A. P. BROOMELL.

RADIATOR VALVE CONTROLLING DEVICE.

APPLICATION FILED FEB. 27, 1915.

1,201,931. Patented Oct. 17, 1916.

Fig. 1.

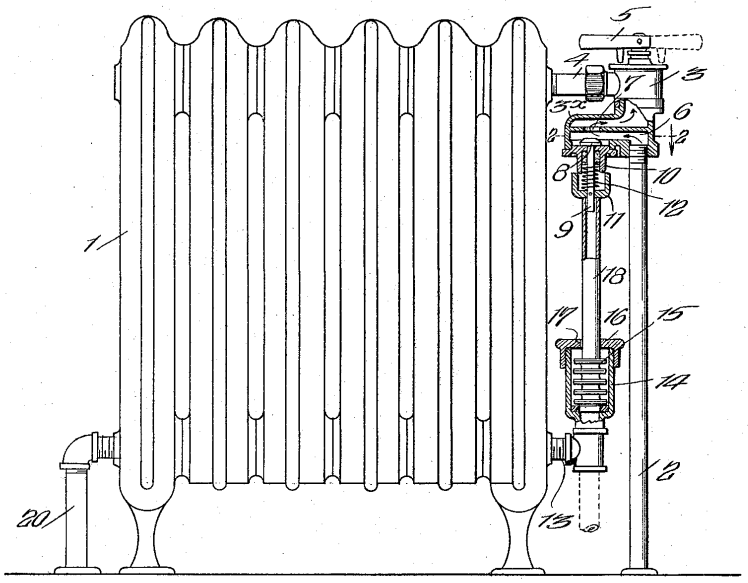
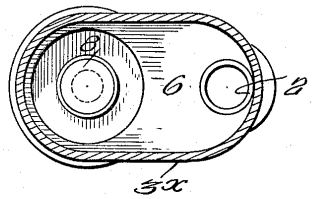


Fig. 2.



WITNESSES:

E. M. Cavanagh

L. A. Stanley

INVENTOR

ALBERT P. BROOMELL,

BY Munn & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

ALBERT P. BROOMELL, OF YORK, PENNSYLVANIA.

RADIATOR-VALVE-CONTROLLING DEVICE.

1,201,931. Specification of Letters Patent. Patented Oct. 17, 1916.

Application filed February 27, 1915. Serial No. 11,087.

To all whom it may concern:

Be it known that I, ALBERT P. BROOMELL, a citizen of the United States, and a resident of York, in the county of York and State of Pennsylvania, have invented a certain new and useful Improvement in Radiator-Valve-Controlling Devices, of which the following is a specification.

My invention relates to improvements in radiator valve controlling devices, and it consists in the combinations, constructions, and arrangements herein described and claimed.

An object of my invention is to provide a device to be used in connection with atmospheric vapor or vacuum heating systems where there is no pressure in the return pipe, for automatically closing the inlet valve when the radiator is full of steam.

A further object of my invention is to provide a device of the type described, which will prevent the waste of steam that is bound to occur when the steam passes out through the return pipe by controlling the amount of steam delivered to the radiator.

A further object of my invention is to provide a device of the type described in which such control is effected by a thermostatic member having communication with the bottom of the radiator, and so arranged as to operate a valve disposed in the inlet pipe.

Other objects and advantages will appear in the following specification and the novel features of the invention will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawings forming part of this application, in which—

Figure 1 is a view of the radiator showing my invention applied thereto, certain parts being shown in section; and Fig. 2 is a section along the line 2—2 of Fig. 1.

As stated before, this device is intended for use in steam heating systems where there is no pressure in the return pipe, said return pipe being open to the atmosphere or being connected to a vacuum pump.

In carrying out my invention, I make use of a radiator such as that shown at 1 in Fig. 1, of the usual type, an inlet pipe 2 connects with the main supply pipe (not shown), and communicates at its top with a valve casing 3. This valve casing 3 communicates in turn with the radiator 1 by means of an intermediate pipe 4. Valve casing 3 is designed to house a regular four ported valve (not shown), or any other suitable type of radiator valve, this valve being designed to be manually operated if desired, by means of a handle 5. The lower part of the valve casing 3 is provided with an extension 3^{x} in which is a partition 6 provided with an opening 7.

A valve 8 is designed to close the opening 7 and this valve is provided with a valve stem bearing which passes through a stuffing box 10 and is secured to a member 11 which is arranged to telescope with a portion of the stuffing box 10 and which houses a spring 12 that normally tends to keep the valve 8 open.

At the bottom of the radiator 1 and preferably at the inlet end of the radiator, is a pipe 13 which communicates with a housing 14 for a thermostatic member 15 which is preferably of the bellows type and which is designed to be filled with a volatile fluid that expands when steam enters the housing 14. The housing 14 is provided with a top 16 having an opening 17 through which a pipe 18 extends, this pipe being secured to the telescopic member 11. The opening 17 is large enough to permit the slow escape of air from the housing 14 when the steam enters the housing, as will be explained later.

The inlet pipe 2 communicates with the space below the partition 6 in the extension 3^{x} of the valve casing 3.

From the foregoing description of the various parts of the device, the operation thereof may be readily understood.

Steam entering the pipe 2 passes below the partition 6, thence through the opening 7, and if the valve in the casing 3 is open, past the valve, through the pipe 4, and into the radiator. As soon as the steam fills the radiator, further entrance of steam will cause it to pass through the pipe 13 and into the housing 14, where it will give up its heat to the thermostatic member 15 causing the expansion of the latter. This will move the pipe 18 upwardly, thereby causing the closing of the valve 8 so as to shut off further entrance of steam.

As the steam begins to condense and the radiator grows colder, the thermostatic member 15 will contract and with the aid of the spring 12 will cause the opening of the valve 8, thereby admitting steam. There is of course an alternate expansion and con-

traction of the thermostatic member which keeps the radiator full of steam, but closes off the supply when the radiator is full.

It will thus be seen that there is little or no steam which passes out through the return pipe 20 at the opposite end of the radiator. The automatic device for controlling the passage of steam into the radiator, in no way prevents the manual manipulation of the valve in the valve casing 3, which is accomplished, as stated above, by means of the handle 5.

The device is simple in construction and positive in operation, and can be very readily applied to radiators of existing type or to systems of the kinds mentioned.

While I have shown a pipe 18 as being the connection between the thermostatic member 15 and the telescopic member 11, it will be understood that I use a pipe simply because the latter is a convenient form of connection, being light in proportion to its strength, but it will be understood that this pipe is not intended to establish communication between these members, but is simply a means of communicating the movement of one member to the other, and may be replaced by a solid rod or any other suitable form of connecting member.

I claim:—

1. The combination with a radiator having an inlet pipe and a return pipe, of a valve casing communicating with said inlet pipe and being provided with a valve adapted to be operated manually, said valve casing having an extension, a partition within said extension provided with an opening, an auxiliary valve adapted to close said opening, a steam supply pipe communicating with said extension on the same side of the partition as the auxiliary valve, a housing, a pipe for establishing communication with the interior of said housing and the bottom of the radiator on the end opposite the return pipe, a thermostatic member disposed within said housing, a rod arranged to pass through one end of said housing for connecting said thermostatic member with said auxiliary valve, and a spring disposed in close proximity to said auxiliary valve for normally keeping the latter open.

2. The combination with a radiator having an inlet and a return pipe, of a valve casing communicating with said inlet pipe and being provided with a valve adapted to be operated manually, said valve casing having an extension, a partition within said extension provided with an opening, an auxiliary valve adapted to close said opening, a spring for normally keeping said auxiliary valve in position to permit free passage of steam through the opening, a steam supply pipe communicating with said extension on the same side of the partition as does the valve, a housing, means for establishing communication between the housing and the interior of the radiator at the bottom thereof and at the end opposite the return pipe, a thermostatic bellows disposed within said housing, a rod arranged to project through one end of said housing for connecting said thermostatic bellows with the auxiliary valve, said thermostatic bellows being operated by the passage of steam from the bottom of the radiator into the housing, whereby the auxiliary valve is brought into position to shut off the incoming steam.

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Witnesses:
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AUTOMATIC HEATING SYSTEM.

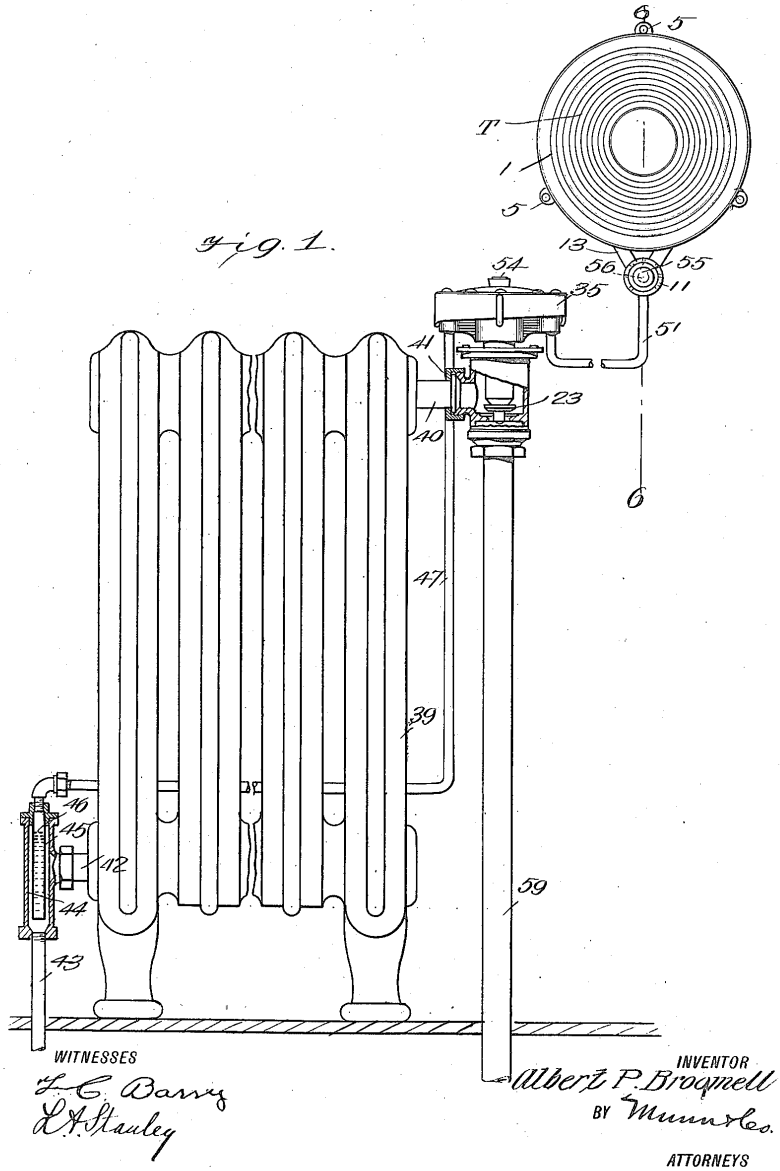
APPLICATION FILED MAR. 16, 1914.

1,236,257.

Patented Aug. 7, 1917.

4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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APPLICATION FILED MAR. 16, 1914.

1,236,257.

Patented Aug. 7, 1917.

4 SHEETS—SHEET 2.

Fig. 2.

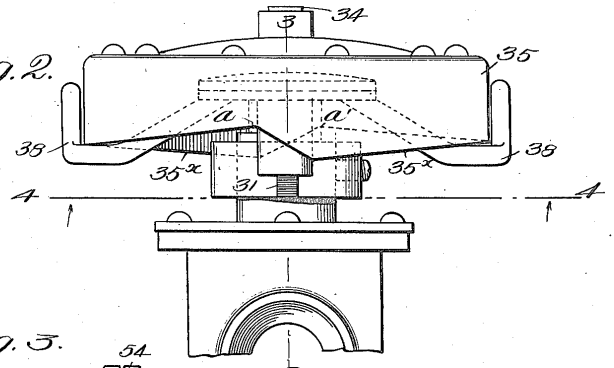

Fig. 3.

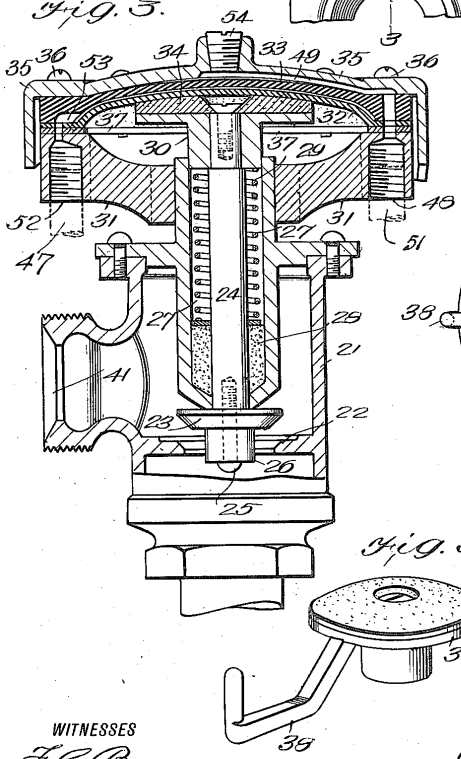

Fig. 4.

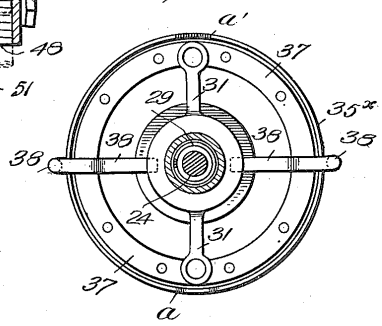

Fig. 5.

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AUTOMATIC HEATING SYSTEM.

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1,236,257.

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4 SHEETS—SHEET 3.

Fig. 6.

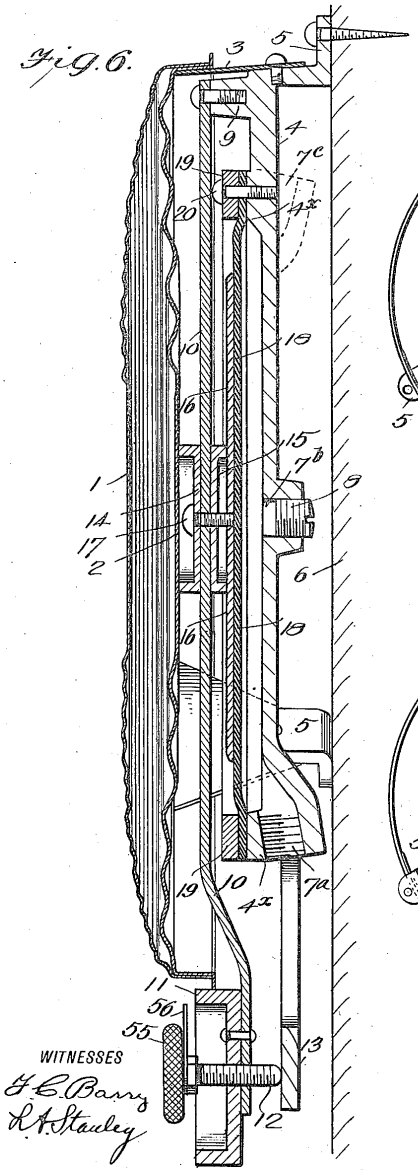


Fig. 7.

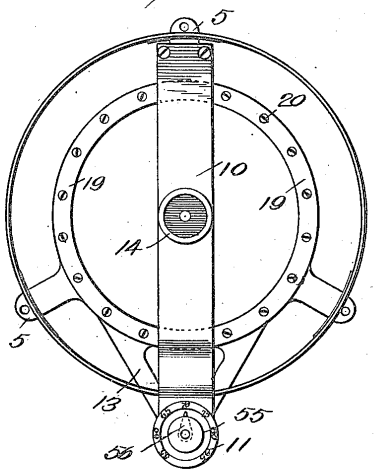
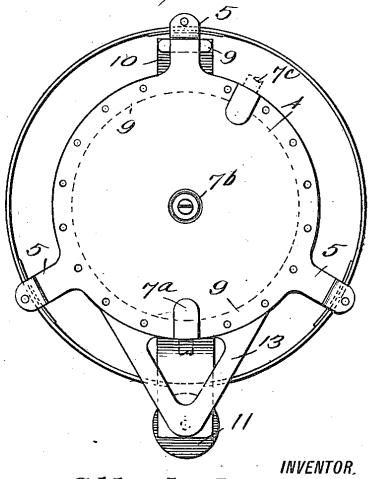


Fig. 8



WITNESSES

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AUTOMATIC HEATING SYSTEM.

APPLICATION FILED MAR. 16, 1914.

1,236,257.

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4 SHEETS—SHEET 4.

Fig. 9.

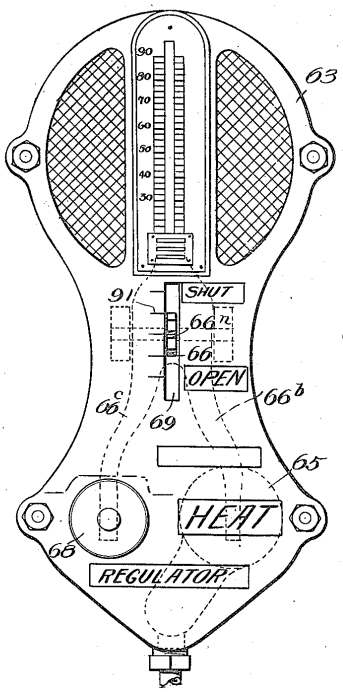


Fig. 10.

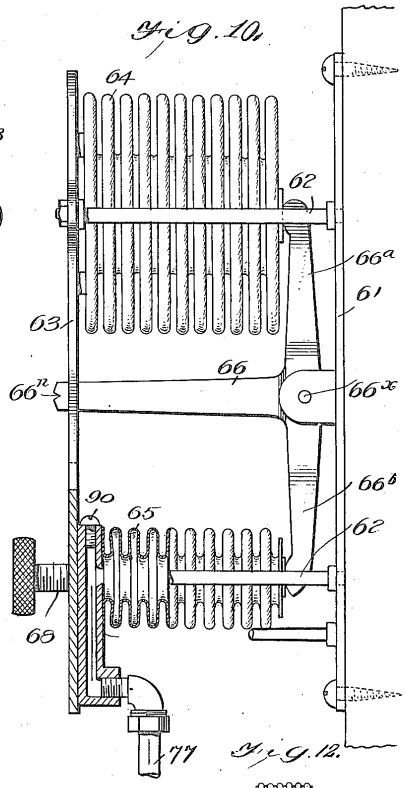


Fig. 12.

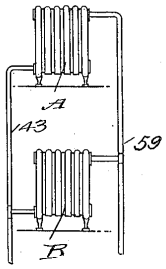
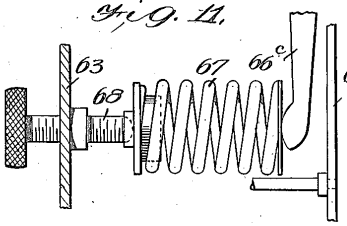


Fig. 11.



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AUTOMATIC HEATING SYSTEM.

1,236,257. Specification of Letters Patent. Patented Aug. 7, 1917.

Application filed March 16, 1914. Serial No. 824,968.

To all whom it may concern:

Be it known that I, ALBERT P. BROOMELL, a citizen of the United States, and a resident of York, in the county of York and State of Pennsylvania, have made certain new and useful Improvements in Automatic Heating Systems, of which the following is a specification.

My invention relates to improvements in automatic heating systems, especially in those heating systems in which steam is used as a heating medium of the so-called low pressure or vacuum type.

An object of my invention is to provide means whereby the radiators of a system may be completely filled with steam, without permitting any of the steam to escape to the outer atmosphere through the "return" pipe.

A further object of my invention is to provide a system of the type described, in which there is no possibility of the steam, which has once passed into a radiator, short circuiting the system, that is to say, working back into a radiator which might be shut off, from the return end, and heating the radiator up. I accomplish the above named objects by providing a device at the "return" end of a radiator which regulates the amount of steam delivered to the radiator.

A further object of my invention is to provide a thermostatic element which is designed to operate (by means of fluid pressure) a valve at the radiator for turning on or cutting off the supply of steam from the latter, the movement of the thermostat being multiplied in the valve, so that for a very slight movement of the thermostatic member the valve will be positively operated from its open position to its closed position or to any position between the two.

Other objects and advantages will appear in the following specification and the novel features of the device will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawings forming part of this application in which

Figure 1 is a view of the general arrangement of the system, certain parts being shown in section,

Fig. 2 is a side view in detail of the radiator valve mechanism,

Fig. 3 is a section along the line 3—3 of Fig. 2,

Fig. 4 is a section along the line 4—4 of Fig. 2,

Fig. 5 is a perspective view of the means for manually operating the valve,

Fig. 6 is a sectional view through the thermostat,

Fig. 7 is a front view of the thermostat, the outer diaphragms being removed,

Fig. 8 is a rear view of the thermostat,

Fig. 9 is a face view of a modified form of thermostat,

Fig. 10 is a side view of the thermostat shown in Fig. 9, a portion of the device being shown in section,

Fig. 11 is a fragmentary view showing a portion of the regulating means for the thermostat set forth in Figs. 9 and 10,

Fig. 12 is a diagrammatic view showing a plurality of radiators connected up to a common steam pipe and a common return pipe.

Referring now particularly to Fig. 6 I have shown therein a thermostat comprising an outer diaphragm 1 and an inner diaphragm 2, the space between these two diaphragms being designed to be partially filled with a volatile liquid. The edges of these diaphragms, as will be seen from the drawing, fit over a casing wall 3 which is secured to a base plate 4, the latter having lugs 5 by means of which it may be attached to the wall 6, or other convenient support. The base plate is provided with a lower opening 7^a, a central opening 7^b, and an upper opening 7^c. Screw plugs, such as shown at 8, are to be used in connection with the device in the manner hereinafter set forth. At one end of the base plate 4 is a lug 9 upon which is mounted a spring 10, which extends to the opposite side of the device, being bent to pass out of the casing and being provided at its outer end with a dial plate 11, through which a regulating screw 12 extends. The end of this regulating screw is rounded, and is arranged to bear upon an arm 13, which is carried by the base plate 4.

Disposed centrally of the device on one side of the spring 10 is a shoe 14 which is designed to bear against the diaphragm 2, while on the opposite side of the spring is a shoe 15 which bears upon a steel plate 16, the shoes 14 and 15, and the steel plate 16 being secured together by means of a screw 17.

The base plate 4 is provided with an annular flange 4^x upon which is placed the outer edge of a circular resilient diaphragm 18, such as rubber or the like. This dia-

phragm is held in place by means of a ring 19, screws 20 being provided for clamping the diaphragm 18 between the ring 19 and the annular flange 4^x. The space between the diaphragm 18 and the base plate 4 is designed to be filled with a fluid, as hereinafter explained.

Referring now to Figs. 2 to 5 inclusive I have shown therein a radiator valve which comprises a valve casing 21 having a valve seat 22 arranged to receive a valve 23. The latter is provided with a valve stem 24 and secured to the valve stem by means of a screw 25 is a throttling lug 26, which, as will be readily seen, partially closes the opening controlled by the valve. This lug is removable, and a larger one or a smaller one may be substituted in lieu thereof, thereby regulating the amount of steam which is permitted to pass when the valve is open. The amount of steam will, of course, depend upon the size of the radiator, and by making use of the proper sized throttling lug 26, the admission of steam, to a certain extent, can be controlled for a particular radiator. The valve stem 24 extends through a chamber 27, which contains a packing 28 at its lower end, the packing being pressed upon by a spring 29 whose upper end bears against a head 30 secured to the valve stem.

Carried by the walls of the chamber 27 are the webs 31. As will be seen from Fig. 3 there are two diaphragms, an inner diaphragm 32 and an outer diaphragm 33. The inner diaphragm engages a heat insulating plate 34 such as fiber or other suitable material, carried by the head 30. The edges of the outer and inner diaphragms are clamped between a ring 37, carried by the webs 31, and a cover 35, by means of screws 36 or other suitable fastening devices. As will be seen from Fig. 2 this cover is provided with downwardly extending flanges having cam surfaces 35^x on its lower edge. The head 30 is revoluble in the walls of the chamber 27, and is provided with arms 38, which extend downwardly, outwardly, and are then bent upwardly, as shown in Fig. 5. As will be seen from Fig. 2, these arms are designed to engage the cam surfaces 35^x, so that by turning the arms the head 30, and hence the valve 23, may be forced downwardly or be permitted to rise by the action of the spring 29, depending upon the direction in which the arms are turned.

Referring now to Fig. 1, 39 denotes a radiator whose inlet 40 is connected with the outlet 41 of the valve casing, shown in detail in Fig. 3. The outlet 42 of the radiator is connected with the "return" pipe 43, by means of a casing 44. The latter has disposed within it a closed receptacle 45 made of heat conducting material and containing a very volatile fluid 46. The upper end of the receptacle communicates by means of a pipe 47, with the inlet 52 in one of the webs 31. This in turn communicates with a space 53 between the outer diaphragm 33 and an inner diaphragm 32. The openings 7^a and 7^b are for the purpose of connecting the thermostat to the radiator valve by means of a tube such as that shown at 51, see Fig. 1. Either one of these openings 7^a or 7^b may be used. If the tube is unexposed, the lower opening 7^a is used and the central opening 7^b is plugged. If the connecting tube is run concealed behind the plaster, the opening 7^a is plugged and the tube or pipe is connected with the opening 7^b. It will be noted that the pipe 51 communicates with the inlet 48 in one of the webs 31, see Fig. 3, this inlet communicating in turn with the space 49 between the outer diaphragm 33 and the cover 35.

