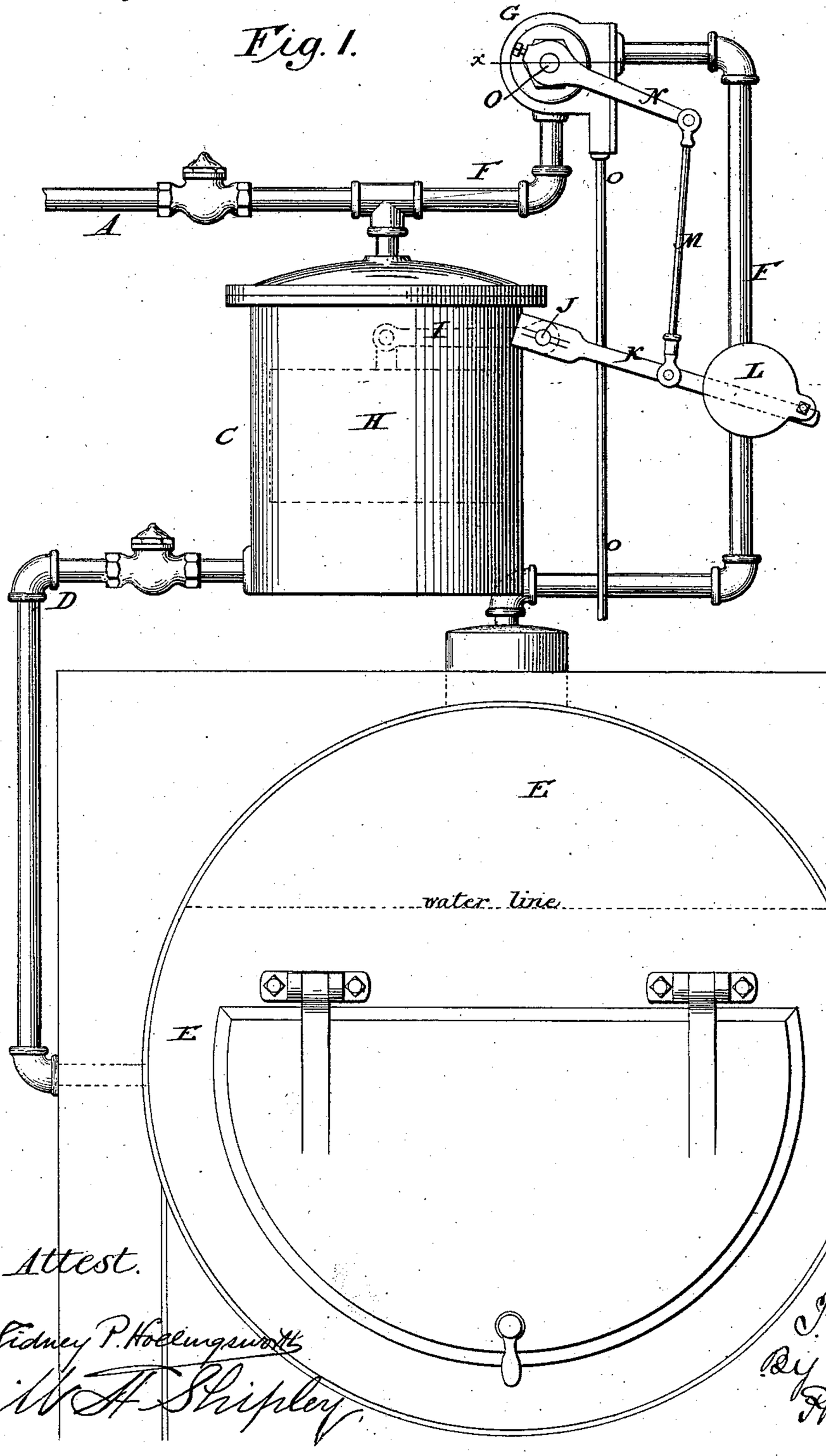
(No Model.) 4 Sheets—Sheet 1.

I. B. DAVIS.

EQUALIZING VALVE FOR STEAM TRAPS.

No. 301,968. Patented July 15, 1884.

Fig. 1.



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EQUALIZING VALVE FOR STEAM TRAPS.

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Fig. 2.

