(No Model.) 3 Sheets—Sheet 1.

R. W. GRAVES.

LIQUID METER.

No. 302,561. Patented July 29, 1884.

Fig. 1.

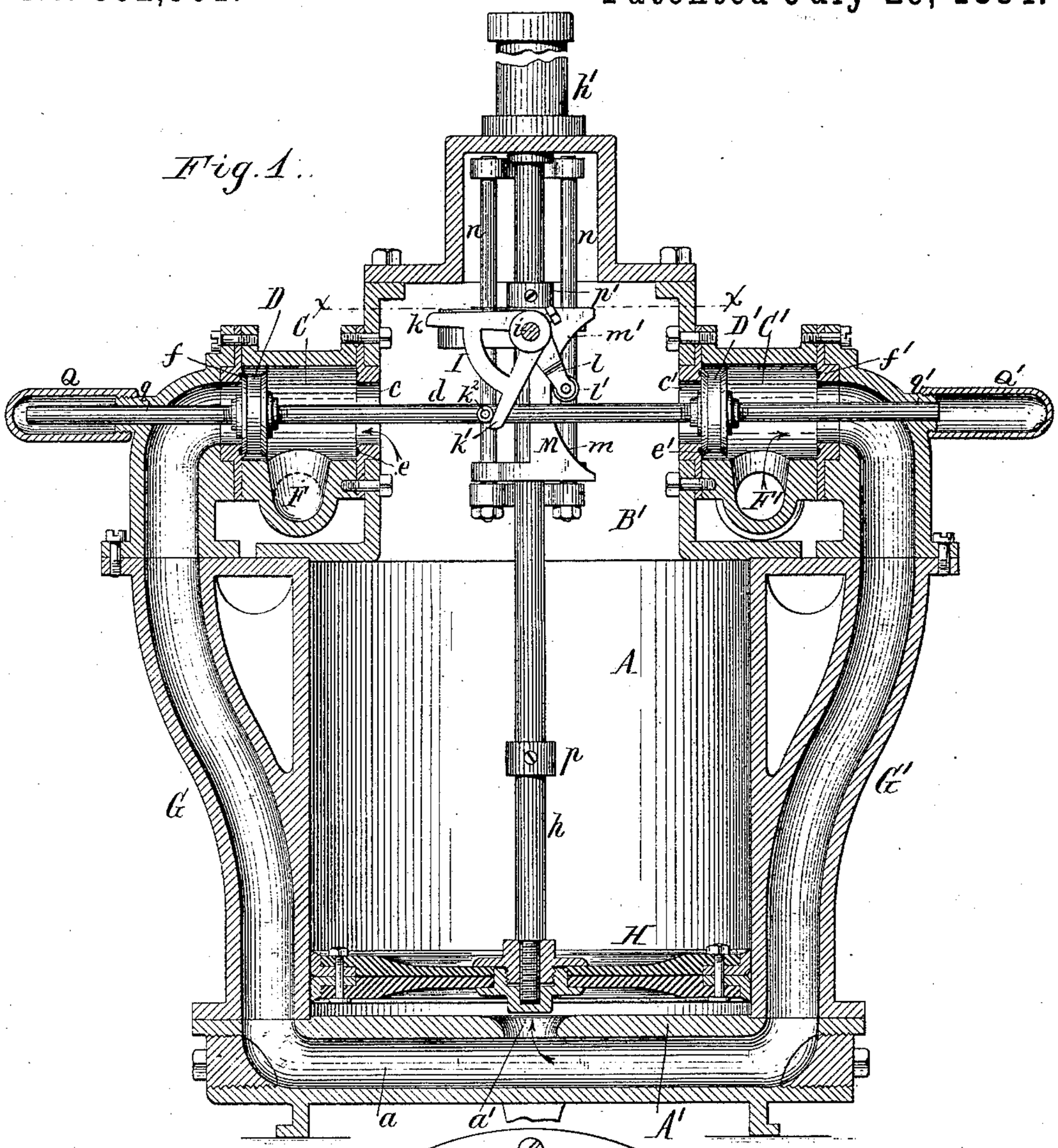

Fig. 2.

