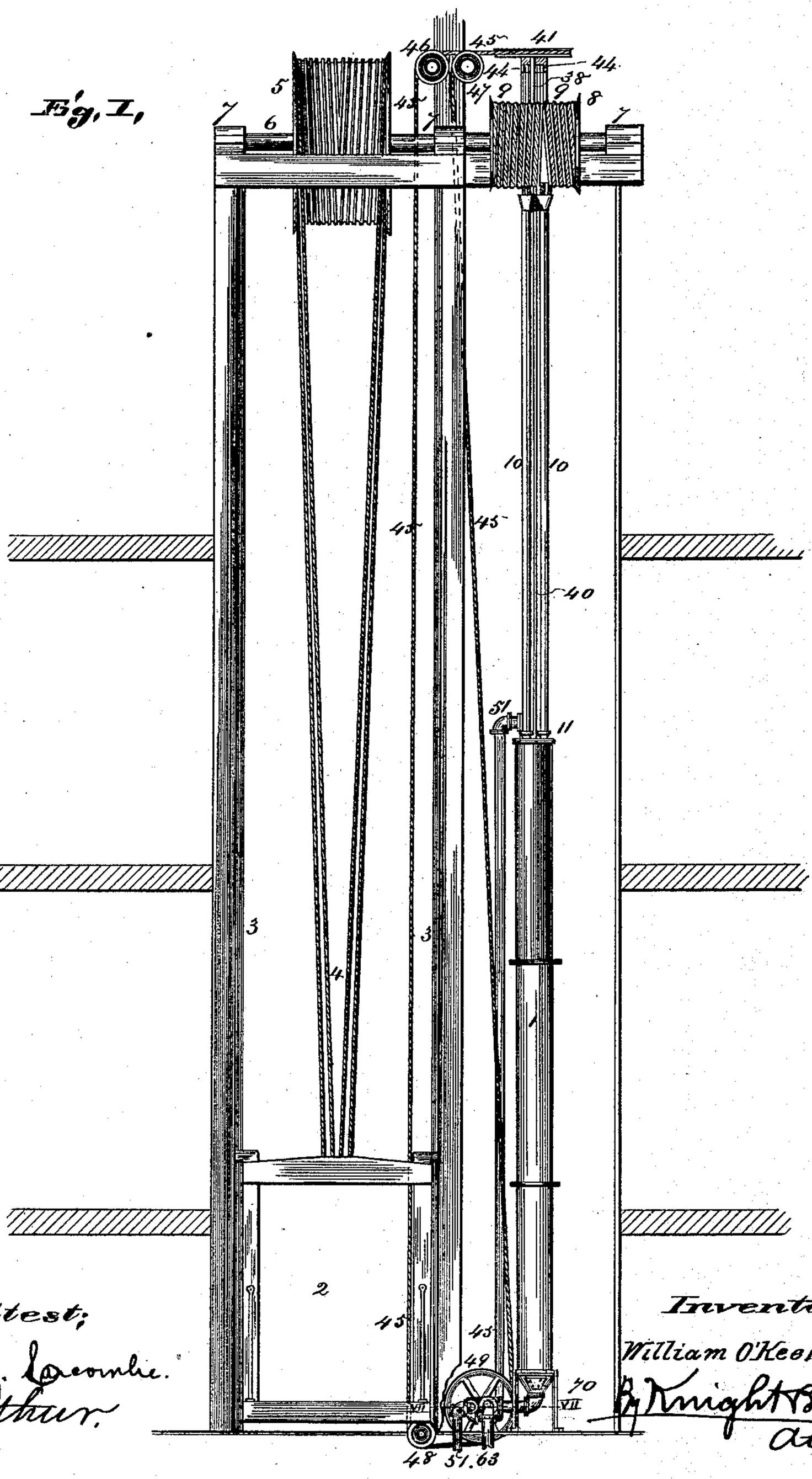
(No Model.) 3 Sheets—Sheet 1.

# W. O'KEEFE.

## HYDRAULIC ELEVATOR.

No. 384,864. Patented June 19, 1888.

Fig. 1.

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## HYDRAULIC ELEVATOR.