From the foregoing description of the various parts of the device, the operation thereof may be readily understood.

The thermostat, which I have denoted in general by T in Fig. 1, is secured in position and the apparatus is connected up, as described. The screw plug 54 in the radiator valve (see Fig. 3) is removed, and a stand pipe, of sufficient height to reach slightly above the level of the opening 7^c at the top of the thermostat (see Fig. 6), is inserted in the opening from which the screw plug 54 was withdrawn. A suitable liquid such as water diluted with alcohol, light oil, or other non-freezing liquid, is now poured into the stand pipe and allowed to flow into the space 49 above the diaphragm 33, and through the pipe 51 into the space between the diaphragm 18 of the thermostat and the base plate 4. When the liquid appears at the air hole, 7^c, the air will have been forced out. The hole 7^c is now plugged up, and the parts all being air-tight it will now be possible to remove the stand pipe from the hole in the top of the valve and to insert the screw plug 54 without losing any of the liquid.

The thermostat may be set by turning the knob 55 to which a hand or pointer 56 is attached to the proper temperature indicated on the dial 11. Upon the position of this screw will depend the pressure of the shoe 15 upon the steel disk 16, which bears upon the diaphragm 18.

Consider now the conditions with the thermostat set—say at 70°, and the radiator valve 23 wide open. Steam is being supplied to the radiator 39 from the steam pipe 59 and as the temperature of the room rises the liquid in the thermostat between the diaphragms 1 and 2 expands and tends to exert pressure on the diaphragm 18, through the medium of the shoes 14 and 15. This will tend to force the liquid out of the thermostat and through the pipe 51 into the space 49

above the outer diaphragm, thereby crowding the latter downwardly against the inner diaphragm and forcing the valve stem downwardly, and bringing the valve in position to shut off the steam. When the temperature falls the diaphragms 1 and 2 of the thermostat will tend to come together and the spring 29 of the radiator valve will tend to force the diaphragms upwardly and thus force the liquid out of the space 49 and back into the thermostat. The action of the spring 29 will open the valve 23 and again permit the steam to enter the radiator. It will thus be seen that the action of the valve 23 depends upon the temperature and is automatic.

Let us consider now the means by which the steam in the radiator is prevented from wasting through the return pipe. As has been before stated, the retainer 45 at the end of the radiator is made of conducting material, so that when the steam begins to enter the casing 44 which surrounds the receptacle 45 the liquid within the receptacle which is very volatile begins to boil and the vapor will pass up through the pipe 47 and into the space 53 between the two diaphragms, forcing the inner diaphragm downwardly, thereby closing the valve 23 and preventing the entrance of more steam. It will be observed that this is done without disturbing the relative amounts of liquids in the thermostat and in the space 49 between the outer diaphragm and the cover 35 of the radiator valve. When the steam stops coming into the casing 44 the liquid within the receptacle 45 will cool off and the vapor pressure will be relieved, thereby opening the valve and permitting more steam to enter. By this arrangement the steam is automatically prevented from escaping through the return pipe, while at the same time the radiator is kept filled with steam, so that every bit of air has been discharged from the radiator, leaving no dead air space. Since there is no steam in the return pipe there is no danger of a short circuiting of the system, that is to say, there is no danger of the steam working back into a radiator which might be shut off and heating the radiator up again. Thus in Fig. 18 the radiators A and B are both connected to the steam pipe 59 and to the return pipe 43. Now the radiator A may be shut off, while the radiator B may be receiving steam. My invention would prevent the passage of steam from the return pipe 43 up into the radiator A, and thereby heating the radiator A.

It will be observed that the coil spring 29 serves the double function of moving the valve 23 and also of compressing the packing 28, thereby insuring against leakage. The heat insulating cover 34 prevents the destruction of the inner diaphragm 32 from the heat of the head 30 of the valve mechanism.

At times it is desirable to close the valve manually and to do this it is only necessary to turn the arms 38 to the right. This will cause them to come into engagement with the cam surfaces 35*, thereby forcing the arms, together with the head 30, and the valve stem, downwardly, thus bringing the valve upon its seat and shutting off the flow of steam. To open the valve the arms are rotated to the left.

In the ordinary automatic heat regulating systems, it is not possible for the occupant of the room to tell whether or not the radiator is open except by feeling the radiator to find out whether it is hot or cold. It sometimes happens that there is no steam in the supply mains of the heating system. The room may be uncomfortably cold and the occupant of the room, not knowing that there is steam in the supply mains will conclude that there is something wrong with the automatic regulating device and will probably think that the radiator valve is shut. This leads to complaint, to tampering with the apparatus, and to dissatisfaction. With the present system one can always tell whether the valve is shut or closed by observing the position of the arms 38 with respect to the edge of the cover 35. Ordinarily these arms are turned so that with the valve open they are as far to the left as they can go, *i. e.*, at the angles *a*—*a'* respectively made by the inclined edges of the flange of the cover 35. Any movement of the valve toward its closed position will, of course, cause the arms to move downwardly away from the edge of the flange, thereby indicating plainly the position of the valve.

A very slight movement of the thermostat diaphragm 18 will cause a multiplied movement of the valve 23. This is due to the fact that the area of the diaphragm in the thermostat is considerably larger than that of the diaphragm of the radiator valve. In practice the area of the diaphragm of the thermostat is four times that of the area of the one on the valve, so that a very small movement—say one-sixteenth of an inch—in the thermostat will move the valve stem one-quarter of an inch, thus closing it entirely. By this means I secure a multiplied movement without using levers or other devices which tend to render the device more complicated and unsatisfactory because of the friction which might be present.

In Figs. 9 and 10, I have shown a modified form of thermostat in which a base plate 61 is secured to the wall or other convenient support, and is provided with bolts or other suitable securing means 62, which hold a front plate 63. Carried by the latter is an expansion member 64 in the form of a

bellows made of brass or other suitable material and designed to be filled with a volatile liquid which vaporizes at low temperature. A second bellows 65 is carried by the plate 63. At 66 I have shown a T-shaped lever, which is pivoted at 66^x, and which is provided with an arm 66^a arranged to bear on one end of the bellows 64, and an arm 66^b arranged to bear on the end of the bellows 65. As will be seen from Fig. 9 there is a branch arm 66^c which bears on the end of a spring 67 whose pressure may be regulated by a screw 68 passing through the plate 63. The outer end of the arm 66 extends through a slot 69 in the front plate 63, and is provided with a central notch 66^n. The upper end of the slot 69 has a legend "Shut," while the lower end has a legend "Open."

It will thus be seen that I have provided a heating system of the low pressure or vacuum type in which great economy is effected owing to the fact that little, if any, steam is permitted to pass out through the return pipe into the atmosphere. This I accomplish without interfering with the free flow of steam into the radiator. The radiator, being full of steam, works at its greatest efficiency. The provision of means for indicating whether or not the radiator valve is open or shut I also regard as an important feature. While I have stated that the bellows are preferably made of brass, it will be understood, of course, that any suitable material might be used. The diaphragms also might be made of other suitable material than rubber, without departing in the least from the spirit and the scope of the invention.

I desire to call particular attention to the fact that in this system the means for preventing any steam from escaping into the return pipe is accomplished, while at the same time providing a return opening of full size. In the ordinary means for preventing steam from getting into the return line the opening from the radiator at the return end is very much contracted and is never opened except slightly. This results in the opening oftentimes being clogged up with a slight amount of sediment which is discharged from the radiator. Obviously no such contingency may happen in the present instance because of the full size opening.

I claim:

In a steam heating system, a radiator, a steam pipe, a valve casing connected with said steam pipe and said radiator, valve mechanism in said valve casing for controlling the admission of steam from said steam pipe into said radiator, said valve mechanism comprising a main valve controlling means and an auxiliary valve controlling means, a thermostat operatively connected with said main valve operating means for operating the latter at a predetermined temperature, means including a thermostat disposed at the return end of the radiator for operating said auxiliary valve controlling means independently of said first named thermostat, manual means for operating the valve independently of either of the thermostatic means, said manual means comprising an arm rigidly secured to the valve stem, and a cam surface carried by the valve casing and arranged to be engaged by the arm for moving the valve toward its seat.

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Witnesses:
R. P. Brown,
Wm. H. Kolb.

(No Model.) 3 Sheets—Sheet 1.

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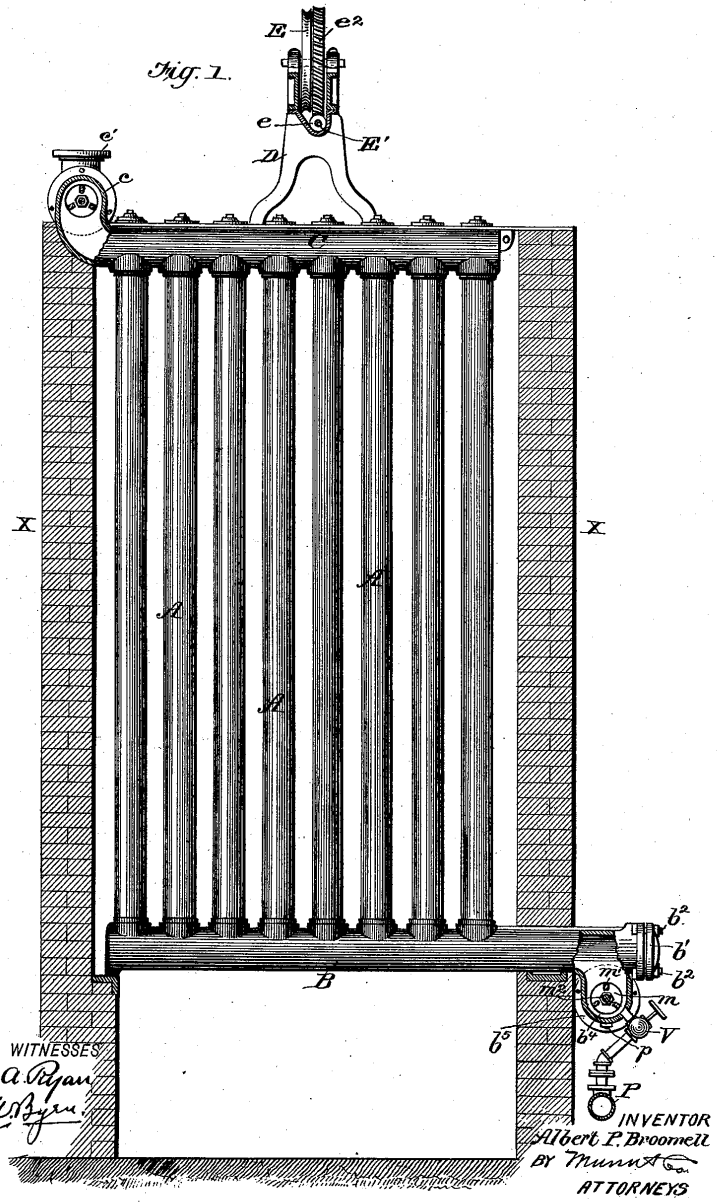
MULTIPLE TUBE WATER HEATER.

No. 603,169. Patented Apr. 26, 1898.

Fig. 1.



WITNESSES:
Jos. A. Ryan
Edw. W. Byrn.

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Albert P. Broomell
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ATTORNEYS

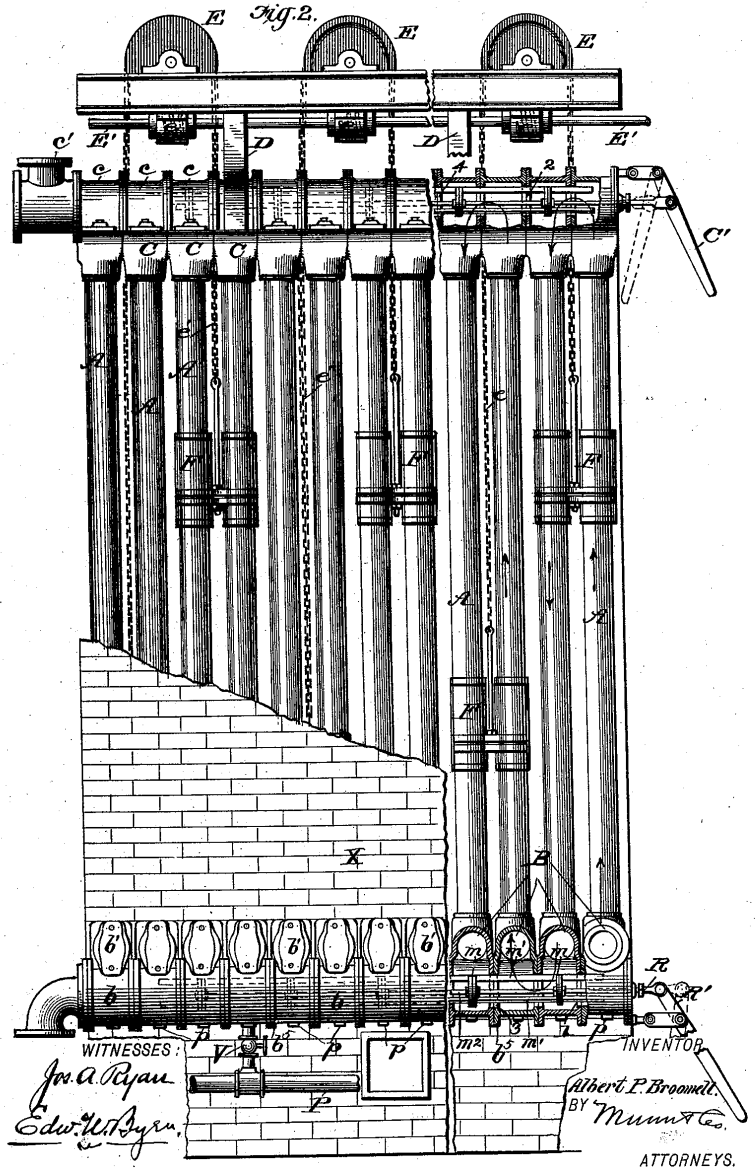
(No Model.) 3 Sheets—Sheet 2.

A. P. BROOMELL.

MULTIPLE TUBE WATER HEATER.

No. 603,169. Patented Apr. 26, 1898.

Fig. 2.



(No Model.) 3 Sheets—Sheet 3.

A. P. BROOMELL.

MULTIPLE TUBE WATER HEATER.

No. 603,169. Patented Apr. 26, 1898.

Fig. 3.

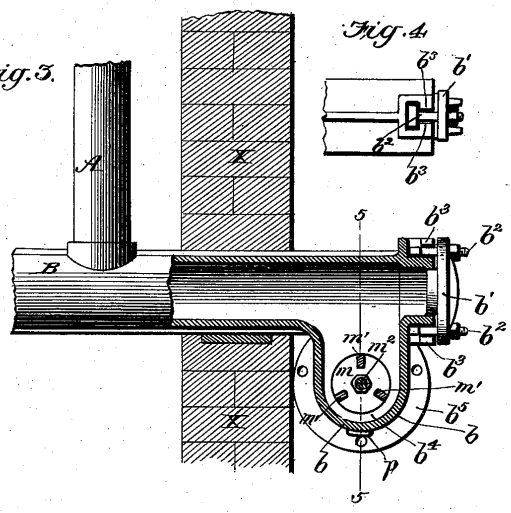


Fig. 4.

Fig. 5.

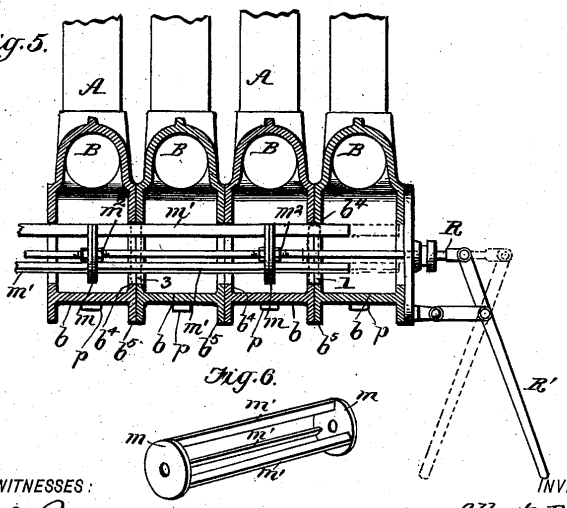


Fig. 6.

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Edw. W. Byrn.

INVENTOR

Albert P. Broomell.

BY Munn & Co.

ATTORNEYS.

UNITED STATES PATENT OFFICE.

ALBERT P. BROOMELL, OF YORK, PENNSYLVANIA.

MULTIPLE-TUBE WATER-HEATER.

SPECIFICATION forming part of Letters Patent No. 603,169, dated April 26, 1898.

Application filed September 29, 1897. Serial No. 653,528. (No model.)

To all whom it may concern:

Be it known that I, ALBERT P. BROOMELL, of York, in the county of York and State of Pennsylvania, have invented a new and useful Improvement in Multiple-Tube Water-Heaters, (known to the engineering trade as "fuel-economizers,") of which the following is a specification.

My invention is in the nature of an improved multiple-tube water-heater designed for the purpose of economizing fuel. It is well understood that every heat unit which escapes with the products of combustion from a furnace is a heat unit lost.

My invention provides a means for saving a portion of these heat units by utilizing them to heat the feed-water. Devices intended to accomplish this result have been heretofore provided which were located in a chamber arranged in the path of the products of combustion from the furnace to the stack, and which devices consisted of a series of tubes through which the feed-water was passed, while the hot gases, smoke, and products of combustion circulated between them.

My improvements consist in a peculiar construction and arrangement of valve by which the water may be made to travel quickly and in a comparatively straight course through the heater from the inlet to the outlet or be made to follow a long and winding passage therethrough, as may be desired.

It also consists in the peculiar construction and arrangement of the couplings of the pipe-sections for joining them together in a simple and practical manner, and one which facilitates cleaning, as will be hereinafter fully described.

Figure 1 is a vertical transverse section through the heater. Fig. 2 is a side view with the outer wall partly broken away and parts of the pipes in section. Fig. 3 is an enlarged vertical section through one of the coupling-sleeves of the header-pipes. Fig. 4 is a top view of this coupling. Fig. 5 is a section on line 5 5 of Fig. 3, and Fig. 6 is a perspective detail of one section of the multiple valve.

In the drawings, Figs. 1 and 2, X represents the brick wall forming the chamber within which the water-heater is located and through which the hot products of combustion are compelled to circulate. This heater consists of a great many series of water-circulating pipes. Each series consists of a number of vertical parallel pipes A, Fig. 1, which at their upper ends are jointed to a horizontal cross-pipe C, which I may call the "top header-pipe," and at their lower ends are joined to a horizontal cross-pipe B or bottom header. Multiples of these vertical and horizontal pipes are arranged side by side throughout the length of the chamber and may be extended indefinitely. Each of the series A B C is coupled to the adjacent series for open communication by a special construction of header-coupling. The bottom header B, Figs. 3, 4, and 5, has cast upon its lower side, outside of the inclosing wall, a flanged sleeve b in open communication with the header, while the end of the header is left open and provided with a detachable cap or cover b', secured in place by T-headed bolts b^2, engaging with lugs b^3 b^3, cast on the end of the header-pipe. The flanged sleeves b of the header-couplings have at their ends both inside flanges b^4, forming valve seats or partitions, and outside flanges b^5, by which the abutting sleeves of adjacent header-couplings are bolted together to make a continuous water-conduit along the lower edges of all the header-pipes.

Within the continuous conduit formed by the abutting sleeves when bolted together I arrange a peculiarly-constructed multiple valve, composed of a series of sections like that shown in Fig. 6. This consists of two end disks m m, connected together by three (more or less) parallel bars m' m' m', which unite the two end disks at points near their peripheries. These end disks have central holes to receive bolts m^2, which connect the disk of one section to that of the next section in longitudinal alinement, the multiple valve being composed of a series of these connected sections. The end disks of the sections are spaced apart a distance equal to twice the length of the coupling-sleeves of the header, and the diameter of these end disks is just equal to or a trifle less than the diameter of the opening through the internal flanges of the coupling-sleeves, so that the disks of the multiple valve may readily pass through and be stopped in the plane of these flanges (which act somewhat like valve-seats) to cut off communication between the several coup-

ling-sleeves, headers, and their attached series of pipes. The end of the multiple valve is connected to a rod R, passing through a stuffing-box to the exterior and there attached to a hand-lever R′ for operating the valve with a longitudinal sliding movement. This valve for the lower header-pipe has a counterpart in the upper header-sleeves *c*, worked by lever C′, the set being constructed, arranged, and operated in the same manner as the lower one.

The purpose and operation of these multiple valves are as follows: Whenever the lever R′ is thrown to the position shown in full lines in Fig. 5, the disks of the valve occupy a position between its seats or the internal flanges at the ends of the sleeves, and water may pass freely through the pipe formed by these abutting sleeves and through the headers and their vertical pipes without hindrance or deflection, being free in such case to follow its own course, which would be a more or less straight course from the inlet to the outlet of the water-heater; but when the lever R′ is shifted, as shown in dotted lines, the disks of the multiple valve are shifted to a position in the plane of the internal flanges b^4 and close the openings in the same at every alternate joint between the sleeves, (the valve-disks being twice the distance apart that the said joints are.) Now (see Fig. 2) if the sectional pipe of the lower header has its valve adjusted to stop up its openings 1 and 3, and the sectional pipe of the upper header has its valve adjusted to stop up its openings 2 and 4, as indicated by the dotted position, it will be seen that the water entering the first header below cannot pass to the second header below on account of the closure of the opening between by the valve-disk at *l*, and therefore the water rises through the first series of pipes to the top, and then it passes to the top header of the second series of pipes, and not being able to pass direct to the third top header on account of the closure of the valve at valve-seat No. 2 it descends in the second series of pipes and passes from the header at the bottom to the next header, (which is not closed on account of the valve-disks being twice as far apart as the openings or valve-seats,) and there it encounters the closed valve of the third joint at its lower header and is again directed upwardly. In this way it will be seen that the water is made to go up one series of pipes, down the next, up the third, and so on, pursuing a very long and winding course through the header, that gives a prolonged exposure to the influence of the hot gases to secure the absorption and utilization of the heat units.

This valve construction, it will be seen, allows the change from a relatively straight and direct passage of the water to a long and winding course to be quickly and conveniently made.

The merit in having the sleeves cast on the lower side of the lower header and upper side of the upper header is that it puts them in a convenient position for coupling and connecting them outside the wall of the casing, and at the lower header it also secures the very important result of leaving the ends of all the headers with a place for the little doors or closing-plates *b′* in alinement with the body of the header-pipes for convenience in inserting a scraper for cleaning out sedimentary deposits which accumulate from time to time in the lower header.

As the multiple valve is adjusted back and forth it will be seen that its three longitudinal bars form guides that rest against the inner edges of the internal flanges and insure the centralization of the valve-disks and the proper registration of the same with their openings or seats.

By removing the terminal head of the last sleeve it will be seen that the entire multiple valve may be easily slid out endwise.

One great advantage of this construction is that any one of the series of pipes may be taken out for repairs without disturbing the others.

At the top part of Fig. 2 are shown a set of scraping devices for cleaning off deposits from the exterior of the pipes and keeping the surface clean for the absorption of the heat. Pairs of scrapers F F are attached to the opposite ends of a chain *e′*, which passes over a pulley E, keyed to a worm-wheel e^2. These worm-wheels engage with worms *e* on a shaft E′, and the shaft is given a slow revolution, first in one direction and then in the other, and works continuously to cause the scrapers to rise and fall over the tubes. These cleaning devices, however, form no part of my invention, and I make no claim to the same.

To facilitate the cleaning of the pockets of the sleeves under the multiple valve, I employ in each sleeve a brass blow-off plug *p*, and blow-off valves V are also arranged at suitable intervals along the valve-casings and either connected with a blow-off pipe P or arranged to discharge into the air, as may be desired.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. Header-pipes for connecting with a series of circulating-pipes at right angles, said header-pipes having formed on their ends and on one side of their longitudinal axes short flanged sleeves in open communication with the header-pipes, the said sleeve of each header-pipe being offset to one side of said pipe and arranged at right angles to it, to form when joined together a continuous conduit, and the end of said header-pipe being provided with an opening and detachable cap giving direct access to the header along its longitudinal axis and outside the said sleeve, substantially as and for the purpose described.

2. The combination of a series of circulating-pipes, two sets of header-pipes joining

onto their ends and having each a common conduit at right angles to the headers, formed by sectional offsetting sleeves arranged at right angles to the headers and bolted together, multiple valves arranged in these two conduits to close communication between the series of pipes alternately at opposite ends to direct the water through them, either without interruption, or with a winding and prolonged course, and detachable caps arranged at the ends of the lower headers above the valve-conduit, substantially as described.

3. The multiple valve comprising end disks connected by longitudinal parallel bars arranged at the periphery of the disks, said end disks being perforated centrally and connected by bolts; in combination with a conduit or casing having inwardly-projecting flanges sustaining said valve, substantially as and for the purpose described.

4. The header-pipes having at or near their ends offsetting sleeves whose longitudinal axes are at right angles to that of the headers, said sleeves having both external and internal flanges, and said external flanges being bolted together, and the internal flanges forming valve-seats, and the multiple valve having a series of disks connected in longitudinal alinement and arranged to be simultaneously adjusted between the flanges, or in the plane of the flanges, substantially as and for the purpose described.

ALBERT P. BROOMELL.

Witnesses:
JOHN F. SPRENKEL,
WM. J. GEMMILL.

No. 650,778. Patented May 29, 1900.

A. P. BROOMELL.

STEAM HEATING APPARATUS.

(Application filed Feb. 5, 1900.)

(No Model.) 4 Sheets—Sheet 1.