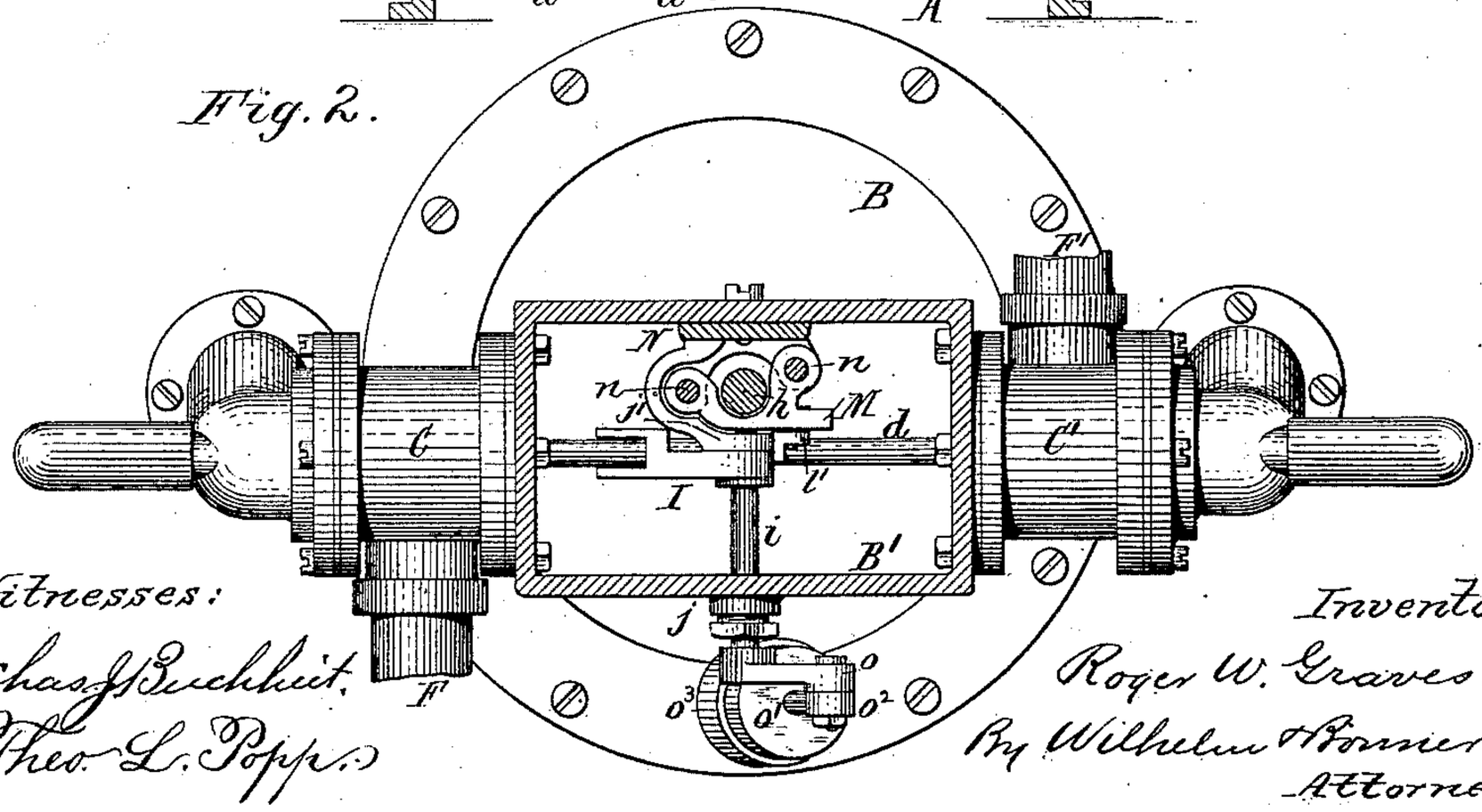

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Fig. 3.