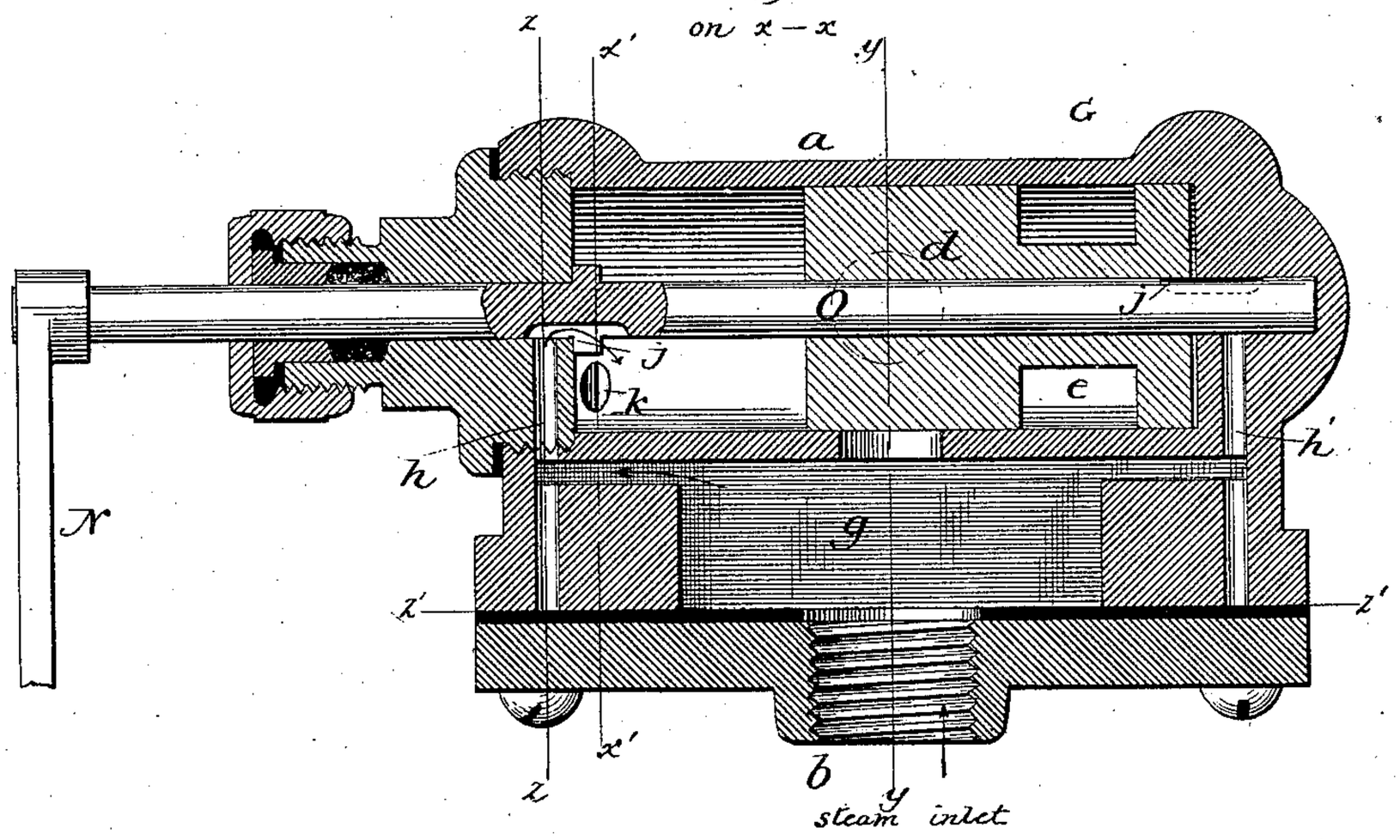


Fig. 3.

