E. F. DAHILL.

MACHINE FOR RAISING AND LOWERING LADDERS.

APPLICATION FILED NOV. 14, 1907.

983,212. Patented Jan. 31, 1911.

3 SHEETS—SHEET 1.

Fig. 1.

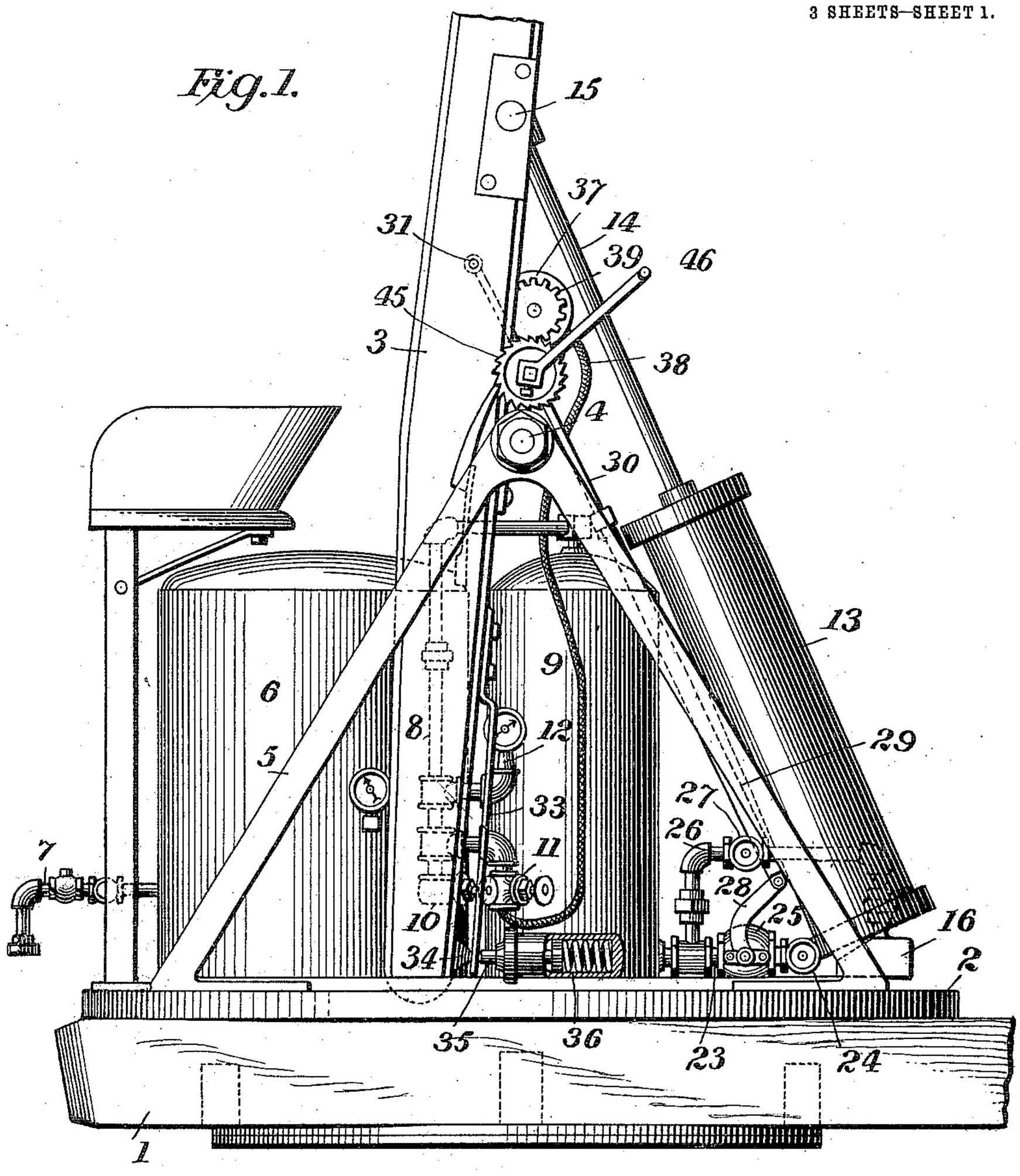
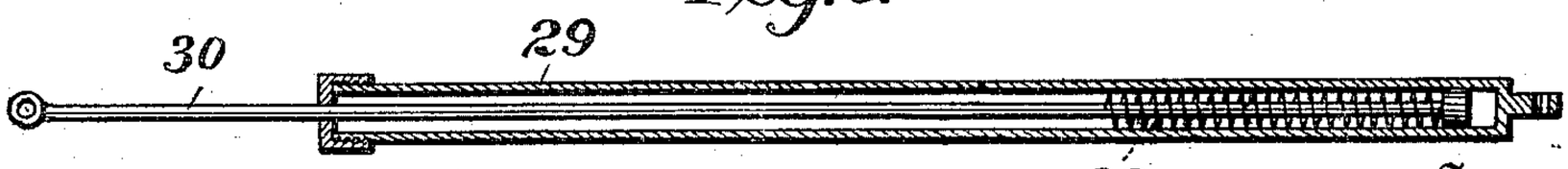


