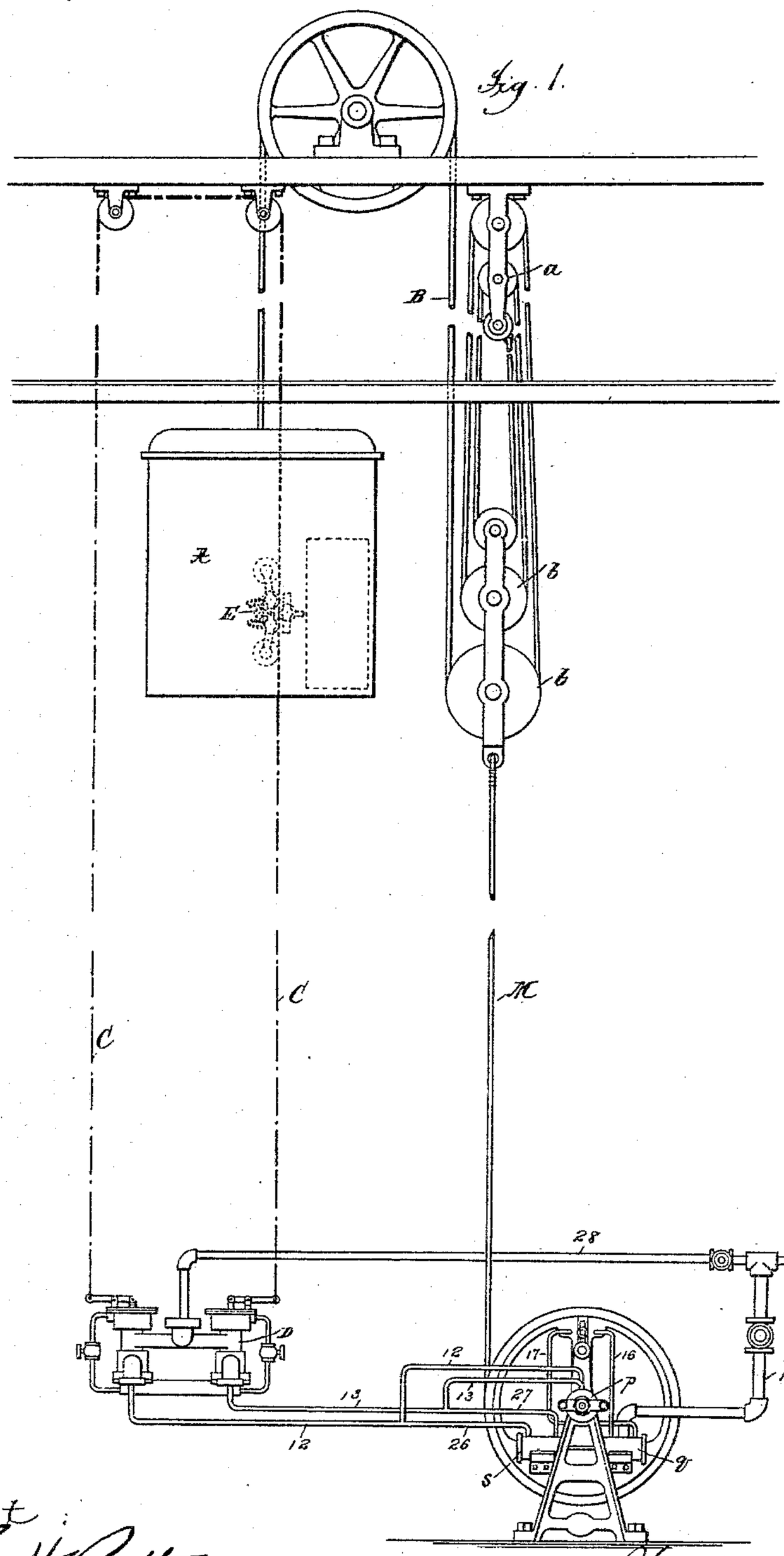
(No Model.) 4 Sheets—Sheet 1.

W. P. GIBSON.

HYDRAULIC MOTOR.

No. 412,331. Patented Oct. 8, 1889.

Fig. 1.



Attest:
Geo. H. Boltz.
Edward Wood

Inventor:
William P. Gibson
By Philip P. Fields & Hoover
Attys

N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.) 4 Sheets—Sheet 2.

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Fig. 3.

