(No Model.)

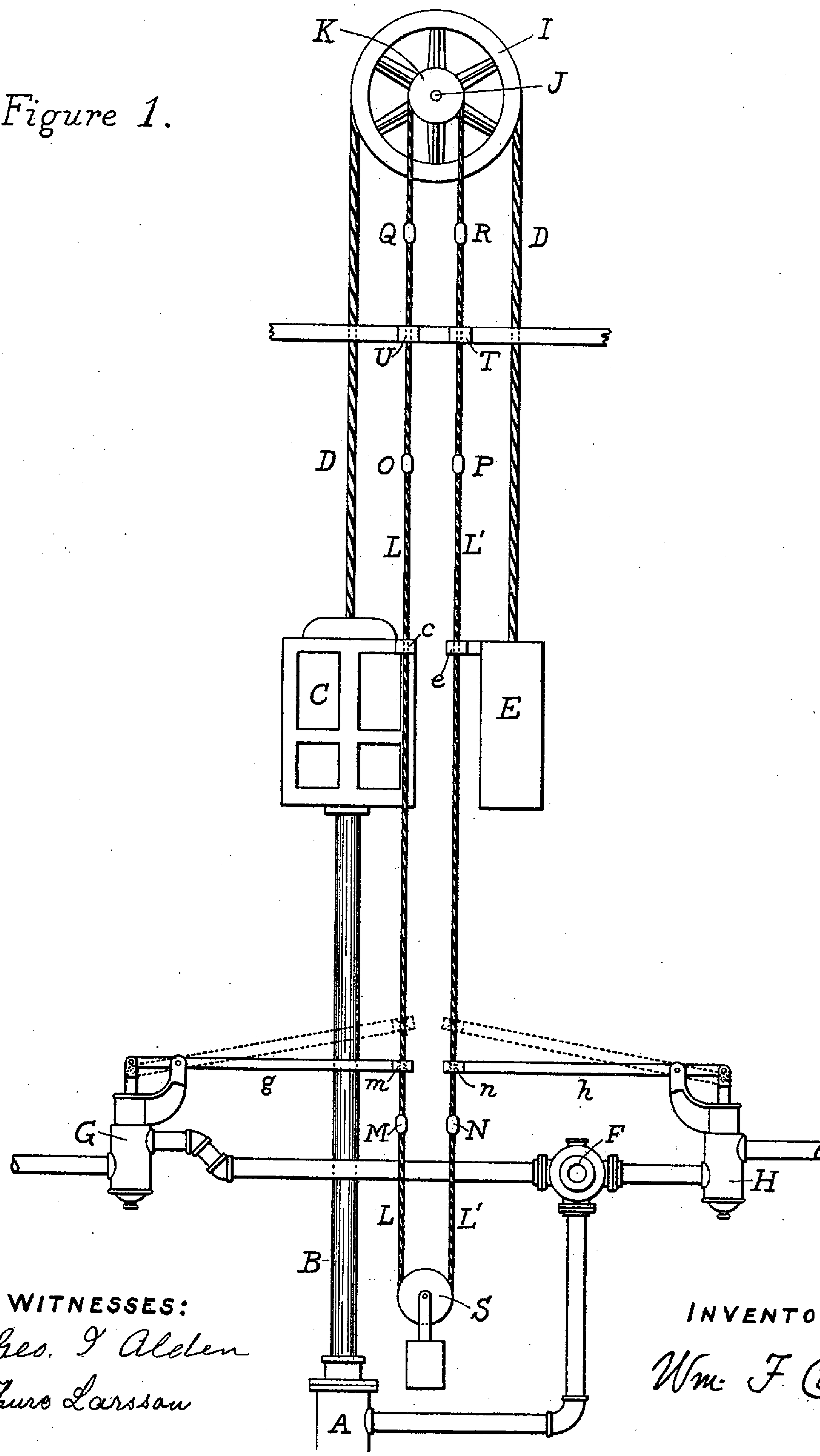
4 Sheets—Sheet 1.