Fig. 3.



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3 SHEETS—SHEET 2.

Fig. 2

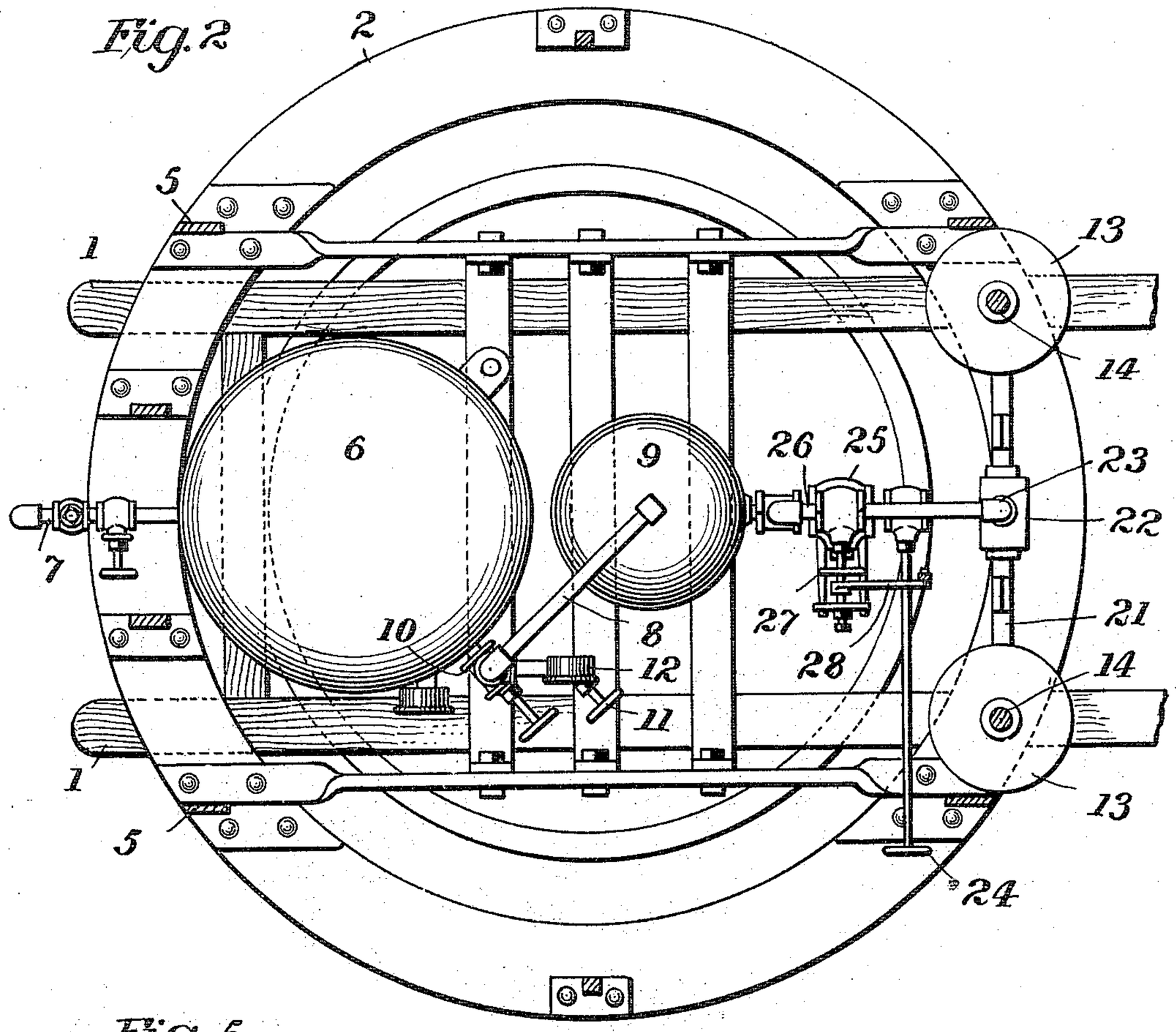


Fig. 5

