May 11, 1937. J. T. MIDYETTE, JR 2,079,915

STEAM HEATING CONTROL APPARATUS

Filed Aug. 15, 1936

Fig. 1.

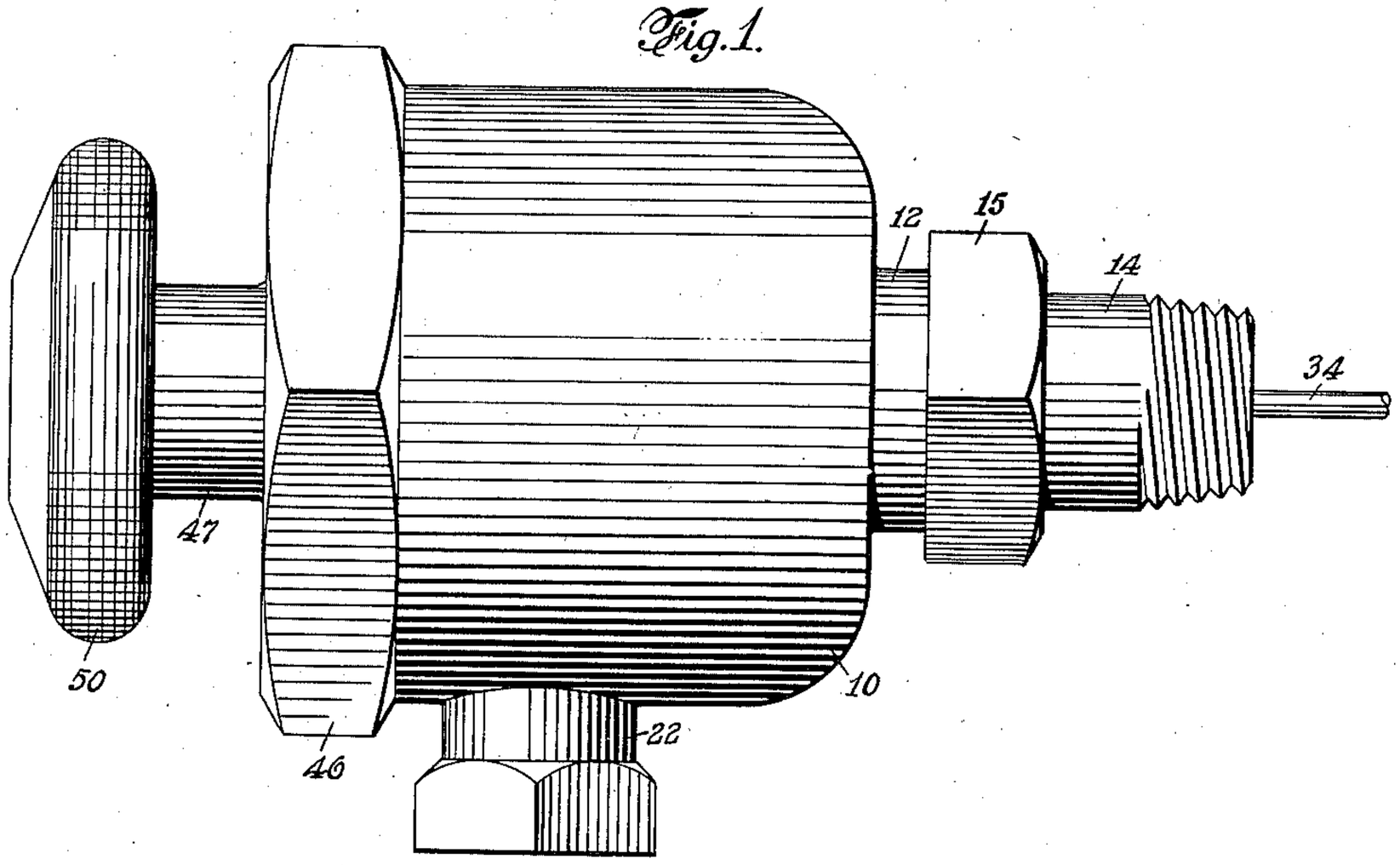


Fig. 2.