W. F. COLE.

MECHANISM FOR OPERATING VALVES OF HYDRAULIC ELEVATORS.

No. 586,990. Patented July 27, 1897.

Figure 1.



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(No Model.)

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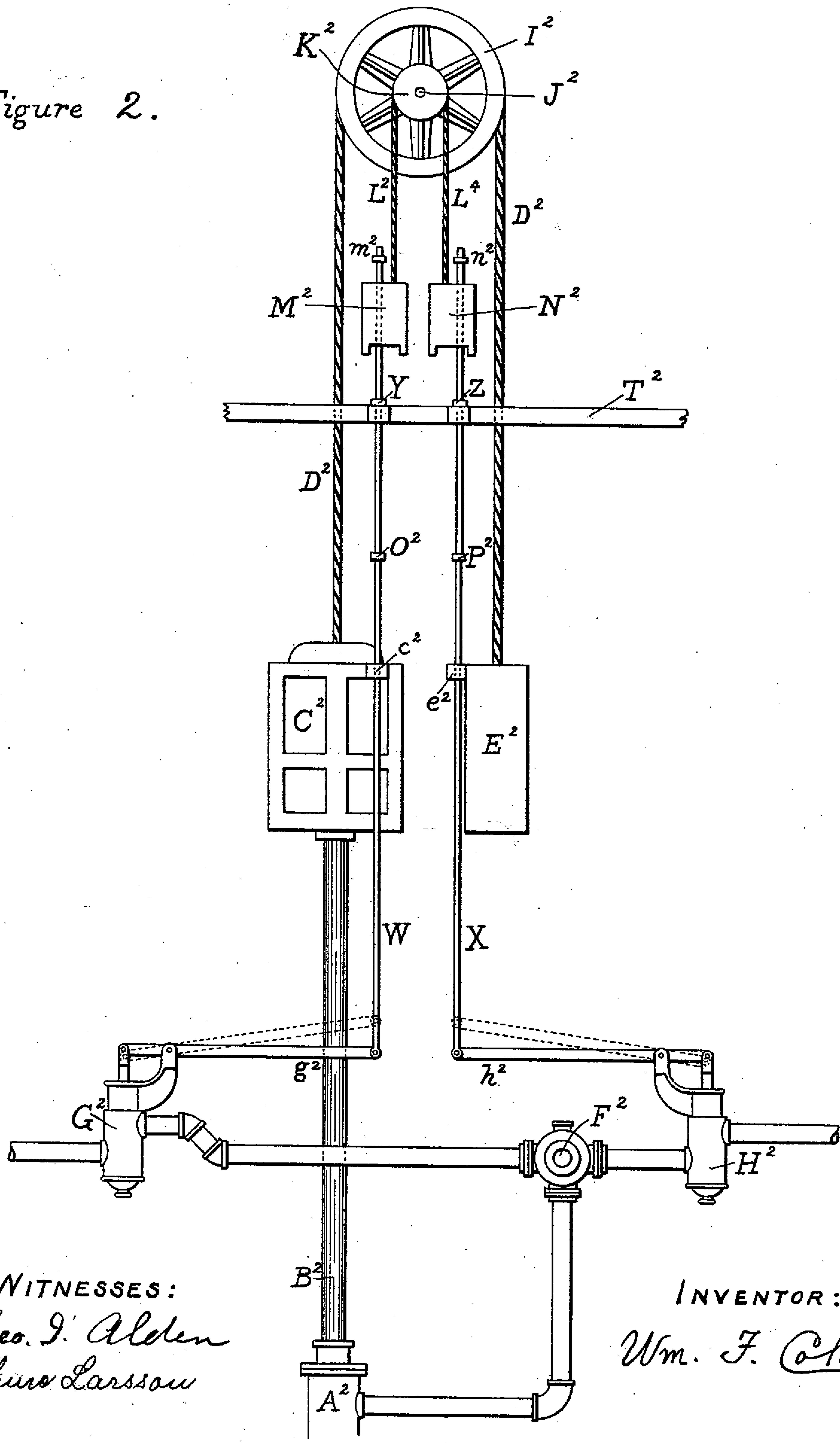
Figure 2.