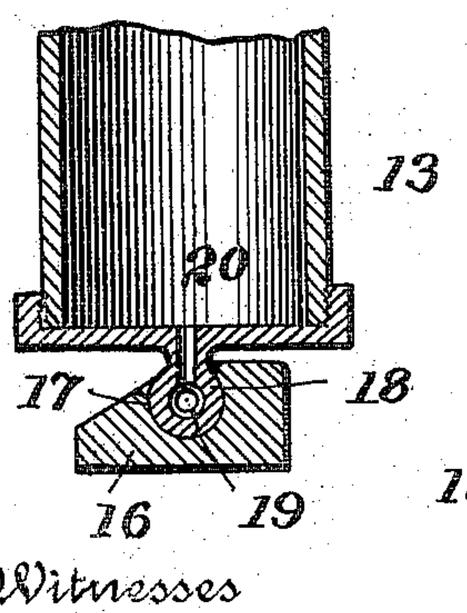
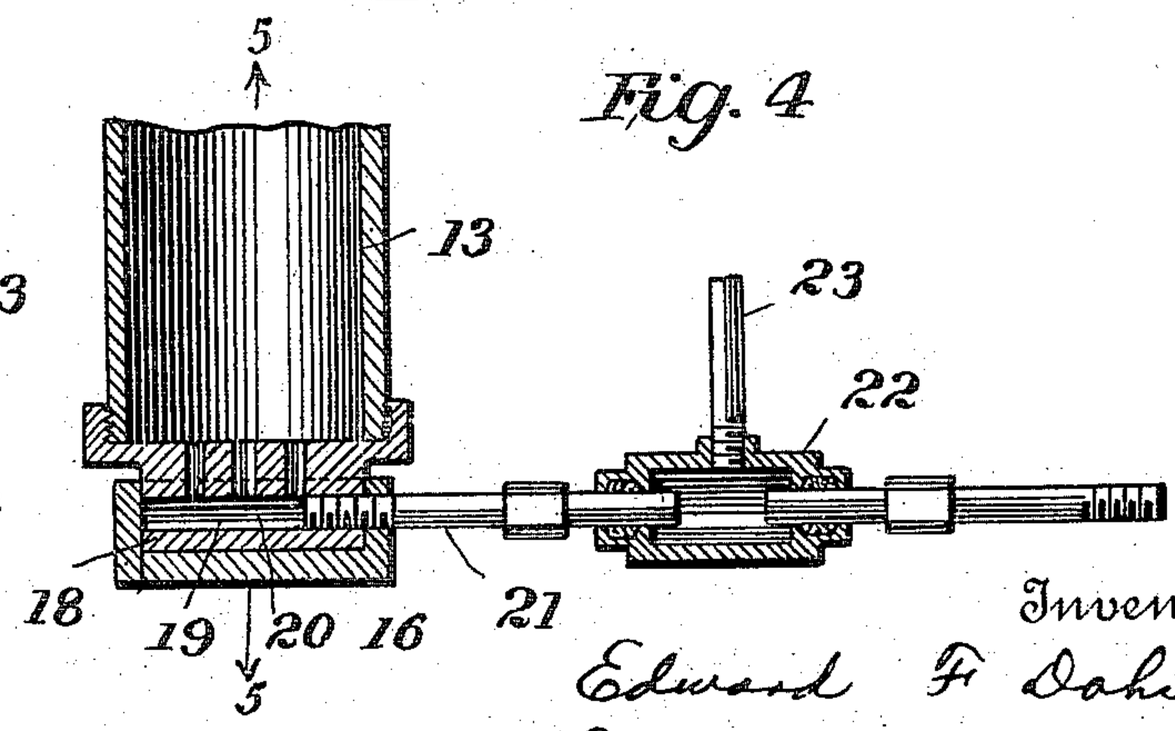


Fig. 4



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3 SHEETS—SHEET 3.

