(No Model.) 3 Sheets—Sheet 1.

W. H. & J. D. GRAY.

HYDRAULIC GOVERNOR FOR ENGINES.

No. 402,015. Patented Apr. 23, 1889.

Fig. 1.

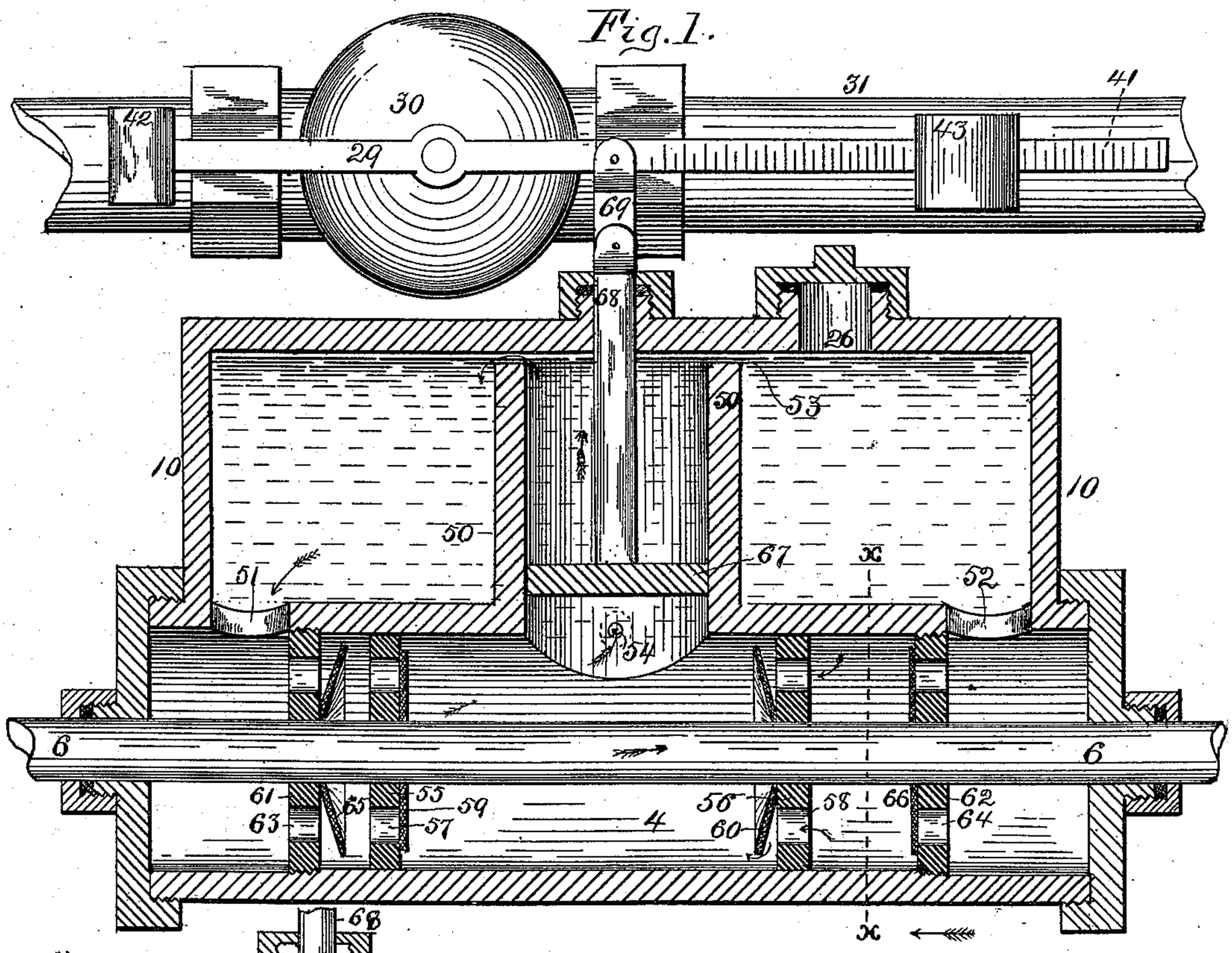


Fig. 2.