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MECHANISM FOR OPERATING VALVES OF HYDRAULIC ELEVATORS.

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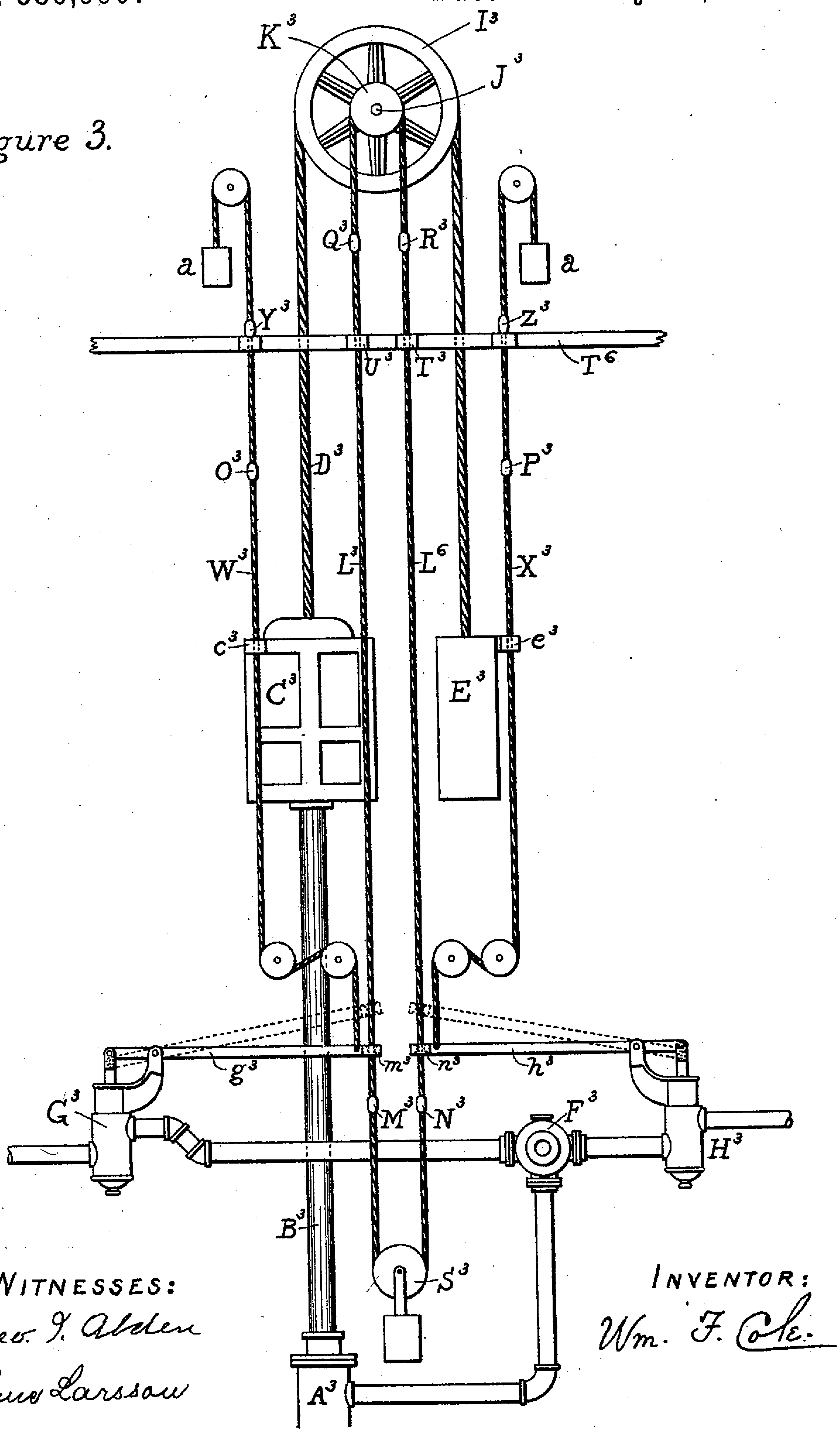
Figure 3.



