J. J. LISCH & W. L. ROOT.

AUTOMATIC COMBINED GAS AND WATER COCK FOR MECHANISMS FOR HEATING LIQUIDS.

APPLICATION FILED APR. 16, 1908.

934,555. Patented Sept. 21, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

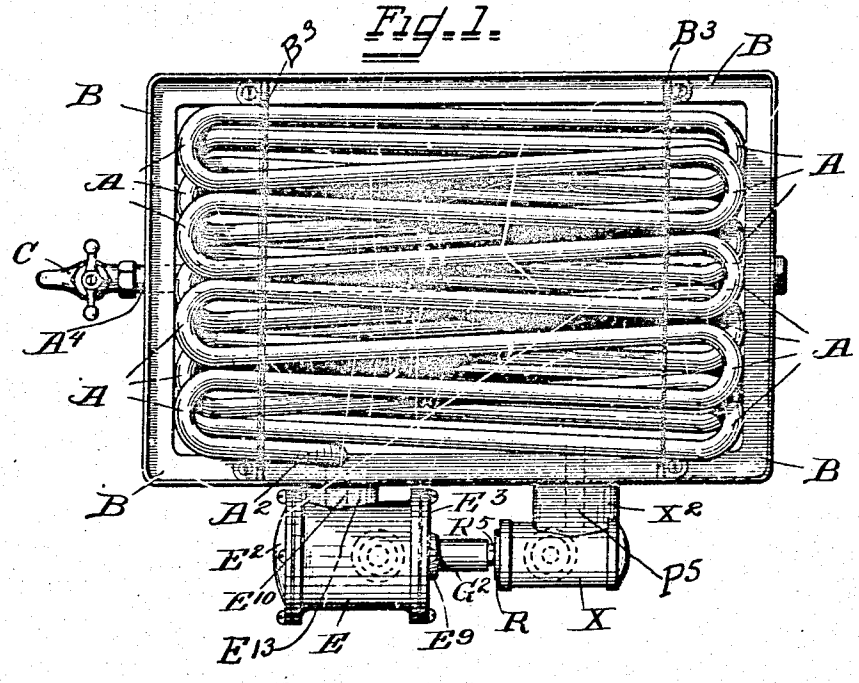
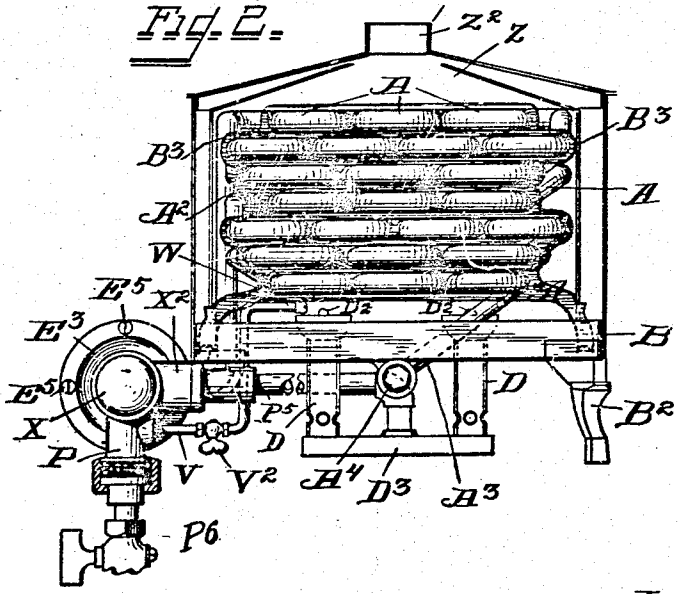


Fig. 2.