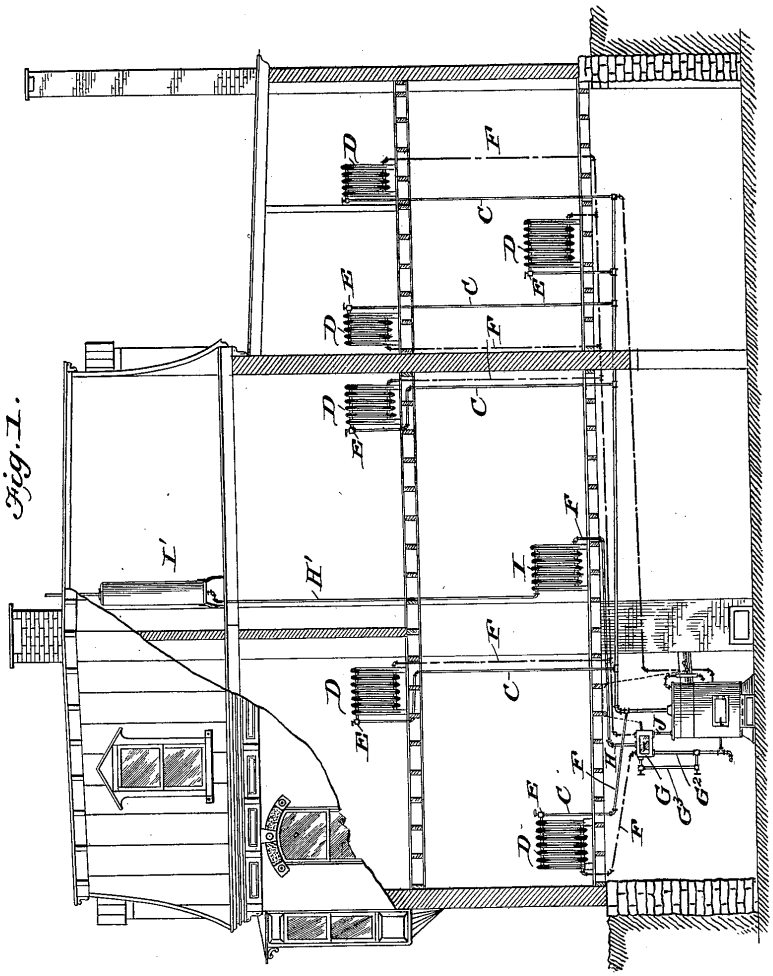

Fig. 1.

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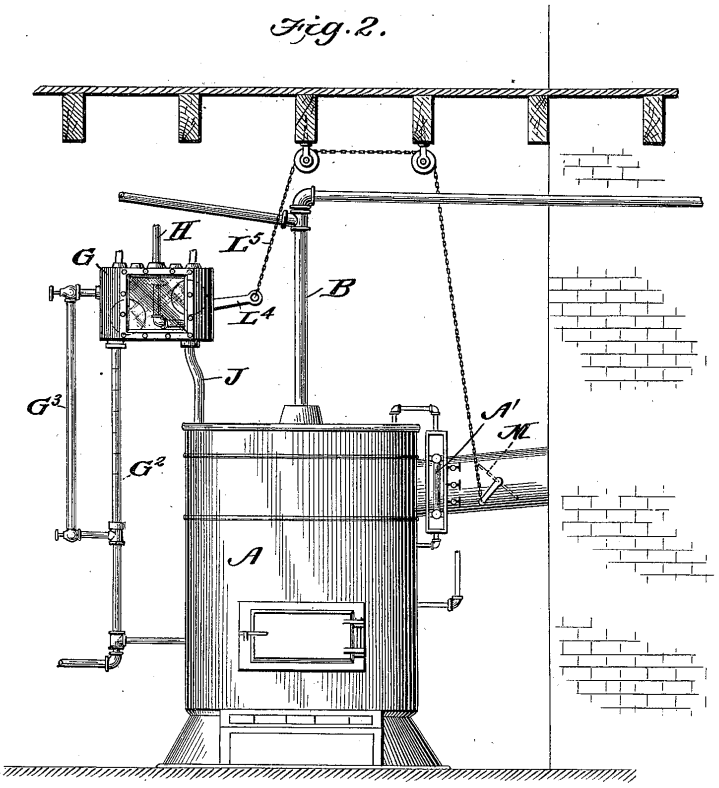
STEAM HEATING APPARATUS.

(Application filed Feb. 5, 1900.)

(No Model.) 4 Sheets—Sheet 2.

Fig. 2.



WITNESSES:

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No. 650,778. Patented May 29, 1900.

A. P. BROOMELL.

STEAM HEATING APPARATUS.

(Application filed Feb. 5, 1900.)

(No Model.) 4 Sheets—Sheet 3.

Fig. 3.

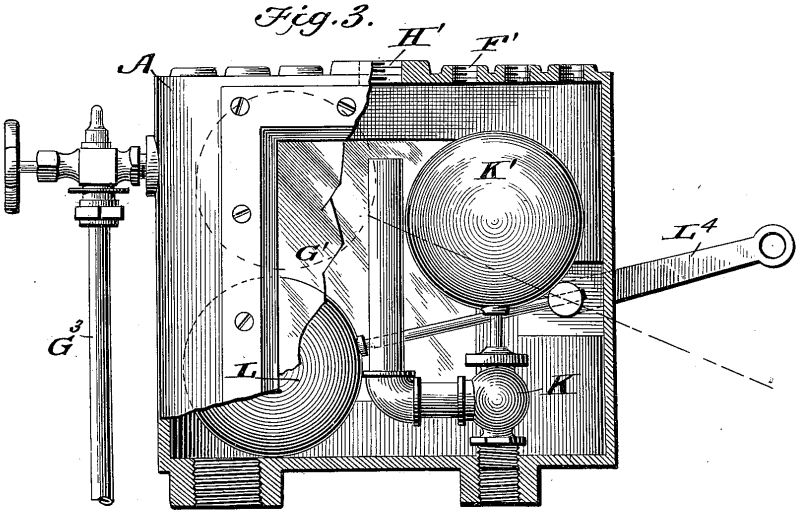
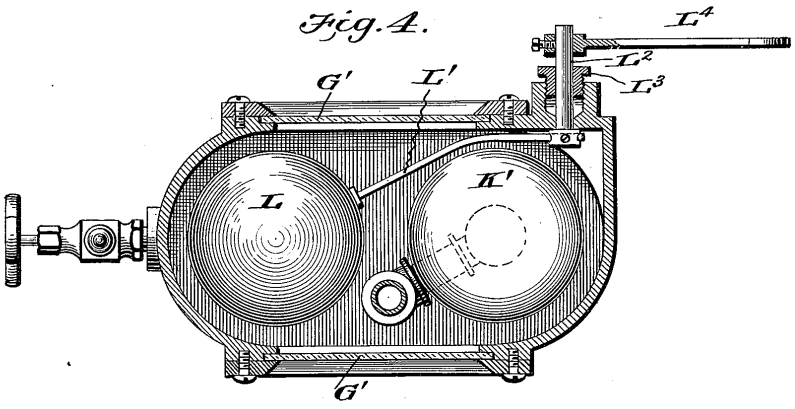


Fig. 4.



WITNESSES:

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Perry B. Hopkin.

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ATTORNEYS

No. 650,778. Patented May 29, 1900.

A. P. BROOMELL.

STEAM HEATING APPARATUS.

(Application filed Feb. 5, 1900.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 5.

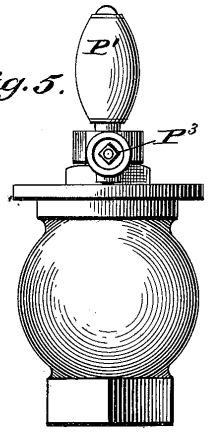


Fig. 6.

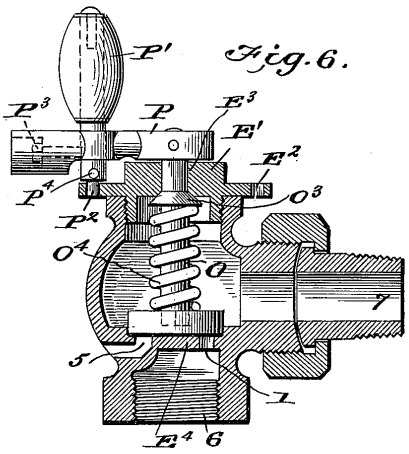


Fig. 7.

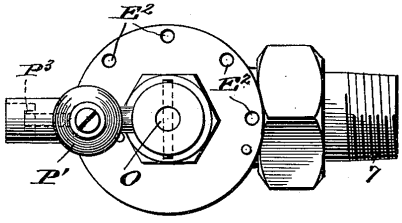
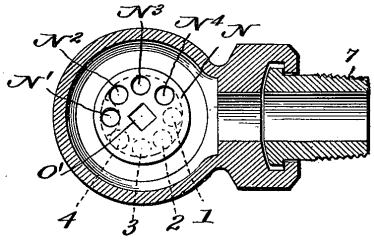


Fig. 8.



WITNESSES:

M. D. Blondell.

Percy B. Turpin.

INVENTOR

A. P. Broomell.

BY Munn & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

ALBERT P. BROOMELL, OF YORK, PENNSYLVANIA.

STEAM HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 650,778, dated May 29, 1900.

Application filed February 5, 1900. Serial No. 4,046. (No model.)

To all whom it may concern:

Be it known that I, ALBERT P. BROOMELL, of York, in the county of York and State of Pennsylvania, have invented a new and useful Improvement in Steam Heating Apparatus, of which the following is a specification.

My invention is an improvement in steam heating apparatus having for an object to provide, first, a steam-heating system by which it is possible to regulate the amount of steam admitted to each radiator and to heat each radiator all or part of the way over, as required; second, a system in which all radiators are open to the atmosphere, the heating being accomplished by the circulation of steam without pressure through the radiators; third, a system in which no air-valves are required on the radiators; fourth, a system in which it is impossible for water to accumulate in the radiators; fifth, a system that will work absolutely noiseless; sixth, a system that can be installed with the use of much smaller pipes than ordinarily used, and, seventh, a system in which are provided means whereby the production of steam in excess of the demand will control the damper of the boiler-furnace and will further automatically operate relief devices, whereby the water of condensation will be returned to the boiler, whereby the shutting off of steam from the radiators will automatically open a vent from such radiators to the atmosphere.

The invention consists in certain novel constructions and combinations of parts, as will be hereinafter described and claimed.

In the drawings, Figure 1 is a sectional elevation of a building presenting in somewhat diagrammatic form a heating apparatus embodying my improvements. Fig. 2 is an elevation of the boiler and parts directly associated therewith. Fig. 3 is a side view, partly broken away in section, of a receiver provided with my improvements. Fig. 4 is a cross-section on about line 4 4 of Fig. 3, and Fig. 5 is an end view of the radiator feed-valve. Fig. 6 is a vertical longitudinal section. Fig. 7 is a top plan view, and Fig. 8 a horizontal section, of the radiator-valve.

The boiler A may be of any suitable form of steam-heating boiler, preferably one having a low water-line. The steam supply pipe or feed pipe B is connected ordinarily at the usual point of outlet of the boiler and is extended in suitable directions and connected by branch pipes C with the heating-radiators D, connecting with such radiator, preferably, but not necessarily, at the top thereof. The feed-pipes connect with the radiators through the medium of the valves E. (Shown in Fig. 1 and in detail in Figs. 5 to 8, inclusive.) This valve E is designed to admit any desired amount of steam to the radiator and will be more fully described hereinafter.

The return-pipes F lead from the radiator back to what I term the "receiver," G. The receiver G is shown in detail in Figs. 3 and 4, and in practice is arranged above the water-line of the boiler and preferably above the steam-space thereof. As shown in Figs. 1 and 2, I form the receiver preferably with glass sides G′, so its interior is exposed to view, and it is connected by a pipe G^2 with the boiler below the water-line of the latter and is supplied with a gage G^3 to indicate by the height of water the pressure in the boiler, graduations being provided on the pipe G^2 or otherwise to indicate the degree of pressure of steam by the height of water in the said pipe.

At its top the receiver G is provided with openings F′ for the return-pipes F and with an opening H′ for the waste-pipe H, leading to the condensing-radiator I. The bottom of the receiver is tapped for the connection of the pipe G^2 and also to receive the relief-pipe J, which opens into the steam-space of the boiler. The pipe J is extended within the receiver and has its upper or discharge end arranged above the normal water-line in the receiver. This pipe J is controlled by the safety or relief valve K, provided with and arranged for operation by the float K′, which float is arranged in the receiver G and for operation by any excessive rise of water in said receiver.

The float L operates in the receiver G and is carried on an arm or lever L′ on a shaft L^2, carried through a stuffing-box L^3, and having an arm L^4, connected by chain L^5 with a damper M, which regulates the fire in the steam-boiler furnace. When the water rises in the receiver G, it will lift the float L, which movement of the float closes the damper to a degree relative to the height to which the float L may rise, the damper moving gradually

toward closed position until it is entirely shut. If the water continues to rise in the receiver after the damper M is shut, the relief-valve will be opened by the rise of its float and the pressure in the boiler will be relieved in the manner more fully described hereinafter.

The condensing-radiators I, of which there may be any desired number, are connected by a pipe H with the receiver and by a pipe H′ with a condensing head or drum I′, placed in the attic or above the roof or otherwise suitably located.

The boiler has a glass gage A′ to indicate the height of the water within it.

When no steam-pressure is on the boiler, the water in the glass gage A′ on the boiler and in the glass gage G^3, attached to the receiver G, will stand at the same level. After fire is made in the boiler and steam generated and before any appreciable pressure is produced the steam will pass out through the main supply-pipe and will be discharged into the radiators in such quantities as the valves E will permit. After the radiators are heated from end to end should there be any steam escaping back through the return-pipes F this steam will be discharged into the receiver, and from this receiver the surplus steam thus discharged will pass into the condensing-radiator, where it will be condensed into water and returned to the receiver, from which point it will, of course, return to the boiler. If there is sufficient fire in the boiler to produce a pressure, it will naturally prevent the water of condensation from returning to the boiler until this water has accumulated in the pipe leading from the receiver to the boiler to a sufficient height to overcome the equilibrium, when it will flow into the boiler by gravity.

In the event of sufficient pressure accumulating in the boiler to lift the water into the body of the receiver the water will come in contact with float L and will lift this float, and as soon as the float L is moved upward the damper M will begin to close, which movement will continue until the damper is entirely shut. If steam continues to increase in pressure after the damper is shut, the water will continue to rise in the receiver G until it reaches the float K′, attached to the relief-valve K, and will lift the relief-valve from its seat, discharging steam from the steam-space in the boiler into the receiver, from which point it will pass through the pipe H on top of the receiver G into the condensing-radiator I above. In the event of the condensing-radiator not having sufficient surface to condense all the steam that may discharge into it from the relief-valve the surplus steam will pass up the pipe H′, connected to the top of the condensing-radiator, and into the condensing-head I′, the surface in which condensing-head will be ample to condense all steam that may reach that point.

The valve E is so constructed as to admit steam to any desired degree to the radiator and to open a vent to the atmosphere when it is adjusted to entirely cut off steam from the radiator. By this valve any desired quantity of steam can be admitted to the radiator, heating the radiator to such a degree as may be necessary to warm the room in which it is placed and making it possible to regulate the temperature of the room to any desired point. As the radiators are open to the atmosphere through the return-pipes and the condensing-radiator, they do not require any air-valves, and the radiators also being open to the atmosphere makes it possible to circulate steam through them without any pressure on the boiler, and there will be no possibility of water accumulating in the radiators. The construction of the valves E is best shown in Figs. 5 to 8, inclusive. The valve includes the casing, having a head E′, provided with a series of sockets E^2 for the stop-pin and an opening E^3 for the valve-stem, the seat E^4 having feed-ports 1, 2, 3, and 4 for the steam and an air-port 5 for communication with the atmosphere, nipples 6 and 7 for connection respectively with the steam-feed pipe and with the radiator, the valve proper, N, having a non-circular socket O′ for the stem O, and the stem O and its spring and handle devices. The valve N fits on the seat E^4 and is provided with the series of ports $N' N^2 N^3 N^4$, which may be turned to register, respectively, with ports 1, 2, 3, and 4 when the valve is fully opened or to open any desired ones of the said ports 1, 2, 3, and 4 to any desired degree. When the valve is in the position shown in Fig. 8, the steam-ports 1, 2, 3, and 4 are closed and the port N′ is in full register with the port 5, opening communication with the atmosphere, breaking the vacuum, and preventing a suction of water from the return-pipe. This is the position of the valve shown in Figs. 6 and 8. If now the valve be moved one point to the right, the port N^4 will register with and open the feed-port 1, the air-port 5 will be closed, and steam will be fed through the port 1 to the radiator. Another step of the valve will open ports 1 and 2, and so on, until the full head of steam is admitted.

The stem O fits at its lower end in the socket O′ and extends upward through an opening O^2 in the head-plate E′, being provided beneath said plate with a packing portion or shoulder O^3 and with a spring O^1, bearing between the same and the valve-plate and operating to press the valve to its seat and the portion O^3 tightly up against the head-plate E′. On the stem above the head-plate I secure the arm P, having near its outer end the handle P′, which has a limited longitudinal movement in the arm and has the stop-pin P^2, which can be set into any one of the sockets E^2 to hold the valve in any desired adjustment. The outer end of the arm P is socketed and receives a screw P^3, by which the handle can be locked in any one of the sockets E^2, and a cross-pin P^4 limits the upward

movement of the handle and prevents its being pulled out of the arm P. The operation of the valve will be readily understood from the foregoing.

My system permits the use of much smaller supply and return pipes than those ordinarily employed.

In the event of the fire being neglected and too much steam-pressure being produced there is no possibility of low water in the boiler, since even if the safety-valve should blow for a long while the water will all be condensed in the condensing-radiator and condensing-head and will return to the boiler by gravity, keeping the proper water-supply in the boiler at all times.

The valve illustrated in Figs. 5, 6, 7, and 8 forms the subject-matter of a separate application for patent, Serial No. 9,275, filed in the United States Patent Office March 19, 1900.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a heating apparatus the combination of the boiler, the steam and return pipes, a receiver receiving the discharge of the return-pipes and located above the water-line of the boiler, a connecting-pipe forming an unobstructed passage between said receiver and the boiler below the water-line in the latter, a steam connection between said receiver and the boiler, a valve controlling such connection, and a float in the receiver for controlling said valve.

2. In a heating apparatus the combination of the boiler, the steam and return pipes, a receiver above the water-line of the boiler and connected with the boiler below its water-line, damper devices, a float in the receiver for operating said damper, a steam connection between the receiver and the boiler, a valve for controlling said steam connection and a float in the receiver for operating said valve.

3. In a heating apparatus the combination with the boiler and damper of a receiver for the water of condensation, the return-pipes for discharging such water to said receiver, connections between said receiver and the boiler, a float in the receiver, devices whereby the said float may operate the damper, a steam connection between the boiler and receiver and means in the receiver for operation by the water therein, whereby to control such steam connection.

4. The combination of the boiler, the damper, the steam-circulating pipes, leading from the boiler, the receiver, the return-pipes leading to the receiver, a pipe connection between the receiver and the boiler below the water-line of the latter, the steam-pipe connecting the steam-space of the boiler with the receiver and extending upward within such receiver, the valve and its float within the receiver for controlling such connecting steam-pipe, and the float in the receiver and connected with the damper by which to operate such damper.

5. A heating apparatus having a boiler, a receiver for the returned water of condensation, a steam-pipe connecting said receiver with the steam-space of the boiler, a float-operated valve controlling the said steam-pipe and an unobstructed water connection between the receiver and the boiler substantially as set forth.

6. The combination of the boiler, the receiver connected with said boiler below the water-line in the latter, a steam connection between the boiler and receiver, a float-operated valve controlling such steam connection and arranged for operation by the water in the receiver, the damper, the float in the receiver for operating said damper, the condensing-radiator connected with the receiver, the connecting-pipes and the heating-radiators provided with a feed-valve arranged to open a vent to the atmosphere when it is adjusted to shut off steam from the radiator substantially as set forth.

7. The apparatus herein described comprising the boiler, the receiver, connections between the boiler and receiver, such connections communicating with the boiler below its water-line, a steam connection between the boiler and receiver, a valve controlling such connection, a float for controlling such valve, such float being arranged for operation by the water in the receiver, the damper, a float in the receiver for operating the damper, the heating-radiators provided with feed-valves arranged to open a vent to the atmosphere when adjusted to shut off steam from the radiators, and connecting-pipes substantially as set forth.

8. In an apparatus substantially as described, the combination with the boiler and a receiver above the water-line of the boiler and connected with such boiler below its water-line, of damper devices, a steam connection between the receiver and the boiler and independent floats arranged in the receiver and connected with and adapted to operate the damper devices and the controlling-valve for the steam connection, and the controlling-valve substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ALBERT P. BROOMELL.

Witnesses:
WM. J. GEMMILL,
WM. J. KUNTZ.

No. 657,059. Patented Aug. 28, 1900.

A. P. BROOMELL.

VALVE.

(Application filed Mar. 19, 1900.)

(No Model.)

Fig. 1.

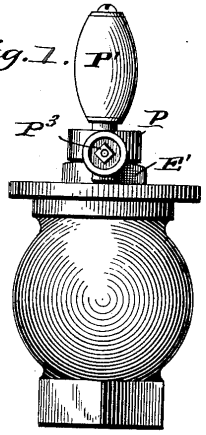


Fig. 2.

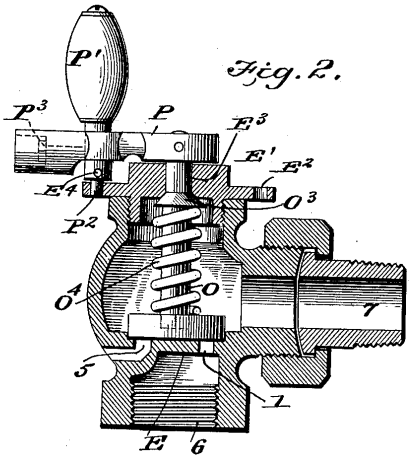


Fig. 3.

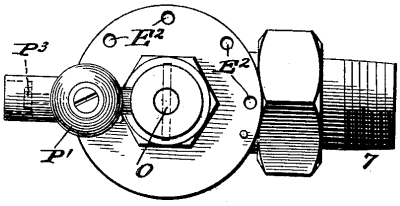
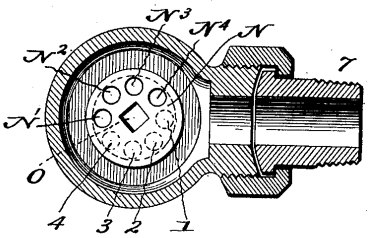


Fig. 4.



WITNESSES:

W. B. Blondell

Perry B. Turpin.

INVENTOR

A. P. Broomell.

BY Munn & Co.

ATTORNEYS.

UNITED STATES PATENT OFFICE.

ALBERT P. BROOMELL, OF YORK, PENNSYLVANIA.

VALVE.

SPECIFICATION forming part of Letters Patent No. 657,059, dated August 28, 1900.

Original application filed February 5, 1900, Serial No. 4,046. Divided and this application filed March 19, 1900. Serial No. 9,275. (No model.)

To all whom it may concern:

Be it known that I, ALBERT P. BROOMELL, residing at York, in the county of York and State of Pennsylvania, have invented a new and useful Improvement in Valves, of which the following is a specification.

My invention is an improvement in valves, and while the valve is capable of a certain general application it is especially designed and adapted for use in connection with a steam-heating system, as described in a former application for patent filed by me February 5, 1900, Serial No. 4,046, and of which this is a divisional application. In the said steam-heating system it is desirable to open a vent to the air when the steam is shut off from the radiator, and therefore the valve forming the subject of the present invention is adapted to vent to the atmosphere when it is adjusted to close or shut off the port leading to the supply.

The invention consists in certain novel constructions and combinations of parts, as will be hereinafter described and claimed.

In the drawings, Figure 1 is an end elevation, Fig. 2 a vertical longitudinal section, Fig. 3 a top plan view, and Fig. 4 a horizontal section, of a valve embodying my invention.

The valve, as shown, comprises the casing having a head E′, which is provided with a series of sockets E^2 for the stop-pin and with an opening E^3 for the valve-stem. Below and in line with the head E′, I provide the valve-seat, which is provided with the feed-ports 1, 2, 3, and 4 for the steam or other medium and with an air or venting port 5 for communication with the atmosphere. The casing is also provided with a nipple 6 for connection with the pipe leading from the source of supply and with a nipple 7, which connects with the radiator or other part to which the steam or other medium is to be supplied. Now in operation the steam or other medium flows into the valve through the nipple 6 and thence out through the nipple 7 when the valve proper is adjusted to feed steam or other medium to the radiator or other device.

The valve proper, N, is provided in its upper side with a non-circular socket O′ for the stem O. The valve N fits upon the seat E^4 and is provided with the series of ports N′, N^2, N^3, and N^4, which may be turned to register, respectively, with the ports 1, 2, 3, and 4 when the valve is fully opened or to open any desired ones of the said ports 1, 2, 3, and 4 to any desired degree. When the valve is in the position shown in Fig. 3, the ports 1, 2, 3, and 4 are closed and the port N′ is in full register with the port 5, thus opening communication with the atmosphere and forming a vent from the radiator or other device with which the valve may be connected. In the case of the use of the device with a steam-radiator this opening of the vent to the atmosphere will break the vacuum and prevent a suction of water from the return-pipe of the system. This position of the valve is shown in Figs. 2 and 4. If now the valve be moved one point to the right, the port N^4 will register with and open the feed-port 1, the air-port 5 will be closed, and the steam or other medium will be fed through the port 1 to the radiator or other device to be supplied. Another step of the valve will open ports 1 and 2, and so on until the valve is fully opened.