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4 Sheets—Sheet 4.

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MECHANISM FOR OPERATING VALVES OF HYDRAULIC ELEVATORS.

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Figure 4.

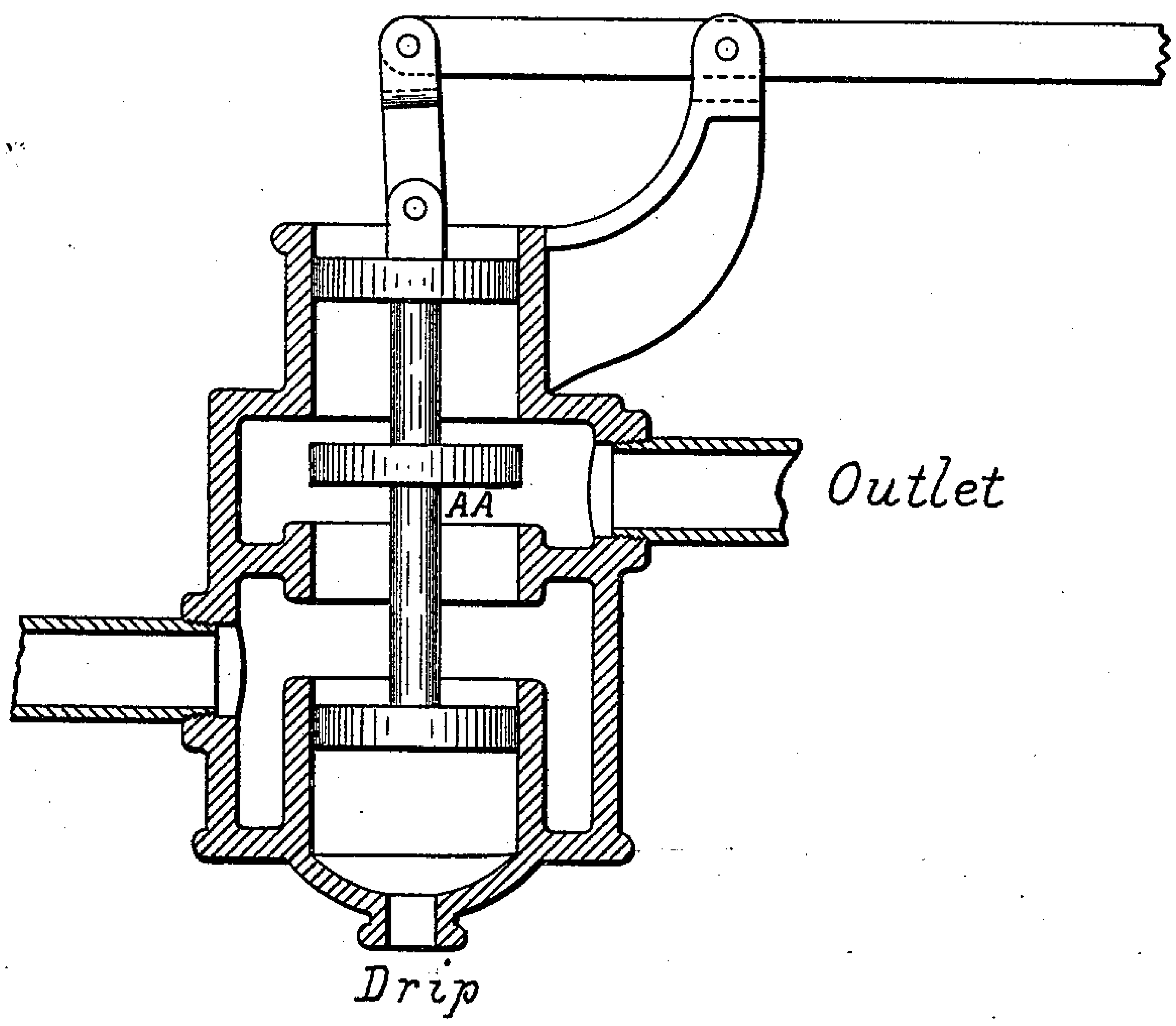
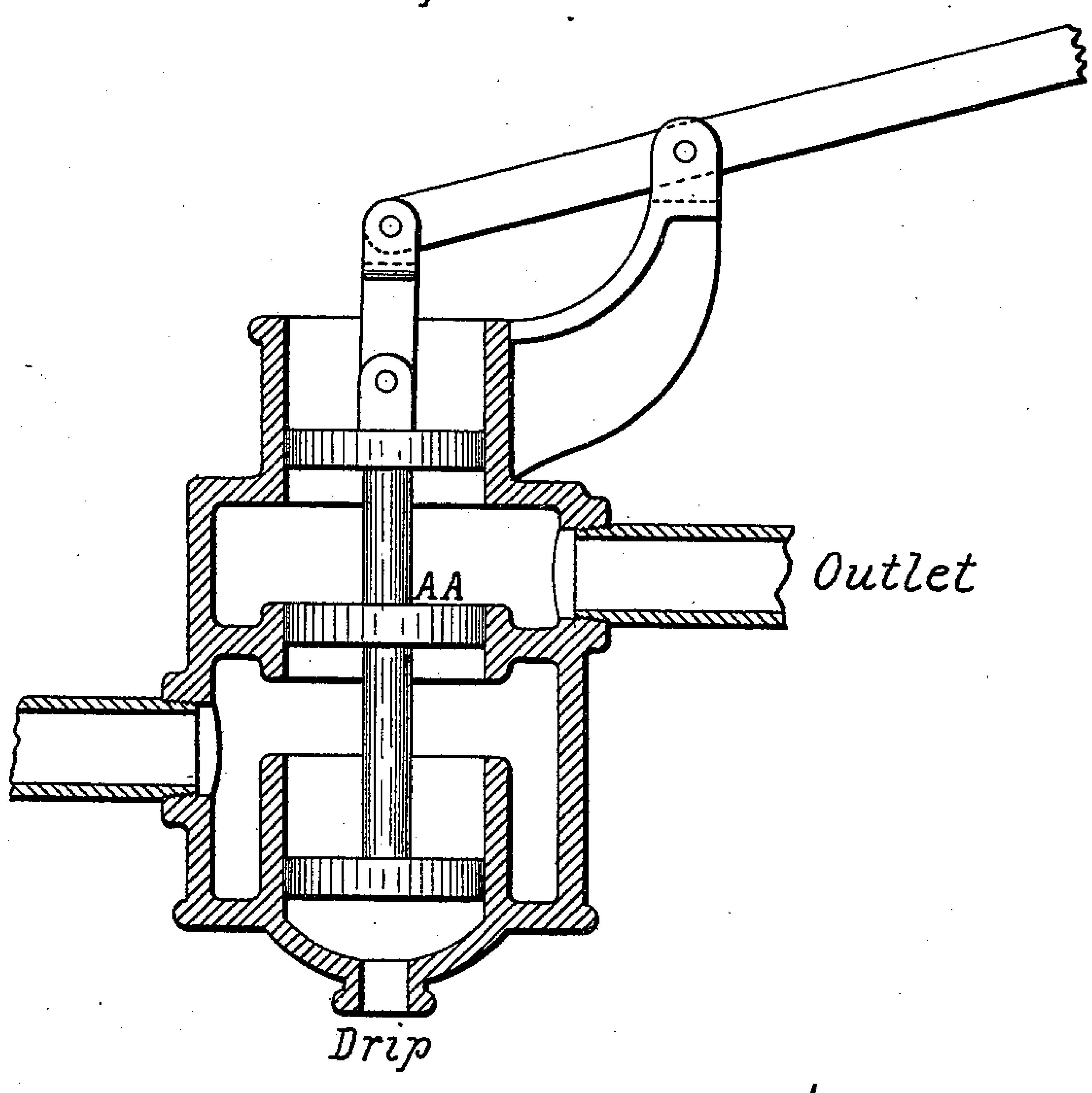


Figure 5.