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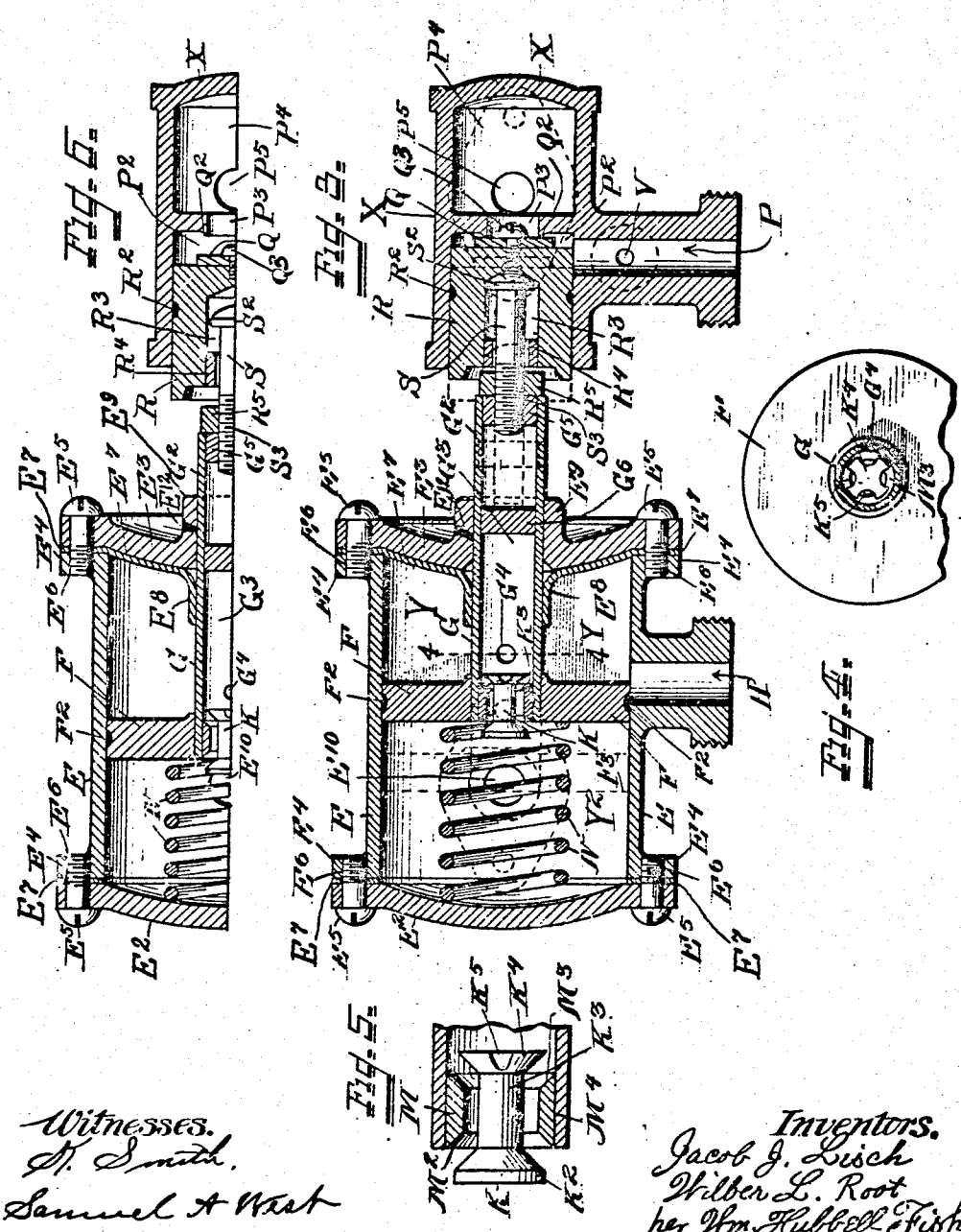

Witnesses.
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UNITED STATES PATENT OFFICE.

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AUTOMATIC COMBINED GAS AND WATER COCK FOR MECHANISMS FOR HEATING LIQUIDS.