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Fig. II,

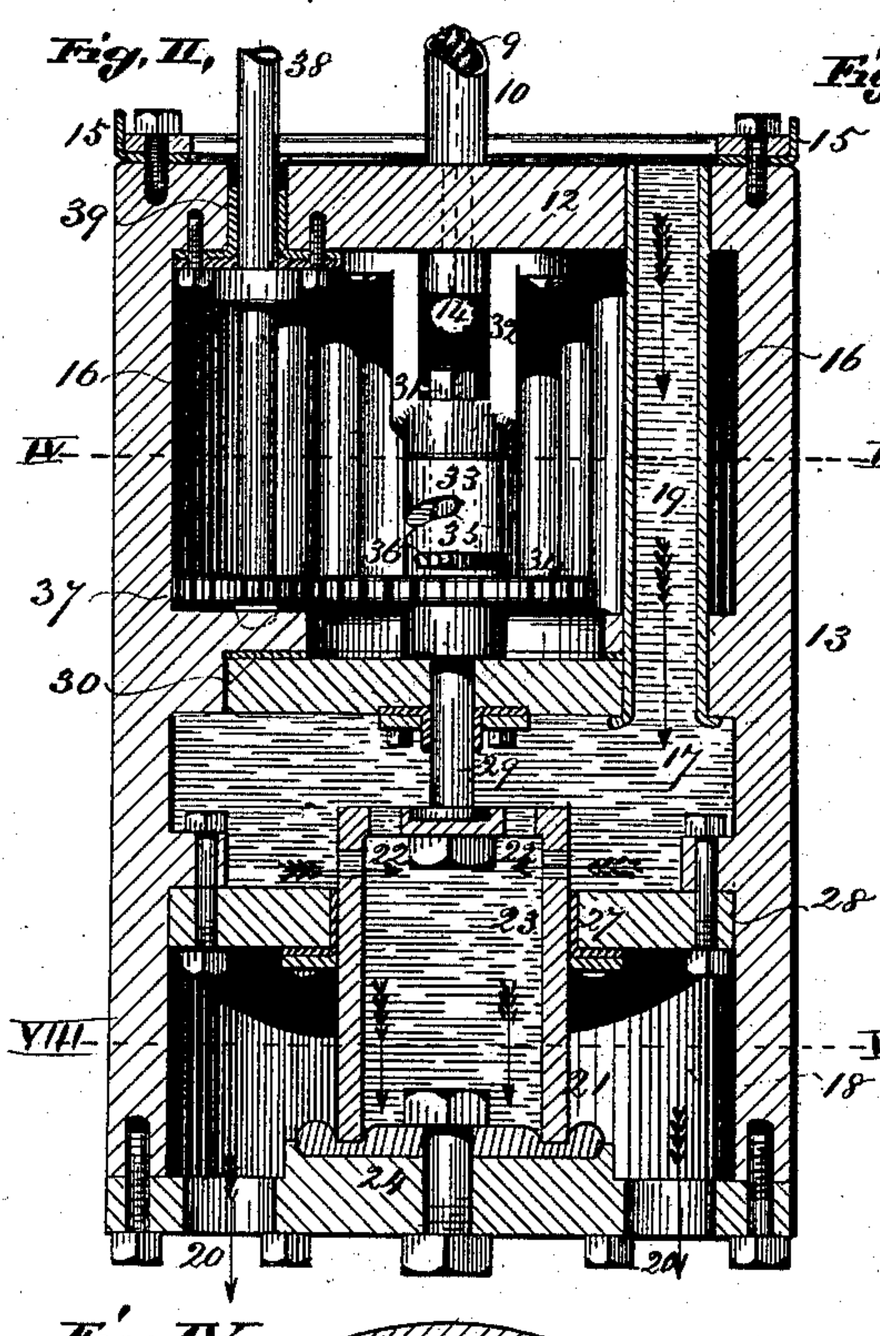



Fig. III,

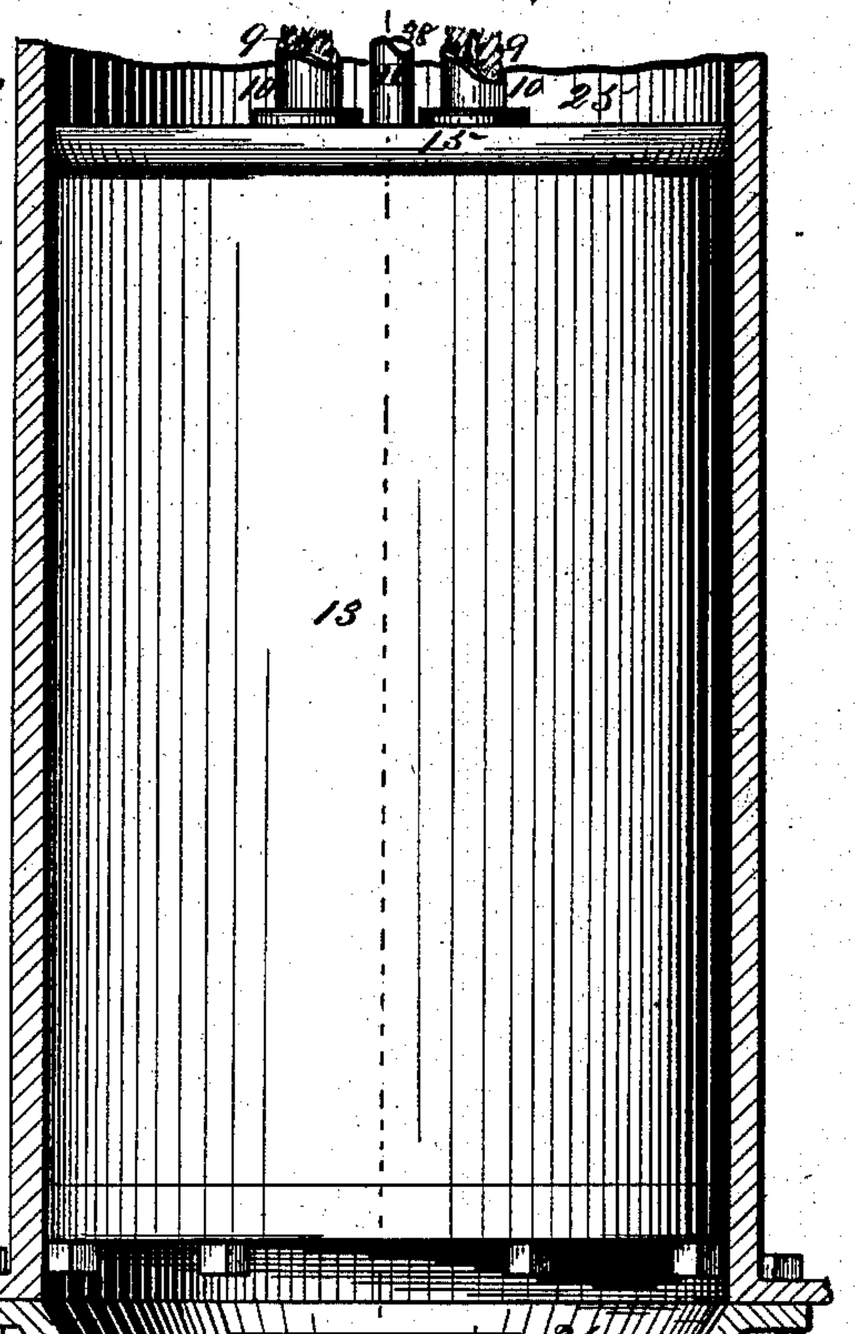



Fig. IV,

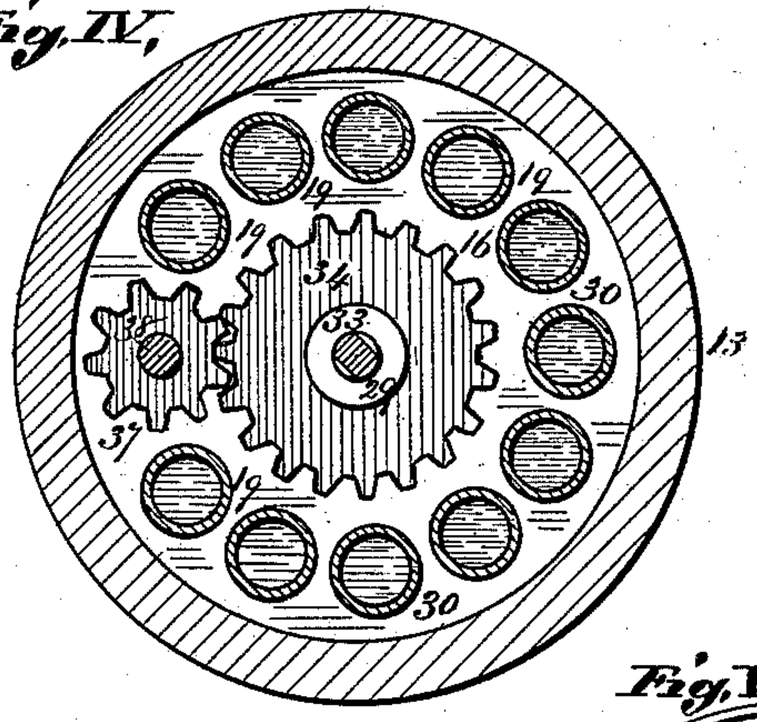