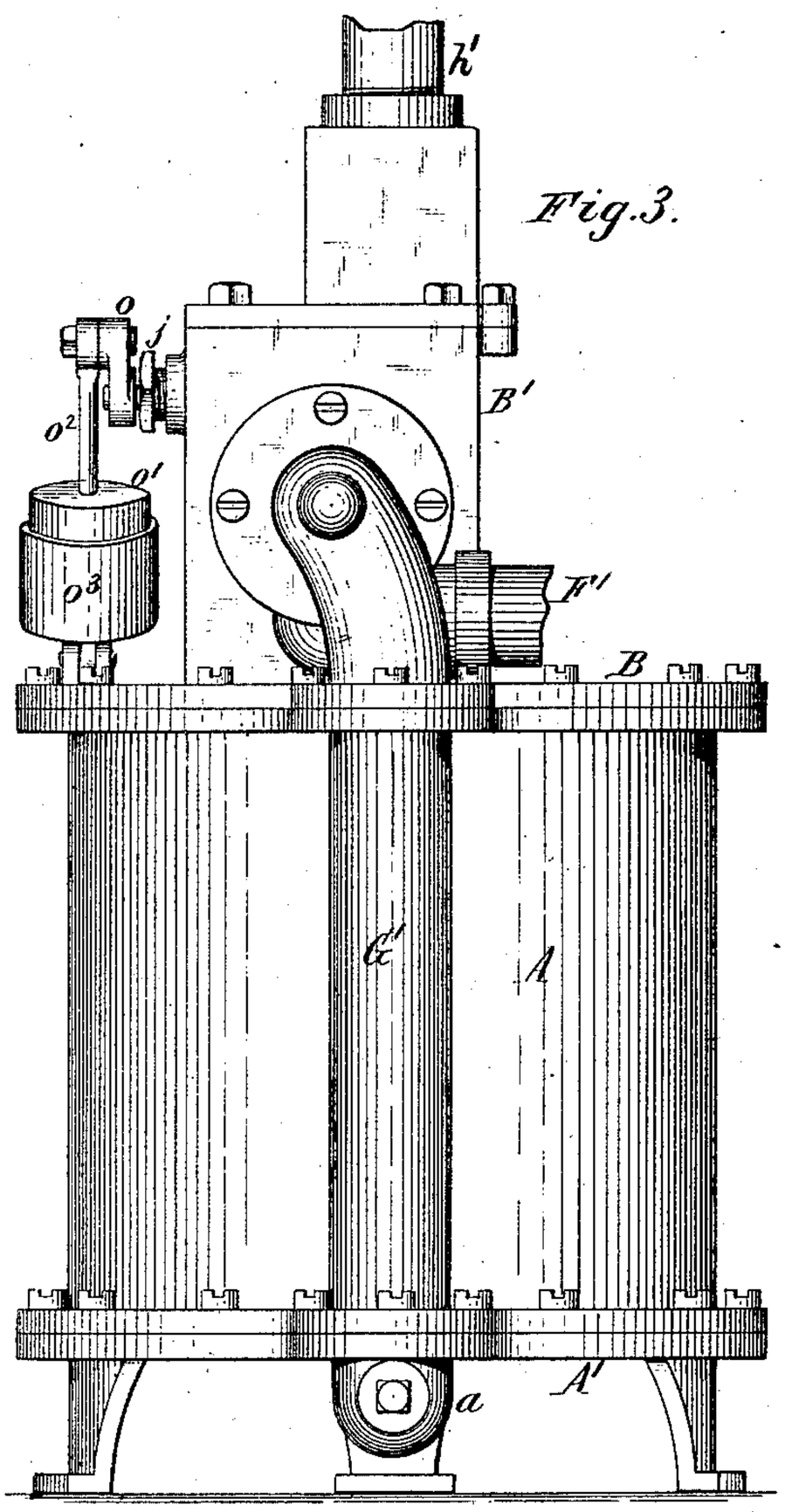

Fig. 4.