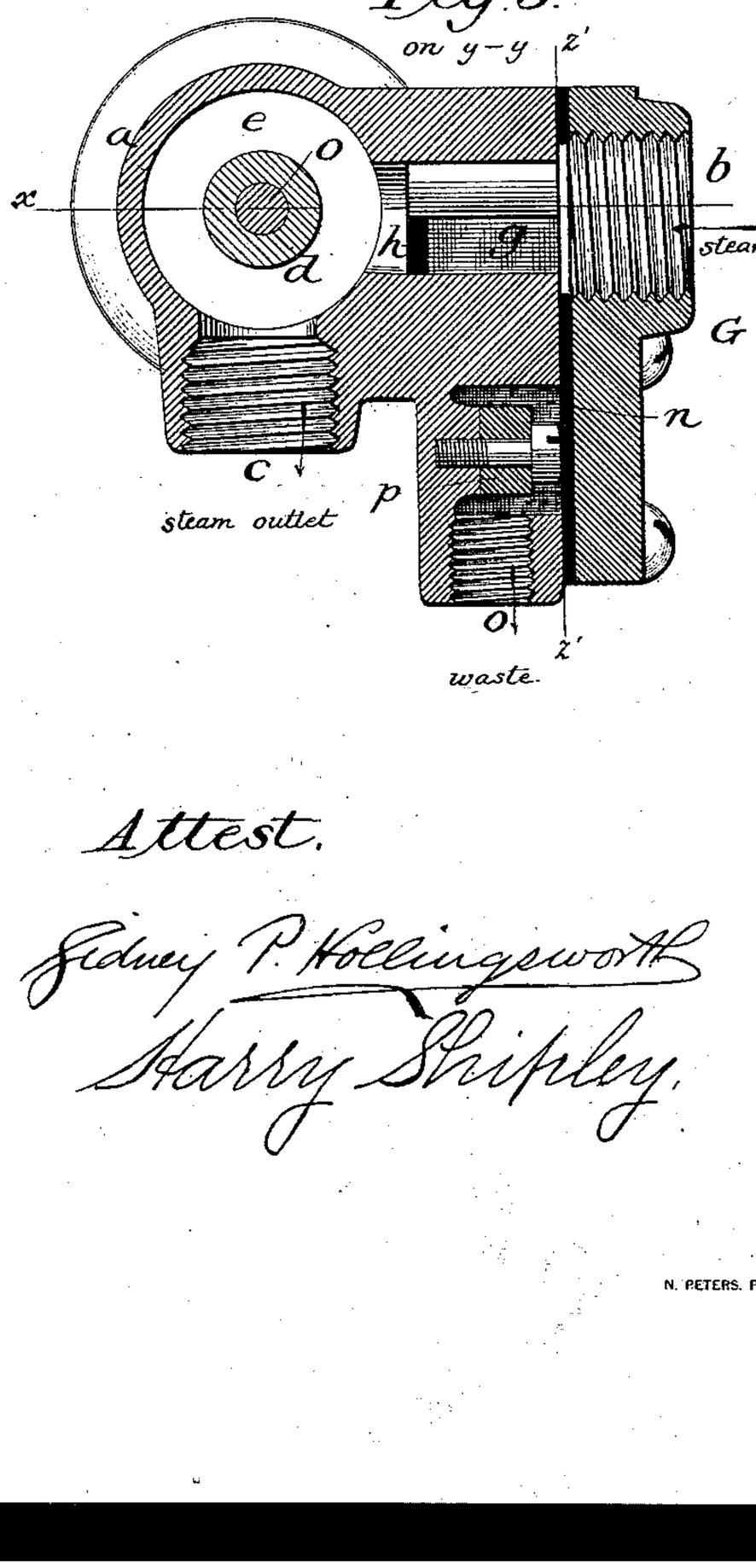
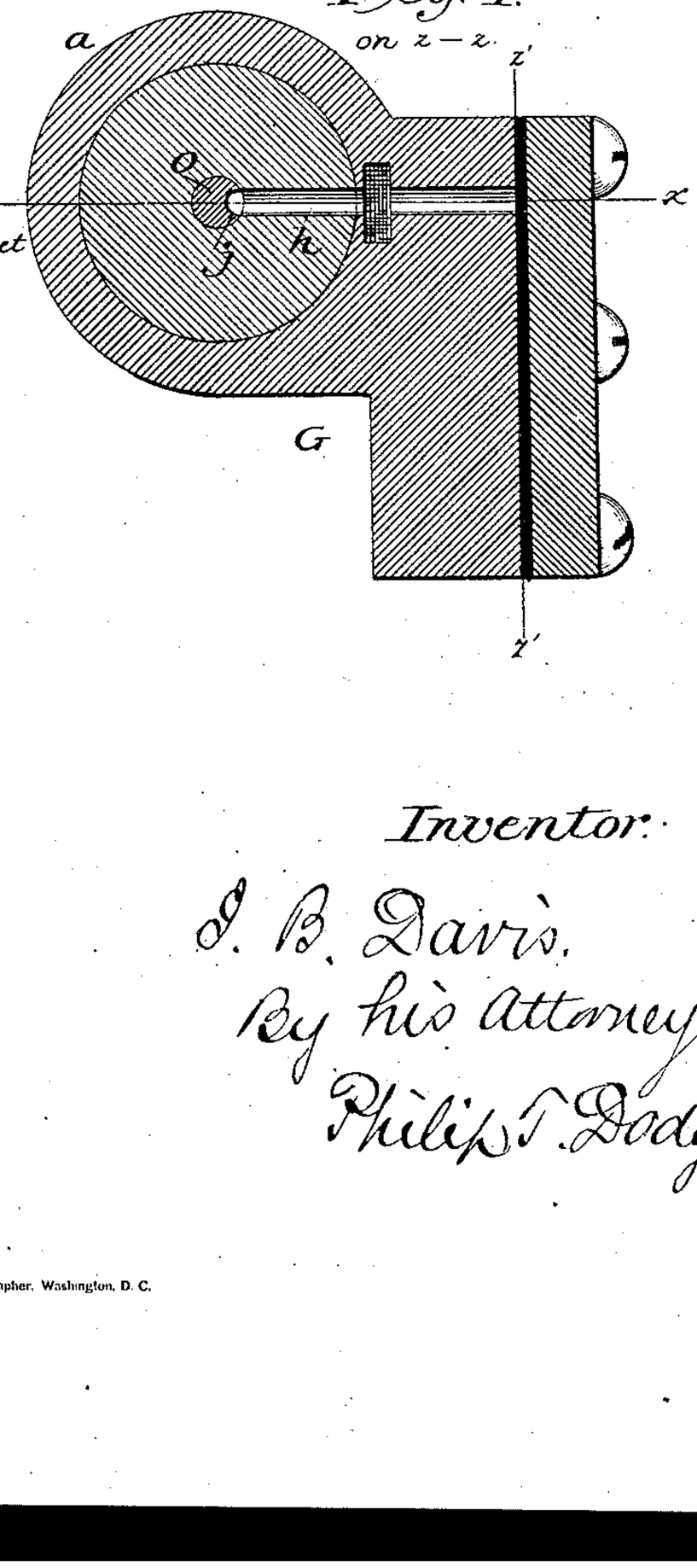


Fig. 4.