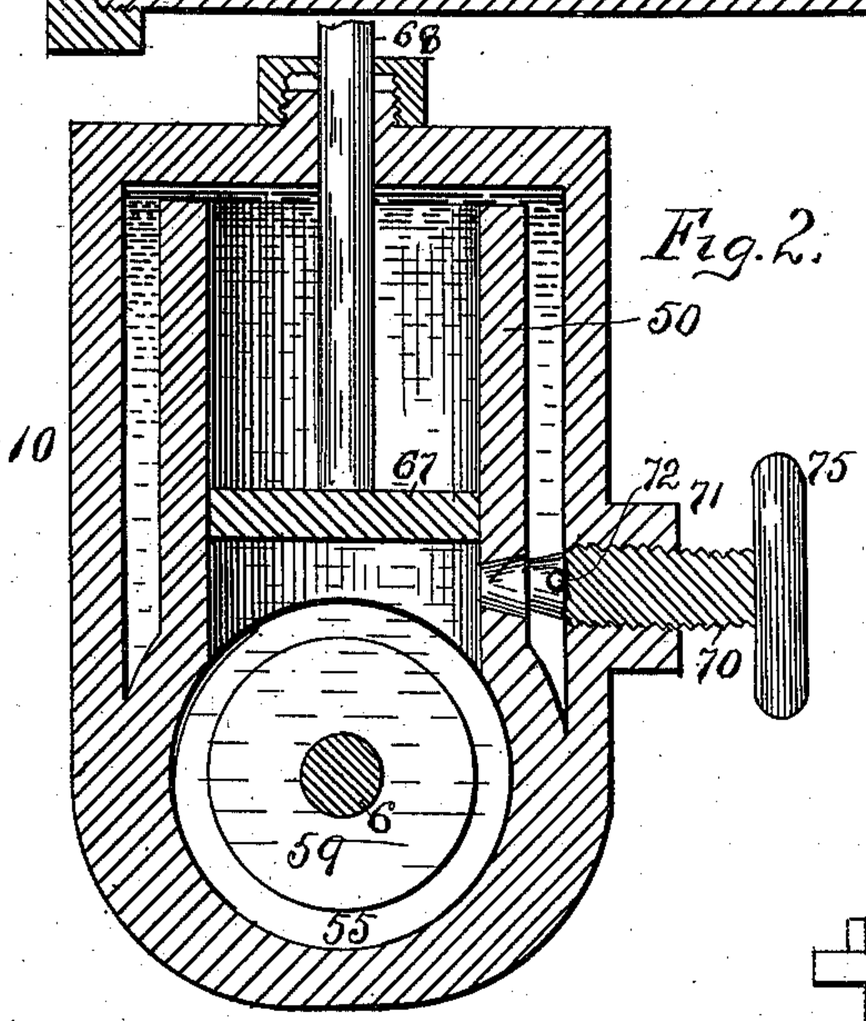
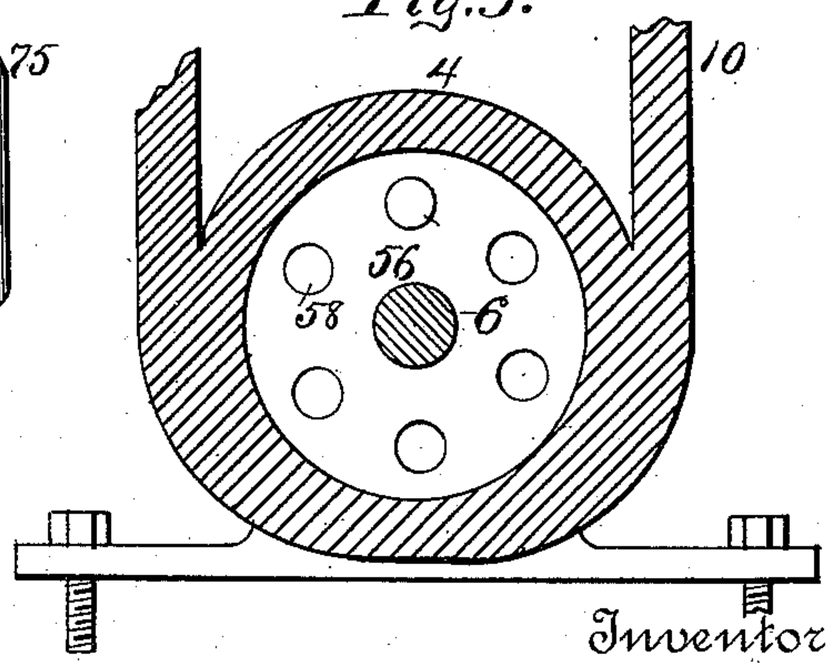