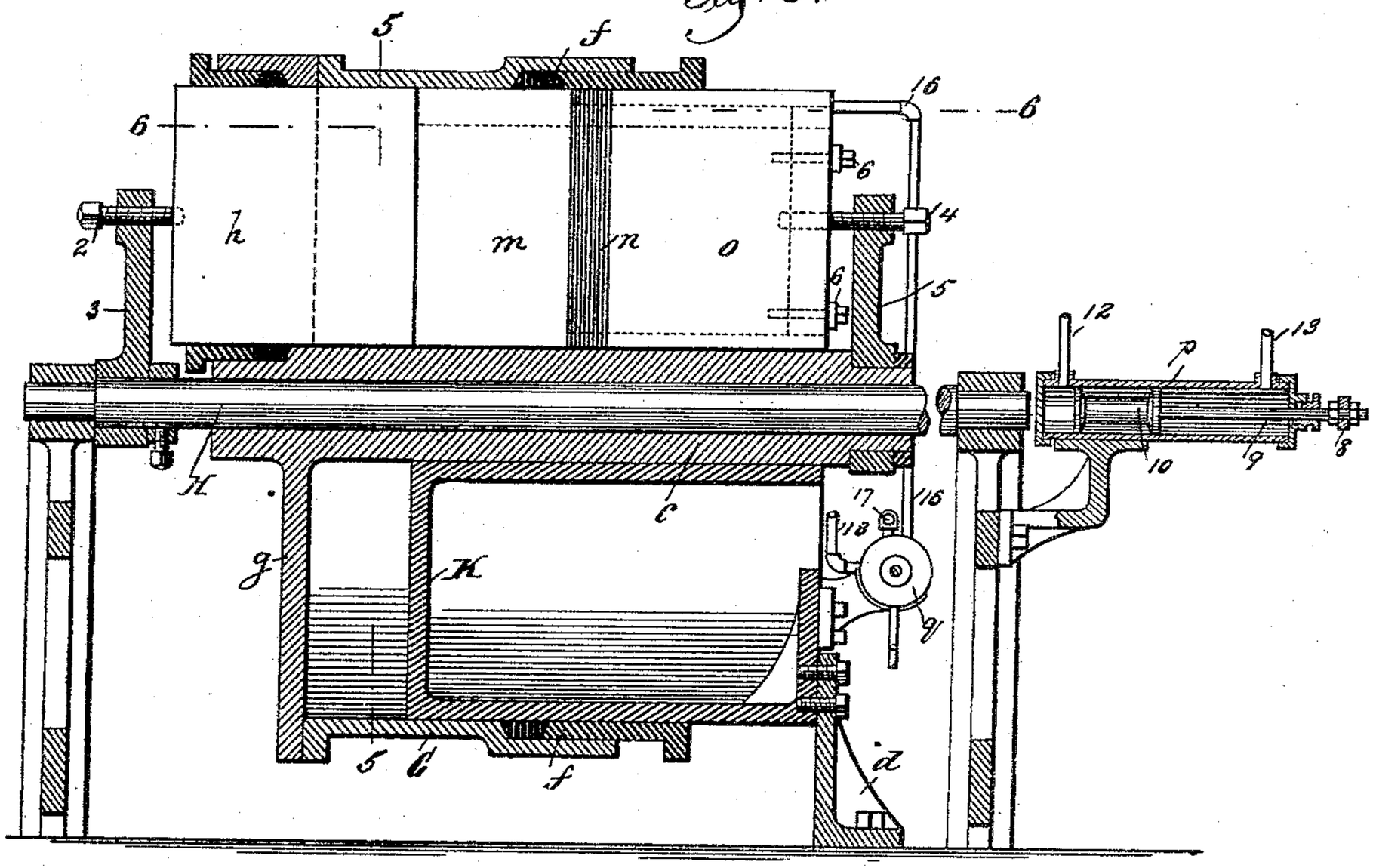
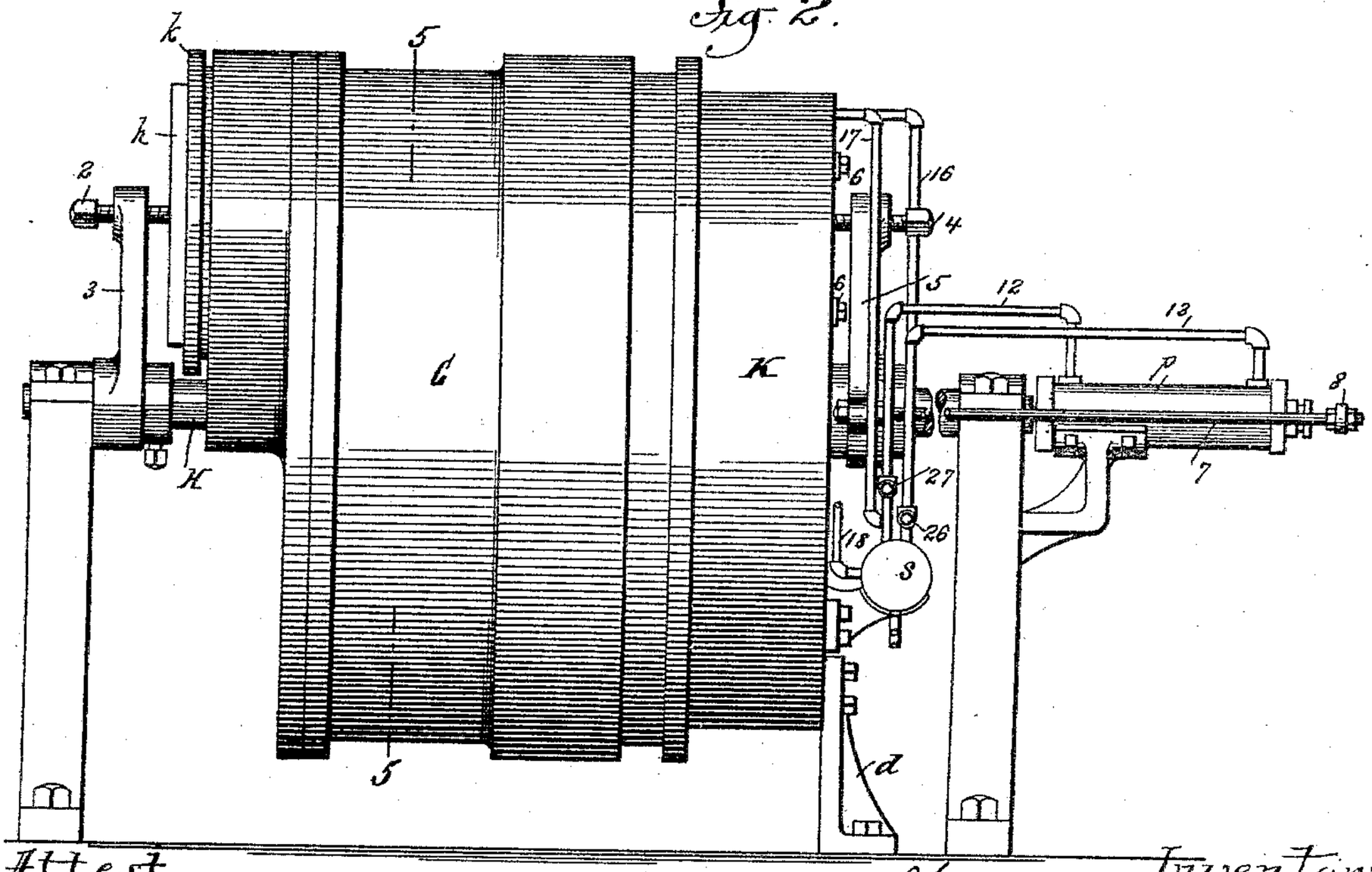