934,555. Specification of Letters Patent. Patented Sept. 21, 1909.

Application filed April 16, 1906. Serial No. 312,006.

To all whom it may concern:

Be it known that we, JACOB J. LISCH and WILBER L. ROOT, citizens of the United States, and residents of the city of Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Automatic Combined Gas and Water Cocks for Mechanism for Heating Liquids, of which the following is a specification.

The several features of our invention and the various advantages resulting from their use conjointly or otherwise will be apparent from the following description and claims.

The main purpose of our invention is to obtain by an economical construction and in an economical manner, with a dependable certainty, the supply of water to a water heater, and the heating of this water by gas for fuel.

In the accompanying drawings, making a part of this application and in which similar letters of reference indicate corresponding parts,—Figure 1 is a top view of mechanism embodying our invention, in combination with one description of mechanism wherewith our improved mechanism can be used. In this view, the cover or hood we usually provide to protect the coils from dirt, and for other obvious purposes, is omitted. Fig. 2 is an elevation of that end of the construction shown in Fig. 1, which faces toward the right in Fig. 1. But this Fig. 2 shows the frame uprights at the sides of the coils, and a cover for the coils. Fig. 3 represents a vertical, central longitudinal section of our improved automatic combined gas and water cock. The drawing of this figure is to a scale larger than that to which Figs. 1 and 2 are drawn. Fig. 4 is a sectional view taken in the plane of the dotted line 4, 4, of Fig. 3, that side of the section being taken which faces toward the right in said Fig. 3. In this view (Fig. 4), the lower part of the piston head, together with the embracing cylinder and its inlet for water, is removed, the primary purpose of the view being to show the formation of the adjacent end of the check valve, and the relation of this valve to the water way at the place in said way wherein it is located. Fig. 5 is a view of the piston valve, in elevation, and of its valve seat and surrounding guard, in section. This view is on a larger scale than that of Figs. 3 and 4. Fig. 6 is a view in vertical, central longitudinal section of the parts illustrated in Fig. 3, only the upper half of the parts being shown. The purpose of this figure is to illustrate one of the portions of the working parts, while the water is being drawn from the heater.

We will now proceed to describe our invention in detail.

The water-heater itself may be of any suitable construction. Inasmuch as it is desirable that the water in the heater should be heated rapidly, the preferred construction is of a kind that will enable much water to be expeditiously heated. This is usually accomplished by a construction that provides a widely distributed or extensive heating surface, and a large amount of fire.

One of the preferred constructions for compactly obtaining a widely extended heating surface consists of a coil or coils of pipes compactly arranged to receive the heat, and a line or lines of flame, or a series of burners.

While our invention is applicable to various kinds of water heaters and of burners, we have shown herein and will describe one of the preferred kinds of water-heaters and one of the preferred arrangement of burners. These are as follows: A indicates a pipe, which extends back and forth in the same plane and then extends into another higher plane, in which it is bent back and forth a number of times. It then extends up into a higher plane and there is again bent and extends back and forth. Its like construction is continued higher up in as many planes as desired, seven of such layers of pipes, in as many planes, being shown in the drawing, Fig. 2. These coils of piping are suitably upheld. A convenient mode of upholding them is as shown by the two terminals of the pipe A. For example, the inlet end portion A^2 of the pipe A serves to uphold the coils of the heater, and the exit end portion A^3 of the pipe A performs a like function.

We provide a frame B, and to this frame we connect the inlet end portion A^2 of the coil and the exit end portion A^3 thereof. The exit end portion A^3 is extended through a suitable connection to whatever place it is desired to deliver the water. In the present instance, this end portion is extended along,

in a straight portion A^4, back beneath the coils to the opposite end of the heater (such extension being shown by dotted lines in Fig. 1) and is at its end provided with the faucet or cock C. It is from this faucet or cock C that the hot water heated in the coils A of the heater is delivered.