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EQUALIZING VALVE FOR STEAM TRAPS.

No. 301,968. Patented July 15, 1884.

Fig. 5.
on x'—x'

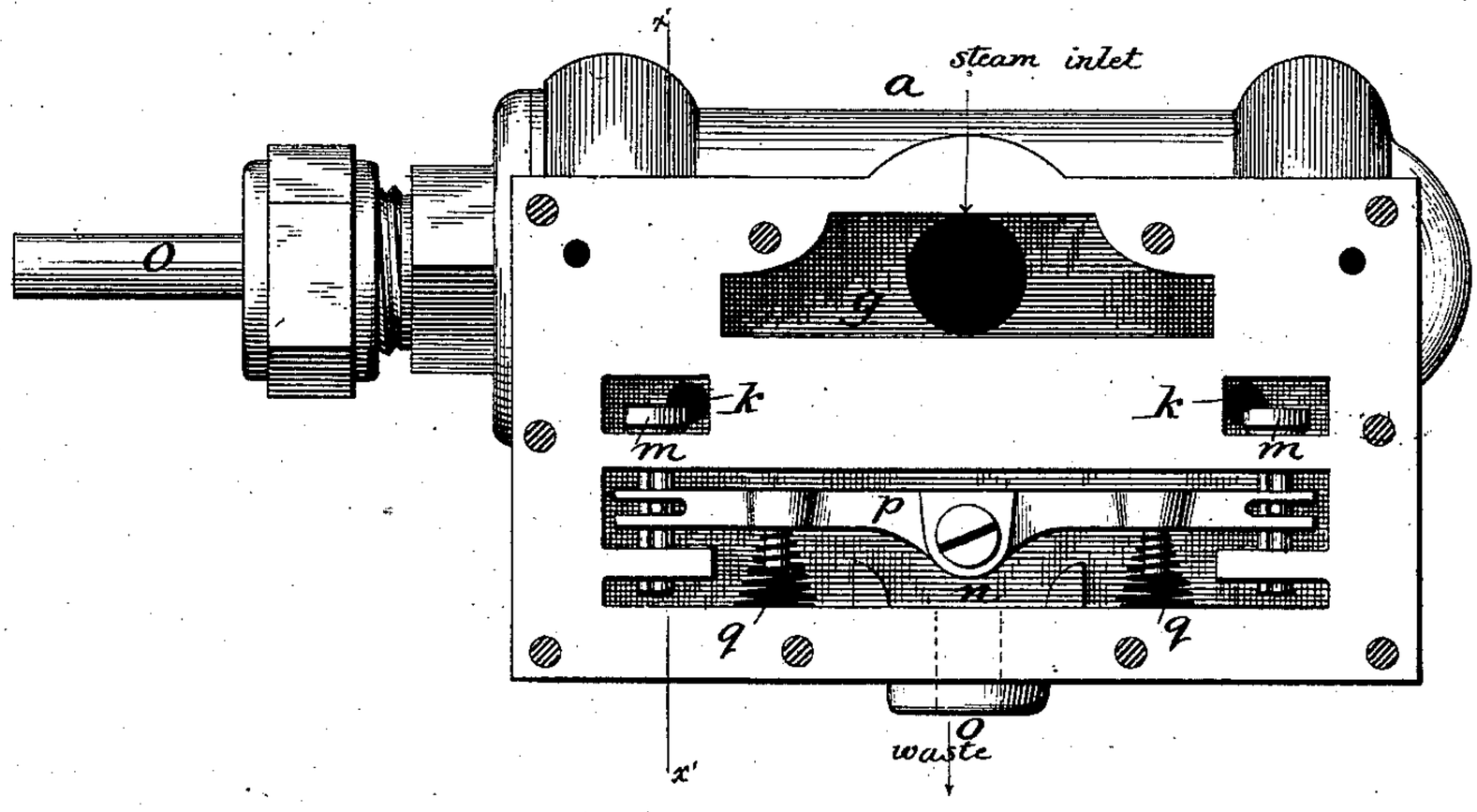
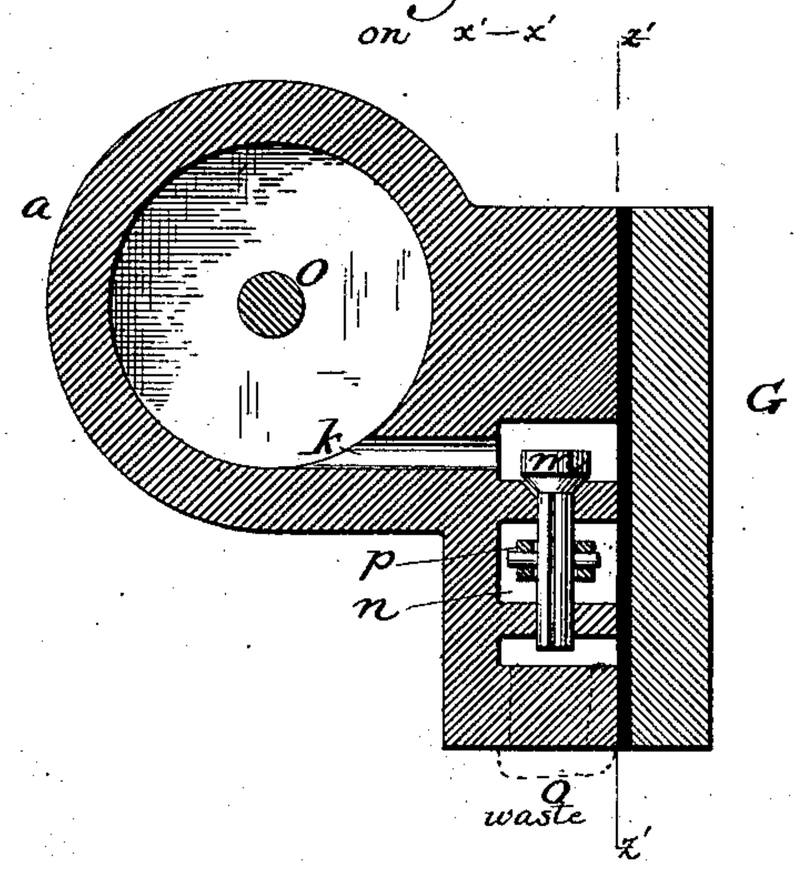