Fig. 2.



Attest
Geo. H. Boltk.
Edward Wood

Inventor:
William P. Gibson
By Philipp Phelps & Hovey
Atty.

(No Model.) 4 Sheets—Sheet 3.

W. P. GIBSON.

HYDRAULIC MOTOR.

No. 412,331. Patented Oct. 8, 1889.

Fig. 4.

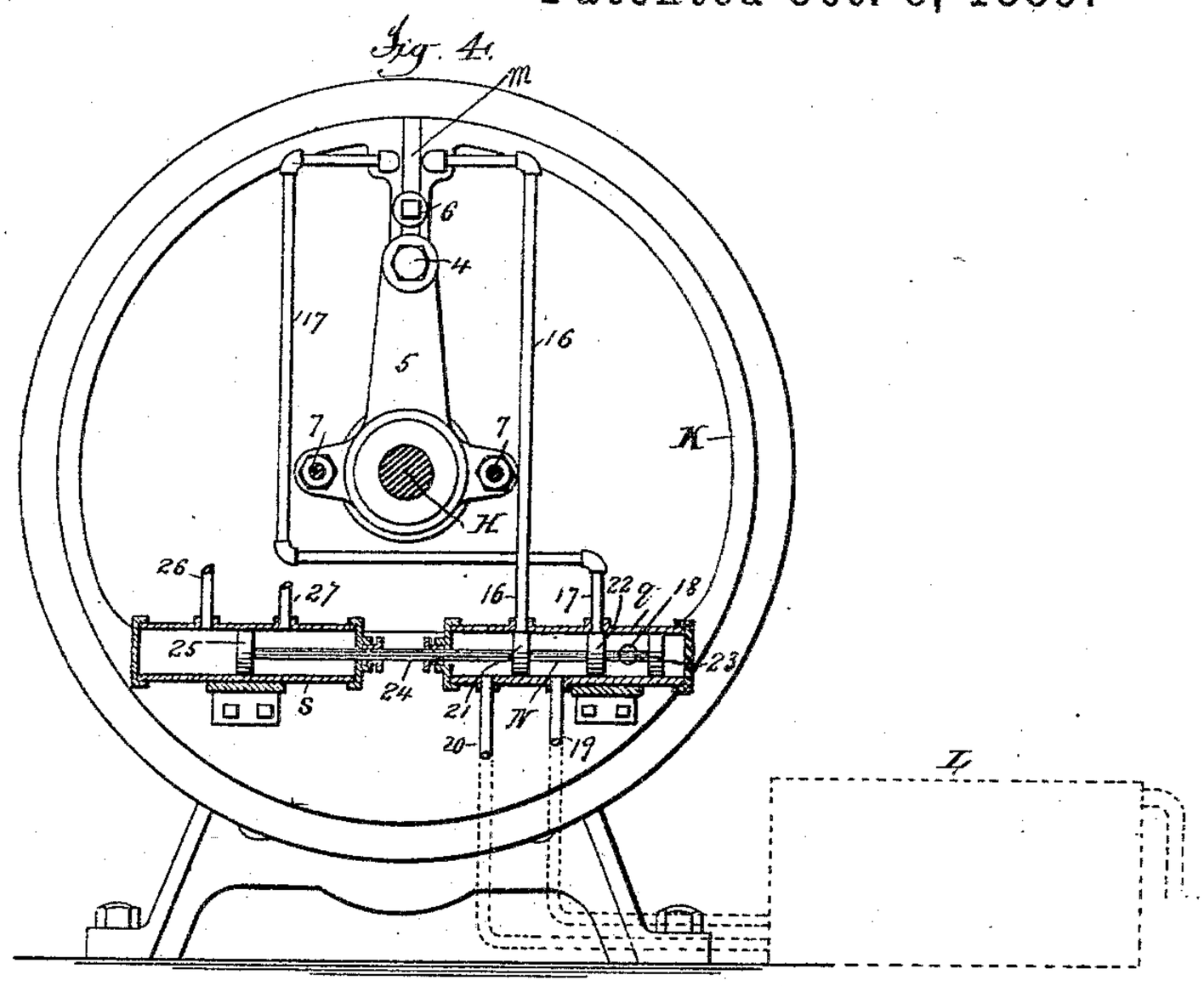
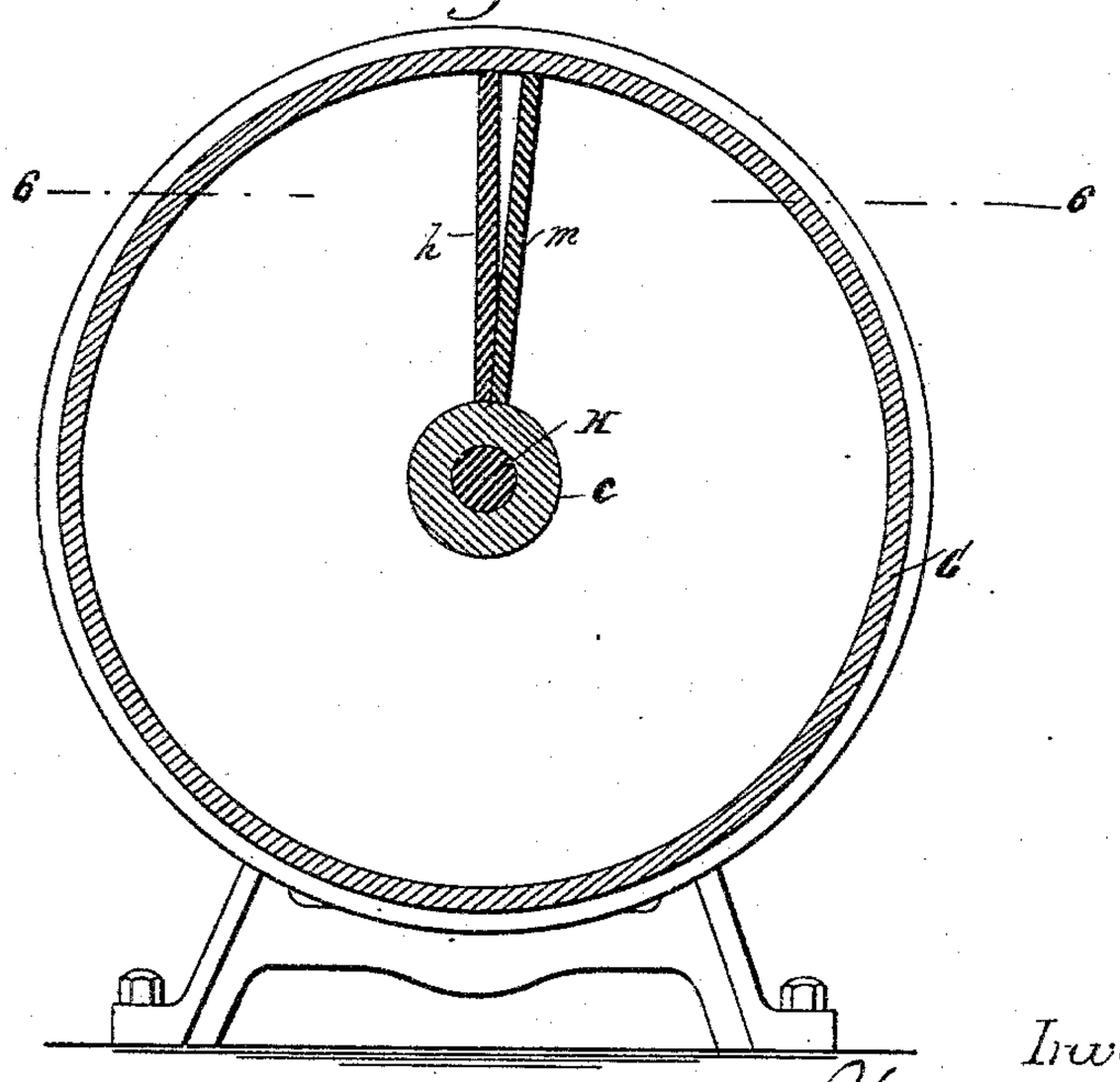


Fig. 5.



Attest:
Chas. H. Bates.
Edward Wood

Inventor:
William P. Gibson
By Philip P. Phelps Hovey
Attys:

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 4 Sheets—Sheet 4.

W. P. GIBSON.

HYDRAULIC MOTOR.

No. 412,331. Patented Oct. 8, 1889.