The frame B is suitably supported from below. Legs B^2, one of which is indicated in Fg. 2, at proper intervals, constitute a preferred means of support. Uprights B^3 extending from the frame B upwardly, not only support the cover Z, but also serve to assist in keeping the coils A in place. These coils A are for this reason connected to these uprights. The cover or hood Z is provided with one or more apertures Z^2 for the escape of the hot air rising from the burners.

The burners D consist of a series of parallel pipes with opening D^2 in the top thereof at suitable intervals. These burners D, D^2 are distributed at proper intervals under the entire bottom surface of the body of the coils of pipe A.

The construction of this heater, as to coils and burners, is not new, and we make no claim for the same.

Our newly invented mechanism is as follows:—

E is a cylinder, properly closed by a rear cylinder head E^2 and a front cylinder head E^3. One of these cylinder heads should be removable. Both are preferably removable, and are removably connected to the cylinder preferably as follows: At each end the cylinder has an outer annular flange E^4. Each cylinder head is bolted to its adjacent end flange E^4 of the cylinder by the securing screws or bolts E^5, which latter pass into the adjacent flange E^4, and by means of a female screw thread in the flange E^4, or by a nut at the opposite side of the flange, make their necessary engagement to hold the head to the flange. In Figs. 3 and 6, female screw threads E^6 are present in the said flange for engaging the screws E^5. A suitable packing E^7 is present between the cylinder head and the adjacent flange E^4. Within this cylinder E is a piston F, capable of sliding back and forth within the cylinder. The periphery of this cylinder fits closely the inner surface of the cylinder and preferably a packing F^2 of any suitable kind is present at the periphery of the cylinder.

A tube G is connected at one end to the piston. The interior space or passageway G^3 of this tube G extends through the piston, and is preferably concentric therewith, so that the axial center of the piston is coincident with the axial center of the passage G^3. This tube G extends forward through the front cylinder head and to a distance beyond the latter. The tube is from one point of view a hollow piston rod. That part of this piston rod which is next to the piston is necessarily hollow, but that part G^2 of the rod which is nearest the gas cylinder is not necessarily tubular, but is preferably so, as will from the further description soon be obvious. This piston rod G should fit closely within the surface of the opening of the head E^5 of the cylinder E, through which it passes. A convenient and economical means for packing it consists in extending the packing E^7 down to and around and upon the piston rod in the form of a gasket E^8.

To enable the cylinder head E^5 to furnish a longer bearing for the piston rod G, it is extended in the form of an annular bearing E^9. An oil passage E^{12} in this bearing permits a lubricating oil to be applied to the piston G so that the latter shall never work hard nor stop by reason of friction, but on the contrary shall always move easily in its bearing in the cylinder head E^3, E^5. The inlet H for introducing the water into the cylinder E is located near the midlength of the cylinder E. Within the passageway G^3 of the piston G is a valve K and its valve seat M. The valve K and its seat M are so relatively constructed that the valve cannot move unduly away from it. To this end, the valve seat has at one end a beveled enlargement M^2 and when the valve is moved forward, constitutes the valve seat proper. When the enlargement K^2 of the valve K is against the beveled portion M^2 (that is the valve seat proper), the valve is closed, and vice versa. From this beveled valve K^2 extends a valve stem K^3. At the opposite end of the valve stem K^3 is an extension K^4 preferably beveled and adapted to fit a beveled annular part M^3 stationary in the passage G^3. The valve K, stem K^3 and extension K^4 thus formed in combination with the stationary valve seat M^2 and stationary part M^3 cannot leave the passage G^3. But because of the length of the stem, this valve, stem and extension are (or viewed as one is) free to move back and forth quite sufficiently to permit the valve to leave its seat far enough to allow much water to pass through between the valve and its seat. When the valve is not only unseated, but the extension K^4 is against the beveled part M^3, the passageway G^3 is not entirely obstructed, but on account of the openings K^5 in the extension K^4, the water can pass through said openings K^5, and at each side of the valve stem K^3, and thence between the valve and its seat, or vice versa.