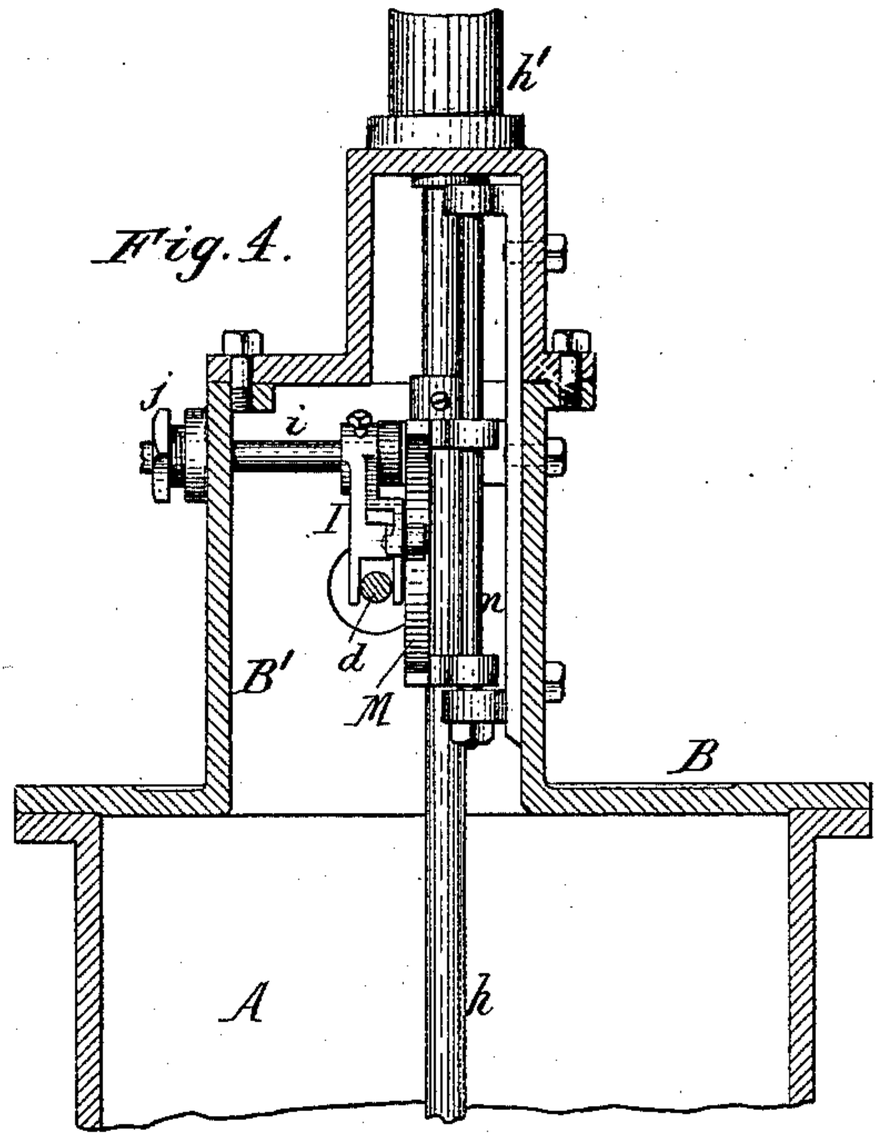

Fig. 6.

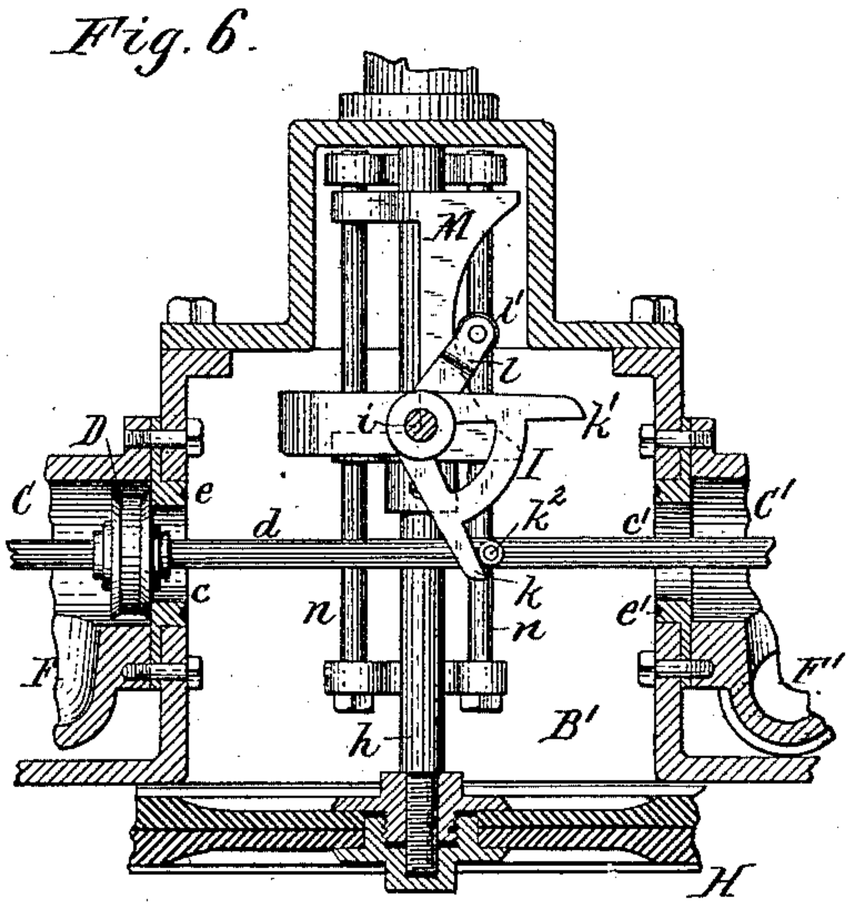

Fig. 5.