Fig. 3.



Witnesses.

Fred. P. Cornwall.

Harry L. Amer.

Inventor

Wm. H. Gray. Jas D. Gray

By their Attorney

S. D. Brashears

(No Model.) 3 Sheets—Sheet 2.

W. H. & J. D. GRAY.

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Fig. 4.

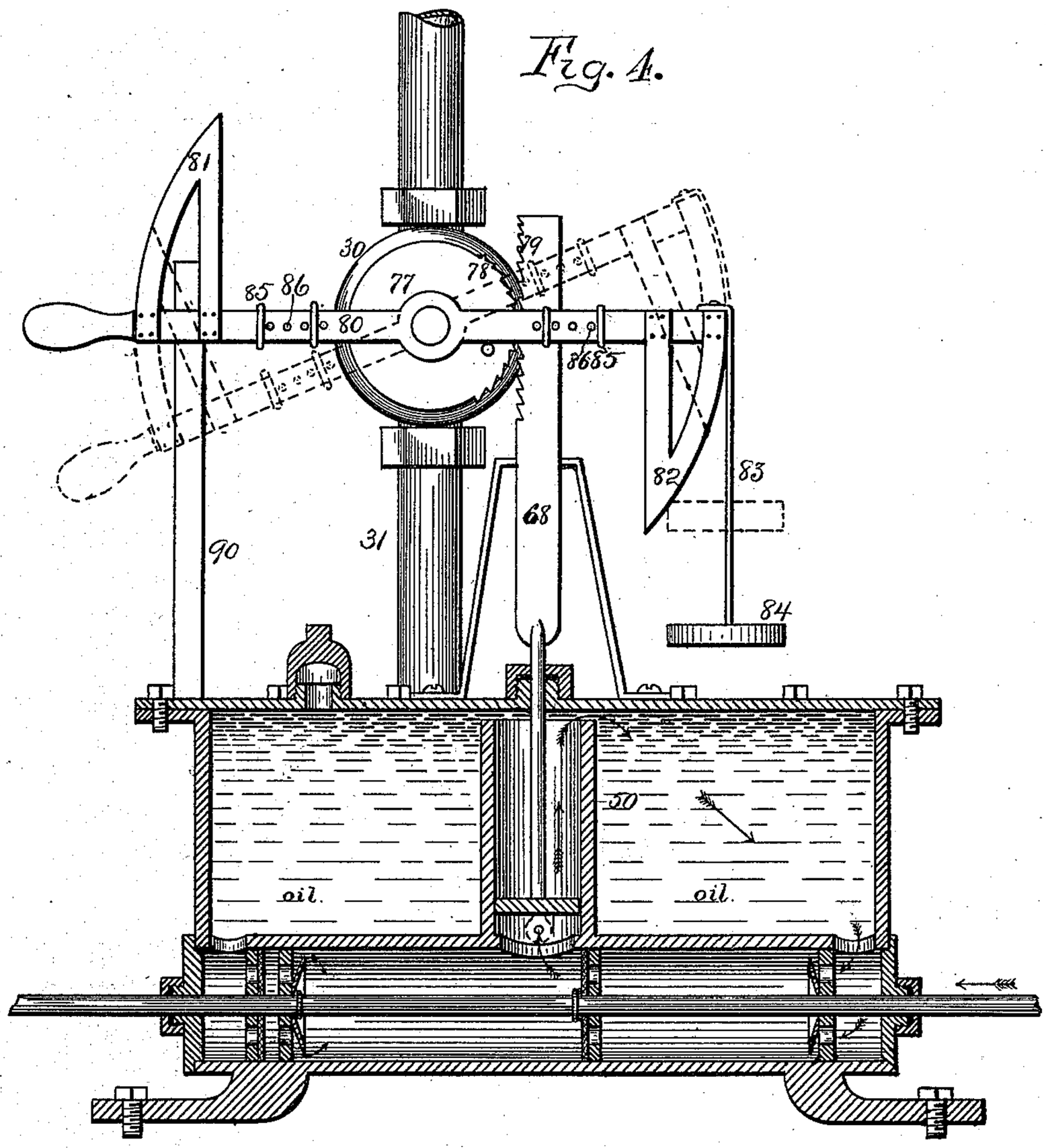


Fig. 5.

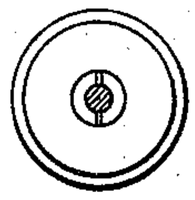


Fig. 6.

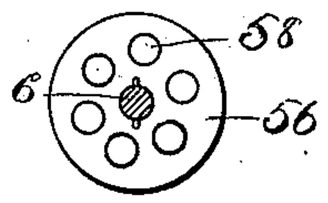
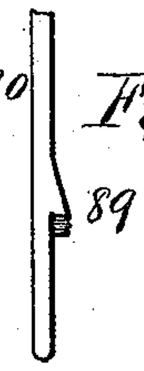


Fig. 7.



WITNESSES,

Harry L. Amer.
M. J. Foote

INVENTOR

Wm. H. Gray. Jas. D. Gray
per S. Brashears
Attorney

(No Model.) 3 Sheets—Sheet 3.

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HYDRAULIC GOVERNOR FOR ENGINES.

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Fig. 8.