For convenience of manufacture, the beveled valve seat M^2 and the beveled part M^3 are united, forming an annular ring M^4.

In the left hand part of the cylinder E is an exit passage E^{10} for the water, as hereinafter described.

For the purpose of insuring entire safety to the coils, in case the water is turned off while the heater is in operation, we provide

the spring N. This spring will operate and move the valve from left to right (see Fig. 3) and close the gas valve and thereby stop the supply of gas to the burners, and so put them out, and thus prevent steam forming and causing an explosion in the coils. In other words, the spring N is a safety spring in case of trouble arising from stoppage of the water in the supply pipe, or otherwise.

In the side of the tube or conduit G, is an exit passageway G^4. This way G^4 is located in said tube G at a place to the right of the piston, Figs. 3 and 6.

The preferred description of gas valve, and the connections between this gas valve and the water valve is as follows:—P indicates the inlet conduit for admitting gas to the heater coils A. P^3 indicates the passage through the gas valve seat Q^2. P^2 is the chamber in which the gas valve Q works. When the valve is open, the passage P^3 is connected to the inlet P by the chamber P^2. The valve proper Q is preferably a leather one, and when brought against its valve seat Q^2, prevents the gas entering the inlet P from passing through the passage P^2 and into the chamber P^4. The valve seat is preferably a raised annular edge, which latter when the valve is against it, presses into the leather, and makes a tight joint. After the gas passes through the valve passage P^2, it passes out of the valve chamber P^4 through the exit opening or conduit P^5. To retain this valve Q in place, and to enable the material of which it is composed to be readily replaced, I connect this valve to the adjacent end of the plunger by a screw Q^3.

In the chamber P^2 is an air tight plunger R. This plunger R works closely in the chamber P^2, its peripheral surface making an air tight connection with the interior surface of the chamber P^2. To effectuate very perfectly this air-tight connection, an annular packing R^2 is present in the periphery of the plunger R. This close connection between the plunger R and the walls of the chamber P^2 prevents the gas which enters the chamber P^2 by the gas inlet P from escaping between the plunger and the adjacent wall of chamber P^2.

S is an adjusting stem for regulating the flow of gas, the amount of the flow being accurately regulated by advancing or retracting the stem relatively to the tube piston G. This stem S has a screw thread S^3 which latter engages the female screw thread of the nut G^5 of the piston tube G, G^2. This nut G^5 is preferably at first separate from said tube or piston rod G, G^2, and is then connected thereto, but may be integral with this rod. By rotating this stem within the nut, the stem may be made to project more or less from the piston rod. The head S^2 of this stem S is within a chamber R^3. This chamber is purposely constructed of such a length that there is room for the head of the stem to move back and forth quite a distance within this chamber R^3 of the plunger R. This head S^2 of the plunger is preferably rounded in front substantially as shown, and is preferably larger in diameter than the body of the stem. One of the advantages of such enlarged head is that it prevents the latter from leaving the plunger. A preferred construction to coöperate with this enlarged head is a sleeve or part R^4 which is at the rear part of the plunger R and is fixed there. As the passage through this sleeve R^4 is of less diameter than the head S^2 of the stem, the latter, when drawn back, cannot slip out of the plunger. After the stem S is fixed in the piston rod, so that the correct amount of it (the stem) projects forward and into the plunger, to keep the stem fixedly there, a set nut R^5 is screwed on this stem and against the stationary nut G^5. This prevents, in the well known manner, the stem from turning, and consequently from moving longitudinally relatively to the piston. When the piston rod is tubular, the diaphragm G^6 is preferably present. Before proceeding to describe the operation of this combination valve, a short description of the conduit connections of these valves is advisable.