Fig. 6.
on x'—x'



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(No Model.) 4 Sheets—Sheet 4.

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Fig. 7.

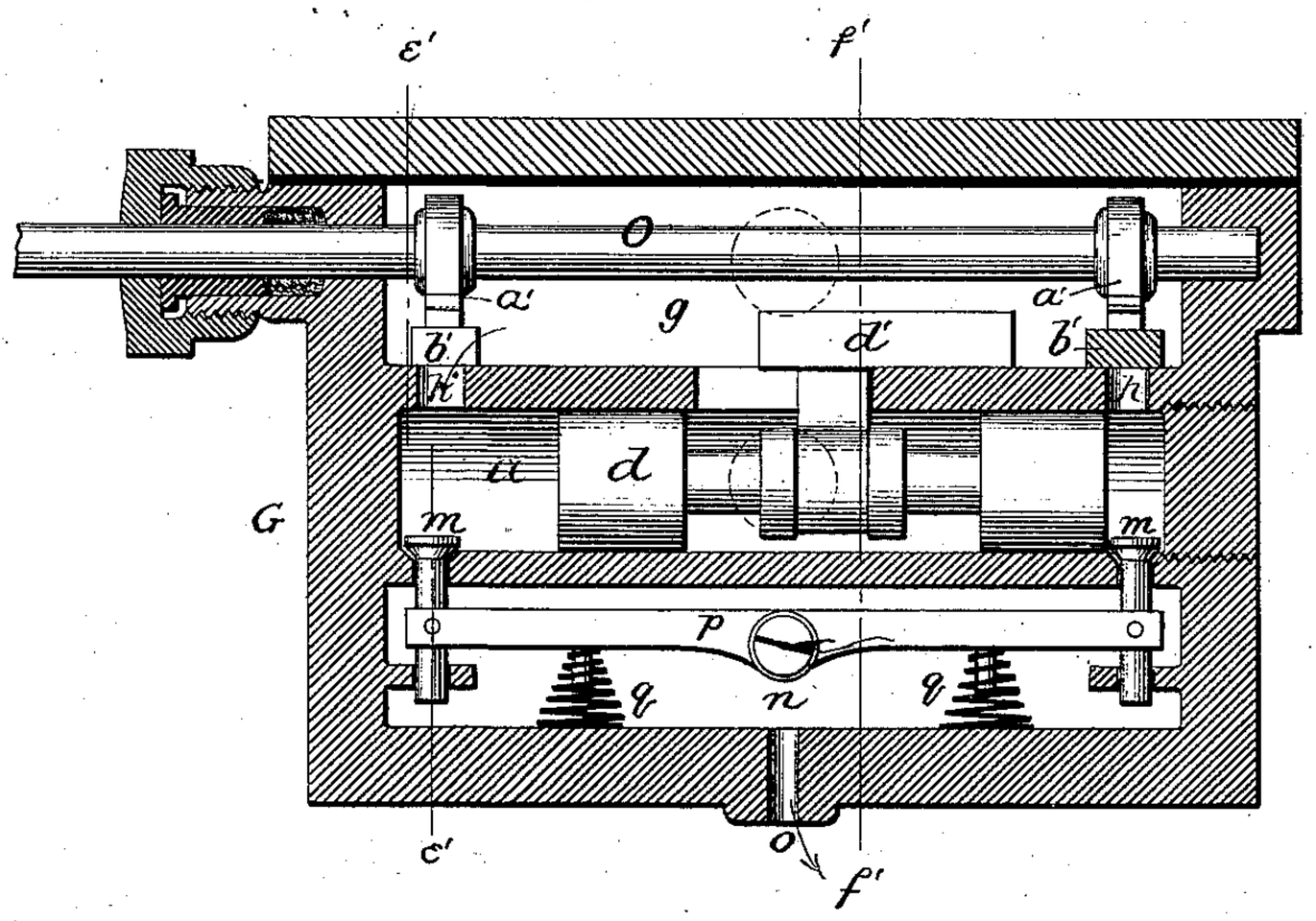


Fig. 8.
on e'–e'

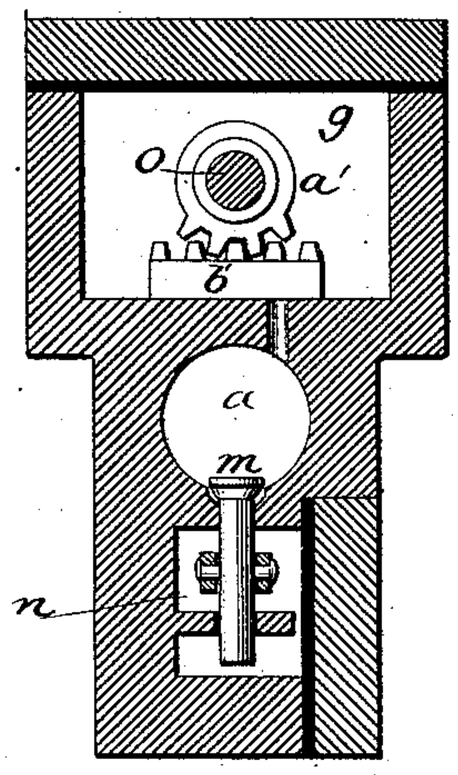
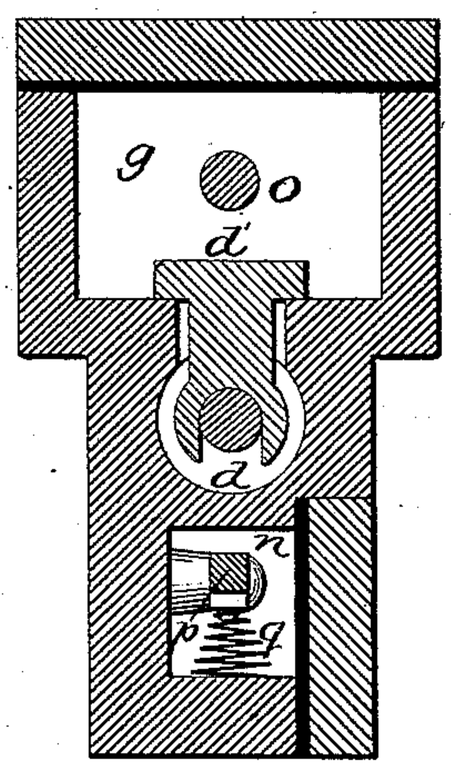


Fig. 9.
on f'–f'



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By his Attorney

Philip T. Dodge.

UNITED STATES PATENT OFFICE.

ISAAC B. DAVIS, OF HARTFORD, CONNECTICUT.

EQUALIZING-VALVE FOR STEAM-TRAPS.

SPECIFICATION forming part of Letters Patent No. 301,968, dated July 15, 1884.

Application filed April 27, 1883. Renewed June 18, 1884. (No model.) Patented in England February 26, 1884, No. 3,966.

To all whom it may concern:

Be it known that I, ISAAC B. DAVIS, of Hartford, in the county of Hartford and State of Connecticut, have invented certain Improvements in Equalizing-Valves for Steam-Traps, of which the following is a specification.

My invention relates to that class of devices commonly known as "equalizing-valves," employed to control the flow of steam, in connection with traps for returning water of condensation to a boiler, for supplying feed-water to boilers, and for other like purposes. My valve embraces a reciprocating piston, which constitutes or actuates the valve proper, and by which the flow of the steam is controlled directly; also, a secondary rotary valve or spindle, by means of which the steam is admitted to force the piston-valve in one direction or the other, as required; also, appliances whereby the water of condensation which may accumulate in the valve is automatically discharged therefrom.

Referring to the accompanying drawings, Figure 1 represents in elevation a steam-boiler, my improved valve, and the appliances used in combination therewith to return the condensation from a series of radiators or other condensing apparatus to the boiler. Fig. 2 is a horizontal central section of my valve on the line *x x*, Fig. 1. Fig. 3 represents a cross-section of the valve on the line *y y*, Fig. 1, the main valve being opened, however, instead of closed, as in the first figure. Fig. 4 is a cross-section of the valve on the line *z z*, Fig. 2. Fig. 5 is a section on the line *z' z'*, Figs. 3 and 6. Fig. 6 is a cross-section on the line *x' x'*, Fig. 2. Fig. 7 is a longitudinal central section through a modified form of my valve. Figs. 8 and 9 are cross-sections of the same on the lines *e' e'* and *f' f'*.