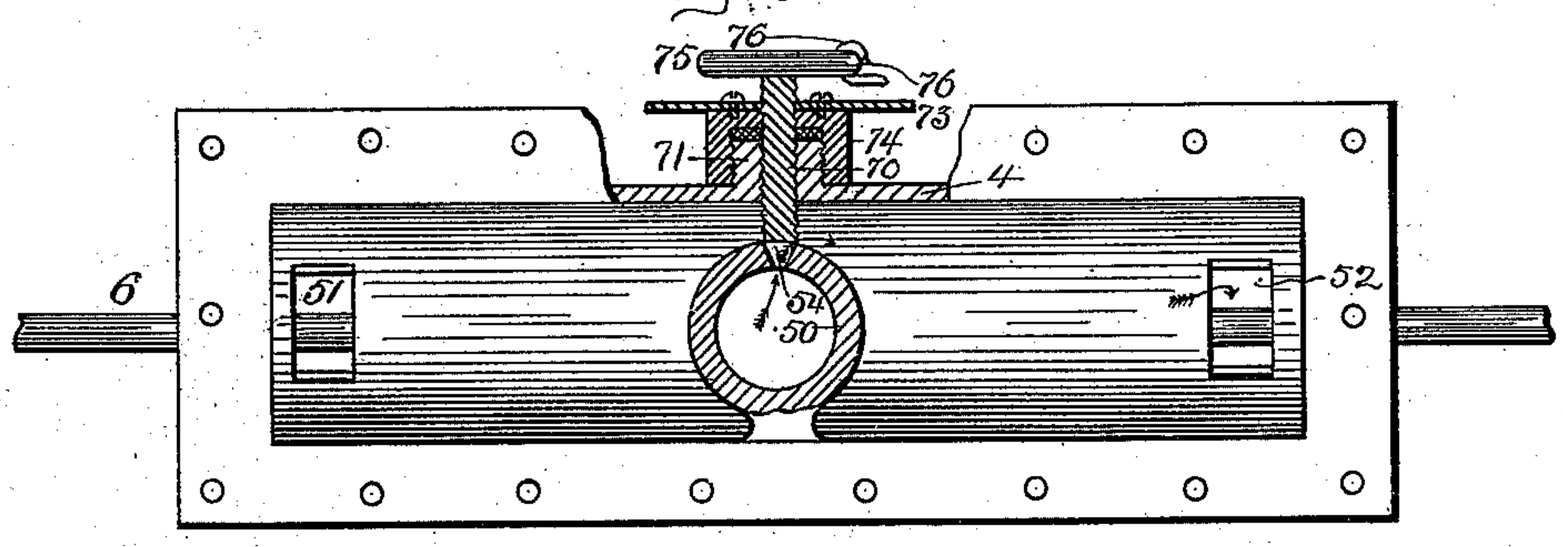


Fig. 9.

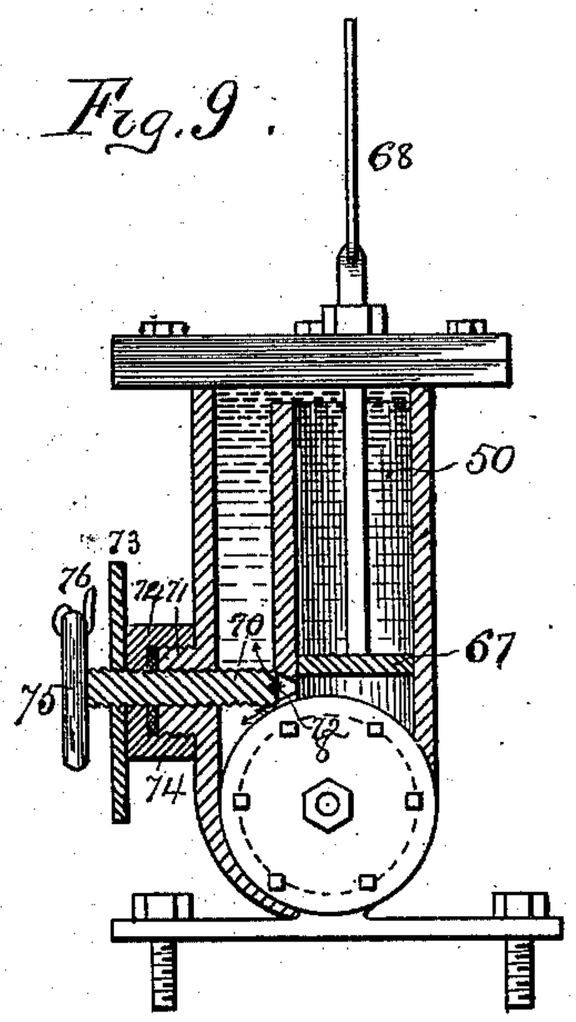
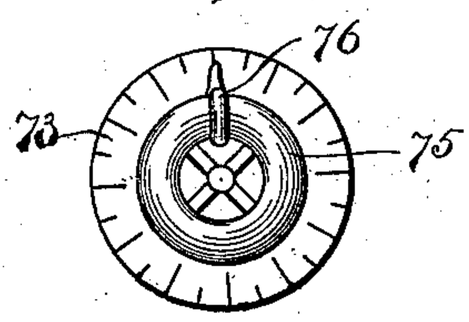


Fig. 10.



WITNESSES,
Harry L. Amer.
M. J. Foote

INVENTOR,
Wm. H. Gray. Jas D. Gray
per S. Brashears
Attorney.

UNITED STATES PATENT OFFICE.

WILLIAM H. GRAY AND JAMES D. GRAY, OF WEST FALLS, MARYLAND, ASSIGNORS TO THE GRAY AUTOMATIC STEAM GOVERNOR COMPANY, OF ALEXANDRIA, VIRGINIA.