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UNITED STATES PATENT OFFICE.

WILLIAM F. COLE, OF WORCESTER, MASSACHUSETTS.

MECHANISM FOR OPERATING VALVES OF HYDRAULIC ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 586,990, dated July 27, 1897.

Application filed March 17, 1897. Serial No. 627,946. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM F. COLE, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Mechanism for Operating the Valves of Hydraulic Elevators, of which the following is a specification.

Hydraulic elevators controlled by so-called "pilot-valves" are usually provided with one or more additional valves, arranged to close automatically and thus stop the car at the ends of the run independent of the action of the main controlling-valve.

My invention relates to a mechanism for operating these additional valves, which are usually called and which I hereinafter denominate "safety-valves."

My invention, though applicable to hydraulic elevators of any type, is especially adapted for use with plunger-elevators, as such elevators are constructed without the slow-moving parts which are generally utilized in operating the safety-valves on cable-elevators. I have found it advantageous to employ two safety-valves—one on the supply-pipe before it enters the main controlling-valve, the other on the exhaust-pipe after it leaves the controlling-valve. The former safety-valve closes and stops the car at the top of the run. The latter safety-valve closes and stops the car at the bottom of the run. My invention is particularly adapted for operating two such safety-valves, but can be employed as well to operate a single safety-valve placed in the pipe connecting the controlling-valve with the elevator-cylinder.

To describe my mechanism and its operation, reference is made to the accompanying drawings, comprising Figures 1, 2, and 3, each of which shows a general elevation of my device, but somewhat differently arranged as to detail, and Figs. 4 and 5, which show sections of the so-called "safety-valve."

Like parts or parts performing similar functions are designated on all the drawings by the same letters, but on Figs. 2 and 3 exponents are generally appended to the letters to facilitate the reference.

Referring to Fig. 1, A, B, C, D, and E designate, respectively, the cylinder, plunger, car, counterweight-rope, and counterweight of a hydraulic elevator.

F designates the main controlling-valve, a three-way "pilot-valve" of usual construction. The arrangement for operating this main controlling-valve from the car is not shown. Various methods for doing this are in quite general use, but they in no way relate to my invention, and illustration here would unnecessarily complicate the drawings.

G designates the supply safety-valve—*i. e.*, the safety-valve located in the line of supply-pipe before it enters the main valve F—and H designates the exhaust safety-valve. The pipe connection between these different valves and the elevator-cylinder is clearly shown and can be readily traced.

On Figs. 1, 2, and 3 of the drawings both of the safety-valves are shown in an open position—*i. e.*, the water has free passage through them, as shown in Fig. 4. They are closed to shut off the water by raising the levers *g* or *h* to the dotted positions shown on Figs. 1, 2, and 3. This shifts their stems to the position shown on Fig. 5, in which position the piston A A now effectually stops the passageway through the valve.

I designates the counterweight-sheave, J the counterweight-shaft, while K designates a drum positively connected with the counterweight-shaft J, so as to always revolve therewith. On the drawings this drum is shown as attached directly to the counterweight-shaft J, but in practice the relative arrangement of the parts will frequently demand that this drum be placed on a secondary shaft driven from the counterweight-shaft through the intervention of some positive gearing.

L and L′ designate the two sections of a rope called the "safety" rope or ropes. This rope makes two or three turns around the drum K, and the two sections then extend down the elevator-well, one section, L, passing through an eyelet *c* on the car and the other section, L′, passing through an eyelet *e* on the counterweight. The first section L passes also through an eyelet *m*, suitably attached to the lever *g*, which operates the supply safety-valve G. The other section of the rope L′ passes likewise through an eyelet *n*, suitably attached to the lever h, which operates the exhaust safety-valve H. The two sections L and L′ are then united and passed around the weighted sheave S, which serves to hold them taut. It is now obvious that whenever the car moves the rope L L′ moves also, the section L in the same direction as the car and the section L′ in the opposite direction. This rope L L′ travels, however, at a slower speed than the car, determined by the relative peripheral velocities of the counterweight-sheave I and the drum K. In practice a ready means of suitably proportioning these velocities is afforded by the gearing, which generally has to be introduced between the counterweight-shaft and drum-shaft to secure a convenient location for the ropes, and which has been alluded to above.