Referring to Fig. 1, A represents the pipe through which the water resulting from the condensation of the steam is returned to the boiler, this pipe connecting with and delivering water into a chamber or trap, C, whence it passes through the pipe D into the boiler E, below the water-line. The trap or water-chamber C also connects at its top through a pipe, F, with the top or steam-space of the boiler, so as to receive live steam therefrom at the proper time.

G represents the equalizing-valve which constitutes the subject-matter of the present invention applied to the pipe F between the boiler and the trap, for the purpose of closing said pipe during the proper intervals.

Within the trap C there is a float, H, connected through a lever, I, and rock-shaft J with an external lever, K, carrying a weight, L, serving as a counter-balance for the float. The lever K is connected by a pitman, M, to a lever, N, applied to the controlling-spindle of the equalizing-valve G, as shown. The arrangement of the parts is such that the equalizing-valve G stands normally in a closed condition, whereby the live steam is prevented from passing through pipe F to the trap. The water of condensation flowing through the pipe A accumulates in the trap or chamber C, gradually elevating the float H therein. The float, through its lever-connections, upon reaching the top of the chamber, causes the valve G to be opened, thereby admitting steam from the pipe F into the top of the trap C, thus equalizing the pressure above and below the water therein, the result of which is that the water flows by gravity through the pipe D into the boiler. The discharge of the water permits the float H to descend, the result being that the equalizing-valve G is again closed and the trap permitted to fall as before.

The general mode of action of the parts above described is similar to that of apparatus now known in the art, and is recited herein in order to give a better understanding of the purposes of my valve.

Passing now to the details of the valve G, which constitutes the subject-matter of the present invention, attention is particularly directed to Figs. 1, 2, and 3, wherein *a* represents the cylindrical body of the valve, closed at the two ends, and provided at one side with an inlet-pipe, *b*, through which the steam is received into the interior, and also with an outlet-port, *c*, at the lower side, through which the steam is permitted to escape and descend to the trap. The flow of steam is checked by closing communication between the inlet *b* and outlet *c*, and this is accomplished, as shown in Fig. 2, by means of a reciprocating piston-valve, *d*. This valve is made of suitable diameter to fit closely within the cylinder A,

and of such length that it may reciprocate therein. At one end the piston is made solid and of such size that when moved to the right end of the cylinder this solid portion will cover the inlet and outlet ports and effectually close the same, as shown in Fig. 2. At the opposite end the valve is provided with a circumferential groove or channel, *e*, of such size and location that when the piston is moved to the left-hand end of the cylinder this channel will be brought in line with the inlet and outlet openings and afford communication between the same, thus permitting the steam to pass directly through the valve to the trap. The movement of the piston to the right or left for the purpose of opening and closing the valves is effected by admitting steam into the piston opposite or against the two ends of the piston alternately. This admission of the steam is controlled by means of the spindle I, extending longitudinally and centrally through the cylinder and valve, as shown in Fig. 2, the spindle being connected at one end with the before-mentioned lever H, by which it receives a limited rotary motion. The cylinder A is provided on one side with an independent chamber, *g*, into which the steam is first received. At its two ends this cylinder is provided with passages or ports *h*, leading to opposite ends of the cylinder-spindle I. The spindle I is provided at its respective ends with two longitudinal grooves or channels, *j j'*, formed in its side, each serving, when in proper position, to form a communication between the corresponding port, *h*, and the interior of the cylinder. The two channels *j j'* stand circumferentially out of line with each other, so that upon turning the spindle in one direction the port *j'* will communicate with the port *h* and admit steam into the left end of the cylinder, while upon turning the spindle I in the opposite direction the channel *j* will be thrown out of line with its port, and the channel *j'* brought opposite the port *h'*, thereby admitting steam into the right end of the cylinder. Thus it will be seen that by rotating the spindle I steam may be admitted into the two ends of the cylinder A alternately, the effect being that the steam acting upon one or the other end of the piston-valve B will cause the same to move to the right or left, permitting the steam to pass through the main valve or preventing its flow through the same, as required.

In order to provide for the escape of the water resulting from the condensation of the steam within the cylinder, I provide means which I will now describe, attention being particularly called to Figs. 2, 5, and 6. Two discharge-ports, *k*, extending from opposite ends of the cylinder A, communicate by check-valves *m* with opposite ends of a chamber, *n*, formed outside of the cylinder, and provided with a drip-pipe, *o*. The two check-valves have their spindles jointed to opposite ends of a horizontal lever, *p*, pivoted at its middle in such manner that the two valves will be opened and closed alternately. Two springs, *q*, seated beneath the ends of the lever, tend to hold the valves normally, and when relieved from pressure in an intermediate position both valves open. When, however, live steam is admitted to either end of the cylinder, it will serve to close the corresponding check-valve, whereby the escape of the live steam will be prevented. This closing of the check-valve at one end causes at the same time the opening of that at the other, so that the steam condensing at said opposite end, and also the exhaust-steam, if any there be, which is not uncondensed, may escape from the port past the chamber *n*, and thence through the outlet *o*, which will communicate through a pipe or conductor with the steam-supply pipe or other receptacle.