Fig. 6.

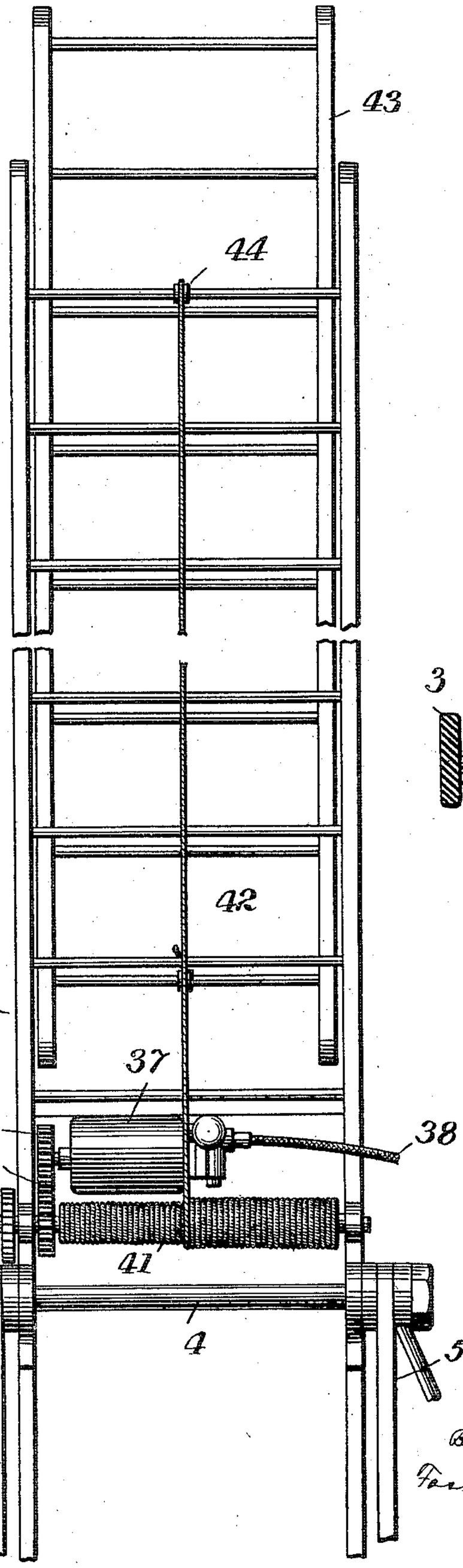

Fig. 7.

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UNITED STATES PATENT OFFICE.

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MACHINE FOR RAISING AND LOWERING LADDERS.

983,212. Specification of Letters Patent. **Patented Jan. 31, 1911.**

Application filed November 14, 1907. Serial No. 402,193.

To all whom it may concern:

Be it known that I, EDWARD F. DAHILL, a citizen of the United States, residing at New Bedford, in the county of Bristol, State of Massachusetts, have invented certain new and useful Improvements in Machines for Raising and Lowering Ladders, of which the following is a specification.

This invention relates to means for raising and lowering a ladder, and is an improvement upon devices of the class disclosed in the patent to Dahill and Goddard, No. 754,282, granted March 8, 1904.

The invention is especially adapted for use on the ladder trucks of fire fighting apparatus such as are in common use in all cities. The ladder is pivotally supported near one end on the truck, and by my invention it is turned on its pivots until it is in a vertical position, or in any other position desired, and it can be easily and quickly raised to any position or lowered from any position with very little physical exertion on the part of the operator. The speed with which the ladder is elevated may be varied according to the desire of the operator, and the ladder may be held rigidly in any position desired through the operation of the elevating means alone.

My device includes pistons mounted below the ladder having pivotal supports and having rigid piston rods connected directly to the ladder so that the power is applied direct.

In the particular form shown my invention includes a tank for containing compressed air, and a tank for liquid under pressure, connections between said tanks, and connections between the liquid tank and the elevating pistons.