Fig. VI, 9

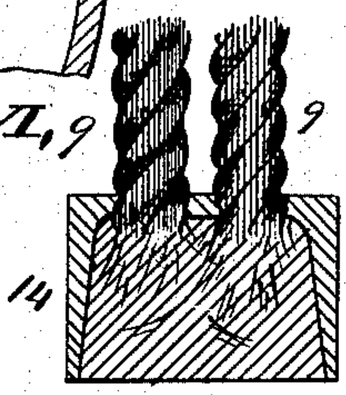
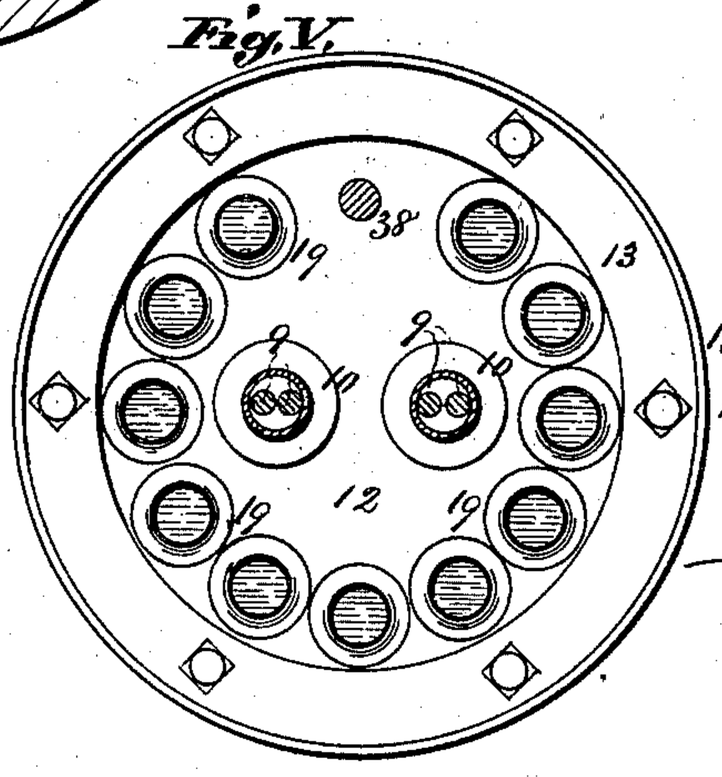



Fig. V.

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## HYDRAULIC ELEVATOR.