The operation is as follows: The lever N being depressed as a result of the accumulation of water in the trap, the spindle I is turned in such position that the port *j'* affords communication between the port *h'* and the right end of the cylinder, whereupon live steam passing into the cylinder forces the piston-valve *d* to the left, thereby opening communication through the main valve, as represented in Fig. 3, permitting steam through the pipe F to the trap. When, however, the discharge of the water from the trap C permits the float to descend, the lever N is elevated, thereby turning the spindle I to the position indicated in Fig. 2, the effect of which will be to cut off the supply of steam at the right end of the cylinder, but admit steam through the port *j* to the left end of the cylinder, thereby causing the valve *d* to be forced to the right, as represented in Fig. 2, closing the main steam-passage.

While I have in the foregoing description described the main valve in the form of a cylindrical piston or plug, and while it is preferred to retain such construction, I may employ sliding valves operated by the rock-shaft or spindle J to control the admission of steam to opposite ends of the piston, and, instead of having the piston serve directly as a valve for controlling the flow of steam through the main ports, may have a sliding valve connected with and operated thereby for the purpose of closing the port, as shown in Figs. 7, 8, and 9.

With the exception of the parts hereinafter enumerated, the construction is the same as in the preceding figures.

In lieu of the steam-admission ports formed in the rotary spindle J, the spindle is provided with openings *a'*, arranged to engage in teeth formed upon the back of slide-valves *b'*. The operating-valves rest in such manner that one of the valves is opened as the other is closed by the rotation of the spindle and pinion, so that the steam is admitted against opposite ends of the piston alternately, causing the same to slide to and fro, as in the preceding form of valve.

The piston, instead of being constructed to serve directly as the valve for controlling the admission of steam through the main ports *h* and *h'*, is reduced or necked down at the middle and connected with a slide-valve, *d'*, arranged to close the steam-admission ports, as plainly represented in Fig. 7. The movement of the piston carrying this valve to and fro causes the valve to alternately open and close the port over which it is arranged to slide.

The parts connecting with opposite ends of the cylinder and the valves for permitting the discharge of the water of condensation are operated in the same manner as in the structure first named.

The construction represented in Figs. 7, 8, and 9 is an equivalent of that represented in the preceding figures, in that it represents the combination, in an equalizing-valve, of steam inlet and outlet ports, a reciprocating steam-actuating valve for closing said ports, secondary valves for admitting steam to opposite ends of the main valves alternately, and two connected valves for permitting the escape of the water of condensation and steam from opposite ends of the cylinder alternately.

The present invention is restricted to those matters and things hereinafter claimed, and as to all matters and things which may be described or shown, but which are not claimed, the right is reserved to make the same the subject of a separate application.

Having thus described my invention, what I claim is—

1. The cylinder provided with inlet and outlet ports, in combination with the piston-valve and the rotary spindle provided with steam-admission ports.

2. In a steam-actuated valve, the cylinder provided with inlet and outlet ports, the grooved reciprocating piston, and the rotary spindle provided at opposite ends with steam-admission channels adapted to register alternately with steam-admission ports, substantially as described.

3. In an equalizing-valve, the combination of a cylinder provided with inlet-ports, the steam-actuated valves controlling the passage of steam through the apparatus, the outlet-ports *k*, the check-valves *m*, and the spring-operated lever connecting said valves, said parts adapted to operate substantially as and for the purpose described.

4. In a piston-valve, the combination of the cylinder A, provided with steam inlet and outlet openings, the piston-valve, the rotary valve I, provided with steam-admission channels, the ports *h h'*, connecting the spindle I with the steam-inlet, the water-discharge ports *k*, and the water-discharge valves *m*, connected by means substantially as described.

5. In an equalizing-valve, the combination, substantially as specified, of steam inlet and outlet ports, the reciprocating steam-actuated valve for closing said ports, secondary valves for admitting steam to opposite ends of the main valve alternately, and two connected valves, substantially as described, for permitting the escape of the water of condensation from opposite ends of the cylinder.

6. In an equalizing-valve, the combination of a cylinder and piston, whereby the closing of the main steam-passage is effected directly or indirectly, as described, the valves for permitting the escape of the water of condensation from opposite ends of said cylinder, and connecting mechanism, substantially as described, whereby the closing of one of said waste-valves is caused to effect the positive opening of the other.

ISAAC B. DAVIS.

Witnesses:
JOHN O. DAVIS,
ALLEN H. NEWTON.