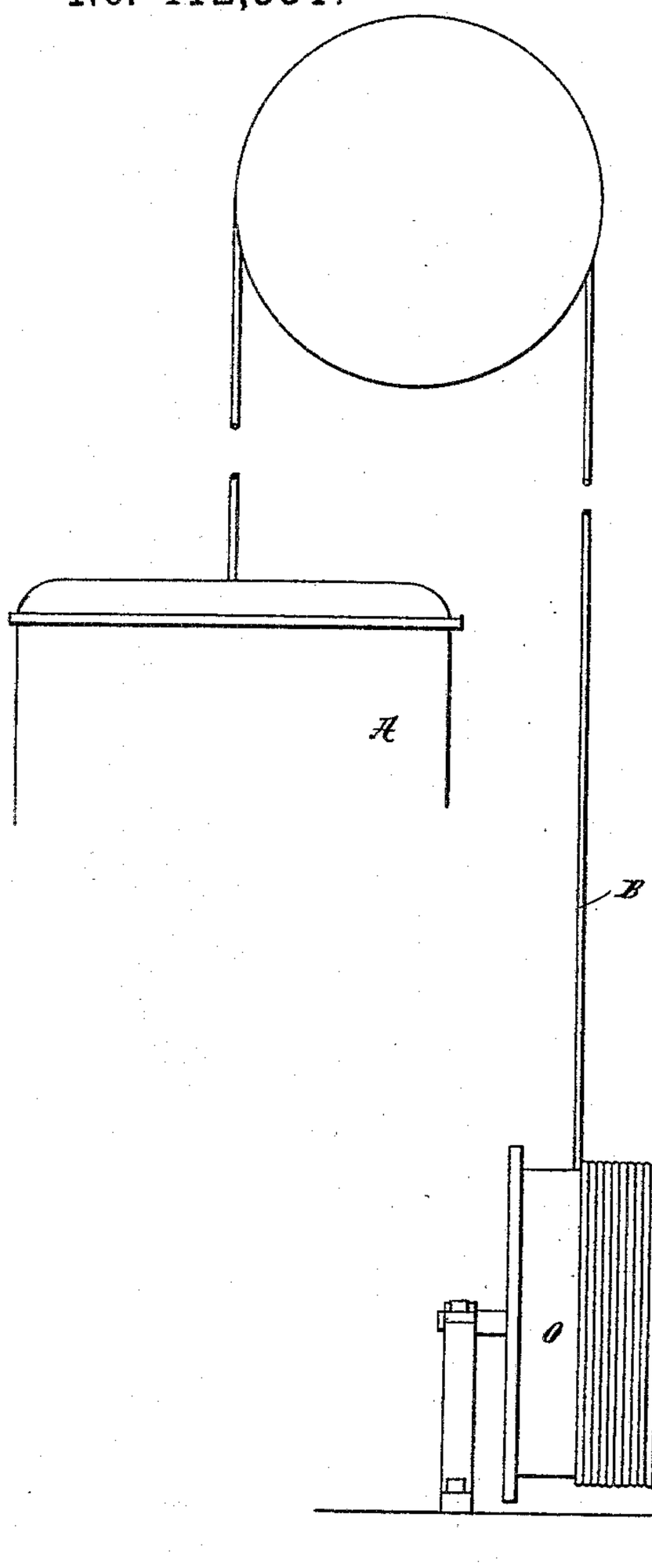


Fig. 6.