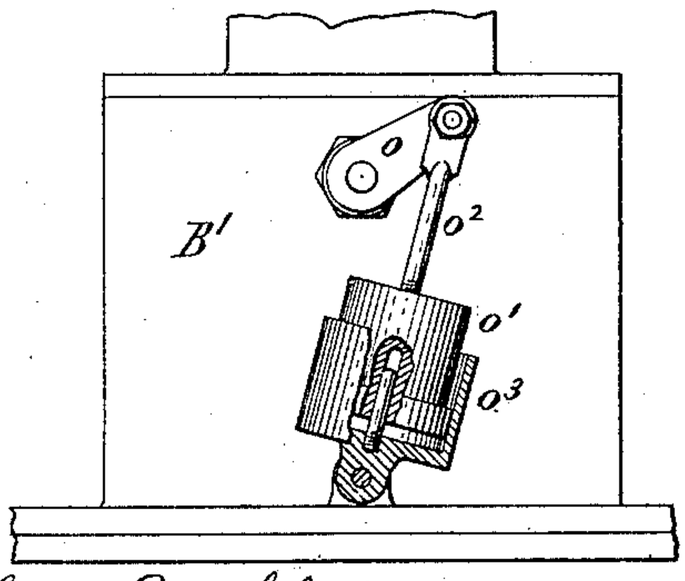

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Fig. 7.