HYDRAULIC GOVERNOR FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 402,015, dated April 23, 1889.

Application filed October 20, 1888. Serial No. 288,617. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM H. GRAY and JAMES D. GRAY, citizens of the United States, residing at West Falls, in the county of Frederick and State of Maryland, have invented certain new and useful Improvements in Hydraulic Governors for Engines; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to hydraulic governors for all classes of machinery, and has for its object to simplify such governors and render them more certain, steady, and reliable in action.

With these objects in view the invention consists in the improved construction, arrangement, and combination of parts hereinafter fully described, and afterward specifically pointed out in the claims.

In the accompanying drawings, Figure 1, Sheet 1, is a longitudinal vertical sectional view through our improved governor, the steam-pipe and the means for regulating it being shown in elevation. Fig. 2 is a transverse vertical sectional view taken on the central line of Fig. 1, the steam-pipe and valve and valve-operating mechanism being omitted. Fig. 3 is a transverse vertical sectional view taken on the line *x x* of Fig. 2, looking in the direction of the arrow. Fig. 4, Sheet 2, is a view showing in longitudinal vertical section the governor shown in Fig. 1 and in elevation another (and preferred) form of mechanism for operating the steam-pipe valve mechanism. Fig. 5 is an inside view in elevation of one of the heads of the horizontal cylinder. Fig. 6 is a view in elevation of the side of one of the piston-heads (or one of the stationary diaphragms) in the horizontal cylinder opposite to that on which the valves are attached. Fig. 7 is a side view of a fragment of the upright shown at the left of Fig. 4, showing the tooth for holding down the valve-lever when desired. Fig. 8, Sheet 3, is a top plan view of the liquid-box, with the top plate and the vertical piston and rod removed, the upright cylinder and mechanism for operating the valve between it and the liquid-box being shown in section. Fig. 9 is a transverse vertical section taken through the liquid-box and vertical cylinder, the horizontal cylinder being shown in end elevation; and Fig. 10 is a view of the graduated scale and indicator on the wheel for operating the flush or plug valve. (Shown in Figs. 8 and 9.)

Like numerals of reference mark the same parts wherever they occur in the various figures of the drawings.

Referring to the drawings by said numerals of reference, 4 is a cylinder closed at each end.

10 is a liquid box or tank, the lower portion of which is occupied by the cylinder 4, which may be secured therein or cast integrally therewith, as plainly shown in Fig. 2.

50 is an upright cylinder mounted centrally upon the cylinder 4, its lower end opening freely into the upper side of said cylinder 4 and its upper end, reaching not quite to the top of the liquid-box, being entirely open, as at 53. The cylinder 4 communicates, near each end, by openings 51 and 52, with the liquid-box 10, which also has communication with the cylinder 50 through the medium of an opening, 54, near its lower end.

The piston-rod 6 extends entirely through the cylinder 4 and has mounted upon it two piston-heads, 55 56, each of which is perforated, as shown at 57 58, and provided on the face toward the center with inward-opening valves 59 60. The cylinder 4 is further provided near each end with a stationary head or diaphragm, as at 61 62, perforated, as at 63 64, and having inward-opening valves, as 65 66. These diaphragms may be screwed into or otherwise secured in the cylinder. Cylinder-heads 7 8, properly bored to permit the reciprocation of the piston-rod 6, are provided to close the ends of the cylinder, and may be secured in any well-known manner.

In the vertical cylinder 50 is a solid piston-head, 67, mounted on the lower end of a piston-rod, 68, which passes up through the top of the box and is secured to the valve above in the steam-supply pipe 31 by means of a link, 69, and valve-rod 29, said valve-rod be-

ing balanced by weight 42 and regulated by the weight 43, according to the graduated scale 41. The opening 54 is closed by a plug-valve, 70, passing through a boss, 71, on the box 10 and controlled in the extent of its inward and outward movement by a pin, 72. It is provided (see Figs. 8, 9, and 10) with a graduated disk, 73, secured to the cover 74 of the boss 71, and on the valve-plug is a wheel, 75, provided with a pointer, 76, to indicate the amount of valve-opening.