E^{10} is the exit water conduit of the cylinder E. This conduit E^{10} connects with the coils of pipes A, and thereby supplies these coils with water. The exit gas conduit P^5 of gas chamber P^4 extends to the pipes D^3, which in turn supply the vertical gas pipes D, which latter deliver the gas at the burner openings D^2. An exit conduit V in the gas inlet conduit P carries continually a small amount of gas to the pilot burner W. The latter is used for igniting the principal and large burner D^3, D, D^2. A stop cock V^2 in the conduit V enables the amount of gas passing to the pilot burner to be regulated, and to be entirely shut off, when the mechanism needs repair, or when it is out of use for a long time.

The valve mechanisms are suitably supported. In the present illustrative instance, the cylinder E is connected by an extension E^{13} to the frame B. The conduit E^{10} passes through this extension.

The chambers P^2 and P^4 are for convenience of manufacture, preferably integral as shown and constitute a single piece which for convenience is designated by the character X. This piece X is connected to the frame B, by an extension X^2. The conduit P^5 passes through this extension X^2.

The mode in which our improved mechanisms operate is as follows: Water is supplied through the inlet pipe H. There is prefer-

ably a means of regulating the flow of water through the pipe H, because in case the water heater mechanism is to be altogether stopped or removed, the water in the pipe which feeds pipe H would continue to flow out at the point on the pipe where the inlet pipe H was removed, thereby occasioning a loss of water, and a possibly injury to what the water comes in contact with. To this end, a stop cock is to be understood as governing the admission of water to pipe H, but as such cock forms no part of our invention, it is omitted from the drawings. Under ordinary use of our invention, the above named cock will be always open and will not be needed. The discharge cock C is opened to let out air that is present in the coils of the heater, and the water supplied by the conduit pipe H passes up into the space Y of the cylinder E, and then passes through the opening at valve K and runs into the space Y^2 of cylinder E, and thence into the conduit E^{10}. It passes through conduit E^{10} into the coil of pipes and duly fills them. During this operation, the gas is shut off from pipe P and from the burners.

As to the operation of the piston and valve K: the water after it has filled the space Y of the cylinder E, presses against the piston F and moves the piston to the left (Fig. 3) to the position shown in Fig. 6. At the same time, the valve K is pressed to the left and is thus opened. The discharge cock C is now closed, whereupon the piston F will return to the position shown by solid lines in Fig. 3, and the valve K will be moved to the right and be closed. The gas is now admitted to pipe P, by turning a suitable cock P^6 and passes into pipe V, and the cock V^2 being opened, the gas exits at the pilot burner W. The latter is now lighted. The heater is now ready for operation. Whenever a person desires to have hot water from the heater, he opens the discharge cock C. The water flows out therefrom. At the same time, the water from the source of supply enters the pipe H and the space Y of cylinder E. In answer to this impulse, the piston F moves quickly to the left all the way over until it occupies the position shown by dotted lines F^3, F^3, in space Y^2 of the cylinder E. This long movement of the piston does through the agency of the piston rod and the stem S draw back the plunger R and the valve Q, thereby opening the passageway P^3 and allowing gas to pass into the chamber P^4. Thence the gas immediately passes into pipe P^5 and thence to the burners D^2. It is there lighted by the flame of the pilot burner W. The flame of the latter ignites the gas of the burner nearest it, and each burner ignites the adjacent one. Thus the various burners are practically simultaneously lighted, and all the burners are heating the water in the coils. As the piping of the coils is thin and the diameter of the piping is small, the water is rapidly heated, and becomes hot, and is ready for delivery, and as it runs out of the delivery faucet C, it is hot and ready for use.