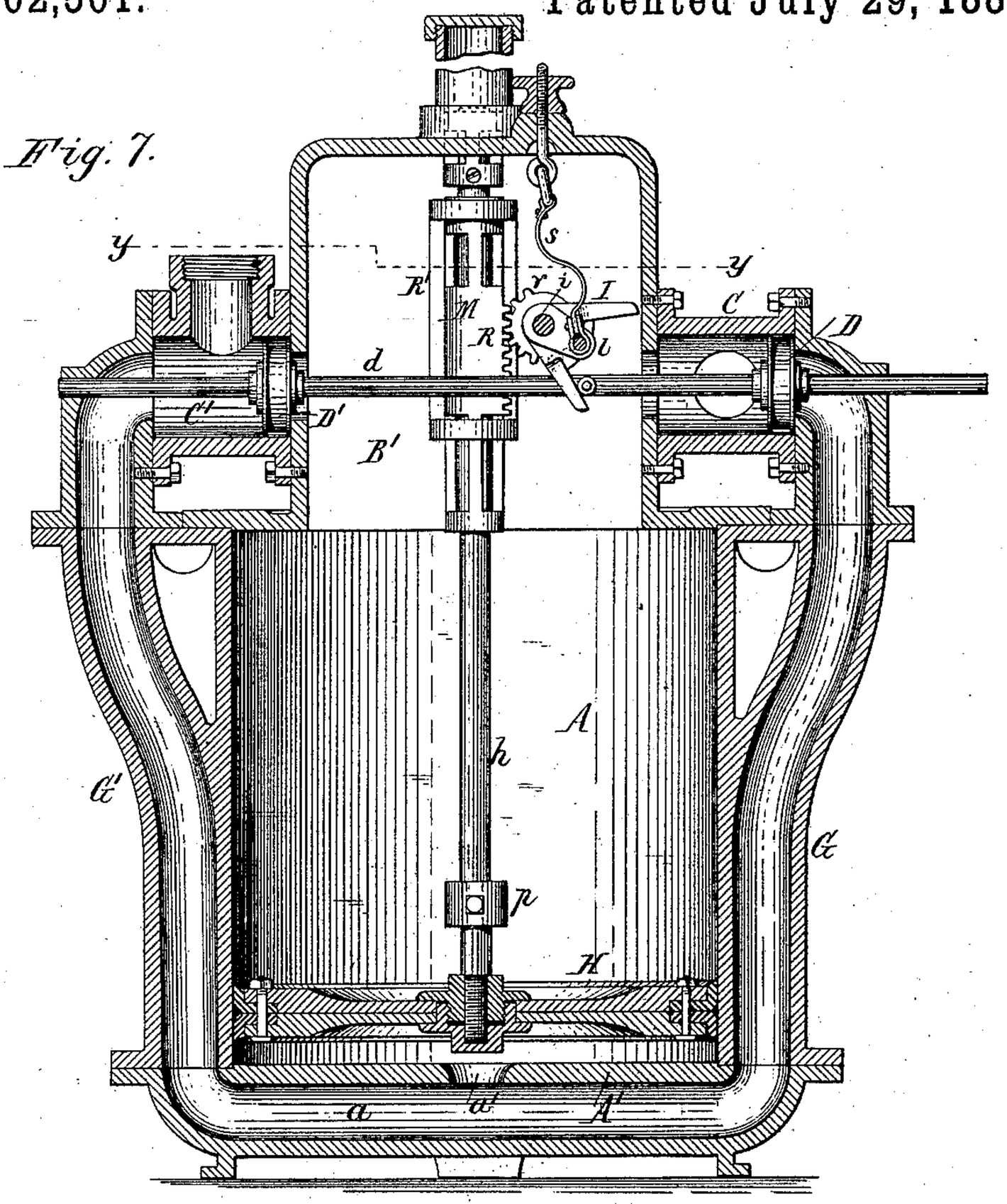
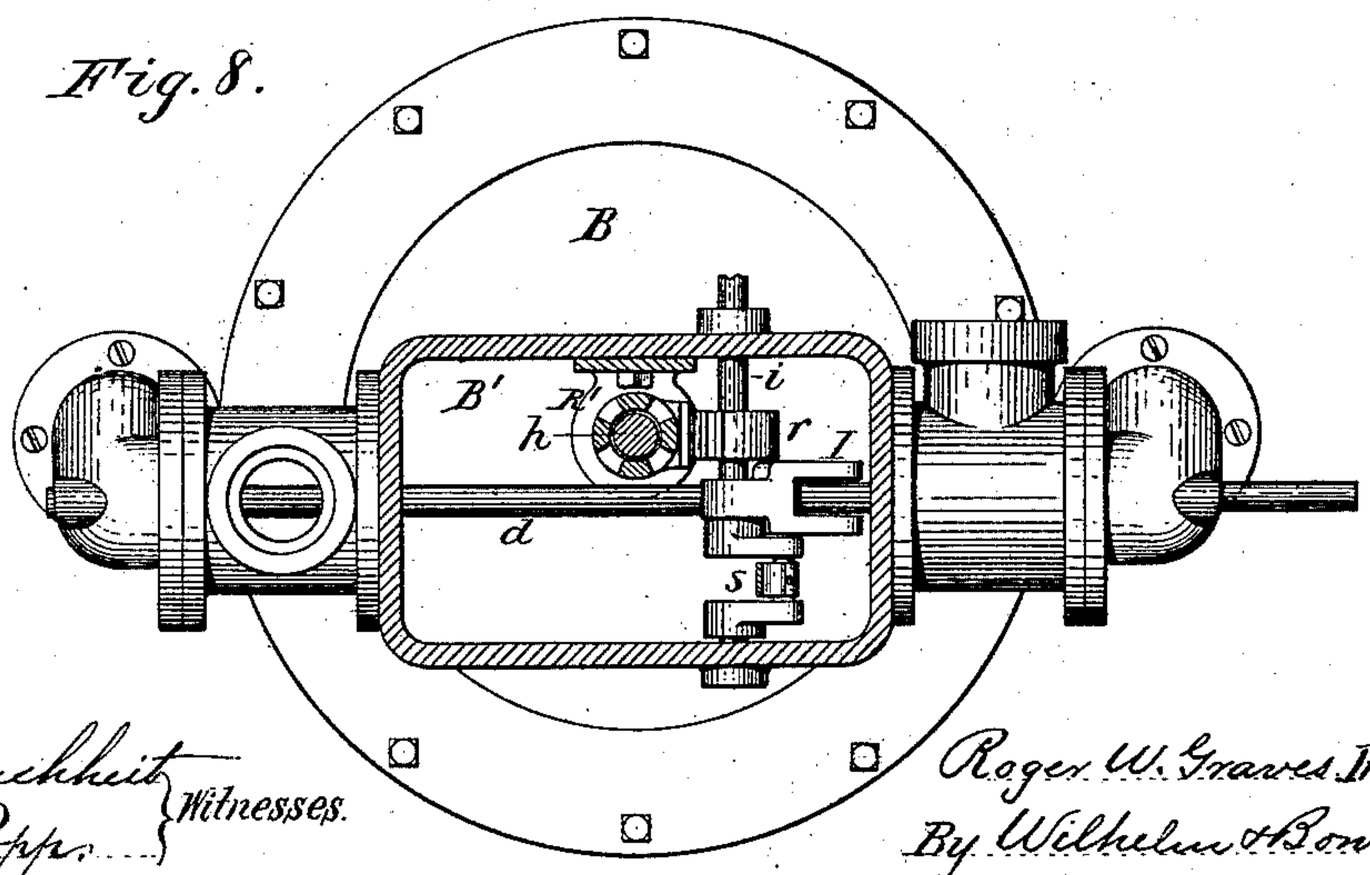


Fig. 8.



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UNITED STATES PATENT OFFICE.

ROGER W. GRAVES, OF BUFFALO, NEW YORK.

LIQUID-METER.

SPECIFICATION forming part of Letters Patent No. 302,561, dated July 29, 1884.

Application filed September 28, 1883. (No model.)

To all whom it may concern:

Be it known that I, ROGER W. GRAVES, of the city of Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Liquid-Meters, of which the following is a specification.

This invention relates to an improvement in that class of liquid-meters in which a reciprocating piston is set in motion by the liquid flowing through the meter, and in which the admission of the liquid to opposite ends of the meter and the exit of the liquid therefrom are controlled by valves operated by the reciprocating piston. The object of my invention is to produce a simple, compact, and reliable meter of this character; and my invention consists of the particular improvements in the construction of the meter which will be hereinafter fully set forth, and pointed out in the claims.