In Fig. 4 we show another (and the preferred) form of mechanism for operating the valve in the steam-pipe 31. In this form there is loosely mounted on the valve-stem a disk, 77, a portion of whose periphery is serrated, having teeth 78. The rod 68 is extended upward and provided with teeth 79, which engage with the teeth 78 on the disk 77. A lever, 80, Fig. 4, is loosely mounted on the valve-stem and balanced by means of the pieces 81 82, secured to its ends, respectively. These pieces are shaped so that their outer edges curve in arcs of a circle described on the valve-stem as a center, and on one end of the lever is secured a cord, 83, carrying at its lower end a weight, 84. As this end of the lever moves, this cord rests on the curved surface of the piece 82, so that the weight is always hanging at the same distance from the center. This distance may be regulated by lengthening or shortening the ends of this lever by sliding the two pieces of which each end is composed through the loops 85 and securing them by means of pins in the holes 86. The downward pull of the weight 84 is communicated to the valve-disk 77 through the medium of a stop-pin, 87, rigidly secured to the disk and projecting therefrom in the path of the weighted end of the lever. At the other end of the lever 80 is a handle, 88, by means of which the valve can be operated by hand when desired. The vertical movement in a straight line of the rod 68 will thus cause the disk to turn, carrying with it the weighted end of the lever 80, thus gradually closing the valve in the steam-pipe and shutting off the steam as the rod rises.

The operation of the invention in the preferred form last described may be described as follows: The piston-rod 6, being connected at one end to either the piston-rod, cross-head, eccentric-rod, or other moving part of the engine, whose supply of steam passes through the pipe 31 and the box 10, and the two cylinders 4 and 50 being filled with liquid, the valve 70 is set at a predetermined point on the scale 73 and at the ends of the lever 80, being adjusted in length and properly set. The engine is now ready for operation. The piston-rod 6, moving to the right, causes the valves on the right-hand piston-head and left-hand diaphragm to open and those on the left-hand piston-head and right-hand diaphragm to close, thus moving the liquid in the left half-cylinder to the right and causing it to pass through opening 54 into box 10. At the same time the liquid in the box passes out at opening 51 into the cylinder 4, so that the body of liquid contained in the left-hand half of box and cylinder moves in the circuit described. Upon the reversal and movement to the left of the piston-rod the whole action is reversed. The valves on the left-hand diaphragm and the right-hand piston-head are closed, and those on the right-hand diaphragm and left-hand piston-head are opened. The liquid in the right-hand portion of the cylinder and box moves in a circuit through opening 52, the valve-ports 64 of the right-hand diaphragm 62, and opening 54. In either motion to right or left, as described, it will be seen that the liquid in the cylinder is forced through the opening 54, and when this opening is regulated in extent by the valve 70 only a given quantity can pass through in a given time, thus only permitting the piston to move at a certain limited speed. When by reason of additional pressure of steam or by the taking off of part of the resistance (the machinery run by the engine) the piston starts at a speed in excess of that allowed by the passage of the liquid through opening 54, the liquid in the cylinder 4 will be forced into cylinder 50, causing the piston-head 67 to rise, carrying up its rod 68 and operating the valve in the steam-pipe 31 to cut off a part of the supply, and thus reduce the power of the engine and lower its speed. As soon as the proper speed is attained by such reduction of the supply the parts will assume their normal position, and the piston-rod 6 be reciprocated and all connecting machinery moved at the speed intended by the position of valve 70. As the rod 68 moves up, the teeth 79 on it will engage with the teeth 78 on the periphery of the disk 77, and thus turn the disk. The stop 87, bearing under the weighted end of the lever 80, will cause the lever to turn with the disk, raising the weight 84, which, as before mentioned, will always exert its force in the same vertical line, thus preventing any variation in such force. When the disk 77 is turned in the opposite direction, the weight 84 will always cause the lever to remain in contact with the stop 87. When the handle 88 is depressed by hand, it will turn the valve independent of the disk, and thus shut off the steam in steam-pipe when required, and it may be held in its depressed position by slipping it under a tooth on the rear side of standard or upright 90, as shown in Figs. 4 and 5. As many such teeth may be provided as are considered necessary.