It also includes the particular means by which the fluids under pressure are regulated for the purpose of elevating the ladder and holding it in any desired position.

My invention further includes means cooperating with the above mentioned pressure cylinders for elevating the extension ladder.

The points of novelty and the advantages of the many new features in my device will be apparent from the following description.

In the accompanying drawings: Figure 1 is a side view of a portion of the front part of a truck showing one end of the ladder and my elevating means attached to it; Fig. 2 is a plan view of what is shown in Fig. 1 omitting the ladder and its pivotal support and the seat for the driver; Fig. 3 is a longitudinal section of the rod which connects the ladder with the operating valve of the elevating means; Fig. 4 is a section through the base of the piston showing the pipe connections for supplying the liquid thereto; Fig. 5 is a cross section taken upon the line 5—5 of Fig. 4. Fig. 6 is a front elevation of a portion of the ladder showing the means for elevating the extension ladder; and Fig. 7 is a cross section showing the operating motor attached to the ladder.

In the drawings 1 represents the forward end of the frame of a truck such as is used by fire departments. A turn table 2 is mounted on this frame and is adapted to turn in a horizontal position to any angle. This turn table carries the ladder and also all parts of the apparatus which constitute my present invention. The ladder 3 is pivotally supported at 4 upon the V-shaped side braces 5. Mounted on the turn table is the tank 6 adapted to contain air under pressure, which is supplied from any suitable source by means of the inlet pipe 7. A pipe 8 leads from this tank to the top of tank 9 which is adapted to contain liquid, and it is to be noted that the pipe 8 is provided with a hand operated valve 10, a valve exhaust port 11 and a pressure gage 12. The liquid used in tank 9 is preferably of such composition that it will not freeze when exposed to cold.

Mounted upon the turn table some distance horizontally from the pivotal support 4 are two piston cylinders 13 which have therein pistons with rigid piston rods 14 connected directly to the side bars of the ladder by pivotal joints 15. Since the point of connection between the piston rod and ladder swings around the pivotal support for the ladder itself it is necessary that the pistons be pivotally supported and in Figs. 4 and 5 I have shown a specific means by which this pivotal support is secured. The supporting block 16 is attached to the turn table and has in its upper surface the longitudinal semi-cylindrical bearing 17, the ends of this semi-cylindrical bearing being closed by plates. The lower ends of the piston cylinders are made with semi-cylindrical projections 18 adapted to fit the bearings 17 and also having a central longitudinal opening 19 therethrough and connections 20 to the interior of the cylinder. This form of

support permits the cylinders to oscillate within certain limits and at the same time furnishes a solid and strong support for them. Each bearing projection 18 has secured therein pipe 21 which serves to admit the liquid which is to operate the piston. The ends of the two pipes 21 are joined by the coupling 22 which has a packing joint connection therewith such that the parts may rotate with reference to each other without destroying the liquid-tight connection. This coupling 22 has a pipe 23 leading therefrom to the liquid cylinder 9, thus furnishing the means for supplying the liquid under pressure from that cylinder to the piston. This pipe 23 has in it two valves, one marked 24, being hand operated, and the other marked 25, being automatically operated by connection with the ladder as hereafter described. A pipe 26 having therein a valve 27 also makes connection with the coupling and with the liquid tank 9, furnishing a by-pass around the automatic valve 25.

The automatic valve 25 is provided with an arm 28 which has attached thereto a rod made up of the sections 29 and 30 and which is pivotally connected to the ladder at the point 31. It will be evident that the motion of the ladder will, through this connecting rod, operate the arm of the valve 25, and it is connected to the ladder at such a point that when the ladder reaches its substantially vertical position the valve 25 will be closed. The closing of the valve shuts off the supply of liquid under pressure to the pistons and consequently prevents those pistons from pushing the ladder beyond the point indicated. It will be clear that by regulating the length of this rod and its point of attachment to the ladder the point at which the elevation of the ladder will be automatically stopped may be adjusted at will. To prevent sudden strains on the valve 25 and its arm 28 I preferably make the connecting rod in two parts as shown in Fig. 3, one part sliding within the other, and the spring 32 operatively interposed between those parts so as to relieve sudden jars.