In the accompanying drawings, consisting of three sheets, Figure 1 is a sectional elevation of my improved meter. Fig. 2 is a top plan view of the same, partly in horizontal section, taken in line *x x*, Fig. 1. Fig. 3 is a side elevation of the meter at right angles to Fig. 1. Fig. 4 is a vertical section of the upper part of the meter at right angles to Fig. 1. Fig. 5 is a partly sectional elevation of the gravity device whereby the valves are reversed. Fig. 6 is a sectional elevation of the upper part of the meter, showing the valves reversed. Fig. 7 is a sectional elevation of my improved meter, showing a modified construction of the mechanism whereby the valves are operated. Fig. 8 is a top plan view of the same, partly in horizontal section, taken in line *y y*, Fig. 7.

Like letters of reference refer to like parts in the several figures.

A represents the measuring-cylinder, and A′ the bottom thereof, provided on its under side with a transverse water-passage, *a*, having a central opening, *a′*.

B represents the top cover of the cylinder, and B′ a chamber formed on the same, and communicating at its bottom with the cylinder A.

C C′ represent the valve-chambers, arranged on opposite sides of the chamber B′, and communicating therewith by openings *c c′*, formed in the sides of the chamber B′ and the inner ends of the valve-chambers C C′.

D D′ are the valves, arranged, respectively, in the chambers C C′, and secured to the same horizontal rod *d*, which extends through the chamber B′ and the openings *c c′*.

e e′ are the valve-seats formed around the openings *c c′*, and *f f′* the seats formed at the opposite ends of the valve-chambers C C′.

F F′ are the passages through which the liquid is conducted to or from the valve-chambers C C′. Each of the latter is provided with one of these passages located between the valve-seats of the chamber, and each may be used as the induction-passage when the other is used as the eduction-passage.

G G′ are tubular channels or ports, which lead from the outer openings of the valve-chambers C C′ to opposite ends of the water-passage *a*.

H represents the piston, which reciprocates in the cylinder A, and *h* is the piston-rod, extending upwardly from the piston through the cylinder A and chamber B′, and terminating in a closed tubular extension, *h′*, which is secured to the chamber B′. The valve-rod *d* is arranged on one side of the piston-rod *h*, and the chamber B′, valve-chambers C C′, and the upper ends of the pipes G G′ are arranged in line with the valve-rod *d*, as clearly shown in Fig. 2.

I represents a rock-arm secured to a horizontal shaft, *i*, which is arranged in the chamber B′ at right angles to the valve-rod *d*. The shaft *i* is supported with its outer end in a stuffing-box, *j*, and with its inner end in a bearing, *j′*. The rock-arm I is provided with two projections or noses, *k k′*, which are adapted to come in contact with a projection, k^2, on the valve-rod *d*, whereby the valve-rod is shifted. The rock-arm I is also provided with an actuating-arm, *l*, carrying at its end a roller, *l′*.

M is a vertical slide, provided with two curved or inclined surfaces, *m m′*, which are adapted to engage alternately against opposite sides of the roller *l′*, and thereby swing the rock-arm I alternately in opposite directions. The slide M moves on vertical guide-rods *n*, which are secured to a supporting-bracket, N. The latter is attached to the in-

ner side of the chamber B′, and carries the bearing *j′*, in which the inner end of the shaft *i* is supported. The outer end of the shaft *i* projects through the stuffing-box *j*, and is provided with an arm, *o*, to which a weight, *o′*, is attached by means of a rod, o^2. The weight *o′* moves in a pivoted cup, o^3, in such manner that the air contained in said cup will form a cushion and deaden the fall of the weight, thereby preventing the valves from striking hard against their seats when they are shifted.

p p′ represent stops or collars secured to the piston-rod *h* respectively below and above the slide M, and at a suitable distance therefrom, so that an intermittent limited movement is imparted to the slide by the reciprocating motion of the piston-rod.

