

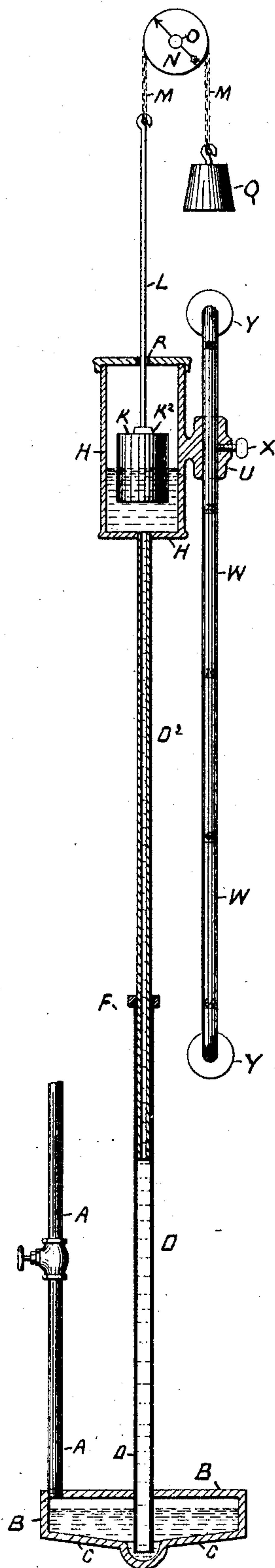
(No Model.)

R. J. FLINN.

APPARATUS FOR OPENING AND CLOSING DAMPERS.

No. 354,312.

Patented Dec. 14, 1886.



WITNESSES

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# UNITED STATES PATENT OFFICE.

RICHARD J. FLINN, OF BOSTON, MASSACHUSETTS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE FLINN MERCURIAL REGULATOR COMPANY, OF PORTLAND, MAINE.

## APPARATUS FOR OPENING AND CLOSING DAMPERS.

SPECIFICATION forming part of Letters Patent No. 354,312, dated December 14, 1886.

Application filed November 30, 1885. Serial No. 184,319. (No model.)

*To all whom it may concern:*

Be it known that I, RICHARD J. FLINN, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Apparatus for Opening and Closing Dampers, &c., of which the following is a full, clear, and exact description.

For the maintenance or regulation at a stated or given pressure of steam in a steam-boiler by an automatic regulation of the draft of the furnace of the boiler, through the closing and opening of the damper of the furnace from the action of the steam-pressure in the boiler, as well known, apparatuses of many kinds have been heretofore devised, and among them one using a column of mercury acted upon by the steam-pressure in the boiler and a float to float in the mercury and to freely move up and down with its rise and fall as the same occurs from the rise and fall of the pressure of the steam in the boiler in communication therewith, and which is suitably connected to the damper to be operated from its said movements—that is, closed or opened, as the case may require—and it is to this particular kind of such apparatuses that this invention pertains, although, as will be evident from the description hereinafter given of the apparatus of this invention, said apparatus is applicable to other purposes, as hereinafter stated. Such apparatuses, in substance and as well known, are composed of a siphon stand-pipe, made of metal or other suitable material, and two vessels, one located at each end of and in communication with the stand-pipe. These vessels are of different superficial areas, the area of the upper being greater than that of the lower and the area of each greater than the superficial area of the siphon stand-pipe connecting the two. In the upper vessel is located a float, floating in the mercury thereof, and suitably connected with the damper, which is to be operated by the rise and fall of said float from the rise and fall of the mercury in said vessel, and the lower vessel is connected by a pipe or other suitable passage for the steam the pressure of which is to be regulated to act upon the mercury in the lower vessel, and which is the mercury-reservoir proper, and through its

action thereon secure a rise or fall of the float, as the case may be, and a movement of the damper in accordance therewith.