It will be noted that the ladder is raised by pressure but descends by gravity, and since it may sometimes be in a vertical position where it will not automatically commence its descent I have provided means for starting it. These means include the spring arm 33 fastened near the lower end of the ladder and being also supported by the coil spring 34. This arm 33 strikes against an abutment 35 which is a spring supported piston mounted in the cylinder 36. The tendency of this structure is to tip the ladder over and make it commence its descent. The structure also furnishes a cushion stop for the ladder preventing jars when it reaches its highest position.

In operation it will be clear that the first thing done is to admit air under pressure from the tank 6 to tank 9 through the pipe 8 and this is done by opening the valve 10. This places the liquid in tank 9 under pressure and that liquid is admitted beneath the piston in the piston cylinder 13 by opening the hand valve 24. The ladder can of course be stopped at any position during its elevation by simply closing valve 24, and it will furthermore be held rigidly in the position indicated, since the liquid in the piston cylinder is naturally incompressible. This is a great advantage incident to the use of liquid in the elevating pistons in place of air, since the air operated piston would not furnish a solid support and the ladder would necessarily vibrate and rock. If it is desired to lower the ladder either from its vertical position or from any intermediate position this can be done simply and easily by closing the valve 10, thus cutting off the air pressure, opening the valve 11, thus relieving the air pressure on the liquid, and then opening the by-pass valve 27. It is to be noted that this by-pass valve 27 can be opened and the liquid exhausted from the pistons even after the automatic valve 25 has been closed.

By providing pistons which extend upwardly as distinguished from a substantially horizontal position a more direct application of power is secured, and by pivotally supporting the piston cylinders and using rigid piston rods the application of power is made direct in whatever position the ladder may be while it is being raised. I believe myself to be the first to thus mount the elevating pistons, and therefore I wish to claim this feature broadly. In order to supply the fluid to the piston cylinders which are pivotally mounted through rigid pipe connections it is necessary that the supply be through the pivot point, but it is to be understood that I do not wish to be limited to the specific construction by which I secure this connection, since the inlet may be through other forms of pivotal supports for the cylinders. The connection between the ladder and the valve in the supply pipe which automatically cuts off the supply is an important feature of my invention and it is clearly applicable to other devices than the particular one which I have shown, and therefore I wish to claim this broadly.

As indicated above, the exhaust port 11 may be permitted to discharge into the atmosphere, but I prefer to combine with the main elevating mechanism above described a motor 37 for raising the extension ladder, which motor is connected by a flexible pipe 38 with the said exhaust port 11. The connection between pipe 38 and the socket 11 may be detachable. As clearly shown in Fig. 6, the motor 37 is mounted on the side bars 3 of the main ladder near its bottom, and is provided with a pinion 39 meshing

with a pinion 40 on a drum 41. A rope or other flexible connection 42 is secured at one end to the lower part of the extension ladder 43, passes over a small pulley 44 at the top of the main ladder, and is adapted to wind at its other end upon the drum 41. It will be understood that, as is usual, the extension ladder 43 is mounted to slide lengthwise of the main ladder 3 and constitutes an extension thereof. It is elevated by the winding of the rope 42 upon the drum 41. The motor 37 which operates drum 41 is in turn operated by the pressure of air which is received from tank 9 through the exhaust port 11. It is never necessary to raise the extension ladder until the main ladder has been raised to the position desired, and as has been pointed out at this time, it is no longer necessary to maintain the air pressure upon the liquid in tank 9. That air pressure must be relieved at some time before the ladder descends, and by my combination I utilize it to raise the extension ladder instead of allowing it to exhaust into the atmosphere. I have shown a ratchet wheel 45 on drum 41 to prevent its reverse movement and to hold the extension ladder in an elevated position, and I have also shown a handle 46 which may be used for turning the drum by hand.

Having thus described my invention, what I claim and desire to secure by Letters Patent, is—

1. In a device of the class described, the combination with a ladder pivotally supported near one end, of a tank for compressed air, a tank for a liquid, valve controlled connections between said tanks, a cylinder pivotally mounted beneath said fire apparatus, a piston within said cylinder, a piston rod connecting said piston with the fire apparatus, pipe connection between said liquid containing tank and said cylinder, a valve in said pipe, connection between said valve and fire apparatus whereby the valve is closed when the fire apparatus reaches its upright position, and a valve controlled by-pass around said valve and means for releasing air from said liquid containing tank.