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Fig. VII,

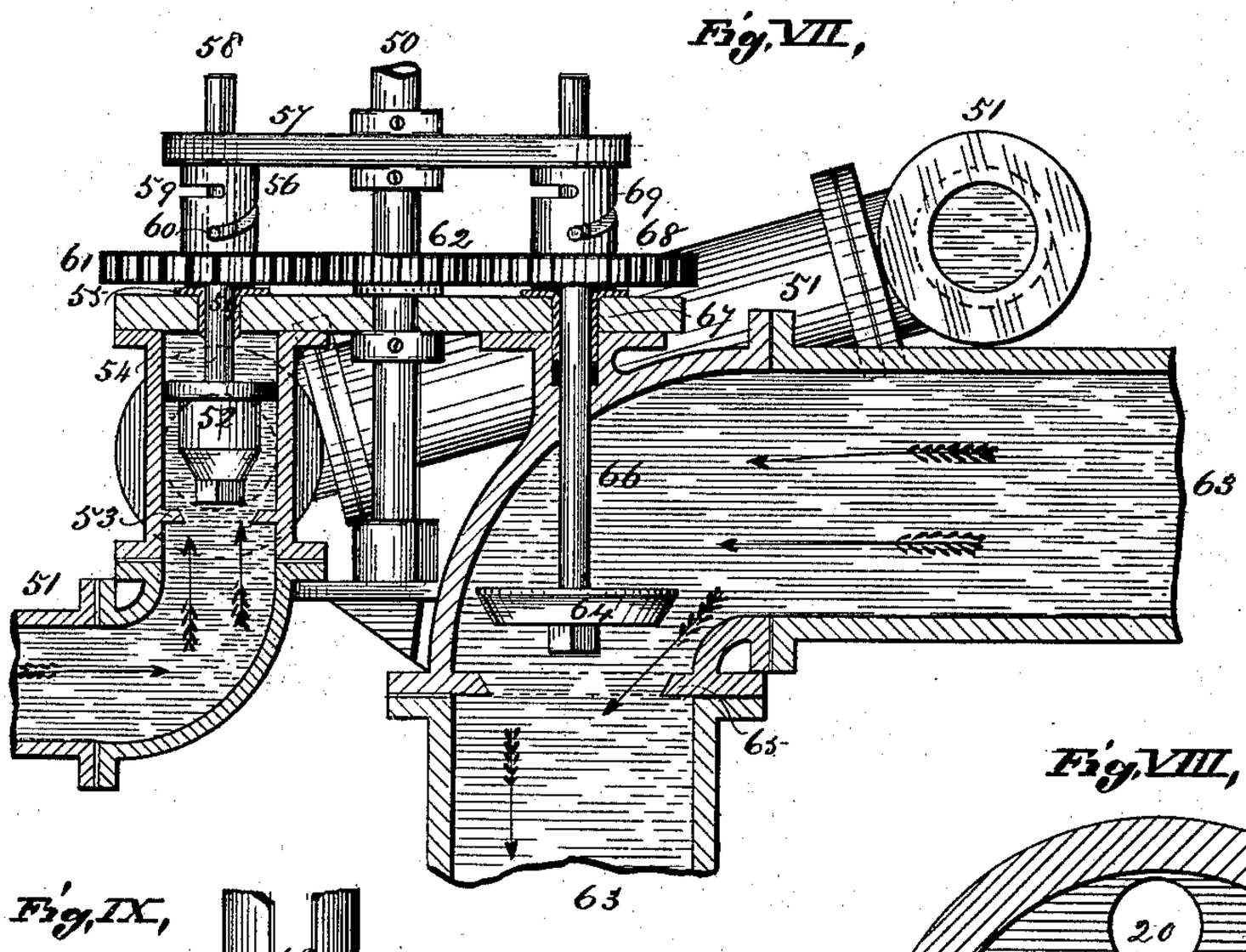



Fig. VIII,

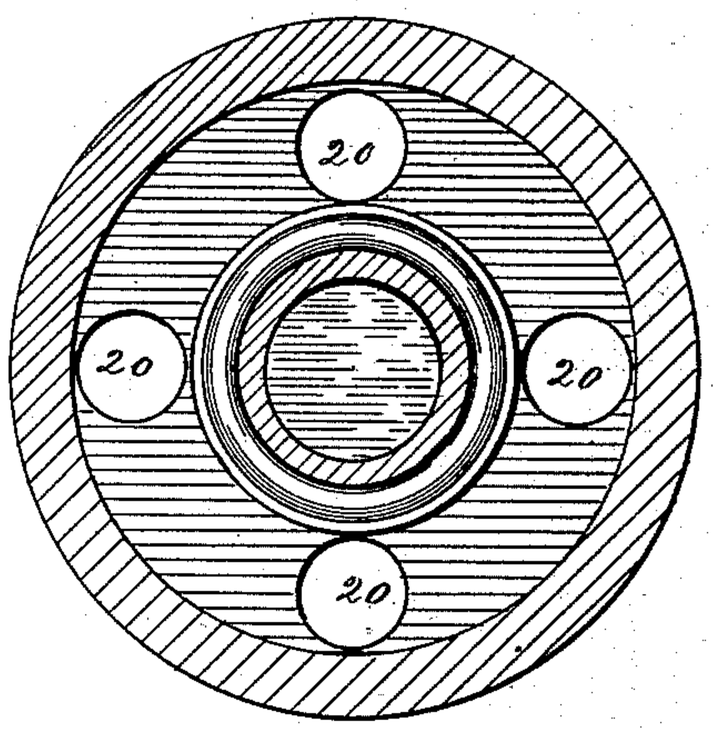



Fig. IX,