As to such apparatuses, this invention consists in the combination, with the lower vessel or mercury-reservoir and the upper vessel or float-chamber containing the float, of a stand-pipe connecting the two and in communication with both, and the whole so constructed that the height of the mercurial column within given limits can be adjusted at pleasure by lengthening and shortening, as it were, the stand pipe; also, in the combination, with the above, of a graduated scale, by which to determine accurately the adjustments aforesaid; again, in the combination of a mercury-reservoir and a float-chamber containing the float, of different superficial areas and the area of the mercury-reservoir greater than that of the float-chamber; also, of a mercury-reservoir and a float-chamber containing the float and having communication with the mercury of the mercury-reservoir below the level thereof, said reservoir being of a cubic capacity for mercury greater than the combined cubic capacity for mercury of said float-chamber with the float in it, and of the means of its communication with the mercury-reservoir; and, again, in the combination, with a mercury-reservoir, a float-chamber in communication therewith, and a float in said chamber, of a valve constructed and arranged and co-operating with the vertical movement of the mercury to arrest its movement and to close the apparatus against a further movement of its contained mercury, and thereby to hold it against liability to escape, all substantially as hereinafter described.

In the drawing forming a part of this specification, the figure is a central vertical section of the improved apparatus, and is one form of construction in accordance with this invention.

In the drawing, A is a pipe for the passage of the fluid the pressure of which is to be regulated, or of a fluid acted upon by the pressure of such fluid, to the apparatus of this invention—as, for illustration, if it is the pressure of steam in a boiler which is to be regulated,



the pipe A may lead either from the steam or the water-space of the boiler. The pipe A enters at the upper portion of and there opens to a shell or vessel, B, which is the lower of the two vessels, making with other parts the apparatus of this invention, and is the mercury-reservoir thereof, and hereinafter to be so called.

DD<sup>2</sup> is a vertical pipe—the stand-pipe of the apparatus, and hereinafter to be so called. The stand-pipe D D<sup>2</sup>, as shown, is composed of two sections telescoping each other, and the upper end of the lower section, D, is provided with a stuffing-box, F, to tightly close the joint between the two sections. This stuffing-box may be of any of the ordinary constructions of stuffing-boxes, and preferably it is adapted to be tightened and loosened in its bearing upon the upper section, so that, tightened, it may act to support the stand-pipe in its section above it and such other parts of the apparatus as are connected therewith, and, loosened, allow the telescoping sections to be moved the one upon the other, to lengthen or shorten the stand-pipe, as the case may be, for the purpose of lengthening and shortening the mercurial column, as will hereinafter more fully appear. The lower end of the lower section, D, of the stand-pipe passes with a closed joint through the upper wall of the mercury-reservoir B, and into and vertically through said reservoir, terminating near the bottom wall or floor, C, thereof, which preferably inclines from its outer edge at all points toward its center and the lower open end of said stand-pipe. The upper end of the upper section, D<sup>2</sup>, of the stand-pipe passes with a closed joint through the lower wall or floor of a shell or vessel, H, and opens thereto, said shell being the upper of the two vessels of the apparatus of this invention, and making the float-chamber thereof, as it will be hereinafter called.

K is a float located in the float-chamber H. This float K is made of metal or other suitable material and otherwise all so as to float in the mercury contained in said float-chamber H, as will hereinafter appear, and from the downward movement of the mercury to secure an operation of the mechanism connected with the float, as hereinafter described.

The float-chamber H, except as to its communication with the stand-pipe D D<sup>2</sup> described, and as to a central opening, R, in its top, is closed on all sides and at all parts, and through this central opening, R, passes a vertical rod, L, attached to and projecting upward from the center of the top of the float. The rod L at its upper end is connected to the lower end of a belt, chain, or other flexible line, M, which passes upward and about a vertically-placed grooved pulley-wheel, N, carried by a horizontal shaft or rod, O, turning in suitable bearings, and which, for instance, may be the damper-rod of the damper to the furnace of a steam-boiler, or the stem of a steam, water, gas, or other fluid valve, or such like; but for the pur-

poses of this specification will be assumed to be the damper-rod of the furnace to a steam-boiler, and hereinafter so called.

The damper-rod O has a weight, Q, applied to it on the side opposite to that at which the chain M of the float K enters upon its grooved pulley N. The weight Q may be either suspended from the opposite end of the chain M to that from which the float is suspended, or from said pulley-wheel or damper-rod; and if from either the pulley-wheel or damper-rod the chain M is required to be fastened to the pulley-wheel or rod. This weight Q is sufficient, as the float rises in its chamber from the rise of the mercury, releasing the weight to action, to secure a turning of the damper-rod O and its damper and all otherwise so that a fall of the float from a fall of the mercury in the float-chamber will secure an opening of said damper, and a rise of the float from a rise of the mercury in the float-chamber will secure a closing of said damper.