When the passage F′ is connected with the pipe through which the water or other liquid is supplied to the meter, and the parts are in the position represented in Fig. 1, the water passes from the valve-chamber *c′*, through the port G′, passage *a*, and opening *a′*, into the cylinder A, under the piston H, and forces the latter upwardly in the cylinder. When the piston has almost reached the limit of its upward movement, the collar *p* strikes against the under side of the slide M and raises the same. The lower incline, *m*, of the slide swings the arm *l* toward the right in Fig. 1, and causes the rock-arm I to swing on its axis in such manner that the projection *k* of the rock-arm will come in contact with the projection k^2 on the valve-rod and cause the latter to move in the proper direction to shift the valves. The rocking movement of the arm I causes the shaft *i* to turn in the direction in which the weight *o′* is lifted until the arm *o* has passed the dead-center, when the weight will descend and cause the completion of the reversing movement of the valves. The water contained in the cylinder A above the piston escapes through the opening *c*, chamber C, and passage F. The valve D′ now rests against the seat *f′* and the valve D against the seat *c*, as represented in Fig. 6, and the water passes from the chamber C′ through the opening *c′* into the chamber B′ and cylinder A above the piston, and forces the latter downward, while the water escapes from below the piston through the port G, chamber C, and passage F. When the piston has nearly reached the limit of its downward movement, the collar *p′* strikes against the upper side of the slide M and lowers the same. The incline *m′* now comes in contact with the roller *l′* and swings the rock-arm I in an opposite direction, whereby the projection *k′* is caused to come in contact with the projection k^2 of the valve-rod *d*. The completion of the shifting movement is again effected by the weight *o′*, as above described. The ends of the valve-rod *d* are guided, respectively, in openings *q q′*, which are protected by closed tubular extensions or covers Q Q′.

In the modified construction represented in Figs. 7 and 8, the shaft *i* is provided with a gear-pinion, *r*, which meshes with a rack-bar, R, formed on the slide M. The latter is guided in a cage, R′, secured to the inner side of the chamber B′, and the last portion of the shifting movement of the valve-rod is effected by a spring, *s*, secured with one end to the top of the chamber B′, and with the other end to the arm *l* of the rock-arm I in such manner that the spring is strained when the arm *l* has reached the dead-center, whereby the reaction of the spring causes the rock-arm to move onward after it has passed this point. The valves are held against their seats by the spring *s* in the construction represented in Figs. 7 and 8, and by the weight *o′* in the construction represented in Figs. 1 to 6. As the water-pressure is exerted upon opposite sides of both valves, the pressure is equalized, and the valves are readily shifted. The outer end of the rock-shaft *i* is connected with any suitable registering mechanism in a common and well-known manner.

I claim as my invention—

1. The combination, with a measuring-cylinder and its piston and piston-rod, of the inlet and outlet valve chambers, arranged at the same end of the cylinder and diametrically opposite each other, an intermediate chamber communicating with the valve-chambers and cylinder, a valve-rod arranged at right angles to the piston-rod and extending through said valve-chambers, inlet and outlet valves secured to said valve-rod, and mechanism located within the intermediate chamber, whereby the valve-rod is actuated from the piston-rod, substantially as described.

2. The combination, with a measuring-cylinder, A, piston H, and piston-rod *h*, of the valve-chambers C C′, arranged at the same end of the cylinder, intermediate chamber, B′, communicating with the cylinder and said valve-chambers, ports G G′, extending from said valve-chambers to the opposite end of the cylinder, valve-rod *d*, arranged at right angles to the piston-rod, valves D D′, secured to said valve-rod, and mechanism whereby the valve-rod is actuated from the piston-rod, substantially as set forth.

3. The combination, with the cylinder A, piston H, and piston-rod *h*, valve-chambers C C′, arranged at the same end of the cylinder, intermediate chamber, B′, communicating with the cylinder and said valve-chambers, valve-rod *d*, arranged at right angles to the piston-rod, and extending through said valve-chambers, and provided with valves D D′, of the rock-arm I and slide M, and mechanism whereby an intermittent reciprocating movement is imparted to the slide from the piston-rod, substantially as described.

4. The combination, with the piston-rod *h*, having stops *p p′*, and the valve-rod *d*, having a projection, k^2, of the slide M, provided with inclines *m m′*, rock-arm I, having projections *k k′*, and arm *l*, substantially as set forth.

5. The combination, with the piston-rod *h*,

having stops *p p'*, and the valve-rod *d*, having a projection, k^2, of the slide M, provided with inclines *m m'*, guide-bars *n*, rock-lever I, having projections *k k'*, and shaft *i*, substantially as set forth.

6. The combination, with a measuring-cylinder, piston, and piston-rod, an inlet and an outlet chamber arranged at the same end of the cylinder, an intermediate chamber communicating with said inlet and outlet chambers, a valve-rod arranged at right angles to said piston-rod, and extending through said inlet and outlet chambers, and provided with valves D D', of a slide, M, a rock-arm, I, mechanism whereby the slide is set in motion from the piston-rod, and mechanism whereby the movement of the slide is completed independent of the piston, substantially as described.

Witness my hand this 22d day of September, 1883.

ROGER W. GRAVES.

Witnesses:
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