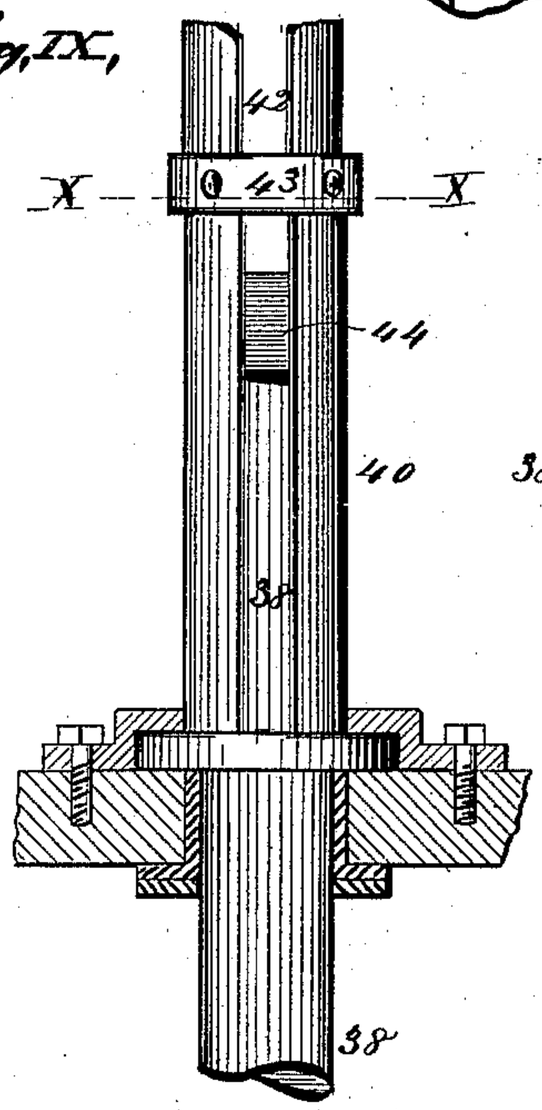
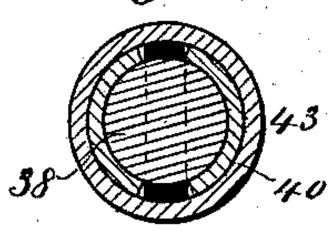



Fig. X,

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# UNITED STATES PATENT OFFICE.