The stem O fits at its lower end in the socket O′ and extends upward through an opening O^2 in the head-plate E′, being provided beneath said plate with a packing portion or shoulder O^3 and with a spring O^4, bearing between the same and the valve-plate and operating to press the valve to its seat and the portion O^3 tightly up against the head-plate E′. On the stem above the head-plate I secure the arm P, having near its outer end the handle P′, which has a limited longitudinal movement in the arm and has a stop-pin P^2, which can be set into any one of the sockets E^2 to hold the valve in any desired adjustment. The outer end of the arm P is socketed and receives a screw P^3, by which the handle can be locked in any one of the sockets E^2, and a cross-pin E^1 limits the upward movement of the handle and prevents its being pulled out of the arm P. By this means the valve may be readily adjusted to and held in any of the positions before described.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The valve herein described having a plu-

rality of ports and movable whereby the said ports may be adjusted successively into feed position combined with the valve-seat having a port opening to the atmosphere with which one of the ports of the valve may register when the valve is adjusted to close the feed-ports.

2. The combination in a valve of the casing having sockets for the stop-pins, the valve-seat having feed and air ports, the valve having openings arranged for registration with said ports, the valve-stem extended through the casing and arranged to operate the valve, the valve-arm, the handle carried by the arm and a stop-pin carried by the handle and arranged to engage the sockets in the casing.

3. The combination of the valve-casing having its head provided with a series of sockets for the stop-pins and with an opening for the valve-stem, the valve-seat having feed and air ports, the valve having a plurality of ports arranged for registration with those of the valve-seat, the valve-stem having the packing portion or disk and movable longitudinally independently of the valve, the spring between said packing portion and said valve, the valve-arm, and the handle and stop-pin substantially as set forth.

4. The valve-casing having sockets for the stop-pin, the valve-arm, the handle movable longitudinally therein and having the stop-pin to enter the sockets in the casing, and means for limiting the movement of the stop-pin, substantially as set forth.

5. The combination of the valve-casing having the sockets for the stop-pin, the valve-arm, the handle movable longitudinally in the said arm and having the stop-pin, the screw for locking the handle from endwise movement, and means for limiting the endwise movement of the handle, substantially as set forth.

6. The combination of the valve-casing having a series of feed-ports and a vent-port, and the valve having a series of ports one of which registers with the vent-port when the valve is closed and the ports of the valve being arranged for successive registration with those of the seat, substantially as set forth.

7. The valve-seat having feed-ports, and an outlet or exhaust port, and the valve having ports corresponding in number with the feed-ports of the seat and movable into full register with the feed-ports in the feeding position of the valve and having one of said valve-ports movable into register with the exhaust-port when the valve is adjusted to close the feed-ports of the valve-seat, the construction being such that all the feed-ports are closed when the exhaust-port is open.

ALBERT P. BROOMELL.

Witnesses:
WM. J. GEMMILL,
WM. J. KUNTZ.

No. 717,335. Patented Dec. 30, 1902.

A. P. BROOMELL.

STEAM HEATING APPARATUS.

(Application filed Apr. 30, 1902.)

(No Model.) 2 Sheets—Sheet 1.

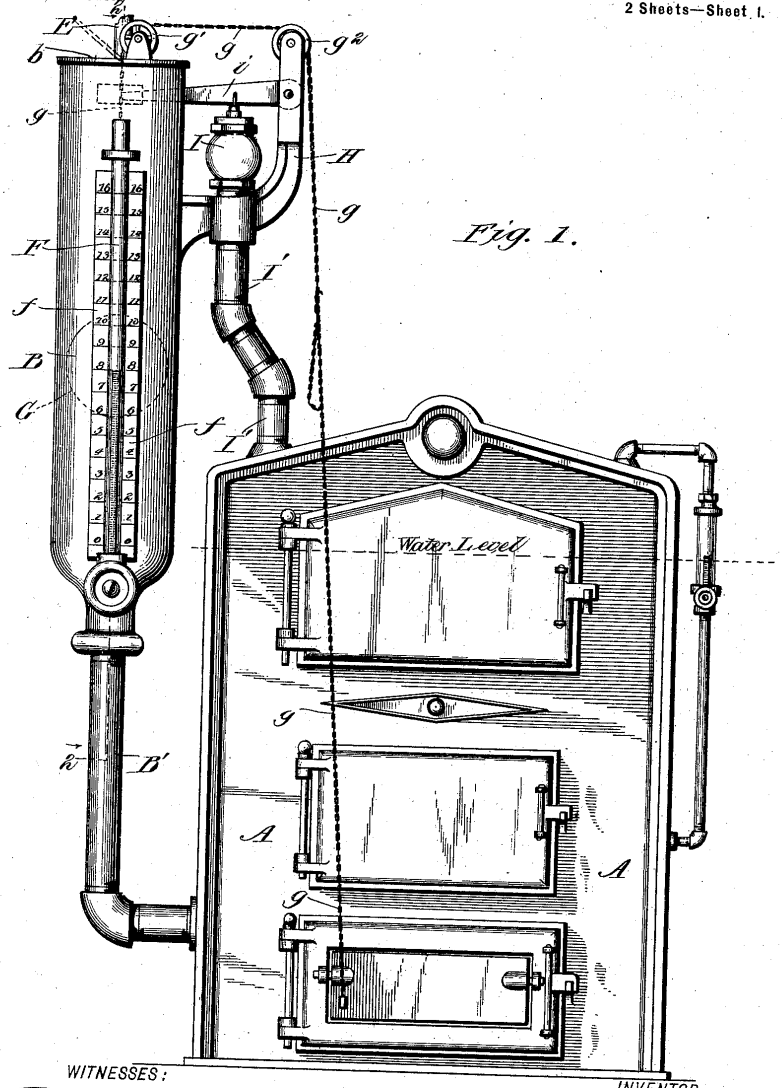


Fig. 1.

WITNESSES:

Fred. P. Bradford

Edw. W. Byrn.

INVENTOR

Albert P. Broomell.

BY Munn & Co.

ATTORNEYS

No. 717,335. Patented Dec. 30, 1902.

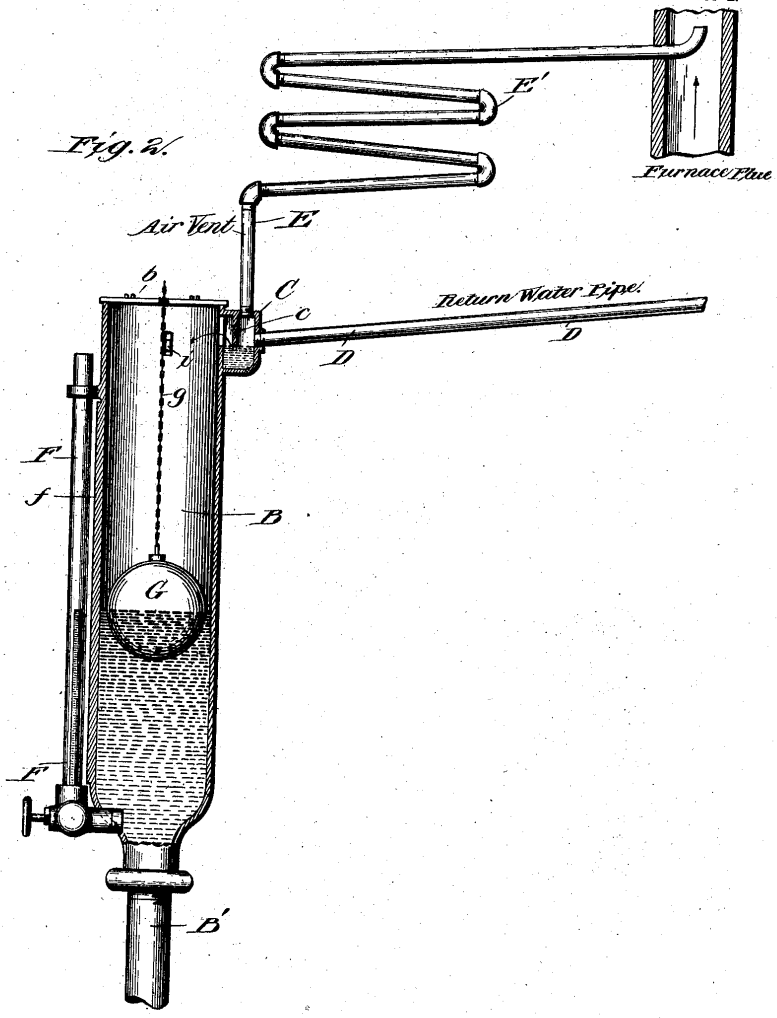
A. P. BROOMELL.

STEAM HEATING APPARATUS.

(Application filed Apr. 30, 1902.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 2.



WITNESSES:

Fred'k P. Bradford

Edw. W. Byrn.

INVENTOR

Albert P. Broomell.

BY Munn & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

ALBERT P. BROOMELL, OF YORK, PENNSYLVANIA.

STEAM HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 717,335, dated December 30, 1902.

Application filed April 30, 1902. Serial No. 105,338. (No model.)

To all whom it may concern:

Be it known that I, ALBERT P. BROOMELL, of York, in the county of York and State of Pennsylvania, have invented a new and useful Improvement in Steam Heating Apparatus, of which the following is a specification.

My invention covers certain improvements in the steam heating apparatus for which Letters Patent were granted me May 2, 1900, No. 650,778. In this system, which I term the "vapor-heating" system, or heating by steam with little or no pressure, I employed an apparatus termed a "receiver," which received the water of condensation from the radiators of the building and any air that accompanied it, sending the air out into the atmosphere and returning the water to the boiler. This receiver had two floats, one of which operated a lever controlling a draft-damper of the furnace to regulate the fire automatically and the other of which floats opened a safety-valve when a pressure of steam forms in the boiler, so that high steaming is impossible. My present invention relates to this part of the apparatus and is designed to afford a simpler, more practical, and more efficient construction of receiver, which I will now proceed to describe with reference to the drawings, in which—

Figure 1 is a front elevation of the receiver shown applied to a boiler, the size of the receiver in relation to the boiler being somewhat exaggerated to more clearly show the parts of said receiver. Fig. 2 is a section through the receiver on line 2 2 of Fig. 1, showing at the top the return connections for condensed water from the radiator and the vent-pipe for air and uncondensed vapor leading to a supplemental condenser which discharges its air into the chimney-flue and by which a slight partial vacuum is created at the discharge end of the return-pipe by the draft of the chimney to aid in the circulation of vapor through the radiators and to positively draw out the air.

In the drawings, A represents the boiler, which may be of any desired form, but which should be one having a low-water line.

B is the receiver, which is a cast-iron upright cylinder with an open top covered by a hinged lid *b*. The bottom end of the cylinder is contracted and connected by a pipe B′ with the boiler at a point below the water-line, and through this pipe B′ the water of condensation from the radiators is returned to the boiler. At the top of this receiver there is connected the return-pipe for the condensed water coming from the various radiators of the building. This return-pipe has a special connection as follows: A chamber C is cast or formed on the back wall of the cylinder at the top, which chamber projects outwardly for a short distance and has a downwardly-depending wall or diaphragm *c*, which does not quite reach the bottom, and forms with the water which accumulates in the bottom of chamber C a small trap. Into the side of this chamber outside of the diaphragm is tapped the return-pipe D for the water of condensation from the radiators of the building, and into the top of this chamber is tapped an air-vent pipe E, which extends to a supplemental condenser E′ and thence through said condenser into the chimney-flue. This supplemental condenser condenses the last vestiges of vapor and returns the ultimate condensation either into the return water-pipe D, to be carried by it to the receiver, or into the receiver direct, as shown, and thence into the boiler again. By connecting this air-vent pipe in this way to the draft of the chimney the full induction of the hot currents rising in the chimney takes the air all out of the radiators without the use of air valves or pumps, and also by a slight partial vacuum positively aids in the circulation of the low-temperature vapors through the radiators in better fulfilment of my principle of vapor heating without any considerable steam-pressure.

On the face of the receiver there is a glass gage F, open at the top and connected at the bottom with the water-space of the receiver, and behind this glass gage is a scale *f*, graduated in ounces and running from zero at the bottom to sixteen ounces, more or less, at the top. In this receiver and in the glass gage the water stands at a level, depending upon the slight steam-pressure in the boiler. When standing at zero, there is no pressure whatever, and when at 8 it indicates eight ounces of pressure.

Inside the receiver is placed a copper float G, of globular shape. This float is connected to a chain *g*, that runs over two pulleys g' g^2

at the top and then descends to and is connected to a draft-damper of the furnace either at the ash-pit, as shown, or in the smoke-pipe of the furnace, or to both, in the well-known way, so that the rise of the float from the rise of the water-column and an increase of pressure will close the drafts of the furnace and diminish the heat of the latter. This float may be adjusted to come into action at any desired height of the water-column, so as to maintain a slight but definite pressure in the boiler of a few ounces to insure circulation of the vapor through the radiators.

On the side of the receiver-cylinder is formed or to it is attached a bracket-arm H, which carries at its upper end one of the pulleys g^2 and also supports a safety-valve I, whose lever i is fulcrumed to the said bracket-arm and after extending across the stem of the safety-valve, to which it is connected by a link, enters the top of the receiver through a slot and rests in a position above the float, to be acted upon by the rise of the latter. This safety-valve is connected by a pipe I′ with the steam-space of the boiler. This valve does not open by any direct pressure of steam on it; but if at any time after the float has turned off the drafts the furnace still continues to make steam then the steam-pressure in the boiler causes the water-column to rise in the receiver, and the float rising on top of the water lifts the lever of the safety-valve to which the valve itself is attached by a link or hook and gives relief to the steam until the water-level is lowered to the point at which it is desired to maintain the pressure. By this means any considerable rise of steam is absolutely prevented and danger from steam-pressure is rendered impossible.

All the return-pipes from the building are connected to discharge into the trap-chamber at the top of the receiver, and by lifting the hinged lid at any time the amount of condensation returning to the receiver can be seen. If there is no pressure in the boiler, the water in the receiver will stand on an exact level with the water in the boiler, which should be at the zero-mark of the indicator. When any pressure is produced in the boiler, the water will rise in the receiver until it balances the pressure in the boiler, and any additional accession of water of condensation will flow into the boiler by gravity. If the float which controls the damper is set at eight ounces, when the water rises in the receiver to that point it will come in contact with the float and lift it, which will cause the furnace-damper to close. If the closing of the damper prevents any increase in steam-pressure, the water will remain stationary in the glass gage. If, however, the steam-pressure continues to increase, the water will rise higher in the receiver and will lift the lever of the relief-valve, as before described. The great advantage of this new form of receiver is its simplicity and freedom from fixtures and steam-joints and the fact that it is possible to close the damper at any point between zero and the full pressure of sixteen ounces. In moderate weather it is sometimes desirable to close the damper on one or two ounces of pressure, while in cold weather the float may be set to close the damper at eight or ten ounces.

By means of the trap-chamber at the top of the receiver I prevent any air from returning to the receiver, and by connecting the air-pipe to the chimney the air is automatically removed and the circulation of vapor is stimulated without the use of air-pumps or any other mechanical appliances.

It will be seen that my vertically-arranged receiver is of substantially uniform cross-section, being just large enough to easily receive the spherical float which is guided in its rise and fall by the walls of the receiver. The chain for the float also is directly connected to the same and passes out the top of the receiver, which does away with all levers extending through the side of the receiver. By locating the trap-chamber on the outside of the receiver it is out of the way of the float as it rises to contact with the relief-valve lever, and yet the water is trapped without the use of cumbersome pendent pipes, and the receiver and all of its accessories are reduced to minimum size and cost and the heating apparatus rendered very simple, compact, and efficient.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a steam heating apparatus, a receiver for the return water of condensation constructed as a vertical chamber having a pipe connection at its upper end for the return-water and a pipe connection at its lower end for returning the said water to the boiler, a draft-damper, a single float fitting within and guided vertically by said chamber, a chain or cord connecting the float to the draft-damper, and a pressure-relief valve with lever extending into the chamber and arranged to be opened by the contact of the float with said lever substantially as described.

2. In a steam heating apparatus, a vertical receiver having an opening at the bottom for the return of the water of condensation to the boiler, said receiver being made of substantially uniform cross-section and having an external chamber formed on the upper end of the same constructed as a trap having communication with the upper end of the receiver and also an opening for the return-water pipe, and a float arranged in the vertical receiver and adapted to be guided in its rise and fall by the said vertical chamber and to be connected to the draft-damper substantially as and for the purpose described.

3. In a steam heating apparatus, a smoke-flue, a receiver for the return of the water of condensation having a trap-chamber at the top with a return circulation-pipe tapped into

the same, and an air-vent pipe extending from this trap-chamber to the smoke-flue for taking off the air and energizing the circulation of vapor by a suction or partial vacuum substantially as described.

4. In a steam heating apparatus, a smoke-flue, a receiver for the return of the water of condensation having a trap-chamber at the top with a return circulation-pipe tapped into the same and an air-vent pipe extending from this trap-chamber, a condenser connected to the pipe, and an outlet-pipe from the condenser connected to the smoke-flue for a suction from the draft of the flue substantially as described.

5. In a steam heating apparatus, a receiver for the return water of condensation constructed as a vertical cylinder having a pipe connection at its upper end for the said return water, and a pipe connection at its lower end for the boiler, a float guided vertically within the cylindrical receiver, a chain or cord attached to the float and connected to the draft-damper of the furnace, and a relief-valve for the steam-boiler arranged externally to the receiver and having a lever extending through the side of the receiver to be operated upon by the direct contact of the float substantially as described.

6. In a steam heating apparatus, a receiver for the return water of condensation constructed as an upright cylinder having a water-gage at its side, a pulley on its top and a projecting bracket-arm bearing a relief-valve, a lever for the same projecting into the receiver, a pulley on top of the bracket, a float arranged in the receiver, a chain passing over the pulleys and connecting the float to the draft-damper of the furnace, said float being also arranged to act upon the lever of the relief-valve substantially as described.

ALBERT P. BROOMELL.

Witnesses:
BERTHA H. GOODMAN,
WILLIAM J. KUNTZ.

No. 770,627. PATENTED SEPT. 20, 1904.

A. P. BROOMELL.

WATER HEATING APPARATUS.

APPLICATION FILED JUNE 23, 1904.

NO MODEL.

Fig. 1.

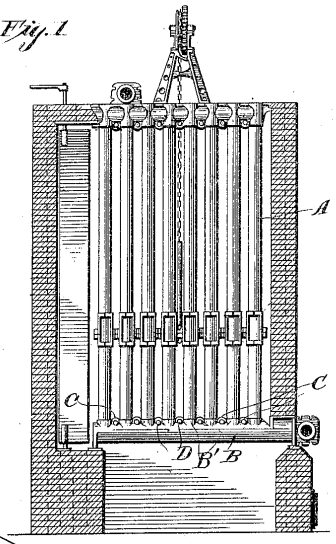


Fig. 2.

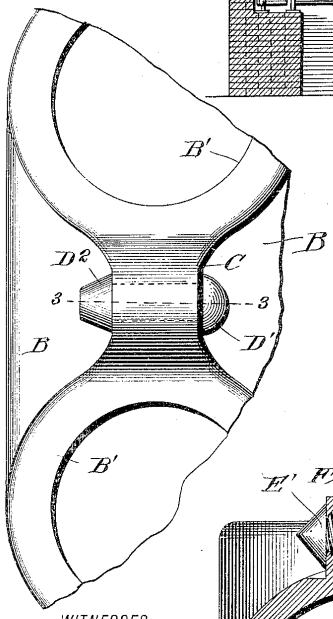


Fig. 3.

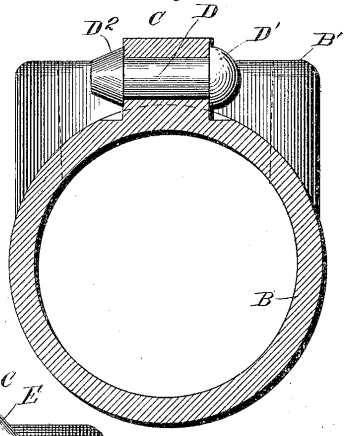
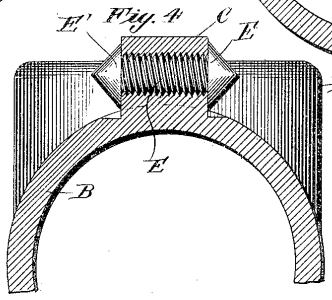


Fig. 4.



WITNESSES:

C. Edward Duffey.

Fred. D. Bradford.

INVENTOR,

Albert P. Broomell

BY Munn & Co.

ATTORNEYS.

No. 770,627. Patented September 20, 1904.

UNITED STATES PATENT OFFICE.

ALBERT P. BROOMELL, OF YORK, PENNSYLVANIA.

WATER-HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 770,627, dated September 20, 1904.

Application filed June 23, 1904. Serial No. 213,871. (No model.)

To all whom it may concern:

Be it known that I, ALBERT P. BROOMELL, a citizen of the United States, and a resident of York, in the county of York and State of Pennsylvania, have made certain new and useful Improvements in Water-Heating Apparatus, of which the following is a specification.

My invention is an improvement in water-heating apparatus commonly called "fuel-economizers," and has for an object to provide a novel construction whereby to prevent the splitting of the headers from the pressure exerted in forcing the tubes or pipes into such headers; and the invention consists in certain novel constructions and combinations of parts, as will be hereinafter described and claimed.

In the drawings, Figure 1 is a sectional elevation of an apparatus embodying my invention. Fig. 2 is a detail plan view of a portion of one of the headers, the pipes or tubes being removed. Fig. 3 is a cross-section on about line 3 3 of Fig. 2, and Fig. 4 shows a different form of bolt from that illustrated in Fig. 3.

In building heating apparatus and in constructing the so-called "economizers," as shown in Fig. 1, it is customary to force the tubes A into the tubular headers B by hydraulic pressure, the joints being tapered. In pressing the series of tubes A into the header a tremendous strain is brought on the metal, and great difficulty has been experienced because of the headers splitting from socket to socket. Higher pressures are demanded from time to time and difficulty is experienced in so constructing the headers as to stand the pressure. It is found in practice that the tendency is for the headers to split longitudinally from socket to socket, and it has proved desirable to provide means by which to prevent this tendency to split. This result is accomplished by providing the header-tube between the pipe-sockets for the heating-pipes A with stay devices, of steel or other metal of high tensile strength, operating transversely the header, and so bracing the same as to prevent its splitting between the adjacent sockets.

In the construction shown and as preferred the header-tube B is provided with the short projecting bosses B′, in which are formed the sockets for the heating-pipes A, and between the adjacent bosses B′, I form the header B with longitudinally-extending webs C, which arch or round upwardly between the bosses B′, as best shown in Figs. 1 and 2.

The transversely-operating stay device is shown in the form of a rivet D, Figs. 2 and 3, or stay-bolt E, Fig. 4, extending transversely through the web C at a point about midway between the adjacent bosses B′, and headed at their opposite ends in such manner as to bind the web transversely, and so brace the same as to prevent the longitudinal splitting of the header-tube between the sockets. In the construction shown in Figs. 2 and 3 the stay-bolt D is in the form of a rivet, having a head D′ at one end and riveted at its other end D^2, thus forming heads at the opposite ends of the rivet and on opposite sides of the web C. It may be desirable in some instances to tap the bolt-hole formed through the web C and run in a threaded stay-bolt, riveting the ends of same as shown at E′ in Fig. 4.

The construction is simple, inexpensive, and is found in practice to efficiently serve the purpose for which it is intended.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The improvement in heating apparatus herein described comprising the header-tube having projecting bosses forming sockets for the heating-pipes and provided between the adjacent bosses with longitudinally-extending webs rounded upwardly between their adjacent bosses, the heater-pipes pressed into their respective sockets in the header-tube and the stay-bolts extending transversely through the webs between the adjacent sockets and headed on opposite sides of the web by which to brace the same whereby to prevent the splitting of the header-tube between the sockets.

2. A header-tube for heaters having pipe-sockets and provided between the same with longitudinal webs extending from socket to socket and with transverse stay-bolts passed through the said webs between the adjacent

sockets, the stay-bolts being extended in a direction at a right angle to the axes of the sockets.

3. A header-tube for heaters having at intervals pipe-sockets for the heating-pipes and provided between such sockets with transversely-operating stay devices whereby to prevent the splitting of the header-tube between the adjacent sockets, the stay devices extending transversely across the line of splitting strain developed in rolling the tubes into the sockets.

4. A header-tube for heaters having sockets for the heater-pipes and between the same longitudinal webs and stay-bolts extending through said webs and transversely across the line of splitting strain developed in rolling the tubes into the sockets and headed at their ends on opposite sides of the webs by which to brace the same whereby to prevent the splitting of the tube from socket to socket.

5. A heater having a header-tube provided with sockets and with pipes pressed into said sockets and provided between the sockets with longitudinal webs and with transverse stay-bolts extending through said webs, and transversely across the line of splitting strain developed in pressing the pipes into the sockets.

6. A header-tube for heaters having sockets for the heating-pipes and webs extending from said sockets and arranged in a plane parallel with the axes of the sockets, and stay devices extending transversely through the said webs substantially as set forth.

ALBERT P. BROOMELL.

Witnesses:

ANDREW J. HERSHEY,

GEO. S. SCHMIDT.

No. 843,995. PATENTED FEB. 12, 1907.

A. P. BROOMELL.

RECEIVER FOR VAPOR HEATING SYSTEMS.