The damper, furnace, and steam-boiler are not shown, as it is not deemed necessary, being so well known and as they of themselves form no part of this invention.

The top of the float-chamber H acts as a stop or abutment to the upward movement or rise of the float in said chamber, and the central opening, R, thereof, through which the rod L of float passes, is sufficiently large to act as a vent and inlet for air to prevent acting as a vent, the cushioning of air and as an inlet, the forming of a vacuum within the floating chamber in the operation of the apparatus of this invention, as hereinafter described. The float K, at the central portion of its upper end, has a face or projection, K<sup>2</sup>, of suitable shape to seat upon and against the inner face of the closed head of the float-chamber H at and about the central opening, R, thereof, and all so as thus to close said opening. A suitable packing may be used on either the face of the valve K<sup>2</sup> or its seat of the closed head of the float-chamber, or on both. U is an ear-piece projecting horizontally from one side of the float-chamber H and fitting by its eye upon a stationary vertical rod, W, which is secured by end ear-pieces, Y, to a suitable stationary and suitably-located support therefor.

X is a set or thumb screw screwing through the ear-piece U, and which, turned up to a bearing on the rod W, fastens the float-chamber to said rod. This vertical rod W is graduated along its length, and, as particularly shown, the lower graduation is marked 60, and the others running upward therefrom are marked in regular steps by fives, 65, 70, 75, and so on, to the upper graduation of the series. Each graduation is in representation of a corresponding pressure of the steam, water, air, gas, or other fluid, the pressure of which is to be regulated by the use of the apparatus of this invention, and said graduated rod and the connection of the float-chamber therewith are all such as to secure a practical and serv-



iceable means of accurately adjusting the apparatus to the pressure of fluid desired to be maintained, as will hereinafter appear.

The float-chamber H and the mercury-reservoir B are of different superficial areas, the mercury-reservoir having the greater superficial area, and, again, the superficial area of the stand-pipe D D<sup>2</sup>, connecting the float-chamber H and mercury-reservoir B, is less than the superficial area of either thereof. The mercury-reservoir has a greater cubic capacity for mercury than the combined cubic capacity for mercury of the float-chamber with the float therein and the stand-pipe connecting the reservoir and chamber.

The mercury-reservoir B is charged with the quantity of mercury necessary for the working of the apparatus, and which quantity must be sufficient to fill the stand-pipe D D<sup>2</sup>, the float-chamber H, with the float K therein, and the mercury-reservoir B, and to a sufficient height in the latter that the end of the stand-pipe opening to the mercury in said reservoir shall be at all times covered or closed by the mercury thereof.

The apparatus thus charged with mercury is ready for use, and as a pertinent illustration of its use suppose it to be connected, as has been hereinbefore described, to a steam-boiler, and the damper-rod of the damper to the furnace of the boiler. In this application of the apparatus the float K must be of a weight not only to float in the mercury of the float-chamber, but also as the mercury in said chamber lowers to lower with it and turn the damper-rod to open the damper, and the apparatus, as a whole, connected as described, obviously is to be suitably supported, the support not being shown, as it is so obvious what it should be as to require neither illustration nor description. Again, as so applied, with an open communication between the steam-pressure of the boiler and the mercury-reservoir, the apparatus, if not already adjusted to the steam-pressure desired to be maintained, is to be so adjusted, and for this adjustment the apparatus must first be relieved of any pressure of its contained mercury, which then will all be accumulated in the mercury-reservoir, and then, having loosened the thumb-screw and stuffing-box F, slide the upper section D<sup>2</sup> of the telescoping stand-pipe D D<sup>2</sup> upon the lower section, D, thereof until an index-mark suitably located on the ear-piece U of the float-chamber is brought to the graduation of the rod W, marked in accordance with the pressure desired to be maintained in the steam-boiler when the stuffing-box is to be tightened up and the thumb screw turned up against the graduated rod W—as, for instance, suppose the pressure desired is a pressure of sixty pounds to the square inch, then the mark of the ear-piece U of the float-chamber should be brought to the graduation marked 60 of the rod W and fastened thereat, it being of course understood that said several graduations of the rod W are all such as when the ear-piece

U of the float-chamber is so fixed at either of them, or at any point between either of them, the apparatus will then be adapted to the maintaining of the pressure of the fluid to a corresponding amount. The apparatus thus adjusted is then put into communication with the steam-pressure in the boiler, and in its operation when a steam-pressure equal to the pressure to which it was adjusted is reached in the boiler the float, from the rise of the mercurial column, has risen in the float chamber sufficiently to secure, through the operation of the weight Q of its connection, described with the damper of the furnace, a close of the damper, and also at or about, but preferably just after, a seating of the valve K<sup>2</sup> of said float, and on a reduction in the pressure of the steam in the steam-boiler, the float then falling from the fall of the mercury, an opening of the damper, and so on, the whole acting, and as is well known, to secure a regulation and the maintaining of the desired pressure of steam in the boiler by and through the regulation of the draft of the furnace to the boiler.