WILLIAM O'KEEFE, OF ST. LOUIS, MISSOURI.

## HYDRAULIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 384,864, dated June 19, 1888.

Application filed October 27, 1887. Serial No. 253,545. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM O'KEEFE, of the city of St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Hydraulic Elevators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, and in which—

Figure I is an elevation of the apparatus with the cab down. Fig. II is a vertical section of the piston-head at II II, Fig. III. Fig. III is a detail vertical section of the cylinder, showing the piston-head in elevation. Fig. IV is a horizontal section of the piston-head at IV IV, Fig. II. Fig. V is a top view of the piston-head. Fig. VI is a vertical section illustrating the manner of securing the cables to the piston-head. Fig. VII is an enlarged horizontal section at VII VII, Fig. I, showing the supply and discharge valves and adjacent parts of the pipes. Fig. VIII is a horizontal section at VIII VIII, Fig. II. Fig. IX is a detail view of the operating rod and sleeve. Fig. X is a horizontal section at X X, Fig. IX.

1 is a vertical water-cylinder, which, in the apparatus as here shown and described, has a height fully equal to half the distance the cab 2 moves in ascending or descending. The cab 2 works between vertical guides 3, with which it is connected in the usual or any suitable way. The cab is supported on wire cables 4, four cables being shown. The upper ends of the cables are attached to a spirally-grooved drum, 5, the points of attachment being near or at the ends of the drum, and the grooves so arranged that as the cables are coiled upon the drum they shall approach each other, and when the cab is at its highest position the cables shall hang from the mid-length of the drum or points in proximity thereto, so that the parts of the cables between the drum and the cab, when the latter is in elevated position, shall be vertical, or nearly so. The drum 5 is fast on a shaft, 6, turning in bearings 7, and having keyed fast to it another drum, 8, which, as here shown and described, is one-half the diameter of the drum 5 and spirally grooved in a similar manner.

9 are wire cables whose upper ends are attached to the drum 8 at or near the ends of the same. The grooves on this drum are arranged in a similar manner to the grooves on the drum 5, so that as the cables are coiled upon the drum they shall approach each other at the points where they hang from the drum, so that at no time shall the cables be much inclined from the vertical. Four of the cables 9 are shown, and, like the cables 4, they are arranged in pairs, each pair passing through a tubular piston-rod, 10, which works through a stuffing-box or cup-packing at 11 in the head of the cylinder 1. The lower ends of the piston-rods 10 and cables 9 are attached to the top 12 of the piston-head 13 in any suitable manner.

In Fig. VI the ends of the cables are shown passing through the top of an anchor, 14, and secured therein by fraying the strands and pouring molten metal into the hollow of the anchor. No novelty, however, is claimed in this manner of securing the ends of wire cables. The top of the anchor has bearing beneath the top of the piston-head. The top of the piston-head has cup-packing 15, preventing the downward passage of water between the piston-head and the cylinder, so that the cab may be raised by the pressure of water upon the top of the piston-head without any loss of water.

It will be understood that the cables 4 and 9 are coiled upon the drums in opposite directions, so that as the cable is coiling on one drum it is uncoiling from the other. The construction of the piston-head is such that the water is allowed to pass vertically through it when the cab is descending and the piston-head rising. The piston-head has three chambers, 16, 17, and 18. The chamber 16 is, or may be, an air-chamber, although the presence of water will not interfere with the working of the mechanism therein.

19 are pipes extending through the top of the piston-head and through the chamber 16 into the middle chamber, 17, so that the latter chamber is in constant communication with the part of the cylinder above the piston-head. The lower chamber, 18, is in constant communication with the part of the cylinder below the piston-head through holes 20 in the bottom of the piston-head.

21 is a hollow cylindrical valve closed at top,

except for a number of holes, 22, by which the interior or chamber 23 of the valve is in communication with the central chamber, 17, of the piston-head, so that the chamber 23 is constantly filled with water when there is water over the piston-head. The annular lower end of the valve 21 rests, when in its downward position, upon a seat, 24, and closes communication between the chamber 23 and the chamber 18, and thus between the part 25 of cylinder above the piston-head and the part 26 below it. The valve 21 passes through hydraulic packing 27 at the diaphragm 28 between the chambers 17 and 18, so that no water may escape from the former chamber into the latter when the valve is closed. This stem 29 of the valve has also packing where it passes through the diaphragm 30. The valve-stem has a square or non-circular part, 31, which passes through a bearing, 32, fixed to the top, 12, of the piston-head. The construction is such that the stem has free endwise or vertical movement in its bearing, but is restrained from turning.