APPLICATION FILED MAY 26, 1906.

Fig. 1.

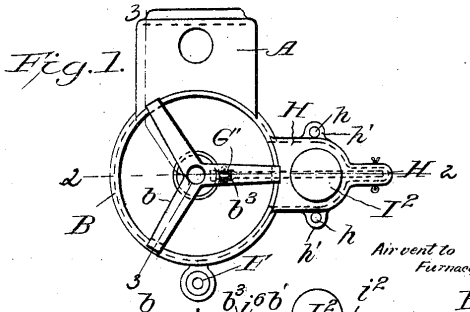
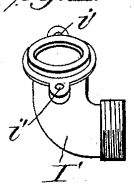


Fig. 4.



Air vent to Furnace Flue

Fig. 3.

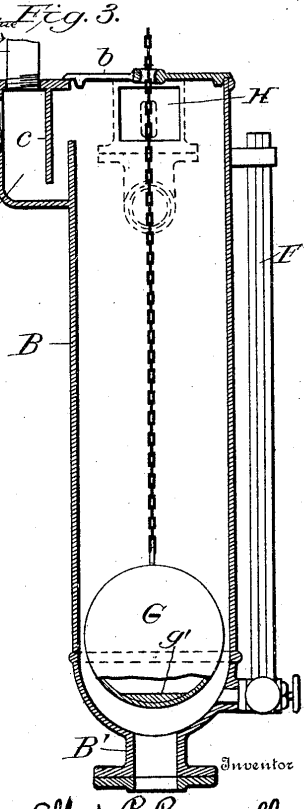
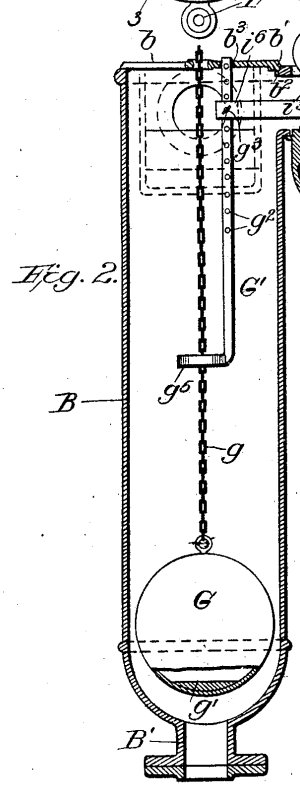


Fig. 2.



Witnesses

C. H. Walker,

Albert Popkins

Inventor

Albert P. Broomell

By Shuteward & Freeby

Attorneys

THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ALBERT P. BROOMELL, OF YORK, PENNSYLVANIA, ASSIGNOR TO VAPOR HEATING COMPANY, OF YORK, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

RECEIVER FOR VAPOR HEATING SYSTEMS.

No. 843,995. Specification of Letters Patent. Patented Feb. 12, 1907.

Application filed May 26, 1906. Serial No. 318,858.

To all whom it may concern:

Be it known that I, ALBERT P. BROOMELL, a citizen of the United States, residing at York, in the county of York, State of Pennsylvania, have invented certain new and useful Improvements in Receivers for Vapor Heating Systems, of which the following is a description, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon.

My invention relates to improvements in the receiver for steam-heating apparatus shown in Patent No. 717,335, December 30, 1902.

The objects of the invention are to prevent any possibility of the water overflowing from the receiver; to provide the lever of the relief-valve with an adjustable rod which may be set to be engaged by the ball, so as to open the relief-valve at any desired pressure; to counterweight the ball at its bottom to keep its chain connection uppermost, and, finally, to cause any water from the relief-valve to overflow into the receiver, whence it will return to the boiler. These objects I accomplish by the construction shown in the drawings, in which—

Figure 1 is a plan of my improved vapor-receiver. Fig. 2 is a section on line 2 2 of Fig. 1. Fig. 3 is a section on line 3 3 of Fig. 1. Fig. 4 is a detail perspective of the elbow-coupling of the safety-valve.

B designates the receiver in the form of an upright cylinder, having an open upper end upon which rests a centrally-apertured concave frame or spider *b*, having a lug *b'*, entering a recess b^2 in the upper edge of the receiver to prevent the spider from turning. The lower contracted end of the receiver is provided with a pipe B' for connection with the boiler at a point below the water-line for the return of the water of condensation or overflow from the safety-valve.

A is a chamber formed at the upper end of the receiver and provided with the depending partition *c*, which terminates above the bottom of the chamber to cause the formation of a water seal. In the side of the chamber outside of the partition *c* is tapped the return-pipe D for the water of condensation from the radiators, while into the top of this portion of the chamber is tapped the vent-pipe E, which leads to the chimney, as in the patent above referred to.

F is the open top water-gage, in which the water stands at a level, depending upon the slight pressure in the boiler, just as in the aforesaid patent.

G designates a suitable float in the receiver, carrying a chain *g*, extending up through the guide-frame or spider *b* and thence to the furnace door or damper, (not shown,) as in the patent referred to. Within the bottom of the float is a weight *g'*, which keeps the eye to which chain *g* is connected always at the top.

On one side of the receiver is formed a relief-valve chamber H, opening into the receiver, this chamber being open at its top and bottom and formed with a lateral offset portion H', in which is pivoted the outer end of the safety-valve lever *i* by means of a split key i^5, the opposite end of which lever extends into the receiver above the float G, where it is provided with a slot i^6. Extending through the slot i^6 is a vertically-adjustable rod G', provided with a series of apertures g^2, through any one of which and the slotted end of the lever is passed a split key or pin g^3. The lower end of the valve-actuating rod G' is provided with an abutment or arm g^5 in the form of a ring which lies in the upward path of the ball-float G and affords a good contact-surface, and the upper end of the rod passes through a slot b^3 in one arm of the spider *b*.

The relief-valve I seats upon the upper end of an elbow-coupling I', which enters the lower open side of the chamber H, to which it is clamped by bolts *h h*, extending through apertured ears *i'* on elbow I' and apertures in the flange *h'* of chamber H. The opposite end of the coupling or connection I' connects with the vapor or steam space of the boiler, as in the patent referred to. In the present construction, however, should the boiler blow off water instead of steam the water will simply run into the receiver and back into the boiler instead of overflowing into the room in which the furnace is situated.

The stem i^2 of the valve I is slotted for the passage of the valve-actuating lever *i*, and to the reduced upper end of the valve-stem is secured a weight in the form of a ball I^2, hav-

ing a socket receiving the said reduced end, the two being secured together by a transverse pin i^3. By pulling out the lever i, which is readily removable, the valve may be rotated and ground to its seat.

The ball works through the open upper end of the chamber H and in practice is made of some less expensive material than the valve itself, the latter being of brass, while the ball is of cast-iron.

The valve is not actuated by steam-pressure in the boiler, but is opened only by the rise of the float.

The operation is substantially the same as in the aforesaid patent and may be briefly stated as follows: All of the return-pipes from the radiators lead to the chamber C, where the air is trapped and conducted to the chimney or other flue. When any pressure exists in the boiler, the water will of course rise in the receiver until it balances the pressure in the boiler, and the rising of the float will cause the closing of the damper and usually prevent increase of pressure in the boiler. Should the pressure in the boiler increase, however, the float will continue to rise and will raise the lever and cause it to open the relief-valve I, and should water blow off it will, as before described, not overflow into the room, but will run into the receiver B. If it is desired to open the relief-valve at a very low pressure, the rod g is lowered near to the ball-float, and where higher pressure is desired the rod will be raised the desired extent.

I do not restrict myself to the particular construction of parts shown, as the same may be varied without departing from the spirit of my invention.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a steam-heating apparatus, a receiver for the water of condensation from the radiators, a connection at the upper end of the receiver for the return water, a connection at the lower end of the receiver for returning the water to the boiler, a damper-actuating float in the receiver, a relief-valve chamber at one side of and opening into the upper end of the receiver, and having a connection for the steam-space of the boiler, a relief-valve in the said chamber, and a lever for lifting the valve extending into the receiver for operation by said float.

2. In a steam-heating apparatus, a receiver for the water of condensation from the radiators, a connection at the upper end of the receiver for the return water, a connection at the lower end of the receiver for returning the water to the boiler, a damper-actuating float in the receiver, a relief-valve chamber opening into the upper end of the receiver and having a connection with the steam-space of the boiler, a relief-valve in the chamber, a lever for lifting the valve, and a rod depending from the lever into the path of the said float.

3. In a steam-heating apparatus, a receiver for the water of condensation from the radiators, a connection at the upper end of the receiver for the return water, a connection at the lower end of the receiver for returning the water to the boiler, a float in the receiver provided with an upwardly-extending damper-actuating chain, a relief-valve chamber opening into the upper end of the receiver, and having a connection for the steam-space of the boiler, a relief-valve in the chamber, a weight secured to the upper side of the valve, and a lever connected to the valve and extending into the receiver for operation by the float.

4. In a steam-heating apparatus, a receiver for the water of condensation from the radiators, a connection at the upper end of the receiver for the return water, a connection at the lower end of the receiver for returning the water to the boiler, a float in the receiver having a damper-actuating chain, a relief-valve having a connection for the steam-space of the boiler, and provided with an operating-lever extending into the receiver, an adjustable rod depending from the inner end of the lever, and having an abutment at its lower end in the upward path of the float.

5. In a steam-heating apparatus, a receiver for the water of condensation from the radiators, a connection at the upper end of the receiver for the return water, a connection at the lower end of the receiver for returning the water to the boiler, a damper-actuating float in the receiver, a relief-valve chamber opening into the upper end of the receiver and open at its top and bottom, an elbow-coupling to connect with the steam-space of the boiler, and entering the lower open side of said chamber, means for securing said elbow to the chamber, a relief-valve seating on the upper end of the elbow, a lever in the chamber connected to said valve and at its free end entering the receiver in operative relation to the float.

6. In a steam-heating apparatus, a receiver for the water of condensation from the radiators, having a trap-chamber at its upper end, a return-pipe connection for said chamber, a vent-pipe connection for the top of said chamber, a connection from the lower end of the receiver to return the water to the boiler, a float in the receiver having a damper-actuating chain and weighted at its lower end to keep the chain connection on top, a relief-valve having a boiler connection and a valve-operating lever entering the receiver for operation by the float.

7. The combination with the relief valve-chamber having a seat at its lower end and open at its top and side, of a valve seated on

the said seat and provided with a weighted extension extending up through the top opening and an actuating-lever removably connected to the valve, whereby on removing the lever the valve may be rotated on its seat by means of its projecting extension.

8. In a steam-heating apparatus, a receiver for the water of condensation from the radiators, a connection at the upper end of the receiver for the return water, a connection at the lower end of the receiver for returning the water to the boiler, a damper-actuating float in the receiver, a relief-valve for the steam-space of the boiler, a lever extending from the valve into the receiver, a vertically-adjustable rod depending from the inner end of the lever and having a lateral abutment at its lower end in the path of the float.

9. In a steam-heating apparatus, a receiver for the water of condensation from the radiators, a connection at the upper end of the receiver for the return water, a connection at the lower end of the receiver for returning the water to the boiler, a guide-frame or spider on the upper open end of the receiver, and having an interlocking connection therewith, a damper-actuating float in the receiver, a relief-valve connected with the steam-space of the boiler, a lever for lifting the valve extending into the receiver, a vertical rod adjustably connected to said lever, guided at its upper end in the guide-frame, or spider, and having a ring-like abutment at its lower end in the path of the float.

In testimony whereof I affix my signature in presence of two witnesses.

ALBERT P. BROOMELL.

Witnesses:
ROSA M. NEUMAN,
ANDREW J. HERSHEY.

No. 843,996. PATENTED FEB. 12, 1907.

A. P. BROOMELL.

VALVE FOR HEATING SYSTEMS.

APPLICATION FILED MAY 26, 1906.

Fig. 1.

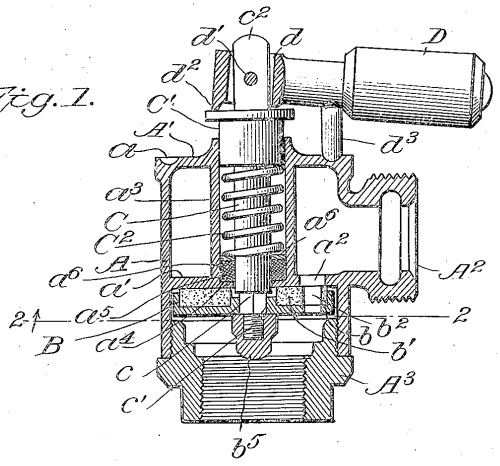


Fig. 3.

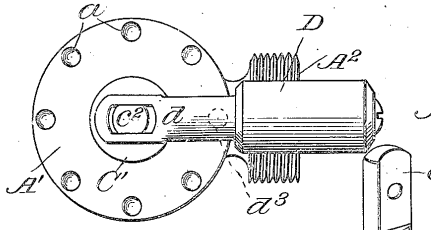


Fig. 2.

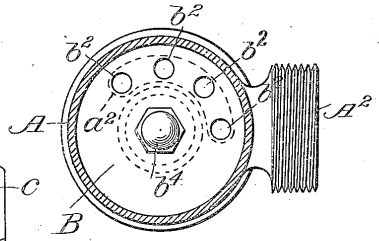
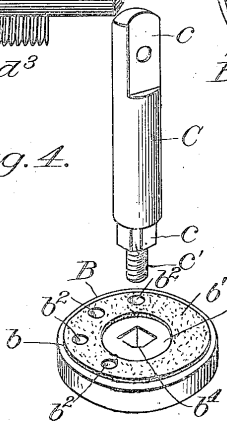


Fig. 4.



Witnesses

C. W. Walker,

Albert Poleur.

Inventor

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By Sturtevant & Fraley

Attorneys.

UNITED STATES PATENT OFFICE.

ALBERT P. BROOMELL, OF YORK, PENNSYLVANIA, ASSIGNOR TO VAPOR HEATING COMPANY, OF YORK, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

VALVE FOR HEATING SYSTEMS.

No. 843,996. Specification of Letters Patent. Patented Feb. 12, 1907.

Application filed May 26, 1906. Serial No. 318,859.

To all whom it may concern:

Be it known that I, ALBERT P. BROOMELL, a citizen of the United States, residing at York, in the county of York, State of Pennsylvania, have invented certain new and useful Improvements in Valves for Heating Systems, of which the following is a description, reference being had to the accompanying drawings and to the letters and figures of reference marked thereon.

The invention relates to improvements in the valve shown in United States Patent No. 657,059, August 28, 1900.

The objects of the invention are to seat the valve, hold its operating-handle in its locked position, and keep the valve-stem properly packed, all by one and the same spring.

These objects I accomplish by the construction shown in the accompanying drawings, in which—

Figure 1 is a central vertical section of my improved valve. Fig. 2 is a horizontal section on line 2 2, Fig. 1. Fig. 3 is a plan view, and Fig. 4 is a perspective view, of the valve-stem and the disk valve separated.

A designates the valve-casing, having a closed upper end A′ and there provided with a circular series of recesses a. One side of the casing is provided with a threaded nipple A^2 to connect with the radiator, and the bottom of the casing is closed by a removable externally and internally threaded cap A^3 for connection with the source of supply.

The casing is divided just below the outlet-nipple A^2 by a transverse partition a', having a semicircular slot a^2, and the center of the partition is connected with the center of the upper end A′ by an integral tube a^3. The opening through the partition at the lower end of the tube is reduced so as to form an annular shoulder a^4 to receive the packing material a^5, above which is a washer a^6.

B is the valve in the form of a disk, having an annular recess b in its upper face, within which fits a non-metallic packing-ring b', of asbestos, fiber, or other suitable material. The upper or working face of this packing-ring projects above the valve-disk B, so that it engages the under side of the partition a' and prevents any metallic part of the valve from coming into contact therewith. The periphery of the valve-disk B is spaced from the interior of the casing A. The valve B b' is provided with a series of circularly-arranged apertures b^2 to register successively with the slot or opening a^2 in partition a'.

The central collar b^3 of the metal disk B is lower than the peripheral or outer flange, and upon it rests the lower shouldered end of the valve-stem C, which stem passes down through the tube a^3 and through washer a^6, packing a^5, and annular shoulder a^4.

The bore of the collar b^3 is generally square, but has one corner flattened, as at b^4, and the squared portion c of the valve-stem is similarly flattened, as at c', so that the valve-disk must be properly positioned before it can be placed on the stem. When in place, the valve is secured by means of the cap-nut b^5, screwed on the lower threaded end of the stem.

C′ is a sliding flanged collar on the valve-stem in the upper end of the tube a^3, and between this collar C′ and the washer a^6 at the bottom of the tube is placed a spiral expansion-spring C^2, through which the valve-stem works.

D is the horizontally-disposed handle, pivoted to rock vertically on the upper end of the valve-stem by means of a slot d, through which passes the flattened upper extremity c^2, secured therein by a transverse pivot-pin d'. The spring C^2 forces the collar C′ upwardly against the lower side of the handle D and causes it to pull upwardly on the stem C, and so hold the non-metallic face b of the valve B against its seat. Furthermore, the spring performs the very important function of compressing the packing material a^5 through the medium of the washer a^6, and so the valve-stem is kept constantly packed.

The handle is provided at the lower side of its outer end beyond its pivot with a projection d^2, which engages the collar C′, and at the opposite side of its pivotal point the handle is provided with a depending locking-lug d^3 to engage any one of the recesses a in the upper face of the valve-casing, the upward force of the spring on projection d^2 tending to press the lug d^3 down and hold the handle against accidental displacement. Thus the spring performs the three important functions of seating the valve, keeping the valve-stem packed, and holding the handle locked.

When it is desired to move one of the

valve-apertures b^2 into register with the slot a^2, the handle D is raised, causing the projection d^2 to bear down on and depress the collar C', when by turning the elevated handle in the proper direction the valve will be rotated to throw the apertures b^2 successively into and out of register with the slot a, thus admitting or shutting off the fluid to the extent desired.

In order to make these valves suitable for different sizes of radiators, it is only necessary to change the size of the apertures b^2 in the valve-disks and not change the size of the valves themselves. For instance, a No. 1 valve for a radiator of twenty-five feet heating-surface will have holes one-eighth of an inch, while a No. 2 valve for a radiator of fifty or sixty feet heating-surface will have holes of three-sixteenths of an inch, and so on. Thus with interchangeable valve-disks valves of only one size are required for all sizes of radiators.

The valve is particularly adapted for use with the steam-heating system shown in Patent 650,778, May 29, 1900; but it may be used in other relations.

I do not restrict myself to the particular construction shown, since the same may be considerably changed without departing from the scope of my invention.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A valve comprising a casing provided with locking-recesses, a rotary valve controlling the passage of fluid through the casing, a stem for the valve, a handle on the stem having a portion to engage any one of said recesses, and a spiral spring between the handle and a part of the casing to hold the valve to its seat and also hold the handle in its locked positions.

2. A valve comprising a casing provided with locking-recesses and a horizontal valve seat or partition, a rotary valve seating upwardly against the lower side of the said seat or partition, a stem extending upwardly through the casing from the valve, a handle pivoted to the upper end of the stem and having a depending lug to engage any one of the said recesses, and a spiral expansion-spring on the stem between the inner end of the handle and a portion of the casing, and holding the handle locked and the valve seated.

3. A valve comprising a casing provided with a horizontal seat or partition between its inlet and outlet openings, a tube connecting the said seat or partition with the closed upper end of the casing; a shoulder being formed at the lower end of the tube, a rotary disk valve seating upwardly against the under side of the partition or seat, a stem extending down through the tube and secured to the valve, a loose collar on the stem in the upper end of the tube, an expansion-spring on the stem between the collar and shoulder, a horizontal handle pivoted to the upper end of the stem and engaged at its under side of its inner end by the spring-pressed collar; the handle having a depending lug to engage the upper side of the valve-casing and hold the handle in its adjusted position.

4. A valve comprising a casing provided with a horizontal seat or partition between its inlet and outlet openings, said seat having a curved slot, a tube connecting the partition with the closed upper end of the casing, a shoulder at the lower end of the tube, a valve-stem extending down through the tube, a valve-disk on the lower end of the stem, having a series of apertures to register with said opening, a horizontal handle having a slotted inner end in which the upper end of the stem is pivoted, a spiral spring on the stem within the tube, a collar on the stem in the upper end of the tube and forced upward by said spring against the handle; the inner end of the handle having a projection engaging the collar and the handle having at the opposite side of its pivot a depending locking-lug to engage the top of the casing and hold the handle in its adjusted position.

5. A valve comprising a casing, a rotary valve controlling the passage through the casing, a stem for the valve, a handle on the stem, means for locking the handle to the casing, a spiral spring on the stem between the handle and a shoulder on the casing to hold the handle in its adjusted position, and packing around the stem between the shoulder and spring and constantly compressed against the stem by said spring.

6. A valve comprising a casing, a rotary upwardly-seating valve controlling the passage through the casing, a stem for the valve, a pivoted handle on the upper end of the stem and adapted to engage the casing at its outer portion, an annular shoulder in the valve-casing above the valve-seat, packing on the shoulder around the stem, a washer on the stem over the packing, and a spiral expansion-spring on the valve-stem between the inner end of the handle and the said washer and acting to hold the outer end of the handle down to the casing, press the valve upwardly to its seat and compress said packing around the valve-stem.

7. A valve comprising a casing, a rotary upwardly-seating valve controlling the passage therethrough; said valve consisting of a metallic disk having an annular recess in its upper face and a non-metallic ring therein and projecting above the walls of the recess to prevent engagement of the metal valve-disk with the seat, a stem extending up through the casing from the valve, a packing for the stem over the valve-seat, a locking-handle for the stem and a spring on the stem

between the handle and packing and serving to hold the valve to the seat, hold the packing around the stem and hold the handle in locking engagement with the casing.

8. A valve comprising a casing, an upwardly-seating rotary valve therein having a semicircular series of apertures to control the passage through the valve, a central opening in the valve having a flattened or guiding portion, a valve-stem extending down through the casing and valve-seat and shaped at its lower end to correspond with the central valve-opening so that it may be placed properly thereon with respect to the valve-apertures, a spring holding the valve to its seat and a locking-handle for the valve acted on by the spring to hold it in its locked position.

9. A valve comprising a casing, a rotary valve controlling the passage through the casing, a locking-handle on the valve-stem and a spiral spring on the stem seating the valve and throwing the handle into locking engagement with the casing.

10. A valve comprising a casing, a valve-seat therein having a slot therethrough, a rotary valve seating upwardly against the seat and having a plurality of openings to successively register with said slot, a stem extending down through the casing, means for predetermining the correct position of the valve on the stem with respect to the openings, a locking-handle on the upper end of the stem and a spiral spring, holding the valve to its seat and the outer end of the handle in locking engagement with the casing.

11. A valve comprising a casing having a valve-seat, and a series of interchangeable valve-disks each having a series of different-sized apertures to enable a single-size valve to be used with different-sized radiators.

In testimony whereof I affix my signature in presence of two witnesses.

ALBERT P. BROOMELL.

Witnesses:
ROSA M. NEUMAN,
ANDREW J. HERSHEY.

A. P. BROOMELL.

VALVE.

APPLICATION FILED OCT. 24, 1907.

907,729. Patented Dec. 29, 1908.

Fig. 1.

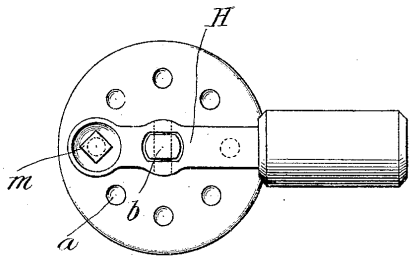


Fig. 2.

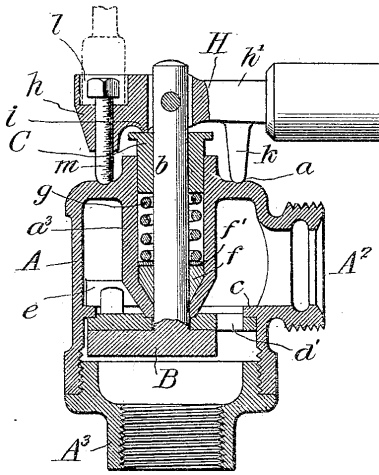


Fig. 3.

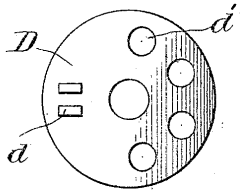
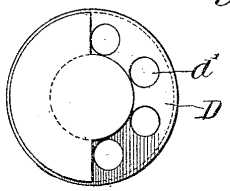


Fig. 4.



Witnesses.

Fenton S. Pelt.

Grace P. Brereton

Inventor

Albert P. Broomell

By

Stuntevant & Mason

Attorneys

UNITED STATES PATENT OFFICE.

ALBERT P. BROOMELL, OF YORK, PENNSYLVANIA, ASSIGNOR TO VAPOR HEATING COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

VALVE.

No. 907,729. Specification of Letters Patent. Patented Dec. 29, 1908.

Application filed October 24, 1907. Serial No. 398,892.

To all whom it may concern:

Be it known that I, ALBERT P. BROOMELL, a citizen of the United States, residing at York, in the county of York, State of Pennsylvania, have invented certain new and useful Improvements in Valves, of which the following is a description, reference being had to the accompanying drawing, and to the letters and figures of reference marked thereon.

This invention relates to valves, of that class shown in United States Patent No. 843,996, issued February 12th, 1907.

The principal object of the invention is to improve the construction of the valve and its seat, and to so construct the latter that it may be readily interchanged with seats having a greater or less number of ports, or ports of different diameter, in accordance with the size of the radiator on which the valve is employed.