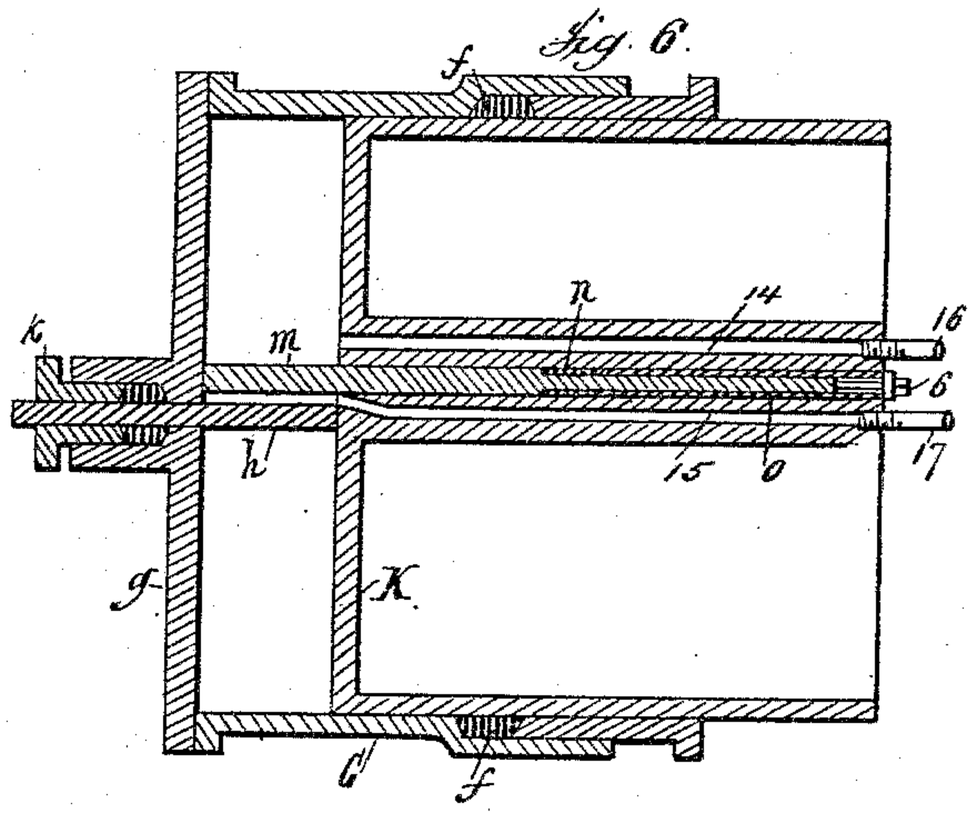
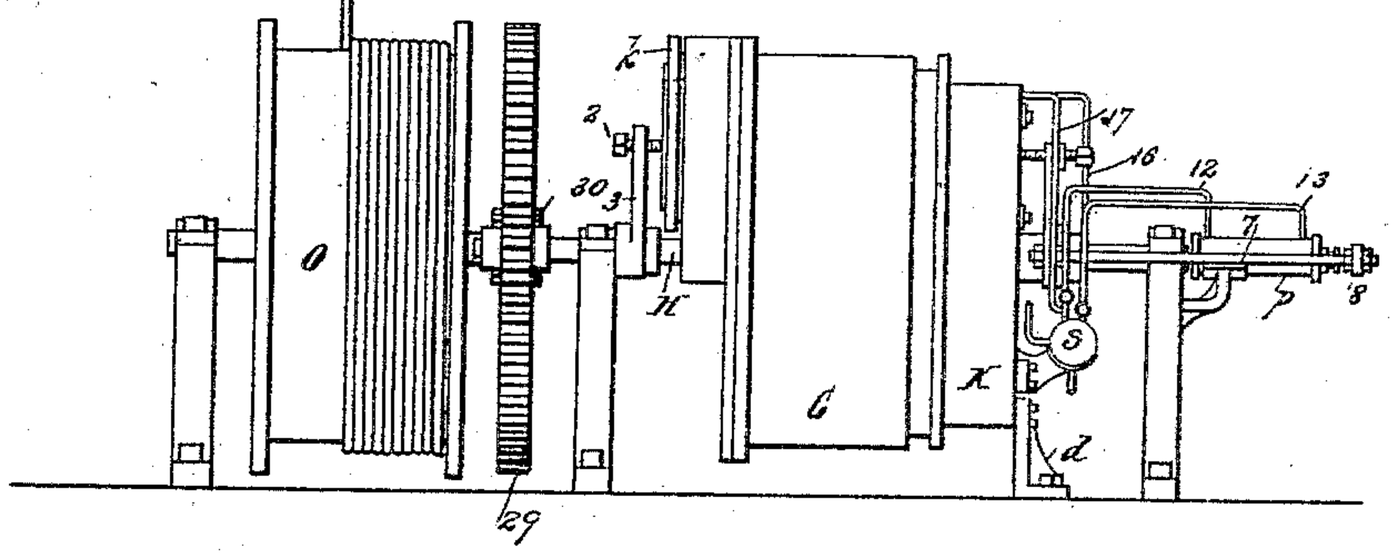


