlling the admission, into the cylinder, on one side of the piston, of a fresh supply of fluid-pressure at each lifting operation of the piston and for controlling the release of such pressure, and a pipe conducting the whole exhaust of the valve to the cylinder on the other side of the piston, which last-mentioned portion of the cylinder is entirely closed against the entrance of the ordinary outside air.

3. In a hoist, the combination with a cylinder having a piston traveling therein, of means for controlling the admission and release of pressure to and from the cylinder and for exhausting into the cylinder on the other side of the piston the entire released pressure before finally exhausting the same to atmosphere and a check-valved outlet in the cylinder.

4. In a hoist, the combination with a cylinder having at one end a port for the admission of fluid-pressure, and near the other end an inlet-port and a check-valved-governed outlet-port, a piston traveling in such cylinder and means for admitting fluid-pressure into the cylinder on one side of the piston and for exhausting that admitted pressure through said inlet-port, into the cylinder on the other side of the piston and finally exhausting such pressure to the atmosphere through said outlet-port.

5. In a hoist, the combination with a cylinder having at lower end a cylinder-port for the admission of fluid-pressure, and near the top end an inlet-port and a check-valved outlet-port, a piston in such cylinder, a valve device comprising a casing having a port and passage communicating with said cylinder-port, an exhaust-port and a supply-port communicating with a source of fluid-pressure, a valve governing said ports, and a pipe connecting between the exhaust-port and the inlet-port at the top end of the cylinder.

6. In a hoist, the combination with a cylinder and its piston, of a valve for controlling fluid-pressure to and from the cylinder and a pivoted arm controlled by the movement of the piston to automatically close the valve against any pull exerted by the operator.

7. In a hoist, the combination with a cylinder and its piston, of a valve device for controlling fluid-pressure to and from the cylinder and an arm pivoted at one end to such valve device, and moved by the piston toward the completion of its upward stroke so as to close such valve against any pull exerted by the operator.

8. In a hoist, the combination with a cylinder and its piston, of a valve device for controlling fluid-pressure to and from the cylinder, a pivoted arm raised by the movement of the piston toward the completion of its upward stroke to automatically close the valve and means for limiting the downward movement of such arm.

9. In a fluid-pressure hoist, the combination with a cylinder and its piston, of a valve governing the fluid-pressure to and from the hoist, tension mechanism normally maintaining the valve in lap position and means in aid of such mechanism to close the valve on the upward stroke of the piston.

10. In a hoist, the combination with a cylinder and its piston, of a valve governing the fluid-pressure to and from the hoist, a spring adapted to return the valve to lap position after movement in either direction and means in aid of such spring to close said valve against the force exerted by the operator.

11. In a hoist, the combination with a cylinder and its piston having a rod, of a valve governing the admission of fluid-pressure to such cylinder and its release therefrom, a lever for operating such valve, and an arm pivoted at one end and having its other end adjacent to the piston-rod and moved thereby as the piston approaches the extremity of its upward stroke, such arm when thus moved by the piston-rod contacting and operating the lever to close the valve.

12. In a hoist, the combination of a cylinder, a piston therein having a piston-rod, a valve governing fluid-pressure to and from the cylinder, levers for operating the valve to admit or release the pressure, and a swiveled depending arm whose lower end is contacted by the piston-rod near the end of the piston's upward stroke and which when raised closes said valve.

13. In a hoist, the combination of a cylinder, a piston therein having a piston-rod, a valve governing fluid-pressure to and from the cylinder, levers for operating the valve to admit or release the pressure, and a swiveled depending arm whose lower end is contacted by the piston-rod near the end of the piston's upward stroke and which when raised closes said valve, and means for limiting the downward movement of such arm.

14. In a hoist, the combination of a cylinder, a piston therein having a piston-rod, a valve governing fluid-pressure to and from the cylinder, levers for operating the valve to

admit or release the pressure, a swiveled depending arm provided with a lateral lug and which is raised by the piston-rod near the end of the piston's upward stroke to cause said lug to contact one of such levers and close the valve.

15. In a hoist, the combination of a cylinder, a piston therein having a piston-rod, a valve device governing fluid-pressure to and from the cylinder, levers for operating the valve to admit or release the pressure, a movable depending arm provided with two lateral lugs and which is raised by the piston-rod near the end of the piston's upward stroke to cause said lug to contact one of such levers and close the valve and a projection on the valve device against which projection the other of said lugs strikes to limit the downward movement of such arm.

16. In a hoist, the combination of a cylinder, a piston therein having a piston-rod with a projection on its lower end, a valve device governing fluid-pressure to and from the cylinder, levers for operating the valve to admit or release the pressure, and a depending arm swiveled on the valve device and provided with two lateral lugs, the lower end of such arm being arranged in the path of travel of such projection on the piston-rod and adapted to be raised thereby to cause one of the lugs to contact and move one of the levers to close the valve, such valve device having a projection against which the other lug strikes to stop the downward movement of the arm.

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