To return to the piston F. After the piston F moves to the left and occupies the position shown by the dotted lines F^3, F^3, it does not remain there, but moves back to the right and occupies a midway position shown in Fig. 6. While the water continues to run, the piston stands at this midposition. When in this position, the inlet H is not at all covered by the piston, but is entirely open, thus allowing a very large passage of water through it. So also the outlet E^{10} is not at all covered by the piston, and allows a very large flow of water through it. The water passing into the space Y of the cylinder then runs through the orifice G^4 of the hollow piston G^2, thence through the openings K^5 of the open valve, thence through the passage around the valve K, thence into the space Y^2 of the cylinder E, thence out through conduit E^{10} and thence into the coils. There it is heated on its way to the delivery faucet C and issues therefrom at a temperature raised from seventy to one hundred and forty degrees. When the outflow of water from the faucet is stopped by turning the same, the back pressure of water in the space Y^2 of the cylinder E will cause the piston F to move toward the right, and through the agency of the piston rod G, stem S, and plunger R closes the valve Q, Q^2, and cuts off the supply of gas to the main burners, leaving only the pilot burner W ignited. As the piston has moved as far as it can to the right, it occupies the position shown in Fig. 3.

Another advantageous function of our invention is as follows: In case the cock at C has been fully and then partly closed, or in case it is partly opened, the water pressure, that is the differential pressure of it partly closes the valve K and moves the piston F back to the position shown in Fig. 6, but as such movement is not enough to close the gas valve Q, consequently the operator can secure a smaller (in this case his desired) amount of water and as the gas is not turned off the water is held over the gas flame, and the water issues at a correspondingly higher degree of temperature. In other words, if the water is turned on full, the action of the piston F and the valve K takes place thus opening in full the gas valve or opening P^3 for the gas to pass to the burners. Then by partly closing cock C, it does not stop the flow of the gas to the burners D^2, but it retards the flow of water so that it flows slower through the coils. The water thus absorbs more heat as it is

held longer over the flames of the burning gas.

Our invention allows a pull and push movement without springs, etc., and allows a play of the plunger in chamber P^2.

By the water pressure on the piston F and valve K, we have a reliable movement and power to automatically turn on and off the gas to the burners simultaneously with the flow of the water, the gas whenever turned on, being lighted by the pilot light W, which latter is always burning.

The term "water" wherever used in the foregoing specification and in the claims, is to be understood to stand for and to include any kind of liquid that can be used in our invention.

The passages K^5 of the valve K may be in the enlargement M^5, instead of in the enlargement K^4 of the valve K. As such construction is readily understood, it is not figured in the drawings.

What we claim as new, and of our invention and desire to secure by Letters Patent, is:—

1. An automatic gas and water cock for water heaters, comprising a cylinder having a water inlet and outlet therein, a piston in said cylinder located between said outlet and inlet, a hollow stem connected to said piston and having an opening therein communicating with the inlet side of the cylinder, said piston having an opening therein communicating with the hollow stem, a valve for preventing the back flow of the water through said opening, a second cylinder having an inlet and outlet therein for gas, a valve controlling the outlet therein, a plunger carrying said valve and a connection from said plunger to the piston stem.

2. An automatic gas and water cock for water heaters, comprising a cylinder having a water inlet and outlet therein, a piston having a central opening and located between said inlet and outlet, a hollow stem having its end fitted in said opening, and an annular ring in the end of said hollow stem forming a valve seat, a spool shaped valve having its body part located in said ring and having one of its heads adapted to engage the valve seat to prevent back flow of the water, and having an opening in its other head, such stem having an opening therein communicating with the inlet side of the cylinder, and a gas valve connected to the said stem.

3. A combination gas and water cock for water heaters comprising a cylinder having an inlet and outlet therein, a piston moving in said cylinder, a stem on the piston, a second cylinder having a gas inlet and outlet therein, a valve controlling the gas outlet, a plunger in the cylinder carrying the said valve, said plunger having a chamber therein, a screw adjustably connected to the stem of the piston and having an enlarged head lying in said chamber and having limited movement therein, and a detent at the end of the chamber adapted to be engaged by the enlarged head of the screw whereby the plunger will be moved.

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