It will be observed that the arrangement of the cylinder 4 with a stationary diaphragm at each end provided with inward-opening valves and leaving a space between each cylinder-head and the corresponding diaphragm, such spaces being open to the liquid-box above, relieves the cylinder-heads of the pressure of liquid necessary to raise the piston in the central upright cylinder. The box is not quite full of liquid, and all liquid under pressure is confined between the three

pistons. When the liquid is discharged into the box either through the opening 54 or over the top of the central vertical cylinder at 53, it simply runs by its own gravity or is drawn into the lower cylinder ready to be again forced into the vertical cylinder or through the opening 54. When the piston-rod 6 and its pistons move to the right, (see Fig. 1,) the pressure is exerted against the right-hand diaphragm, and when the motion is to the left (see Fig. 4) the pressure is against the left-hand diaphragm. In each case and at all times the cylinder-heads 7 and 8 are relieved of such pressure, so that only sufficient packing is required to prevent leakage due to the body of the liquid in the box. This gives great ease of motion to the piston-rod 6 through such cylinder-heads, and will make the governor move much more freely and run much longer without repairing. It is only necessary to make the piston-rod 68 to fit fairly close where it emerges from the box, this rendering it more easy and free in operation. The liquid-box is thus made sufficiently tight by simply providing such packing as is necessary to guard against leakage due to the weight of liquid in the box free from all other pressure. It will be seen, also, that the two cylinders, the pistons, diaphragms, valves, &c., are all inclosed in the box, the only things passing out being the piston-rods and the valve-stem 70. This compact arrangement is of great importance on many grounds, especially those of economy of space and cost, absence of liability to get out of order, and simplicity. The two cylinders may be cast together and integrally with the box, except its top and the cylinder-heads, thus dispensing with much expensive work in fitting.

Having thus fully described our invention, what we claim as new, and desire to secure by Letters Patent of the United States, is—

1. In combination, the close liquid-box 10, the two communicating cylinders 4 and 50 therein, having communication therewith at 51, 52, and 54, the pistons and diaphragms at opposite sides of the opening 54, and the pistons 67, with rod 68, passing through the top of box 10, as set forth.

2. In combination, a liquid box or reservoir, a cylinder therein having near each end a stationary diaphragm with inward-opening valve, a piston-rod in the cylinder carrying two heads with inward-opening valves, a second cylinder communicating with the first and with the liquid-box, a valve to control the opening to the liquid-box, and a piston in the second cylinder whose rod connects with and operates the supply-valve, as set forth.

3. In combination, the liquid-cylinder, the supplementary cylinder communicating therewith, the liquid-box communicating with both cylinders, and the valve between the supplementary cylinder and liquid-box, having a pointer and graduated scale to indicate the speed, as set forth.

4. In combination, the liquid-box, the liquid-cylinder, and the supplemental cylinder having communication with each other, the valve between the supplemental cylinder and the liquid-box, and the pin in its plug to limit the extent of its adjustment in either direction, as set forth.

5. In combination, the rod 68, having teeth 79, the supply-pipe valve, its stem, the disk mounted thereon having teeth to engage those on the rod, and the lever 80, engaging therewith, as set forth.

6. In combination, the extensible lever having curved pieces 81 and 82 at its ends and mounted upon the supply-valve stem, the cord 83, having weight 84 at one end and the handle 88 at the other end of the lever, the disk on the valve-stem, and the stop 87 thereon, as and for the purposes set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

WILLIAM H. GRAY.
JAMES D. GRAY.

Witnesses:
S. BRASHEARS,
M. J. FOOTE.