2. In a device of the class described, the combination with a ladder pivotally supported near one end, of means operated by fluid pressure for elevating said ladder on its pivot, means for controlling the supply of fluid under pressure to said operating means, connections between said controlling means and ladder for cutting off the supply when the ladder reaches its elevated position, means for releasing pressure on said fluid supply and a valve-controlled by-pass for returning the fluid under pressure to the source of supply.

3. In a device of the class described, the combination with a ladder pivotally supported near one end, of a tank for containing liquid, means for applying pressure to said liquid, means below said ladder for elevating it operated by the liquid under pressure, pipe connections between said tank and operating means, an automatic valve in said connections for shutting off the supply when the ladder is elevated, a by-pass for releasing the liquid from the elevating means, hand operated valves in said pipe and by-pass, a spring on the end of said ladder and an abutment against which said spring bears when the ladder is vertical.

4. In a device of the class described, the combination with a ladder pivotally supported near one end, of upwardly extending piston cylinders mounted below said ladder, pivotal supports for said cylinders at right angles to the axes of the cylinders and permitting oscillation thereof, fluid supply pipes entering the cylinders through the pivotal supports and being attached to said cylinders, a coupling joining the ends of the supply pipes for adjacent cylinders the said coupling being rotatively connected to the pipes, a supply pipe for fluid under pressure connected to said coupling, an automatic cut off in said pipe, and a valve controlled by-pass connected to said coupling.

5. In a device of the class described, the combination with a pivotally mounted ladder, of a liquid operated piston for elevating said ladder, a tank for containing liquid under pressure, connection between said tank and piston, means for supplying air under pressure to said tank, a valve controlled exhaust port for relieving the air pressure in said tank, an air motor, connection between said exhaust port and motor, an extension ladder carried by the pivoted ladder, and connections between said extension ladder and motor whereby the said motor may raise the extension ladder.

6. In a device of the class described, the combination with a pivoted ladder, of fluid operated means for elevating said ladder, means for exhausting the fluid in said means to relieve the pressure therein, an extension ladder carried by the pivoted ladder, a fluid operated motor for elevating said extension ladder, and connections between said motor and the said exhaust whereby the motor is operated by the exhaust fluid.

7. In a device of the class described, the combination with a pivoted ladder, of fluid operated means for elevating said ladder, means for exhausting the fluid in said means to relieve the pressure therein, an extension ladder carried by the pivoted ladder, a fluid operated motor for elevating said extension ladder, the said motor being carried by the pivoted ladder, and a flexible pipe connecting said motor with the said exhaust whereby the motor may be operated by the exhaust fluid.

8. The combination with a truck, of fire apparatus thereon pivotally supported near

one end, a tank for containing liquid, an air tank, means for admitting air under pressure from said tank to the liquid tank, means below said fire apparatus for raising it on its pivot operated by the liquid under pressure, connections between said liquid tank and said elevating means, an automatic valve in said connections for shutting off the supply when the fire apparatus is elevated, means for releasing pressure in said liquid tank and a by-pass connected with said liquid tank for releasing the liquid from the elevating means.

9. The combination with a truck, of fire apparatus thereon pivotally supported near one end, a tank for compressed air, a tank for a liquid, valve controlled connections between said tanks, means for releasing air from said liquid tank, a cylinder pivotally mounted beneath said fire apparatus, a piston within said cylinder, a piston rod connecting said piston with the fire apparatus, pipe connection between said liquid containing tank and said cylinder, a valve in said pipe, connection between said valve and fire apparatus whereby the valve is closed when the fire apparatus reaches its upright position, and a valve controlled by-pass around said valve for releasing the liquid in the cylinder.

10. In a device of the class described, the combination with a fire apparatus pivotally supported near one end, of upwardly extending piston cylinders mounted below said fire apparatus, pivotal supports for said cylinders at right angles to the axes of the cylinders and permitting oscillation thereof, fluid supply pipes entering the cylinders through the pivotal supports and being attached to said cylinders, a coupling joining the ends of the supply pipes for adjacent cylinders, the said coupling being rotatively connected to the pipes, and a supply pipe for fluid under pressure connected to said coupling.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD F. DAHILL.

Witnesses:
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J. F. C. PADDACK.