A further object is to provide a novel means for holding the valve seating member in position in such manner as to permit ready removal, and further to form the disk of Babbitt metal or similar alloy, which will permit ready easy adjustment of the valve, and at the same time form a steam-tight seat.

A still further object of the invention is to provide means whereby the valve may be locked in any position to which it may be adjusted.

In the accompanying drawings, Figure 1 is a plan view of a valve constructed in accordance with the invention; Fig. 2 is a vertical sectional view of the same; Fig. 3 is a plan view of the valve-seating disk, detached; and Fig. 4 is an inverted plan view of the valve and its seating disk.

The valve casing A is closed at the top, and is provided with an annular series of recesses a. One side of the casing is provided with a threaded nipple A^2, to connect with the radiator, and at the bottom of the casing is a detachable internally and externally threaded cap A^3, for connection with the source of supply.

Depending from the top of the casing is a tube a^3, the lower end of which is tapered to form a reduced central opening for the passage of a valve stem b, at the lower end of which is a valve B, which is formed integral with the stem, and is approximately semi-circular in form.

Extending inward from the circular wall of the casing is an annular flange c, which, in connection with the lower end of the tube a^3 forms a stop for limiting the upward movement of a disk D, that is formed of Babbitt metal or similar alloy, the central portion of said disk having an opening for the passage of the valve stem. From the upper face of the disk extend two spaced lugs d arranged to fit on either side of a radial bar e, that extends from the central tube to the casing, and is preferably cast integral therewith.

The disk D is provided with ports d', the number and area of which are governed by the size of the radiator to which the valve is to be attached, and it is a simple matter to detach one disk and place another in position, for the purpose of changing the capacity of the valve or in case renewal is necessary.

The valve stem extends upward through a packing ring f, which fits within the frusto-conical recess in the bottom of the tube a^3, and on this packing ring is a washer f' against which bears a helical compression spring g, encircling the valve stem. The stem also passes freely through a flanged collar C^6 that fits in the top of the tube a^3, and the upper end of the stem is pivoted to a handled valve-operating lever H, having two arms h, h'. From the arm h depends a small lug i that bears against the top of the collar C^6 close to the stem, and from the arm h' depends a longer lug k, that may fit in any one of the recesses a. The spring is under constant stress, and operates to keep the packing compressed; to hold the valve closed; to maintain the lever H in adjusted position, and also to hold the valve seating disk in place, so that no screws, bolts or other fastening means are necessary. The outer end of the arm h of the operating lever is provided with a recess l, and from the bottom of the recess is bored or tapped downward to receive a screw m, the head of which is housed in the recess, and is of such shape as to permit engagement by a removable key or wrench, as indicated by dotted lines in Fig. 2. The screw may be turned down in order to force its lower end into any one of the recesses, a, and thus lock the valve in any position to which it may be adjusted.

In order to turn the valve, the screw m is turned up out of the recess, and the handled end of the lever is raised, causing the lug i to bear on collar C, and act as a fulcrum, in

order that the lug *k* may be raised clear of the recesses. The handle is then turned, and motion transmitted to the valve, in order to open or close any of the ports in the valve seat, and thus control the quantity of fluid passing.

In order to change the capacity of the valve to suit radiators of different size, it is merely necessary to change the valve disk, the disks having ports varying in number, and also varying in diameter, so that the valve may be made of any capacity, by placing a proper valve disk in position.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. A valve casing having inlet and discharge openings, a rotary valve therein, means for rotating said valve automatic means for temporarily holding the same in predetermined positions, and independent means for positively locking said valve against movement, in any of its adjusted positions.

2. A valve casing having inlet and discharge openings, a rotary valve therein, means for rotating said valve including a handle, a locking lug carried by said handle and automatic means for causing said locking lug to engage the casing for temporarily holding said valve in predetermined positions, and independent means for positively locking said valve against movement, in any of its adjusted positions.

3. A valve casing having inlet and discharge openings, a rotary valve therein, means for rotating said valve including a handle, a locking lug carried by said handle and engaging the casing for temporarily holding said valve in predetermined positions, a spring for normally holding said lug against said casing, and independent means for positively locking said valve against movement, in any of its adjusted positions.

4. A valve casing having inlet and discharge openings, a detachable seating disk formed of Babbitt metal and located between the openings, said disk having a plurality of ports therein, a valve, means for rotating said valve, whereby one or more of said ports may be opened, and a spring surrounding the stem of the valve and operating to seat the valve and to hold the disk in position in the casing.

5. A valve casing having an inwardly extending flange, a central tube a ported disk engaging the lower face of the flange, interengaging members on casing and disk for preventing rotative movement of the latter, a valve seated against the lower face of the disk and a stem carrying said valve and extending upward through said central tube, and a spring located in said tube for holding said valve against said disk, and said disk against said flange.

6. A valve casing having an inwardly extending flange and provided with a central tube, an arm extending from the casing to the tube, a ported disk seated against the flange and bottom of the tube, and provided with a pair of spaced lugs engaging said arm, a valve seated against the disk, and a spring-elevated stem carrying said valve.

7. A valve casing having an inwardly extending flange and provided with a central tube, the lower end of which is contracted in diameter, a ported disk bearing against the bottom of the flange and tube, a valve, and a stem extending through an opening in the disk, and upwardly through said tube a spring located in said tube and operating to hold the valve seated against said disk.

8. A valve casing having an inwardly extending flange, and provided with a central tube having a contracted lower end, a ported disk bearing against the bottom of the flange and tube, means for preventing rotative movement of the disk, a valve seated against the lower face of the disk, a stem carrying the valve and passing up through the tube, a packing disposed in the lower portion of the tube, a spring bearing on the packing, a collar seated on the spring and having an opening through which the stem passes, and an operating member secured to the stem.

9. A valve casing, a valve therein, a stem carrying the valve, a two-armed lever secured to the stem at a point outside the casing, a collar through which the stem passes, a lug carried by each arm of the lever, one lug bearing on the collar and the other on the casing, a valve-supporting spring acting on said collar, and a locking screw carried by one of the arms of the lever.

10. In a valve of the class described, a casing having an annular series of recesses, a valve, a carrying stem therefor, a two-armed handled lever pivoted to said stem, a lug carried by one arm of the lever, and an adjustable locking screw carried by the other arm of the lever, the lug and screw being arranged to enter the recesses to lock the valve in adjusted position.

11. In a valve of the class described, a casing having an annular series of locking recesses, a valve, a spring-elevated stem carrying the valve, a collar surrounding the stem above the spring, a two-armed lever pivoted to the stem and having a lug bearing on the collar, a second lug carried by the handled arm of the lever, and arranged to engage the recesses, the opposite arm of said lever having a recess, and a tapped opening in alinement therewith, and a screw mounted in said opening and arranged to engage the locking recesses, the head of the screw being housed in the arm recess.

12. In combination a valve casing, a segment closing valve therein, said valve having a stem formed integral therewith, a detach-

able seating disk having a plurality of ports therein, and means for rotating said valve whereby said segment may be turned successively over said ports.

13. In combination a valve casing, a segment closing valve therein, said valve having a stem formed integral therewith, a detachable seating disk having a plurality of ports therein and means for rotating said valve whereby said segment may be turned successively over said ports, and means for holding said seating disk against rotation.

14. A valve casing having inlet and discharge openings, a ported disk detachably held within said casing, means for holding said disk from rotation, a segmental closing valve seated against said disk, a stem formed integral with said valve and a spring for holding said valve against said ported disk and said ported disk in place in the casing.

15. A valve casing having inlet and discharge openings, rotary valve therein including a valve stem, a handle pivoted to said valve stem, a lug carried by said handle and engaging depressions in the top of said casing, for temporarily locking the said valve in predetermined positions, and a key operated locking screw carried by said pivoted handle for permanently locking said valve when desired.

In testimony whereof I affix my signature, in presence of two witnesses.

ALBERT P. BROOMELL.

Witnesses:

ROY C. NEY,

ROSA M. NEUMAN.

J. DE W. ARNOLD.

VAPOR HEATING SYSTEM.

APPLICATION FILED OCT. 23, 1907.

909,737. Patented Jan. 12, 1909.

Fig. 2.

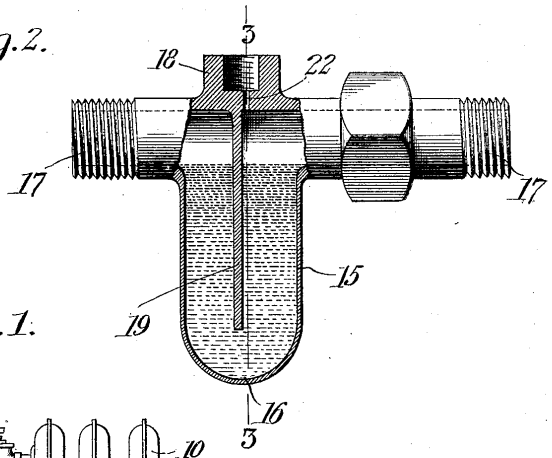


Fig. 1.

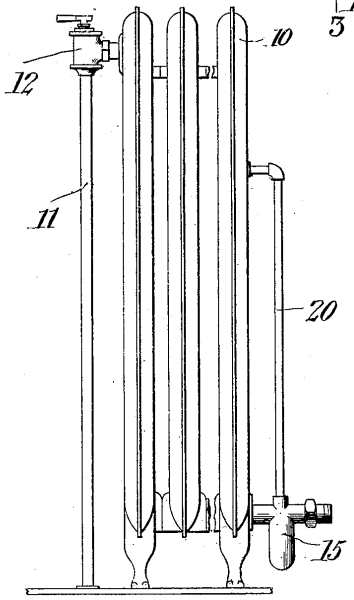
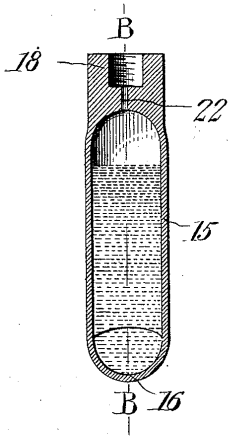


Fig. 3.



WITNESSES

C. E. Smith.

Albert Popkins

INVENTOR

John DeWitt Arnold

By Church and Church

Attorneys

UNITED STATES PATENT OFFICE.

JOHN DE WITT ARNOLD, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO VAPOR HEATING COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

VAPOR HEATING SYSTEM.

No. 909,737. Specification of Letters Patent. Patented Jan. 12, 1909.

Application filed October 23, 1907. Serial No. 398,762.

To all whom it may concern:

Be it known that I, JOHN DE WITT ARNOLD, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Vapor Heating Systems, of which the following is a description, reference being had to the accompanying drawing, and to the letters and figures of reference marked thereon.

This invention relates to vapor heating systems, such as shown and described in my Patent No. 650,778, granted May 29th, 1900. In this system, the vapor ascends in the supply pipes, and enters the radiators in a natural way, and not by force or pressure. Air and condensation are removed from the radiators through return pipes, and delivered into a receiver from which the water returns to the boiler by gravity, while the air is carried up through an air line into condensing coils, and thence into the chimney. While this form of radiator, wherein the air and condensation pass out through the same opening, is practical, and can be successfully operated, I have found that there are certain advantages in taking the air from the radiator at a point distant from the outflow of condensation.

The object of my invention, therefore, is to provide a radiator of the above character, with an air outlet, which is connected to said radiator at a point above its horizontal center.

A further object of the invention is to provide an air outlet which is connected with the return pipe, and sealed against the return of the air into the radiator at the lower part thereof.

These and other objects will in part be obvious, and in part be more fully hereinafter pointed out.

In the accompanying drawings, Figure 1 is an elevation of a radiator, provided with an air vent and return connection constructed in accordance with the invention; Fig. 2 is a detail view of the return connection, drawn to an enlarged scale; Fig. 3 is a transverse sectional view on the line 3—3 of Fig. 2.

Similar numerals of reference are employed to designate corresponding parts throughout the several figures of the drawing.

The radiator 10 is of the ordinary construction, and the upper end of its inlet side is connected to a vapor supply pipe 11, through the medium of a valve 12. The water of condensation returns to the receiver and thence to the boiler, through the return connection 15, arranged at the lower end of the discharge side of the radiator.

The return connection 15 is in the form of a trap, having a downwardly extending water-receiving chamber 16, from each side of which extend nipples or couplings 17, for connection with the radiator and the return pipe, and these connections are disposed in the same horizontal plane.

At the top of the fitting is an integral boss, from which depends a partition 19, terminating short of the bottom of the casing 16.

The upper portion of the boss is tapped for the reception of the lower end of an air vent tube 20, which leads from the final section of the radiator, and is connected to the latter preferably at some distance above its horizontal center.

Extending through the boss is a small opening 22, which leads into the casing 16 at the discharge side of the latter.

The trap is at all times filled with water up to the level of the bottoms of the nipples or other connections. The air escapes from the radiator through the vent tube 20, and as said tube is connected to the return pipe at a point beyond the water seal, no air can return into the radiator at the bottom. I am, therefore, able to draw from the radiator the air contained therein, and thus allow the radiator to be quickly filled with the heated vapor.

Owing to the fact that the air outlet is connected with the chimney, considerable suction is caused, which will aid in freeing the radiator of air.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

The combination of a radiator, an inlet pipe, a supply pipe connected thereto, an independent return fitting connected to said radiator including a casing having coupling connections at its opposite side, a coupling

connection on the upper side of said casing, said casing having a partition connected to the central upper portion thereof and extending downwardly and terminating short of the bottom of the casing, said casing having an opening leading from the coupling at the upper side of the casing into the casing at the discharge side of the partition, and a vent pipe leading from said coupling at the upper side of the casing to the radiator at a point above its middle section.

In testimony whereof I affix my signature, in presence of two witnesses.

JOHN DE WITT ARNOLD.

Witnesses:
EARL M. BARKER,
JAS. FIELEMEYER.

A. P. BROOMELL.

AUTOMATIC HEAT REGULATOR.

APPLICATION FILED OCT. 4, 1912.

1,068,216. Patented July 22, 1913.

Fig. 1.

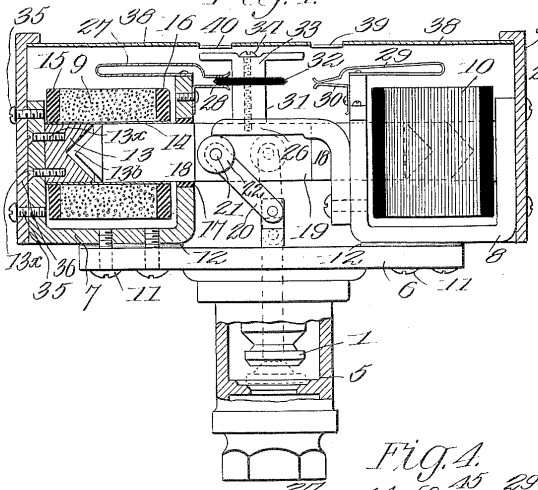


Fig. 2.

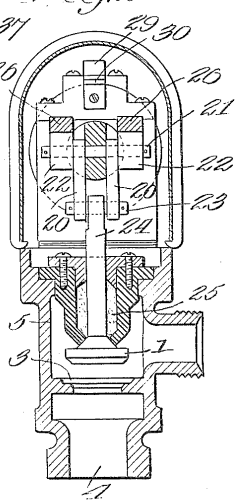


Fig. 4.

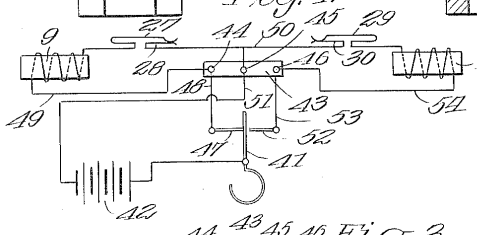
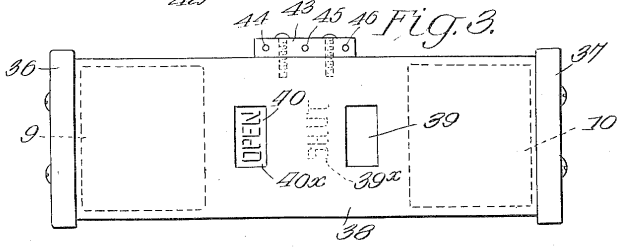


Fig. 3.



WITNESSES

Samuel E. Wade.

L. P. Stanley

INVENTOR

ALBERT P. BROOMELL

BY Munn & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

ALBERT P. BROOMELL, OF YORK, PENNSYLVANIA.

AUTOMATIC HEAT-REGULATOR.

1,068,216. Specification of Letters Patent. Patented July 22, 1913.

Application filed October 4, 1912. Serial No. 723,876.

To all whom it may concern:

Be it known that I, ALBERT P. BROOMELL, a citizen of the United States, and a resident of York, in the county of York and State of Pennsylvania, have made certain new and useful Improvements in Automatic Heat-Regulators, of which the following is a specification.

My invention relates to improvements in automatic heat regulators, and it consists in the combinations, constructions, and arrangements herein described and claimed.

An object of my invention is to provide a magnetic device which may open and control valves, such as the valves of radiators, dampers, hot air flues and the like.

A further object of my invention is to provide means controlled by a thermostat for operating the valves and for effectively locking the valve in its closed position, thereby resisting pressure tending to open it, but which will automatically operate to release the valve and to withdraw it from its seat when the temperature has reached a certain point.

A further object of my invention is to provide a simple device for accomplishing the above named objects, which is made of few parts, and which is therefore not liable to easily get out of order.

Other objects and advantages will appear in the following specification, and the novel features of the device will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawings forming part of this application in which—

Figure 1 is a longitudinal section through the device, Fig. 2 is a transverse section through the device, Fig. 3 is a plan view of the device, and Fig. 4 is a diagrammatic view showing the electric connections.

In carrying out my invention I make use of a part of the heating apparatus, such as the valve of a radiator. Such a valve I have shown at 1 in Figs. 1 and 2. This valve is designed to engage the valve seat 3, so as to cut off or establish communication with the interior 4 of the valve casing 5 on the opposite side of the valve seat from the valve 2.

Secured to the valve casing 5 is a plate or cap 6 to which is secured at its ends the yokes 7 and 8 of the cylinders 9 and 10 respectively, screws 11 being provided for that purpose. Between the yokes 7 and 8 and the cap or plate 6 are a series of thin spacing plates 12 whose purpose will be explained later. A description of the construction of one solenoid will suffice, since they are both precisely alike. The yoke 7 has secured to it by means of screws 13^x an inwardly projecting extension 13, which has a recess 13^b at one end. A cylinder 14 is supported on the extension 13, and is provided on its exterior with the insulating heads 15 and 16 respectively. Between these heads the wire of the solenoid is wound.

The yoke 7 is provided with an opening having an insulating bushing 17 therein. A core 18 is provided for each solenoid, these cores being connected by means of a bar 19.

On each side of the bar 19 are the links 20 (see Fig. 2). The pivot pin, or shaft, 21 also bears rollers 22 outside of the frame 20. The links 20 are pivotally connected by means of the pivot pin 23 with the valve stem 24 of the valve 2. This valve stem is provided with a packing gland 25.

Secured to the yoke 8 are L-shaped members 26, which are designed to form abutment members for the rollers 22. Each yoke is provided with a pair of spring contacts such as those shown at 27 and 28 on the yoke 7 and 29 and 30 on the yoke 8. The ends of these contacts are normally together, and are turned outwardly as clearly shown in the drawing.

Disposed upon the bar 19 is an upwardly projecting member 31 at the top of which is an insulating bar or rod 32. Above the insulating bar 32 is a T-shaped member 33. The bar 32 is clamped between the lower and upper members 31 and 33 by means of a screw 34.

Secured to the yoke 7 by means of screws 35 is an end plate 36. A similar end plate 37 is secured to the yoke 8. A casing 38 is provided and extends between the heads 36 and 37. This casing is provided with a pair of openings 39 and 40. The T-shaped member 33 bears on one of its laterally extending arms the word "shut" as shown at 39^x in Fig. 3, while the other arm bears the word "open" as shown at 40^x in Fig. 3.

In Fig. 4 I have shown the circuit connections by means of which the device is operated. These consist of a thermostat 41, battery 42, and an insulating plate 43 having binding posts 44, 45 and 46.

A description of the operation of the circuits will be best understood by a statement of the operation of the device.

The thermostat 41 may be of any approved type to operate at any predetermined temperature. In Fig. 4, I have shown the thermostat as being in engagement with the contact 47. Battery current will now flow from the battery 42 through 41, 47, 48, 44, 49, solenoid 9, 27, 28, 50, 45, 51, and back to battery. This will energize the solenoid 9 and draw the core into the position shown in Fig. 1. Just at the end of the movement of the core, the insulating bar 32 will enter between and separate the spring contacts 27 and 28, thereby cutting off the current. The valve 1 will be opened, and will stay open until the temperature increases sufficiently to move the thermostat over against the opposite contact 52. When the thermostat member 41 is in engagement with the contact 52 the current will flow from battery 42, through 41, 52, 53, 46, 54, solenoid 10, 29, 30, 50, 51 to battery. This will energize the solenoid 10 and the core will be drawn away from the solenoid 9. At the end of its movement the insulating member 32 will enter between and separate the spring contacts 29 and 30, thereby cutting off the current.

The movement of the core toward the solenoid 10 will cause the valve to engage its seat. The links 22 will then be in the dotted line position shown in Fig. 1. Pressure against the valve will tend to be resisted by the abutment member 26, and therefore the valve is positively held against pressure. When, however, the temperature has so far decreased as to cause the movement of the thermostat, the solenoid 9 will move the core as heretofore explained. This movement is faciliated by means of the rollers 22, which tend to decrease the friction so as to permit the movement of the core to open the valve. As the T-shaped member 33 is shifted, it brings the words "shut" and "open" before the respective openings 39^x and 40^x, so that the user of the device may always know the position of the valve.

It will be noted that in my device the current is cut off as soon as the solenoid has done its work. There is therefore a great economy in current, because the period between the vibration from one contact to another may represent a considerable time, and if the current were on the solenoids it would not only result in waste of current, but in an undue extension of the parts, due to the heating of the coils and would interfere with the proper operation of the device. The feature of the positive locking of the valve I regard as very important. This permits the device to be used with systems having either high or low pressure. It will be noted that the valve is moved by the solenoid regardless of the pressure. Thus when it is used with a system having very low pressure, the valve is positively opened, as effectively as if it were used on a system having pressure behind the valve.

In order that the valve 1 may be brought into position upon its seat, I provide the spacing plates 12 which may be made of any suitable material. These plates may be used so as to bring the valve to its proper position. As the valve becomes worn, adjustment may be necessary, and certain of these parts may be removed or replaced in order to bring the valve into its proper position for closing at the right moment.

I claim:

1. The combination with a thermostat and a source of current, of a valve operating device controlled by the thermostat, said valve operating device comprising a pair of solenoids each provided with a core, a rigid member connecting said cores, connections between the valve stem and said rigid connecting member for operating the valve, said connections comprising links pivotally secured to said rigid connecting member at one end and to the valve stem at the other, friction rollers carried by the pivotal connection of the links with the rigid member, and an abutment member arranged to be engaged by the periphery of said rollers.

2. In a heat regulating device, the combination with a valve having a valve stem, of a pair of solenoids secured to the valve casing, movable cores for said solenoids, a bar rigidly connecting said cores together, links pivotally connecting said rigid bar with said valve stem, a pair of normally closed spring contacts carried by each solenoid, an insulating plug carried by said bar and arranged to enter between and to separate either pair of said closed contacts, an interior casing provided with openings, and an indicating device carried by said insulating plug and having portions arranged to register with the openings to indicate the position of the bar.

3. In a heat regulating device, a valve casing, a pair of yokes secured to said valve casing, a pair of solenoids carried by said yokes, a core for each solenoid, a common connecting bar for said cores, a valve in said valve casing having a slidable valve stem, a pair of spring contacts carried by one of said solenoids, an insulating plug carried by said bar and arranged to enter between and to separate said pair of contacts and to be frictionally held by said contacts, and means connecting the valve stem and the common connecting bar for operating the valve through the motion of the bar.

4. In a heat regulating device, a valve casing, a pair of yokes secured to said valve casing, a pair of solenoids carried by said yokes, a core for each solenoid, a common

connecting bar for said cores, a valve in said valve casing having a slidable valve stem, a pair of spring contacts carried by one of said solenoids, an insulating plug carried by said bar and arranged to enter between and to separate said pair of contacts and to be frictionally held by said contacts, and means connecting the valve stem and the common connecting bar for operating the valve through the motion of the bar, said means comprising links secured to said valve stem at one end and to the common connecting bar at the other and arranged to be brought into alinement with the valve stem when the insulating core has entered between the spring contact members.

5. In a heat regulating device, a valve casing, a pair of yokes secured to said valve casing, a pair of solenoids carried by said yokes, a core for each solenoid, a common connecting bar for said cores, a valve in said valve casing having a sildable valve stem, a pair of spring contacts carried by one of said solenoids, an insulating plug carried by said bar and arranged to enter between and to separate said pair of contacts and to be frictionally held by said contacts, means connecting the valve stem and the common connecting bar for operating the valve through the motion of the bar, said means comprising links secured to said valve stem at one end and to the common connecting bar at the other end and arranged to be brought into alinement with the valve stem when the insulating core has entered between the spring contact members, and means for relieving the connecting rod from end thrust of the links when the latter are in alinement with the valve stem.