M is a clamp or button made fast to the rope L in such a position that it will engage the eyelet m, lift the lever g, and finally close the supply safety-valve G just as the car reaches the top of its run. N is another button arranged to similarly engage the lever h and close the exhaust safety-valve H just as the car reaches the bottom of the run. As the rope L travels slower than the car, (in practice very considerably so,) it is evident that the buttons M and N can be set so as to engage the eyelets m and n, and thus begin to close the safety-valves while the car is yet at some distance from the ends of its run, thus insuring a gradual and very easy stop.

To provide for any possible slipping of the rope L L′ on the drum K and to make the device positive in its action, a button O is fastened to the rope L in such a position that the eyelet c on the more rapidly moving car will overtake and engage this button O just before the car reaches the end of its run. As by this time the elevator has been brought very nearly to rest by the gradual closing of the safety-valve G, the eyelet c strikes the button O so gently as to occasion no shock or jar and the safety-valve G is finally closed tight by motion of the car itself. Should the rope L slip back any on the drum K, as soon as the eyelet c picks up the button O, the tension is taken off of that portion of the rope between the button O and drum K, and the weight of the sheave S, pulling on the opposite section L′, draws the rope forward again to its proper position, while the correctness of the stop is in no way impaired.

To prevent a premature stopping of the car in case the rope L has slipped forward on the drum K, (or what is in effect the same, viz: if the counterweight-rope D has slipped back on the sheave I,) another button R is provided on the reverse section of the rope L′ and set to strike a fixed eyelet T (through which the rope passes) when the car lacks perhaps a couple of inches of being at the end of the run. (It makes a very good adjustment to have the button R engage the eyelet T simultaneously as the eyelet c engages the button O, but exactness is not necessary.) Now as soon as this button R strikes the eyelet T the tension is taken from that portion of the rope-section L′ between this button R and the drum K, allowing the drum to revolve without imparting further movement to the rope. The rope is thus slipped back where it belongs and the final stopping of the car is correctly effected.

As soon as the car is started down by reversing the main valve F the supply safety-valve G is opened by the weight of the lever g (or its equivalent) as fast as the slower-moving button m will allow. The elevator is stopped smoothly at the bottom of the run by the gradual closing of the exhaust safety-valve H, begun when the button N on the now upward-moving rope-section L′ engages the eyelet n and completed when the eyelet e on the counterweight engages the button P. The button Q and fixed eyelet U correct in the same manner as the button R and fixed eyelet T any slipping of the rope that would vitiate the correctness of the stop.

In the modification shown in Fig. 2, A^2, B^2, C^2, D^2, and E^2 designate, respectively, the plunger, car, counterweight-rope, and counterweight. I^2 designates the counterweight-sheave, J^2 the counterweight-shaft, and K^2 the drum, made fast to this shaft. The rope L^2 L^4 makes two or three turns around the drum K^2, and is held taut by the weights M^2 and N^2, hung one from each end of the rope. T^2 is a shelf projecting into the well-room somewhat above the run of the car and so located that the weights M^2 and N^2 alternately lodge upon it just before the car reaches the ends of the run, thus relieving the tension from one section of the rope and allowing the rope to slip on the drum in case the adjustment has become impaired. To the end of the safety-valve levers g^2 and h^2 are attached the rods W and X, which extend up the well-room, passing one through an eyelet c^2 on the car, the other through an eyelet e^2 on the counterweight. The rod W passes also through an eyelet in the shelf T^2 and a hole through the weight M^2, while the rod X passes through another eyelet in the shelf T^2 and then through a similar hole in the weight N^2. Y and Z are collars on the rods W and X, which rest upon the shelf T^2, and thus prevent the levers from dropping too low. m^2 is a collar placed on the rod W so that the weight M^2 will engage it, pick up the rod, and thus begin to close the supply safety-valve G^2 while the car is some little distance from the end of the run. The eyelet c^2, carried by the car, overtakes and engages the collar O^2 when the car has almost reached the top of the run, making the stop positive. As the car approaches the bottom of the run the weight N^2 engages the collar n^2, gradually closing the exhaust safety-valve H^2, and finally the counterweight-eyelet e^2 overtakes and picks up the collar P^2, making the stop complete.