33 is a sleeve turning upon the stem and carrying a cog-wheel, 34.

35 is a cam-slot in the sleeve extending completely through it from the valve-stem to the outside of the sleeve. The lower part is horizontal.

36 is a pin projecting from the valve-stem into the slot. The construction is such that when the sleeve is turned while the pin is in the horizontal part of the slot the valve 21 is not moved; but when the pin is in the inclined part of the slot the valve is raised or lowered, according to the direction in which the sleeve is turned.

37 is a cog-wheel meshing into the cog-wheel 34. The wheel 37 is upon a shaft, 38, passing through hydraulic packing 39 in the top of the piston-head. The shaft extends also through packing in the cylinder-head and into a sleeve, 40, which extends from the cylinder-head to the cable-drums, where it carries a cord-pulley, 41. The sleeve is longitudinally slotted through on both sides from near its top to near its bottom. The slot is seen at 42, Fig. IX. The sleeve is surrounded at intervals by bands 43, to prevent the spreading of the slots. The shaft 38 has at or near its upper end projections 44, which work in the slots 42, and while permitting the free vertical movement of the shaft in the sleeve causes the sleeve and shaft to turn together, so that when the pulley 41 is turned the shaft is turned and the valve 21 raised or lowered by the described means.

45 is the operating cord or cable, which passes around the pulley 41 and over two guide-pulleys, 46 and 47. From the pulley 46 the cord or cable 45 extends vertically downward to a pulley, 48, passing through the floor of the cab or just beside the floor, so as to be in easy reach of the person having charge of the cab. From the pulley 48 the cord passes to and around a pulley, 49, upon a shaft, 50. The cord 45 is prevented from slipping on either of the pulleys 41 or 49, because it is absolutely necessary that they should be turned simultaneously. This may be done in various well-known ways. For instance, the cord may be attached to the pulley or may take one or more turns around it, (or both;) or the grooves of the pulleys may be of such a character as to prevent any slip of the cord. This may be done by forming the groove with transverse or oblique ribs or by making it acute, so that the cord would be pressed tight in the groove. I will now turn to the water-supply to the hydraulic cylinder 1.

51 is a pipe in communication with a city main or other service, from which water may be got of sufficient pressure to work the apparatus. This pipe extends to the upper end of the hydraulic cylinder 1, with which it is in free communication.

52 is a valve in said pipe, closing against a seat, 53, to stop the pipe. The valve-stem 54 extends through a hydraulic packing, 55, and through a sleeve, 56, and a plate, 57. The part 58 of the stem passing through plate 57 is square or of other non-circular form, and passes through a hole of similar form in the plate, so that the stem is thereby prevented from turning. The sleeve 56 upon the stem 54 has a cam-slot, 59, the upper part of which is circumferential or at a right angle to the stem, and the lower part of which is oblique.

60 is a pin fixed in the stem and passing into the cam-groove. The construction is such that if the sleeve is turned while the pin is in the oblique part of the cam-slot the valve 52 is moved to or from its seat; but if the pin is in the circumferential part the turning of the stem imparts no movement to the valve. The sleeve 56 carries a cog-wheel, 61, which engages with a cog-wheel, 62, on the shaft 50, so that by turning the shaft 50 the sleeve 56 is turned. The lower part, 26, of the cylinder is in communication with an eduction or waste pipe, 63, through which the water has free escape when a valve, 64, is open. The seat of this valve is seen at 65.

66 is the valve-stem passing through packing 67 and through the guide-plate 57. The part 68 of the valve-stem passing through the guide-plate is square or otherwise non-circular, and passes through a similar hole in the guide-plate, to prevent the rotation of the stem, as with valve 52. Upon the stem 66 is a sleeve, 69, similar in all respects to the sleeve 56, so that the two valves 52 and 64 will open and close simultaneously, the sleeves being turned in the same direction by means of the cog-wheels 61 and 68 upon the sleeves, which both engage with the cog-wheel 62. When valves 52 and 64 are open, valve 21 in the piston-head is closed and water will enter the top of the hydraulic cylinder, and will force the piston-head downward and lift the cab. When it is desired to stop the movement of the cab, the operating-cord is moved so as to close valves 52 and 64. In doing this the pin 36 moves along the horizontal part of the cam-slot 35, (in sleeve

33,) and consequently the valve 21 is not moved. A further movement of the operating-cord in the same direction will carry the pin 36 into the oblique part of the cam-slot 35, and the valve 21 will be opened, which will allow the water to pass through the piston-head, and the weight of the cab will carry it downward and draw the piston-head upward in the cylinder, the speed of movement being governed by the weight of the cab and load thereon and the degree to which the valve 21 is opened. It will be seen that the lowering of the cab will be done without any waste of water, and the speed of movement may be regulated with the greatest ease by means of the operating-cord. The speed of ascent may also be regulated by the opening of the valves 52 and 64 to a certain degree. It will be understood that an extreme movement of the operating-cord will open either the valves 52 and 64 or the valve 21, and that when the cord is in an intermediate position all three valves are closed, and then the cab will be stationary. The eduction or waste opening from the hydraulic cylinder 1 is made larger than the induction-opening leading into the top of the cylinder. The purpose of this is to allow such free escape to the water that its weight will act to draw down the piston-head, as it will tend to form a vacuum beneath the piston-head. In order to make this use of the waste water to the greatest degree, air should not be allowed to enter the chamber 26 at the bottom of the cylinder. The air may be excluded by an upward bend in the waste-pipe or by any other suitable air-seal.