6. In a heat regulating device, a valve casing, a pair of yokes secured to said valve casing, a pair of solenoids carried by said yokes, a core for each solenoid, a common connecting bar for said cores, a valve in said valve casing having a slidable valve stem, a pair of spring contacts carried by said bar and arranged to enter between and to separate said pair of contacts and to be frictionally held by said contacts, means connecting the valve stem and the common connecting bar for operating the valve through the motion of the bar, said means comprising links secured to said valve stem at one end and to the common connecting bar at the other end and arranged to be brought into alinement with the valve stem when the insulating core has entered between the spring contact members, and means for relieving the connecting rod from end thrust of the links when the latter are in alinement with the valve stem, said means comprising an L-shaped abutment member secured to one of said solenoids.

ALBERT P. BROOMELL.

Witnesses:
H. E. BOLLINGER,
N. H. HALL.

A. P. BROOMELL.

THERMOSTATIC MEANS FOR OPERATING HOT AIR REGISTERS.

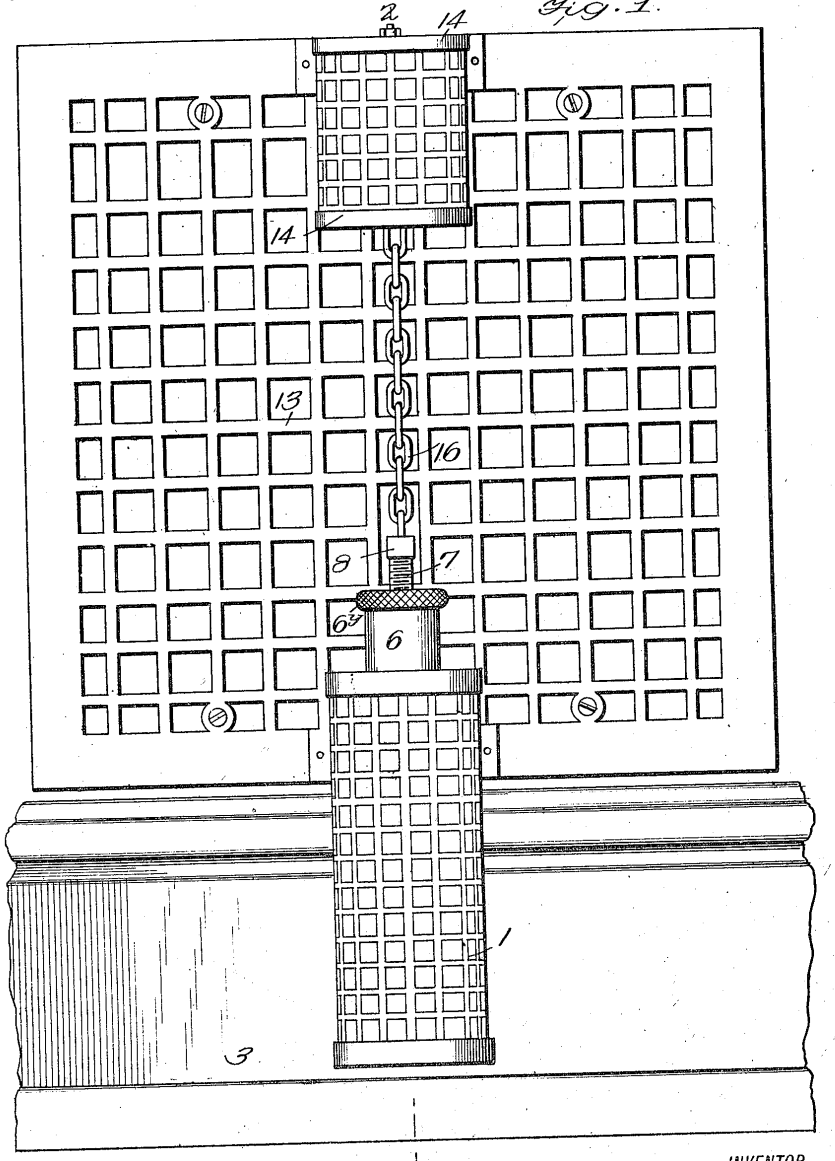
APPLICATION FILED JULY 7, 1914.

1,133,089.

Patented Mar. 23, 1915.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

J. K. Phillips

L. A. Stanley

INVENTOR

ALBERT P. BROOMELL

BY Munn & Co.

ATTORNEYS

A. P. BROOMELL.

THERMOSTATIC MEANS FOR OPERATING HOT AIR REGISTERS.

APPLICATION FILED JULY 7, 1914.

1,133,089.

Patented Mar. 23, 1915.

2 SHEETS—SHEET 2.

Fig. 2.

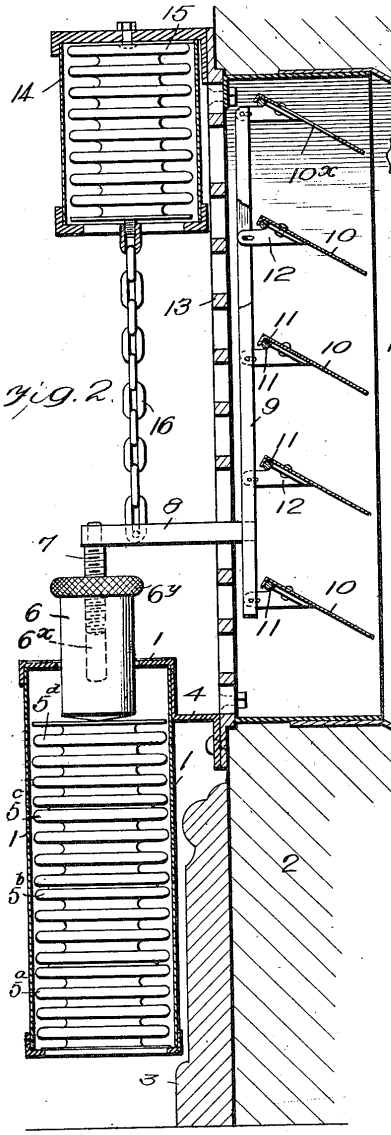


Fig. 3.

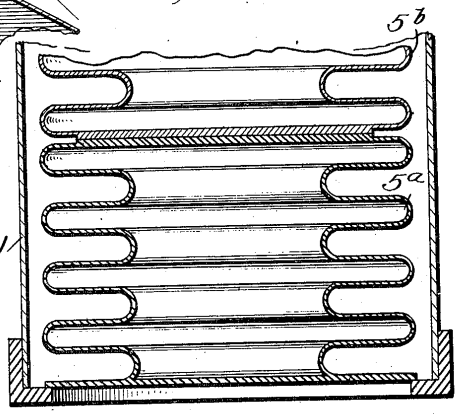
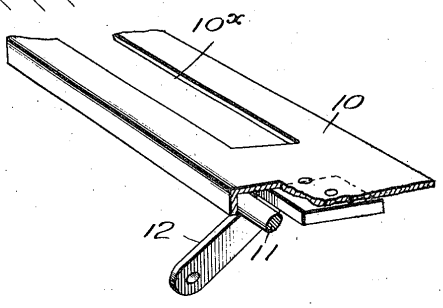


Fig. 4.



WITNESSES

J. K. Phillips

L. A. Stanley

INVENTOR

ALBERT P. BROOMELL

BY Munn & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

ALBERT P. BROOMELL, OF YORK, PENNSYLVANIA.

THERMOSTATIC MEANS FOR OPERATING HOT-AIR REGISTERS.

1,133,089. Specification of Letters Patent. Patented Mar. 23, 1915.

Application filed July 7, 1914. Serial No. 849,584.

To all whom it may concern:

Be it known that I, ALBERT P. BROOMELL, a citizen of the United States, and a resident of York, in the county of York and State of Pennsylvania, have made certain new and useful Improvements in Thermostatic Means for Operating Hot-Air Registers, of which the following is a specification.

My invention relates to improvements in devices for operating the registers of hot air heating systems and it consists in the combinations, constructions, and arrangements herein described and claimed.

An object of my invention is to provide a simple device which may be used in connection with a hot air heating system which will automatically open and close the register gates.

A further object of my invention is to provide a device of the type described in which a thermostatic member is attached directly to the register gates for operating the same and having means whereby the gates may be opened or closed at predetermined temperatures.

A further object of my invention is to provide an auxiliary thermostat for causing the closure of the register gates in case the fire in the furnace should go out and cold air should come in through the register.

Other objects and advantages will appear in the following specification and the novel features of the device will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawings forming part of this application in which—

Figure 1 is a face view of the device, Fig. 2 is a section along the line 2—2 of Fig. 1, Fig. 3 is an enlarged sectional view through a portion of the lower thermostat, and Fig. 4 is a perspective view of one of the register gates.

In carrying out my invention I provide a casing 1 for the lower thermostat which is secured to the wall 2 just below the face of the register and preferably just above the base board 3 by means of a bracket 4 or in any other suitable way. This casing, as shown in Fig. 1, is preferably in the form of a grating which will permit the free flow of air around the thermostat inclosed therein. The latter is preferably made up of a series of thermostatic members such as those shown at 5^a, 5^b, 5^c and 5^d. These sections are set one on top of the other for the purpose of sub-dividing the volatile liquid with which the thermostatic member is charged. I have found that by sub-dividing the bellows into sections the movement of the thermostat is much quicker and more accurate than if one long thermostatic bellows is used. My invention contemplates the use however of any suitable thermostat. Arranged to project through the top of the casing 1 is a weight 6 which has a threaded bore 6^x adapted to receive a screw 7 which depends from an arm 8. The knurled head 6^v of the weight 6 permits its adjustment on the screw. The arm 8 is attached to a common operating rod 9.

The gates 10 of the register are made of a very light material such as sheet aluminum or thin brass and each gate is pivotally hinged on a brass rod 11 and is provided with an arm 12 having a pivotal connection with the common operating rod 9. The top gate is provided with a cut-away portion 10^x, the purpose of which will be explained later.

Disposed at the top of the register opening, in front of the grating 13, is a casing 14 which contains an upper thermostatic member 15, the latter being preferably of the bellows type, as shown in the drawings. This thermostatic member 15 is connected with the arm 8 by means of a chain 16. The casing 14 consists preferably of a grating, as shown in Fig. 1 so as to permit the air from the register to play directly on the upper thermostatic member 15.

From the foregoing description of the various parts of the device the operation thereof may be readily understood.

Fig. 3 shows the lower thermostatic member as cold and contracted to its shortest length. If the room temperature increases this thermostat will expand and will carry up with it the weight which is shown resting on the top of the thermostat and this in turn will cause the gates to swing on their pivotal supports so as to close the register or to partially close it, depending upon the amount of expansion of the lower thermostatic member. If it is desired to have the register close later, so that the room will go to a higher temperature, the weight 6 is screwed to the right so as to lift it up from the thermostat thereby necessitating a further movement of the latter before it comes in contact with the weight, thus delaying the closing of the register until the higher temperature is reached. This lower thermostatic member is charged with a vola-

tile liquid in such a manner that it begins expanding at about 65° F.

The upper thermostatic member 14 is charged to begin expanding at about ninety to one hundred degrees F. which temperature is always reached by the incoming warm air. The expansion of the upper thermostatic member has no effect on the register gates, since the chain 16 will be merely slackened up when the upper thermostat is expanded. Let us now assume that the fire in the furnace goes down and that cold air is being discharged through the register. As soon as the temperature of this air drops below the point at which the upper thermostatic member will expand this thermostat will contract and by means of the chain connection will pull the bar 8 and the weight 6 upwardly, thus closing the register and preventing the admission of cold air so long as the air in the register chamber is cold. When, however, the warm air begins to come in, the upper thermostatic member will begin to expand.

In order that the register gates may be opened at the initial entrance of the warm air I provide a cut-away portion 10^x in the upper gate so that even when the latter is closed the hot air may flow through and thus quickly warm the upper thermostat, so as to cause its expansion and thereby permit the opening of the register gates through the downward movement of the weight 6.

It will thus be seen that I have provided a device having register gates which are positively operated by the movement of an individual thermostat connected with the gates so as to control the temperature of the room and in addition have provided an auxiliary thermostatic member for closing the gates when there is an abnormal decrease of temperature, as for instance when the fire goes out. This automatic regulation therefore provides for all the ordinary contingencies which may occur in the regulation of the temperature of a hot air heating system.

I claim:

1. In a hot air heating system, a register provided with gates, a thermostatic member connected with said gates for operating the latter at predetermined temperature, and an auxiliary thermostatic member acting independently of said first-named thermostatic member for operating the register gates at an abnormally low temperature.

2. In a hot air heating system, a register provided with gates, a thermostat connected with said gates for causing the latter to open below a predetermined room temperature and to close at a higher temperature, and an auxiliary thermostatic member for causing the closing of the register gates below the operating temperature of the first mentioned thermostatic member.

3. In a hot air heating system, a register provided with gates, a thermostat connected with said gates for causing the latter to open below a predetermined room temperature and to close at a higher temperature, and an auxiliary thermostatic member acting independently of said first-named thermostatic member for causing the closing of the register gates when cold air is passing out through the register.

4. In a hot air heating system having a register provided with pivoted gates, a common operating rod for moving said pivoted gates, a counterweight secured to said common operating rod, a thermostatic bellows disposed below said counterweight and arranged to engage the latter in its movement under expansion, the position of said counter weight being adjustable with respect to said thermostatic bellows.

5. In a hot air heating system, a register provided with movable gates, a thermostat disposed below the register and being operatively connected with said gates for opening and closing the latter at a predetermined temperature, and an auxiliary thermostat disposed in front of the register in the path of the incoming hot air, said auxiliary thermostat being operatively connected with the register gates for closing the latter when cold air is coming through the register.

6. In a hot air heating system, a register provided with pivoted gates, an operating rod for said pivoted gates, a counterweight carried by said common operating rod, a thermostatic member disposed below the register and arranged to engage said counterweight in its movement for opening and closing the gates at a predetermined temperature, an auxiliary thermostatic member disposed in front of the register in the path of the air coming through the register, and a flexible connection between said counterweight and said auxiliary thermostatic member, the contraction of said auxiliary member serving to raise the counterweight.

7. In a hot air heating system, a register provided with gates, a main thermostatic member, an auxiliary thermostatic member acting in conjunction with said main thermostatic member for operating the gates at a predetermined temperature, said auxiliary thermostatic member acting independently of said main thermostatic member for operating the gates at an abnormally low temperature.

ALBERT P. BROOMELL.

Witnesses:
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A. P. BROOMELL.

AUTOMATIC HEAT CONTROLLING DEVICE.

APPLICATION FILED JULY 8, 1914.

1,133,090. Patented Mar. 23, 1915.

2 SHEETS—SHEET 1.

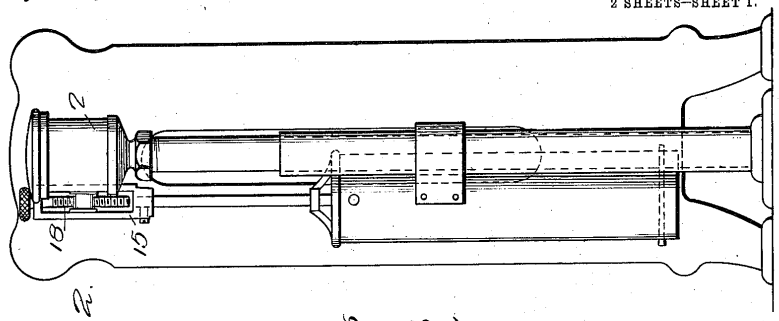

Fig. 2.

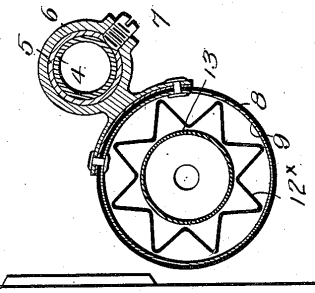

Fig. 3.

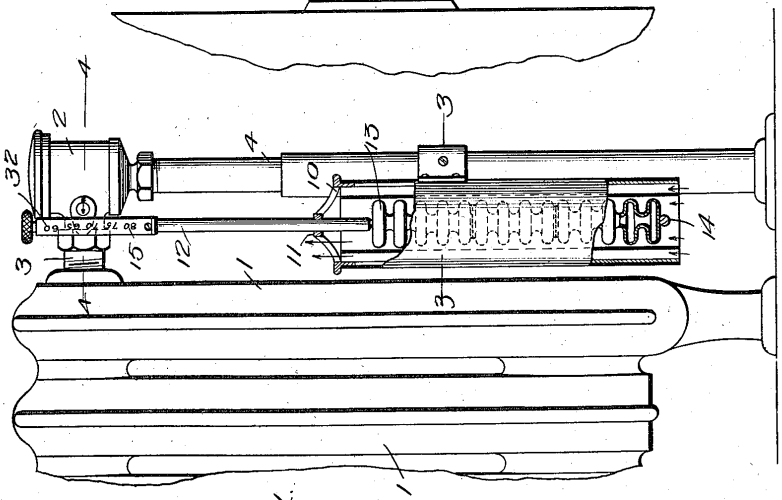

Fig. 1.

WITNESSES

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AUTOMATIC HEAT CONTROLLING DEVICE.

APPLICATION FILED JULY 8, 1914.

1,133,090. **Patented Mar. 23, 1915.**

2 SHEETS—SHEET 2.

Fig. 4.

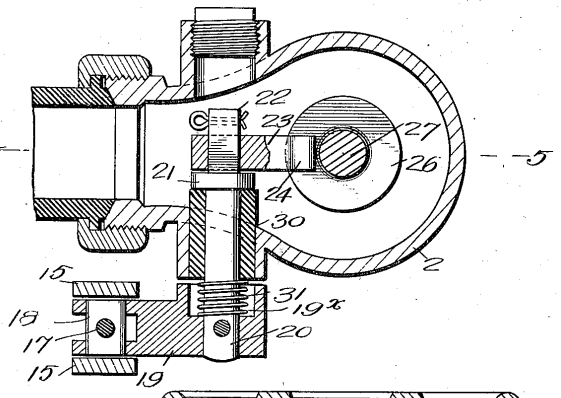


Fig. 5.

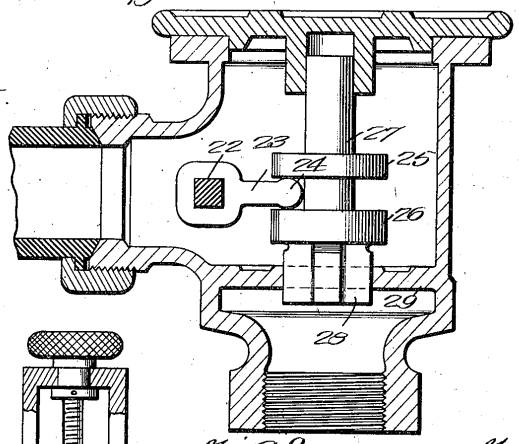


Fig. 6.

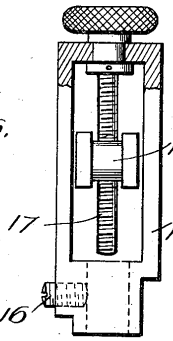


Fig. 9.

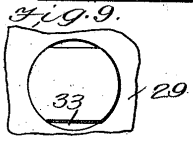


Fig. 10.

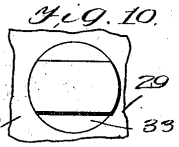


Fig. 7.

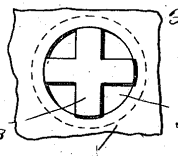
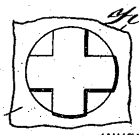


Fig. 8.



WITNESSES

H. C. Barry

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INVENTOR

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ATTORNEYS

UNITED STATES PATENT OFFICE.

ALBERT P. BROOMELL, OF YORK, PENNSYLVANIA.

AUTOMATIC HEAT-CONTROLLING DEVICE.

1,133,090. Specification of Letters Patent. Patented Mar. 23, 1915.

Application filed July 8, 1914. Serial No. 849,679.

To all whom it may concern:

Be it known that I, ALBERT P. BROOMELL, a citizen of the United States, and a resident of York, in the county of York and State of Pennsylvania, have made certain new and useful Improvements in Automatic Heat-Controlling Devices, of which the following is a specification.

My invention relates to improvements in devices for automatically controlling the heat given out by radiators and the like, and it consists in the combinations, constructions, and arrangements herein described and claimed.

An object of my invention is to provide a device in which a thermostatic member is directly connected with a radiator valve so as to control the valve in accordance with the temperature of the room.

A further object of my invention is to provide a device of the type described in which a thermostatic member is placed close to the floor, but is protected from the heat of the radiator and from the steam pipe so that the air which reaches the thermostatic member will be substantially at the same temperature as the air at the floor of the room in which the radiator is placed.

A further object of my invention is to provide a device of the type described with means for regulating the device so as to cause the valve to operate at any predetermined temperature.

Other objects and advantages will appear in the following specification and the novel features of the device will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawings forming part of this application in which—

Figure 1 is a side view of the device, certain parts being shown in section, Fig. 2 is an end view, Fig. 3 is a sectional view on a line 3—3 of Fig. 1, a portion of the radiator being shown in plan view, Fig. 4 is an enlarged section through the valve on the line 4—4 of Fig. 1, Fig. 5 is a section along the line 5—5 of Fig. 4, Fig. 6 is a detail view of a yoke, Fig. 7 is a bottom plan view of the valve proper, and Figs. 8, 9 and 10 are similar views of modified forms of valves.

In carrying out my invention I may make use of a radiator 1 of any type such as a steam radiator or a hot water radiator.

At 2 is shown a valve casing which communicates with the radiator 1 by means of a pipe or nipple 3 and which is connected with the source of steam or water supply by means of a supply pipe 4. For some distance up from the floor I inclose a pipe 4 with a heat insulating covering 5 made of fiber or other heat insulating material. Around the fiber covering 5 is secured a clamping member 6 having a set screw 7 for adjusting the same in various positions. This clamping member bears a metallic tube 8 which is preferably nickel plated and which is lined on the inside with a heat insulating sheet 9 of fiber or other suitable heat insulating material. The tube is provided at its top with a spider 10 whose central portion 11 forms a guide member for a stem 12, as will be hereinafter explained. Inside of the fiber insulating member 9 is a corrugated tube $12^{\times}$ and within the corrugated tube is a thermostatic bellows 13 whose lower end rests upon a suitable support 14, but whose upper end is free to move when the bellows is expanded or contracted.

The stem 12 is secured in the lower end of a yoke 15 (a detail view of which is shown in Fig. 6) by means of a set screw 16. This yoke bears a regulating screw 17 which passes through a wrist pin 18 carried by an arm 19 secured at the end of a rock shaft 20 which passes through the walls of the valve casing 2, and which is provided with a collar 21 and a squared portion 22 arranged to pass through an arm 23. The latter has a rounded end 24 which extends between an upper and a lower collar 25 and 26 respectively on the valve stem 27. The collar 26 serves as a valve and is provided with guide wings 28 which extend through the opening in the partition 29. The rock shaft 20 (see Fig. 4) is provided with a sleeve 30 of soft metal such as Babbitt. A spiral spring 31 holds the collar 21 close to the end of the Babbitt sleeve and thus forms a steam-tight joint thereby doing away with the necessity of packing. This spring is inclosed in a recess $19^{\times}$ in the rock arm 19, this forming a housing for the spring. The yoke 15 is provided on one side with a series

of marks 32 indicating temperatures, while the arm 19 bears an arrow which points toward the temperature scale.

From the foregoing description of the various parts of the device the operation thereof may be readily understood.

The yoke 15 together with its adjusting screw and the rod 12 is of sufficient weight to keep the valve always open. When the thermostatic bellows is cold and collapsed to its shortest length the rod 12 is down against the top of the bellows. If the temperature increases the bellows will expand and force the rod 12 upwardly, thereby rotating the rock shaft and causing the closure or the partial closure of the valve 26. If it is desired to close the valve at a higher temperature the regulating screw is turned to the right, which will pull the connecting rod up away from the bellows so that the latter will have to move farther by increased temperature before it will transmit movement to the valve.

It will thus be seen that I have provided a heat regulating device in which the thermostatic member is attached directly to the radiator valve with a simple adjusting means so as to vary the temperature at which the valve will be opened. The arrangement of the heat insulating means for the bellows keeps the latter at substantially the temperature of the air near the floor. At the same time the steam supply pipe serves as a means for supporting the thermostatic member.

In order to adapt the valves to different size radiators so that they will not be flooded with steam I may add metal to the guide wings 28, thereby providing passages 33 of greater or less area as shown in the modified forms in Figs. 8 to 10 inclusive. The thermostatic member 13 is preferably made up of a series of individual sections which are set one on top of the other. These sections are partially filled with volatile liquid which will tend to cause the expansion of the sections, thereby lengthening the thermostatic member 13 as a whole and causing the movement of the rod 12. I have found that by subdividing the bellows into sections the movement of the thermostat is much quicker and more accurate than if one long thermostatic bellows is used. My invention contemplates the use, however, of any suitable thermostat.

I claim:—

1. The combination with a radiator having a supply pipe, of a valve casing communicating with said radiator and said supply pipe, a valve therein for controlling the heating fluid, a thermostat casing carried by said supply pipe, said thermostat casing being open at the bottom and at the top, means carried by the supply pipe and by the thermostat casing for insulating the heat from the radiator and from the supply pipe, a thermostat disposed within said thermostat casing, means disposed between said thermostat and said valve for operating the latter, said last named means comprising a depending rod connected with the valve, and means for shifting the position of the rod with respect to the thermostat so as to vary the point of contact of the thermostat with the rod.

2. The combination with a radiator having a supply pipe, of a valve casing communicating with said radiator and with said supply pipe, a valve within said casing for controlling the supply of heating fluid, a thermostatic member carried by said supply pipe, means for insulating said thermostatc member from the heat from said radiator and said supply pipe, means connected with said thermostatic member for positively operating said valve at a predetermined temperature, and means for regulating the temperature at which the valve is operated.