It is sometimes inconvenient or undesirable to locate the rope from the drum so as to pass through eyelets both on the car and counterweight. In such a case I introduce an auxiliary rope or ropes, as shown on Fig. 3. Here the rope-sections L^3 L^6 do not pass through the car and counterweight-eyelets, but instead two auxiliary ropes W^3 and X^3 are attached to the safety-valve levers. After passing over as many sheaves at the bottom of the well as may be necessary to bring them to the desired position these ropes extend up through the eyelets c^3 and e^3 to the top of the run. The little weights *a a*, attached to the ends of these ropes, are only heavy enough to slightly overbalance the weight of the ropes themselves and thus prevent these ropes from becoming slack when the safety-valves are partly closed. The buttons Y^3 Z^3 rest upon the shelf T^6 and prevent the valve-levers from dropping too low.

I have found in practice that the counterweight-eyelet *e* and the button P may be safely omitted, as the adjustment is corrected by the buttons R and Q and eyelets T and U every time the elevator goes to the end of the run. It would be practicable to omit instead of the counterweight-eyelet *e* the car-eyelet *c* and stop O and depend wholly upon this counterweight-eyelet *e* and the remaining buttons and eyelets to preserve the correct adjustment, but where convenient I prefer to keep both car and counterweight-eyelets as additional safeguards.

Modifications of this device other than those illustrated and described will readily present themselves to the intelligent artisan. Therefore I do not limit my invention to the precise arrangement shown, but broadly claim the following, viz:

1. In an elevator-controlling device the combination of a car and a counterweight, a shaft and a sheave thereon, a rope connecting said car and counterweight and passing over said sheave, a drum positively connected with said shaft and always revolving therewith, a valve-rope driven by said drum, and a safety-valve arranged to be closed by the motion of said valve-rope.

2. In an elevator-controlling device, the combination of a moving car, a slower-moving valve-rope, a safety-valve arranged to be nearly closed by movement of this rope, a button, such as O, suitably connected with the safety-valve, and an eyelet on the car adapted to engage the button O and complete the closing of the valve.

3. In an elevator-controlling device, the combination of a moving car and counterweight, a slower-moving valve-rope, a safety-valve arranged to be nearly closed by movement of this rope, a button, such as P, suitably connected with the safety-valve, and an eyelet on the counterweight adapted to engage the button P and complete the closing of the valve.

4. In an elevator-controlling device, the combination of a moving car and counterweight, a slower-moving valve-rope, two safety-valves (supply and exhaust) arranged to be alternately nearly closed by the movement of this rope, two buttons, such as O and P, suitably connected one with each of the safety-valves, and two eyelets, one on the car, the other on the counterweight, adapted to alternately engage one of the buttons and complete the closing of one of the safety-valves.

5. In an elevator-controlling device, the combination of a drum revolved by the counterweight-shaft, a valve-rope driven by said drum and having two sections hanging in the elevator-well, a weight normally acting simultaneously on each section of the valve-rope, two fixed eyelets through which the valve-rope sections pass, and two buttons so attached, one to each section of the valve-rope as to alternately engage the fixed eyelets and take the weight from one section of the valve-rope, all for the purpose above described and specified.

6. In combination with an elevator-controlling device, a drum revolved by the counterweight-shaft, a suitably-tensioned valve-rope driven by said drum and means for taking the tension from each section of the rope alternately as the elevator reaches the end of its run.

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