Fig. 7.



Attest.
Geo. H. Bolte
Edward S. Wood

Inventor:
William P. Gibson
By Philipp Philipp & Hoover
Attys.

UNITED STATES PATENT OFFICE.

WILLIAM P. GIBSON, OF NEW YORK, N. Y.

HYDRAULIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 412,331, dated October 8, 1889.

Application filed January 5, 1889. Serial No. 295,648. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM P. GIBSON, a citizen of the United States, residing at New York, county of New York, and State of New York, have invented certain new and useful Improvements in Hydraulic Motors, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to an oscillating hydraulic motor, which, although adapted for many purposes, is especially designed for use as a hoisting-motor for elevators, it being one of the principal objects of the invention to produce a motor for use in connection with elevators and for other purposes in which the power developed shall be automatically regulated to conform to the load to be moved.

A full understanding of the invention can be best given by an illustration and a detailed description of the motor embodying the same, and therefore all preliminary description will be omitted and a detailed description given, reference being had to the accompanying drawings, in which—

Figure 1 is a diagrammatic view showing the motor applied as a hoisting-motor for an elevator, the motor being shown in end elevation. Fig. 2 is an enlarged side elevation of the motor. Fig. 3 is a longitudinal vertical section of the same. Fig. 4 is an enlarged end elevation of the motor, partly in section. Fig. 5 is a cross-section of the motor, taken on the line 5 of Figs. 2 and 3. Fig. 6 is a horizontal section taken on substantially the line 6 of Figs. 3 and 5. Fig. 7 is a side elevation of the motor, showing a different means of transmitting the motion to the elevator-car.

Referring to said figures, it is to be understood that A represents an elevator-car of ordinary form, and B its hoisting-cable. The cable B, as shown in Fig. 1, is passed around a series of stationary sheaves *a* and a corresponding series of traveling sheaves *b*, which hang in the depending loops of the cable, and by which means a comparatively limited movement of the traveling sheaves will impart a comparatively extended movement to the car. The purpose of this will appear when the construction and operation of the motor are explained.

The movements of the car are in the case illustrated controlled by means of a rope C, which passes through or adjacent to the car and has its ends connected to operate the valves of an auxiliary-valve apparatus D, which controls the movements of the motor. The valve apparatus, as herein illustrated, is of the construction described in my companion application for Letters Patent, filed December 31, 1888, Serial No. 294,995, and need not therefore be more particularly explained. The invention, however, is not limited to this form of valve apparatus, but may be used in connection with any suitable valve apparatus operated from the car by any suitable form of connections.

In Fig. 1 the car is shown as provided with a deflecting apparatus E, for operating the rope C to control the movements of the motor. This deflecting apparatus is of the form shown and described in my companion application for Letters Patent, filed December 31, 1888, Serial No. 294,999, and forms no part of the present invention, and will not therefore be more particularly referred to.