3. The combination with a radiator having a supply pipe, of a valve casing communicating with said radiator and with said supply pipe, a valve within said casing for controlling the supply of heating fluid, a thermostatic member carried by said supply pipe, means for insulating said thermostatic member from the heat from said radiator and said supply pipe, a rocker arm connected with said valve for operating the latter, a yoke pivotally connected to said rocker arm, and a rod secured to said yoke and arranged to be engaged by said thermostatic member for moving said yoke and said rocker arm.

4. The combination with a radiator having a supply pipe, of a valve casing communicating with said radiator and with said supply pipe, a valve within said casing for controlling the supply of heating fluid, a thermostatic member carried by said supply pipe, means for insulating said thermostatic member from the heat from said radiator and said supply pipe, a rocker arm connected to said valve for operating the latter, a wrist pin carried thereby and having a threaded opening, a regulating screw disposed in the threaded opening of the wrist pin, a yoke connected with said regulating screw and movable with respect to the rocker arm when the screw is turned, and a rod rigidly connected with said yoke and arranged to extend into operative relation with said thermostatic member.

5. The combination with a radiator having an individual supply pipe, of a valve casing carried by said supply pipe, an individual inlet establishing communication between said radiator and said valve casing, said individual supply pipe and said valve casing being in close proximity to

said radiator, a valve within said valve casing for controlling the heating fluid, a thermostat member carried by said supply pipe, means for insulating said thermostat member from the heat from said radiator and said supply pipe, means connected with said thermostat member for positively operating said valve at a predetermined temperature, and means for regulating the temperature at which the valve is operated.

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Witnesses:
GRACE M. DRAYER,
WM. H. KOLLER.

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J. L. BROOMELL, EXECUTRIX.
OIL BURNING APPARATUS.
APPLICATION FILED MAR. 19, 1921.

1,423,181. Patented July 18, 1922.

3 SHEETS—SHEET 1.

Fig. 1.

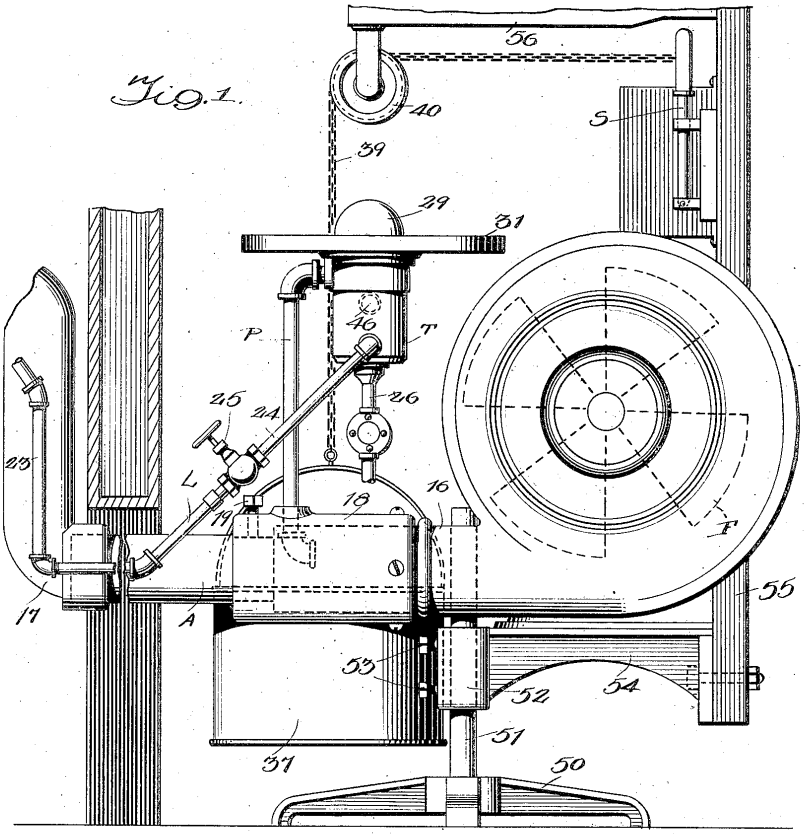
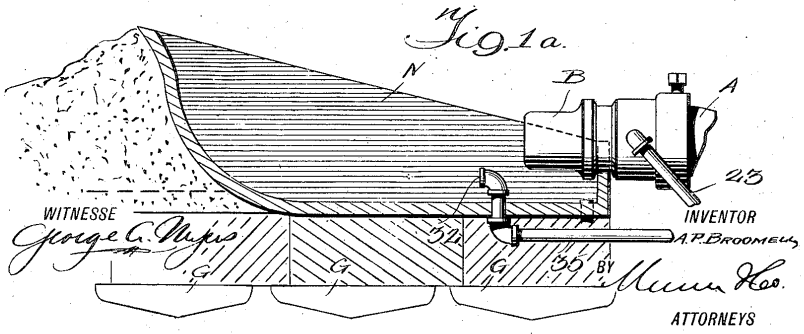


Fig. 1a.



A. P. BROOMELL, DEC'D.
J. L. BROOMELL, EXECUTRIX.
OIL BURNING APPARATUS.
APPLICATION FILED MAR. 19, 1921.

1,423,181. Patented July 18, 1922.

3 SHEETS—SHEET 2.

Fig. 2.

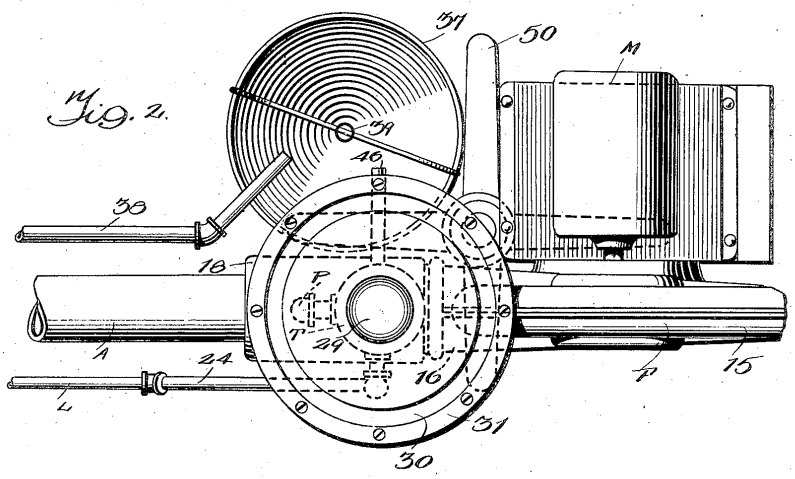


Fig. 2a.

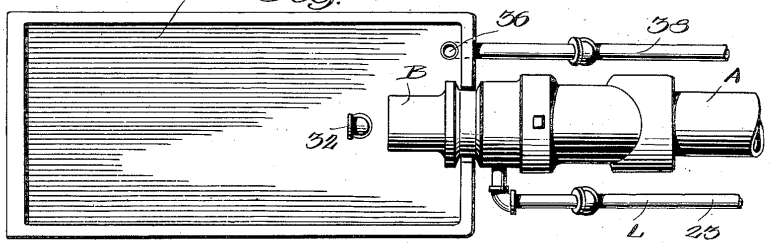
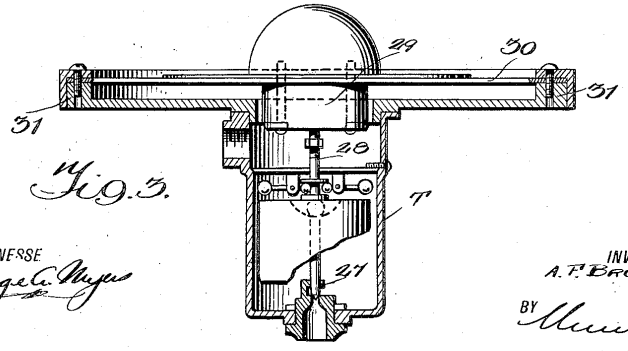


Fig. 3.



WITNESSE
George E. Myers

INVENTOR
A. P. BROOMELL,
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ATTORNEYS

A. P. BROOMELL, DEC'D.
J. L. BROOMELL, EXECUTRIX.
OIL BURNING APPARATUS.
APPLICATION FILED MAR. 19, 1921.

1,423,181. Patented July 18, 1922.

3 SHEETS—SHEET 3.

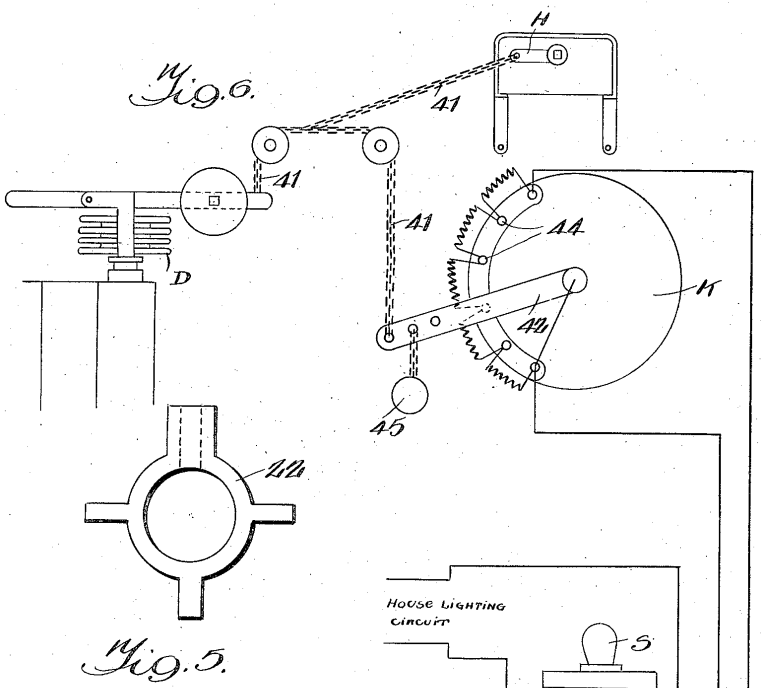
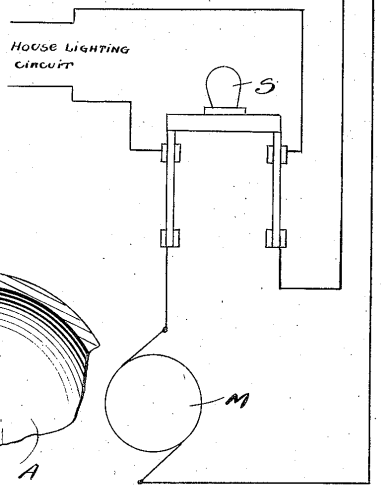


Fig. 6.

Fig. 5.



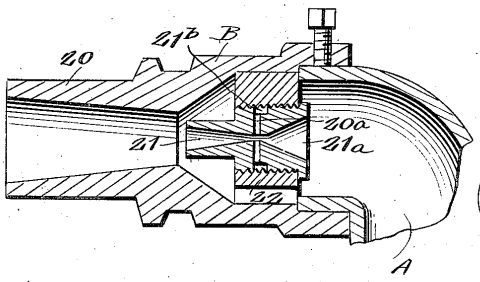


Fig. 4.

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UNITED STATES PATENT OFFICE.

ALBERT PRESTON BROOMELL, OF YORK, PENNSYLVANIA; JANET L. BROOMELL EXECUTRIX OF SAID ALBERT PRESTON BROOMELL, DECEASED.

OIL-BURNING APPARATUS.

1,423,181. Specification of Letters Patent. Patented July 18, 1922.

Application filed March 19, 1921. Serial No. 453,663.

To all whom it may concern:

Be it known that I, ALBERT PRESTON BROOMELL, a citizen of the United States, and a resident of York, in the county of York and State of Pennsylvania, have invented certain new and useful Improvements in Oil-Burning Apparatus, of which the following is a specification.

My invention relates to oil burning apparatus and more particularly to an apparatus especially designed for use in conjunction with a boiler, the purpose of my invention being the provision of an apparatus having pneumatic means for feeding oil to the burner of the apparatus under pressure and delivering a blast of air to the burner to effect atomization of the oil to produce a highly combustible mixture.

It is also a purpose of my invention to provide an oil burning apparatus which is constructed to permit of its ready application to any standard form of boiler furnace without necessitating the removal of more than one section of the grate, and which must be positioned so that its burner is in close proximity to the heating surface of the boiler so that loss of heat by radiation is prevented and the greatest heating efficiency obtained.

Furthermore, my invention provides positive means for preventing leakage of the oil supply valve comprised in the apparatus, automatic means for controlling the pneumatic means to vary the heat intensity of the burner in accordance with the steam pressure in the boiler, and means which is automatically operable to discontinue the pneumatic means should the burner of the apparatus be extinguished during continued operation of the apparatus.

I will describe one form of oil burning apparatus embodying my invention and will then point out the novel features thereof in claims.

In the accompanying drawings:

Figures 1 and 1ª are views showing a portion of a boiler and fire box having applied thereto one form of oil burning apparatus embodying my invention.

Figures 2 and 2ª are views showing in top plan the apparatus shown in Figure 1.

Figure 3 is an enlarged vertical sectional view of the oil feeding mechanism embodied in the apparatus shown in the preceding views.

Figure 4 is an enlarged detail sectional view of the burner embodied in the apparatus.

Figure 5 is an enlarged detail view of the yoke embodied in the burner shown in Figure 4.

Figure 6 is a view partly diagrammatic showing one form of regulating means embodying my invention for the oil burning apparatus shown in the preceding views.

Similar reference characters refer to similar parts in each of the several views.

Referring specifically to the drawings and particularly to Figure 1, the oil burning apparatus in its present embodiment comprises a fan blower F, operated by a variable speed motor M (Figure 2) and housed within a casing 15, which is in communication with one end of an air line A. The air line A includes a section 16 preferably formed integral with the casing 15 and a separable section 17 which is detachably connected to the section 16 by means of a sleeve 18 that is secured to the section 16 and which carries a set screw 19 adapted to engage the section 17 for securing the two sections together. As shown in Figures 1 and 1ª, the section 17 is in the form of a goose-neck or substantially Z-shaped form so as to permit of its ready application to the fire box of a boiler and to position a burner designated generally at B above the grate of the fire box and in close proximity to the lower side of the boiler.

As shown in Figure 4, the burner B in the presence instance comprises a nozzle 20 having a conical bore and a pocket at the small end of the bore in which is centrally positioned a mixing nozzle 21 by means of a yoke 22 of the form shown in Figure 5. The mixing nozzle 21 is provided with a double conical bore and a plurality of radially extending ducts 21ª which communicate at their inner ends with the bore in the manner shown and which communicate at their outer ends with a groove 21ᵇ. An oil line designated at L is connected to the yoke 22 and is in communication with the groove 21ᵇ in the manner shown in Figure 4, this oil line comprising a plurality of sections of pipe so formed and connected as to provide a goose-neck portion 23 and an upwardly inclined portion 24, which latter is provided with a feed valve 25. The upper end of the inclined portion 24 communicates with a reservoir

tank T to which oil is supplied from a suitable source of supply (not shown) by a feed pipe 26. As shown in Figure 3, the feed pipe 26 communicates with the lower end of the tank T, and the passage of oil into the tank is controlled by a float-operated needle valve 27 including a stem 28 which projects upwardly within the tank and which is adapted to be engaged by a weight 29 to effect a closing of the valve against the action of the float when certain conditions exist in the apparatus. The weight 29 is movably supported by means of a diaphragm 30 supported in a collar 31 carried by the upper end of the tank T.

As shown in Figure 1, the reservoir tank T communicates with the section 16 of the air line through the medium of a pipe P, the upper end of which is connected to the upper end of the tank, while its lower end extends through the sleeve 18 and is so positioned within the section 16 as to deflect a portion of the draft created into the pipe upwardly into the tank.

As shown in Figures 1[a] and 2[a], a flame pan N is positioned in advance of the burner B, the shape of which is such as to effect an upward deflection of the flame emanating from the burner and into direct contact with the under side of the boiler, as will be hereinafter described. The pan N is provided with a pilot light 32 at a point adjacent to the burner B, and this pilot light is adapted to be fed with gas or oil to the source of supply through the medium of a pipe 35. The pan N is also provided with a drain outlet 36 that communicates with a bucket 37 through the medium of a pipe 38, the bucket being movably supported on a chain 39 trained over a pulley 40 and connected to an electric switch S. By this arrangement it will be seen that all unburnt oil in the pan N is conveyed to the bucket 37, and when such accumulation becomes excessive it serves to lower the bucket to effect an actuation of the switch S as will be more fully described hereinafter.

Referring now to Figure 6, I have here shown one form of regulating means for the motor M which is designed to vary the rotational speed of the fan F for increasing or decreasing the amount of oil and air supplied to the burner, such regulating means being controlled by conventional heat and damper regulating devices associated with the boiler so that the oil burning apparatus can be controlled to maintain a constant pressure within the boiler. This regulating means comprises in the present instance a control switch designated at K which is operatively connected to a damper regulator D and a heat regulator H through the medium of chains 41 in the manner shown. The switch K is in the form of a rheostat and includes a movable contact arm 42 pivoted at the point indicated at 43 so as to engage any one of a plurality of contacts 44. A weight 45 normally maintains the contact arm 42 in its lowermost position. The chain 41 is connected to the free end of the contact arm 42 so as to be operated by the regulators D and H and to thereby vary the resistance interposed in a circuit including the motor M. As shown diagrammatically, the circuit also includes the switch S and in such manner that current from the house lighting system is only supplied to the motor when the switch S is closed.

In the operation of the oil burning apparatus, the switch S being closed current is applied to the motor M from the lighting system, the potential of which is determined by the position of the contact arm 42 of the control switch. With the contact arm 42 engaging the lowermost contact 44, all of the resistance of the rheostat is interposed in the circuit of the motor, and in the practical construction of the apparatus this resistance is designed to allow of the actuation of the motor. The motor M is of the variable speed type which has the advantage in its present use of reducing the flame emanating from the burner B without entirely extinguishing the flame. Furthermore it effects a gradual starting of the fan F which has a decided advantage in oil burning apparatus of this type.

With the regulators D and H in normal position, the contact arm 42 engages the uppermost contact 44 which allows of the entire current from the lighting system to be conveyed to the motor M. Upon starting of the motor M, rotation of the fan F is effected and in such direction as to create a draft in the air line A in the direction of the burner B. That portion of the air current which is deflected from the air line by means of the pipe P enters the upper end of the tank T and above the body of oil contained therein, it being understood that the operation of the needle valve is such as to maintain a definite quantity of oil within the tank. Under the pressure created by the influx of air, the oil in the tank T is ejected to the burner through the fuel line L, it being particularly noted that such forcible feeding is necessary because the reservoir tank T is disposed on a level below that of the burner B. The oil from the fuel line enters the mixing nozzle 21 and under the action of the air traversing the nozzle 20, an intermixing of the oil and air is effected with a simultaneous atomizing of the oil so that it leaves the burner in the form of atomized fuel. The pilot light 32 serves to ignite the atomized fuel from the burner B, with the flame impinging upon the curved sides of the pan N where it is deflected upwardly into contact with the

boiler. The quantity of oil supplied to the burner can be readily controlled by a manipulation of the feed valve 25 so as to produce a highly combustible mixture.

As the oil is ejected from the reservoir tank T, it is re-supplied by gravity with oil from the feed pipe 26 by an opening of the needle valve 27. This opening of the valve 27 is permitted by a lifting of the weight 29 through an upward deflection of the diaphragm 30 by the air pressure entering tank from the pipe P. As soon as the weight disengages the stem 28 of the valve 27, the float of the needle valve operates to open the valve as will be understood so that after the initial starting of the apparatus, the needle valve will continue to regulate the supply of oil to the reservoir tank so as to maintain a definite quantity therein. However, as soon as the air pressure to the tank ceases, the diaphragm returns to its normal position under the action of the weight 29 with the latter engaging the valve stem 28 and thereby force the valve into closed position. I consider this an important feature of my invention because float-operated needle valves as heretofore proposed are uncertain in their operation as it has been found that the needle valves will stick in open position and when moved to closed position do not effect the complete closure of the port. However, by the provision of the weight 29 positive means is provided for completely closing the valve thus insuring the proper operation of the needle valve to regulate the amount of oil supplied to the tank.

When excessive steam pressure exists in the boiler as a result of the continued operation of the oil burning apparatus, the damper regulator D operates to effect a lowering of the contact arm 42 under the action of the weight 45 thereby introducing resistance into the circuit of the motor and reducing the speed of the latter so that the rotational speed of the fan is correspondingly reduced. With the reduction in speed of the fan, it will be clear that the intensity of the air blast in the air line and pipe P is likewise reduced thus decreasing the amount of air and oil supplied to the burner B. This naturally reduces the flame and heat intensity of the burner. Should steam continue to accumulate within the boiler, the contact arm 42 will move to its lowermost position thereby effecting a stoppage of the motor and a discontinuance of the oil supply to the burner.

When an automatic temperature regulator of the Minneapolis or Arco type is used to regulate or discontinue the fire when the room temperature in which the heating regulator is placed reaches a certain pre-determined temperature, the heat regulator will operate to lift the weight of the damper regulator and will permit the weight on the arm of the rheostat to bring the contact arm of the rheostat down to the extreme bottom, thus stopping the motor entirely and shutting off the oil. When the room temperature goes down the motor of the heat regulator will revolve one half turn, permitting the damper regulator weight to go down and pull up the arm of the rheostat and start up the motor.

To prevent continued operation of the apparatus after the burner has been extinguished, or when the pilot light fails to effect a lighting of the burner at the initial starting of the apparatus, it will be clear that the unburnt oil deposited in the flame pan N, will accumulate within the bucket 37 and thereby effect an opening of the switch S. When the switch S is opened current is no longer supplied to the motor M so that the operation of the apparatus is discontinued. As a further safety, a drip pipe 46 is provided which extends from the reservoir tank T above the normal oil level within the tank so that in the event the needle valve fails to operate properly while the fan F is in operation so that more oil is applied to the tank than the burner will consume, the surplus oil will be delivered to the bucket 37 so as to open the switch S and thus stop the motor.

In the application of the apparatus to a fire box, the apparatus as a unit is supported for vertical adjustment to permit of its application to fire boxes of various dimensions. To this end I provide a stand including a base 50, a standard 51 upon which is slidably fitted a sleeve 52 adapted to be locked in any position upon the stem by means of set screws 53. Integrally formed with the sleeve 52 is a platform 54 upon which is supported the motor M in the manner shown in Figure 2. Bolted to the platform 54 is a panel 55 upon which is mounted the control switch K, the switch S and the necessary conductors for electrically connecting the switches to each other and to the motor. An arm 56 is sustained on the panel 55 and provides means for supporting the pulley 40.

In the application of the apparatus to the fire box of a boiler as shown in Figures 1 and 1^a, the burner B and flame pan N are positioned above the sectional grate which is covered with fire brick. The sections of the grate are designated at G in Figure 1^a, and it is to be noted that in order to apply the pan and burner to the fire box it is only necessary to remove one section of the grate. This permits the grate to be covered with bricks and sand, thus confining the heat from the burner above the grate and thereby preventing its radiation to the ash pit. This not only increases the efficiency of the burner but also greatly reduces the noise produced by combustion. That space which is created by the removal of one grate sec-

tion can be covered, if desired, by simply placing pieces of metal at each side of the goose-neck of the air line.

Although I have herein shown and described only one form of oil burning apparatus embodying my invention, it is to be understood that various changes and modifications may be made herein without departing from the spirit of the invention and the spirit and scope of the appended claims.

What I claim is:

1. An oil burning apparatus comprising, a burner, means for supplying air under pressure to the burner, an oil reservoir connected to and disposed below the burner, means connecting the first means with the reservoir to cause said means to force the oil from the reservoir to said burner, a source of oil supply connected to the reservoir, a float operated control valve between the reservoir and the source of supply, and positive means acting to close said control valve, the last means being operable by the second means to allow of the opening of said control valve.

2. An oil burning apparatus comprising, a burner, means for supplying air under pressure to the burner, an oil reservoir connected to and disposed below the burner, means connecting the first means with the reservoir to cause said means to force the oil from the reservoir to said burner, a source of oil supply connected to the reservoir, a control valve between the reservoir and the source of supply, and a weighted diaphragm normally closing said control valve and associated with the second means so as to be ineffective to close the valve when the first means is operated.

3. In an oil burning apparatus, an oil reservoir, a source of oil supply communicating with the reservoir, a float-operated valve for controlling the passage of oil from the source of supply to the reservoir, a weighted diaphragm normally acting to close the valve, and pneumatic means for forcing the oil from the reservoir and to actuate said diaphragm to permit the opening of said valve.

4. In an oil burning apparatus, an oil reservoir, an oil supply connected to the reservoir, a burner above the reservoir, a fuel line connecting the burner and reservoir, a float-operated valve controlling the passage of oil from the source of supply to the reservoir, positive means normally acting to close the valve, and pneumatic means for forcing the oil from the reservoir to said burner and for rendering said means ineffective to close said valve.

5. An oil burning apparatus comprising a burner, an oil reservoir connected to the burner, a source of oil supply connected to the reservoir, a control valve between the reservoir and the source of oil supply, means continuously actuated to yieldingly maintain said control valve in a certain position, and pneumatic means operable at times to render said continuously actuated means ineffective for holding said control valve in the said position.

6. An oil burning apparatus comprising a burner, an oil reservoir connected to the burner, a source of oil supply connected to the reservoir, a control valve between the reservoir and the source of oil supply, gravity actuated means for normally maintaining said control valve in closed position, and means for supplying air under pressure to the reservoir to force oil therefrom to the burner and to render said gravity controlled means ineffective for holding said control valve in closed position.

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