In the operation of the apparatus its contained mercury is acted upon by the pressure of the steam of the boiler, and as this pressure varies the height of the mercurial column is varied, on an increase resulting, as has been stated, in a rise and on a decrease in a fall of the float K, and through it securing a closing and an opening of the damper of the furnace, as has been described, as also a closing and opening of the opening R of the float-chamber by the valve K<sup>2</sup> of the float.

The valve of the float and its seat (particularly shown and described) are at the upper portion of the float-chamber and float; but they may be otherwise situated, and yet secure the result stated.

A valve and seat therefor, combined with and operating in relation to the movement of a float, K, in a float-chamber, H, all substantially as has been described, enables the mercury to be retained in the apparatus and against any possibility of escape or loss should the pressure go above the pressure at which the apparatus is adjusted, while at the same time the necessary ingress to and egress of air from the float-chamber is allowed. This is very essential in the practical use and operation of mercurial pressure and vacuum-regulating apparatus of the class to which this invention pertains.

The telescope construction of the stand-pipe D D<sup>2</sup> enables said pipe to be lengthened or shortened, as may be necessary, to adapt the apparatus to the pressure of steam desired to be maintained in the boiler, a shortening of the pipe from a given length adapting it for reduced and a lengthening of the pipe from the same given length adapting it for increased pressure in relation to the pressure to which at said given length it is adapted.

The stand-pipe D D<sup>2</sup>, although particularly described and shown as made in two telescoping sections, may be similarly made in



three or more telescoping sections, and the lower sections may be arranged to telescope in and through the mercury-reservoir by suitably constructing it therefor, and as the same is shown and described in another application made by me the 17th day of April, 1886, Serial No. 199,245, and which as to such specific construction forms part of the invention included therein.

The graduations particularly shown and described as on a stationary vertical rod, W, may be on an in-and out moving section of the telescoping stand-pipe or any other suitable part of the apparatus, and yet secure the same result.

In the apparatus of this invention, as has been described, and as in all mercurial apparatuses of the same class, as well known, a variation of pressure in the steam-boiler, for instance, causes a vertical movement of the mercury in the mercury-reservoir and float-chamber and of the float in said float-chamber, and from this movement of the mercury and float the damper, &c., is opened or closed, as the case may be, said opening and closing being wholly dependent upon the rise and fall of the float and of the portion of the mercury contained in the chamber for said float. Plainly, if the float-chamber and mercury-reservoir are of the same superficial area, then the mercury rises and falls in the float-chamber to the same extent that the mercury does in the mercury-reservoir; but by making the float-chamber of a smaller superficial area than the mercury-reservoir, and which is an important feature of this invention, then the mercury in the float-chamber, as also the float, will have a vertical movement of greater length than the length of vertical movement of the mercury in the mercury-reservoir, from all of which it is plain that from such a relative arrangement of superficial areas of the float-chamber and mercury-reservoir the apparatus can be adapted to secure with a minimum vertical movement of the mercury in the mercury-reservoir the maximum vertical movement of the mercury in the float-chamber and of the float floating therein; or, in other words, to have in practical operation substantially most of the movement of the mercury to occur in the float-chamber, where it is most required, and at the same time making the apparatus most sensitive and active to small variations in the pressure of the steam in the steam-boiler—all very and most important advantages and results. Again, having the mercury-reservoir of a cubic capacity for mercury greater than the combined cubic capacity for mercury of the float-chamber with the float in it and its connection with the mercury-reservoir, combined with a dip of the communication of the float-chamber, with the mercury-reservoir below the level of the mercury of said reservoir, insures at all times the seal and close of said communication between the float-chamber and the mercury-reservoir with the mercury of said reservoir, and prevents any possibility of the steam, wa-

ter, or other fluid acting upon the mercury in the mercury-reservoir from passing up through the mercurial column and blowing off or escaping, it being of course understood that at such times as this would be liable to occur the upward movement of the float has been in some manner arrested.