The motor embodying the present invention consists, primarily, of a cylinder G, which is mounted upon a shaft H, supported in a suitable frame-work. The cylinder G is free to move longitudinally upon the shaft H, and may be free to turn upon the shaft, as indicated in Fig. 3; or it may be splined to the shaft, the shaft being free to turn in its bearings, as in the case of the construction illustrated in Fig. 7, which will be hereinafter explained. One end of the cylinder G is closed by a head *g*, while the opposite end of the cylinder is open. Entering and fitting into the open end of the cylinder G is an annular head K, which is supported upon a sleeve *c*, which is secured to the cylinder-head *g* and surrounds the shaft H. The head K is secured to a stationary bracket *d*, by which it is prevented from turning with the cylinder G. The open end of the cylinder G is provided with a suitable stuffing-box *f* or other means for forming a tight joint between the cylinder and the head. Passing through the head *g* of the cylinder G is a plate *h*, forming a piston, which fills the entire space between the sleeve *c* and the wall of the cylinder G and fits tightly against the inner end of the head K, this plate being held in posi-

tion against the head K by means of an adjusting-screw 2, supported in an arm 3, extending from the shaft H and fixed against longitudinal movement on said shaft. The head *g* of the cylinder G is provided with a suitable stuffing-box *k*, which surrounds the plate *h* and forms a tight joint between the plate and the head of the cylinder. Passing through the head K is a similar plate *m*, which also fills the entire space between the sleeve *c* and the wall of the cylinder G and fits tightly against the head *g* of the cylinder at one side of the plate *h*. The plate *m* is held snugly against the head *g* of the cylinder by means of a set-screw 4, carried upon the arm 5, which extends from the sleeve *c*, and is arranged so as to permit said sleeve to turn freely without imparting any movement to the arm, but is arranged so as to be prevented from having any longitudinal movement on the sleeve.

For the purpose of forming a tight joint between the plate *m* and the head K the plate is reduced in size within the head, so as to form a space for receiving a suitable packing *n*, which is held in position by means of a cap *o*, which fits over the outer end of the plate and abuts against the packing, and is held in position by means of screws 6.

The arm 5, which, as before stated, is loose upon the sleeve *c*, but is connected by the screw 4 with the plate *m*, so as to be prevented from turning about the sleeve, is connected by a pair of rods 7 with a cross-head 8, to which is connected the rod 9 of a piston 10, which works in a small cylinder *p*, located in line with the shaft H. The cylinder *p* communicates at its opposite ends with pipes 12 13, which are controlled by the valve apparatus D in such manner as to admit and exhaust the water under pressure to and from the opposite ends of the cylinder *p* at the will of the conductor in the car.

The head K is provided with two ports 14 15, which open into the cylinder G upon opposite sides of the plate *m*. These ports communicate through pipes 16 17 with a valve-chest *q*, which also communicates with a supply-pipe 18 and with two exhaust-pipes 19 20, which lead to a tank L. The valve-chest *q* is provided with a valve N, composed of three pistons 21 22 23, which are mounted upon a single rod 24, and the ports opening into the chest from the pipes 16, 17, 18, 19, and 20 are so arranged that when the valve is in its mid-position the pistons 21 22 will close the ports leading to the pipes 16 17, respectively, and thus prevent both the induction and exhaust of water to and from the cylinder G. When, however, the valve is moved to the left, the respective pipes 17 18 and 16 19 will be brought into communication, so that the water contained in the cylinder G upon one side of the plate *m* will be free to pass out through the pipes 16 19 to the tank L, while the water from the supply-pipe 18 will be free to enter through the pipe 17 to the cylinder upon the opposite side of the plate *m*. The tank L is of course provided with a suitable overflow-pipe.

When the valve is moved to the right, communication will be cut off between the pipes 17 18 and established between the pipes 17 19 and 16 20, respectively, thereby allowing the water contained in the cylinder upon one side of the plate *m* to pass out through the pipes 17 19 to the tank and water to pass in from the tank through the pipes 20 16 to the cylinder upon the opposite side of the plate *m*.

The valve N may be operated in any suitable manner from the car or from any other position, according to the use to which the motor is applied. In the present case, however, it is shown as operated through the auxiliary-valve apparatus D, which is of the construction before stated, or may be of any of the other well-known constructions for this purpose. To this end the rod 24 is extended and provided with a piston 25, which works in a cylinder *s*, having pipes 26 27, which communicate with the pipes 12 13, and through which the water is admitted from the valve apparatus D to the opposite ends of the cylinder to move the valve in one direction or the other, as may be required.

The water for operating the pistons 10 and 25 is supplied through a pipe 28, which communicates with the valve apparatus D and with the supply-pipe 18, or with any other source from which water can be obtained under the necessary pressure.

In the application of the invention illustrated in Fig. 1 the cylinder G forms a drum, upon which is wound a cable M, which is connected to the frame in which the traveling sheaves *b* are mounted.

The operation of the motor when thus applied is as follows: When the motor is in its normal position, the piston 10 will be moved outward in the cylinder *p*, thereby, through the connections which have been described, moving the cylinder G on the shaft H until the head K is nearly or quite in contact with the head *g*. Assuming, now, that it is desired to cause the car to ascend, the proper one of the valves of the valve apparatus D will be operated to allow the water under pressure to pass from the pipe 28 to the pipes 13 27, and enter the outer end of the cylinder *p* and the inner end of the cylinder *s*, the water in the opposite ends of the cylinders at the same time escaping through the pipes 12 26. The water admitted to the cylinder *s* will operate upon the piston 25 to move the valve to the left, thereby establishing communication between the pipes 18 17 to admit water to the cylinder G upon one side of the plate *m*, and at the same time communication will be established between the pipes 16 19 to allow the water upon the other side of the plate *m* to escape. The water thus entering the cylinder G through the pipe 17 will exert a pressure tending to move the plates *h m* apart.