At 70 is shown a hand-hole, by which access may be had to the cylinder-chamber 26. The handle is closed by a cover, so as to prevent the entrance of air or escape of water.

In all hydraulic elevators where the water is not perfectly clear, and where it leaves the cylinder at the same end it enters, the sediment causes great damage by cutting the piston-head and cylinder, so that the hydraulic packing is quickly destroyed and channels cut in the metal. It will be seen that these injuries are avoided almost entirely where the water is allowed to escape downward through the piston-head, as the current would wash the head clean each time the piston-head moved upward in the cylinder, the current flowing inward from the packing 15 to the pipes 19. As the packing 15 extends above the level of the piston-head, there is no recess in which the sediment can gather.

It will be seen that the weight of the piston-head with the water contained forms a counter-balance to the cab when the cab is at rest or ascending, the water at such times always filling the chambers 17 18 of the piston-head, and being retained by the valve 21. When, however, the valve 21 is open, the cab is descending, so that the weight of the counterbalancing piston-head is lessened, and thus the weight of the counter-balance varies according to the requirements of the case.

I will now give what I consider the special advantage of the tubular piston-rods 10, containing each one or more cables, 9.

Where a solid piston-rod is used, it may contain a hidden flaw, which will render it weak at that point, and it may break under a heavy strain; but with wire the case is different, for the making of the wire is a practical test of its strength, and when a number of wires are together in a cable its actual strength may be definitely known, and consequently there can be no reasonable possibility of failure. A cable cannot, of course, work through a packing-box or hydraulic packing without a casing; hence the necessity of the tubular piston-rods 10, through which the cables pass. It will be understood that when a cable is stretched it tends to untwist, so that if a single cable or any number of cables were connected centrally to the piston-head the piston-head would be turned within the cylinder. To overcome this tendency, duplicate piston-rods are used, which pass through distinct holes in the cylinder-head, (and thus the turning of the piston-head is prevented.)

I claim as my invention—

1. In a hoisting apparatus, the piston-head working in a hydraulic cylinder provided with longitudinal way for the passage of water, a valve having a stem in said way, a pin on said stem, a cam for engaging under said pin, and a shaft extending through said piston-head for operating said cam, substantially as and for the purpose set forth.

2. In a hoisting apparatus, the combination, with the piston having a water-way from end to end, of a valve and valve-seat interposed in said way, a sleeve having a cam-slot, a stem secured to said valve and against rotation projecting through said sleeve, a pin on said stem engaging in said slot, and a shaft adapted to rotate said sleeve, substantially as set forth.

3. The combination of piston-head 13, having water-way through it, a valve in the lower part of the piston-head governing the water-way, the cam-sleeve 33, with cam-slot, a stud-pin on the valve-stem having bearing in the cam slot, means for preventing the rotation of the valve-stem, a cog-wheel upon the sleeve, and the shaft 38, carrying a cog-wheel engaging the wheel upon the sleeve 33, substantially as and for the purpose set forth.

4. The combination, in a hydraulic elevator, of a cylinder, a piston working in said cylinder and having a water-way through it, a valve controlling the water-way, a shaft operating said valve and adapted to move endwise with the piston and through a hydraulic packing in the cylinder-head, and a tubular shaft telescoped upon the said valve-operating shaft, which latter has endwise movement in the tubular shaft and connection therewith enforcing their simultaneous rotary movement, substantially as and for the purpose set forth.

5. The combination of the three valve-stems 29, 54, and 66 of the piston-head valve, the

inlet-valve, and the outlet-valve, cam sleeves on said valve-stems, pins on the stems having bearing in the cam-slots of the sleeves, said slots having circumferential and inclined portions, as set forth, means for preventing the rotation of the valve-stems, the telescoped shaft 38 40, a pulley on this shaft, connected by the operating-cord with a pulley on the shaft 50, and a cog-wheel on shaft 50, engaging cog-wheels upon the cam-sleeves operating the inlet and outlet valves 52 and 64, substantially as and for the purpose set forth.

WILLIAM O'KEEFE.

Witnesses:

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JOS. WAHLE.