The apparatus herein described in practical use has been found to be most sensitive and efficient and useful, securing an absolutely perfect regulation of the steam-pressure in the boiler by causing an opening and closing of the damper of the furnace in proper relation to an increase or decrease in said pressure as the same from time to time occurs.

The upward and downward moving float may be connected in many ways to the damper-rod other than that particularly described—as, for instance, by a vertical rack-bar meshing with a pinion gear-wheel on the damper-rod—and it is not intended to limit this invention in the relation of the connection of its float with the part to operate from its rise and fall.

The float-chamber and its float may be varied in length and diameter, as also the mercury-reservoir, for adaptations of the apparatus to special purposes, but taking care in each instance to preserve the relative superficial areas and cubic capacities between the float-chamber and mercury-reservoir, as has been described.

The apparatus, as particularly described and shown, is capable of adjustment to varying pressures; but this capability may be dispensed with, if so desired. Again, although the apparatus has been particularly shown and described for securing the opening and closing of a damper to the furnace of a steam-boiler as the pressure of steam in the boiler falls from or rises to the pressure desired, the same apparatus, and without substantial or material changes in the construction, arrangement, and operation of its parts, may be usefully, advantageously, and practically employed for other purposes—as, for instance, to the opening and closing of valves in apparatuses of various kinds using steam, air, gas, and other fluids, and to the end of maintaining such fluids at a given or stated pressure, and therefore it is not intended to limit the invention in this regard. As illustrations of some of its uses, above referred to, may be mentioned valves of steam, hot-water and hot-air, heating and drying apparatuses, feed-water and air-pressure apparatuses, safety and reducing valves, valves for regulating pressure of steam, water or gas, and the vacuum in a vacuum-pan or in the condenser of a steam-engine, through regulating the speed of the pump or other apparatus, producing the vacuum or the flow of the injection-water to the condenser, &c.

Having thus described my invention, I claim—

1. In combination, a mercury-reservoir, B, a float-chamber, H, containing a float, K, and a stand-pipe, D D<sup>2</sup>, connecting said reservoir



and chamber, constructed and arranged to be lengthened and shortened, and, so lengthened and shortened, secured against movement, and said reservoir and float each separately connected, substantially as described, and for the purpose specified.

2. In combination, a mercury-reservoir, B, and a float-chamber, H, containing a float, K, connected together and having the mercury-reservoir of a greater superficial area than that of said float-chamber with the float in it, and of the connecting parts thereof, and said reservoir and float separately connected, substantially as described, for the purpose specified.

3. In combination, a mercury-reservoir, B, a float-chamber, H, containing a float, K, and a stand-pipe connecting said reservoir and chamber and provided with a graduated scale, all constructed and arranged for the stand-pipe to be lengthened and shortened, and such adjustments made certain and definite, and the reservoir and float separately connected, substantially as described, and for the purpose specified.

4. In combination, a mercury-reservoir, B, a float-chamber connected thereto, a float, K, located in said float-chamber, and a valve and seat therefor, the valve being opened and closed by the vertical movement of the mercury, and the mercury-reservoir and float separately connected, substantially as described, for the purpose specified.

5. In combination, a mercury-reservoir, B, and a float-chamber, H, containing a float, K, and in communication with said reservoir, and said reservoir of a greater cubic capacity for mercury than the cubic capacity of float-chamber with float in it and its said communication with said reservoir, and the reservoir and float separately connected, substantially as described, for the purpose specified.

6. In combination, a stand-pipe, D D<sup>2</sup>, in telescoping sections, a mercury-reservoir, B, a float-chamber, H, connected by said stand-pipe, and a float, K, in said float-chamber, and the mercury-reservoir and float-chamber separately connected, substantially as described, for the purpose specified.

7. In combination, a stand-pipe, D D<sup>2</sup>, in telescoping sections, a mercury-reservoir, B, and float-chamber H, connected by said stand-pipe, a float, K, in said float-chamber, and a stationary graduated rod, W, connected to the stand-pipe, and the mercury-reservoir and float separately connected, substantially as described, for the purpose specified.

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

RICHARD J. FLINN.

Witnesses:

ALBERT W. BROWN,  
WM. S. BELLOWS.