The plate *m* being, however, held stationary, this pressure will tend to move the plate *h* away from the plate *m*, and thus revolve the cylinder G in the direction to wind up the cable M onto the cylinder and raise the car. The head K being, however, at this time nearly or quite in contact with the head *g*, the area of the plates *h m*, upon which the water acts, will be very small, and consequently if the car contains any considerable load this pressure will not be sufficient to raise it. At the same time, however, that water is thus admitted to act upon the plates *h m* to move them apart water is also admitted under pressure through the pipe 13 to the outer end of the cylinder *p*, and the water thus admitted to the cylinder *p* will operate upon the piston 10 to move the latter inward and move the cylinder G along the shaft H, so as to separate the heads K and *g* and increase the area of the plates *h m* to be acted upon by the water, and this will continue until the area of the plates has been sufficiently increased to cause the pressure of the water admitted to the cylinder G to raise the car. As soon as the car starts, the valve of the apparatus D will be closed, so as to shut off the further admission of water to the cylinder *s*. The valve N having, however, been shifted to the left, the water will continue to enter the cylinder G and turn said cylinder about the shaft H, so as to wind up the cable M and raise the car. To stop the car, the other valve of the apparatus D will be operated so as to move the valve N in the reverse direction and shut off the admission and exhaust of the water to and from the cylinder G. The plate *h* will then be locked in position by the water upon both its sides, so as to hold the cylinder G and the car in any position in which they are stopped.

To cause the car to descend, the proper valve of the apparatus D will be operated to move the valve N to the right from its mid-position, thereby allowing the water upon one side of the plate *m* to pass out through the pipes 17 19 to the tank L and the water to be drawn by suction from the tank into the cylinder upon the other side of the plate *h*. To stop the car in its descent, the valve N is moved back to its mid-position, the same as in arresting the car in its ascent. As the valve of the apparatus D is operated to allow the car to descend, the water will be admitted to the inner end of the cylinder *p*, and will, as the car completes its descent, exert sufficient pressure upon the piston 10 of said cylinder to move it outward and restore the cylinder G to its original position. It will thus be seen that the amount of water consumed at each ascent and descent of the car is proportioned to the load upon the car, so that when the car carries a light load a less quantity of water at a given pressure is required to effect the ascent than when the car is loaded heavier, whereas in hydraulic elevators as ordinarily constructed the volume of water consumed at each ascent and descent of the car is the same, regardless of the load upon the car.

If in any case it should not be desired to cause the water to circulate from one side to the other of the plate *h* during the descent of the car, the pipes 16 20 and port 14 will be omitted.

From the foregoing it will be seen that with the motor thus organized it is necessary to accomplish the entire ascent or descent of the car with something less than one revolution of the cylinder G. This makes it necessary, unless the cylinder is made of very great diameter, to provide means for multiplying the movement derived from the cylinder before it is transmitted to the car, and it is for this purpose that the series of fixed and traveling sheaves *a b* are employed. The same result may be accomplished in other ways—as, for example, as shown in Fig. 7, in which case the sleeve *c* of the cylinder G is splined to the shaft H, and the shaft is made capable of revolving in its bearings, and is extended and provided with a gear 29, which engages with a small pinion 30, secured to the shaft of a drum O, upon which the hoisting-cable B is wound. By this means the movement of the drum O is sufficiently increased beyond the movement of the cylinder G to effect the necessary winding and unwinding of the cable B to give the car the necessary travel.

What I claim is—

1. The combination, with the cylinder G and the head K, fitting into the cylinder, one of said parts being fixed and the other oscillating, and one being capable of longitudinal movement with relation to the other, of the movable plate *h*, carried by the cylinder and fitting against the head K, the movable plate *m*, carried by the head K and fitting against the head of the cylinder at one side of the plate *h*, and a port 15, for admitting and exhausting the liquid to and from the cylinder between the plates, substantially as described.

2. The combination, with the oscillating and longitudinally-moving cylinder G, of the fixed head K, fitting into said cylinder, the plate *h*, carried by the cylinder G and movable in the direction of the length of the cylinder, so as to maintain contact with the head K, the plate *m*, carried by the head K and entering the cylinder at one side of the plate *h* and movable longitudinally with the cylinder, and a port 15, for admitting and exhausting the liquid to and from the cylinder between the plates, substantially as described.

3. The combination, with the oscillating and longitudinally-moving cylinder G, of the fixed head K, fitting into said cylinder, the plate *h*, carried by the cylinder G and movable in the direction of the length of the cylinder, so as to maintain contact with the head K, the plate *m*, carried by the head K and entering the cylinder at one side of the plate *h* and movable longitudinally with the cylinder, a port 15, for admitting and exhausting the

liquid to and from the cylinder between the plates, and the cylinder *p*, having a piston 10 connected to the cylinder G to move the same longitudinally, substantially as described.

4. The combination, with the cylinder G and the head K, fitting into the cylinder, one of said parts being fixed and the other oscillating, and one being capable of longitudinal movement with relation to the other, of the movable plate *h*, carried by the cylinder and fitting against the head K, the movable plate *m*, carried by the head K and fitting against the head of the cylinder at one side of the plate *h*, and ports 14 15, for admitting and exhausting the liquid to and from the cylinder upon the opposite sides of the plate *m*, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WM. P. GIBSON.

Witnesses:
J. J. KENNEDY,
G. M. BORST.