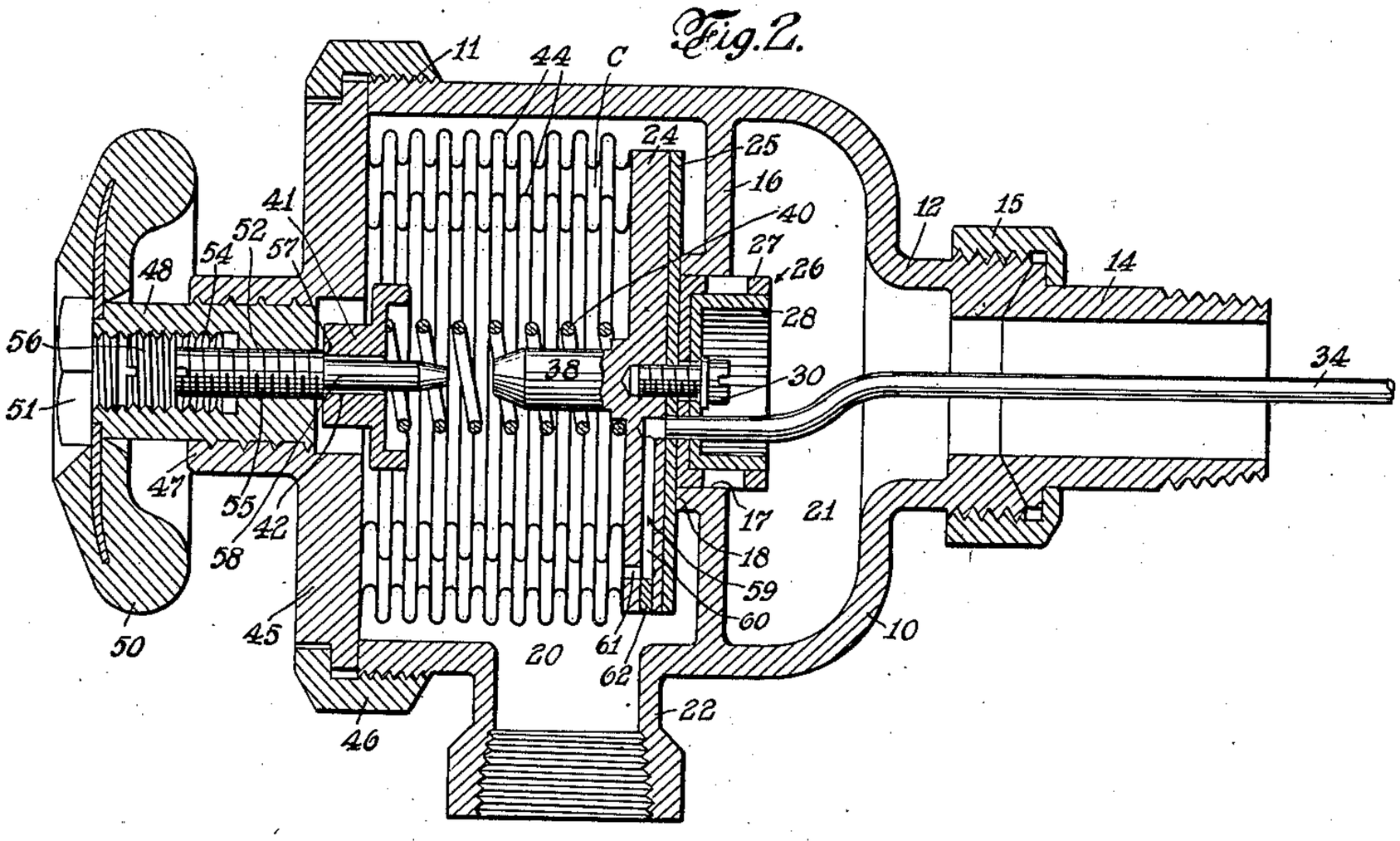


Fig. 3.

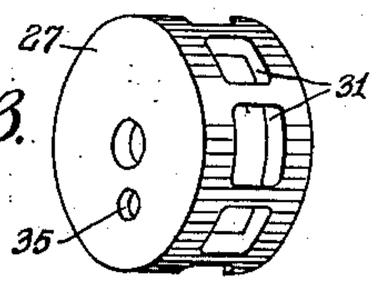
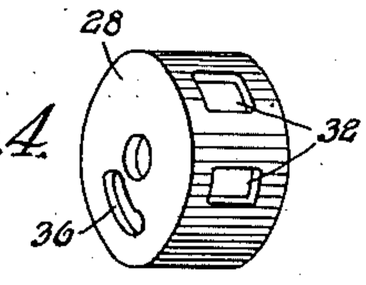


Fig. 4.



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2,079,915

STEAM HEATING CONTROL APPARATUS

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Application August 15, 1936, Serial No. 96,193

13 Claims. (Cl. 137—153)

This invention relates generally to steam heating control apparatus and has particular reference to means for controlling or regulating the amount of steam entering a radiator in a so-called two-pipe steam heating system.

As is well known to those skilled in the art to which two-pipe steam heating systems relate, it is customary to employ a plurality of either fixed or adjustable inlet orifices located near the several radiators and disposed respectively in the individual steam supply branches leading thereto, the purpose of such orifices being to proportion the rate of steam flow according to radiator requirements as determined, for example, by the factor of condensation; and to also employ pressure-differential-actuated valves disposed respectively in the steam supply branches leading to the individual radiators for controlling or regulating the admission of steam of the radiators by way of their associated inlet orifices.

Inlet orifices and pressure-differential-actuated valves, as heretofore employed for the purpose above mentioned, are open to certain inherent objections. For example, an objection heretofore encountered in connection with inlet orifices resides in the fact that it has been difficult to obtain orifice values (considered in terms of units or orifice area) best suited to meet conditions peculiar to the respective radiators of a given installation, whereas the main objection heretofore encountered in connection with pressure-differential-actuated values resides in the fact that they are expensive and frequently fail to so function as to meet such requirements as nicety of and reliability in operation.

Objects of the present invention are to overcome the foregoing objections and to that end the invention contemplates a control unit which includes an improved inlet orifice in cooperative association with an improved pressure-differential-actuated steam control or regulating valve.

Other objects and advantages of the invention will become apparent from the following description when taken in connection with the accompanying drawing, in which—

Fig. 1 is a view in elevation of a control unit embodying the present invention; Fig. 2 is a vertical, longitudinal, sectional view of the unit appearing in Fig. 1; Fig. 3 is a perspective view of an outer orifice cup, which is shown in Fig. 2 as connected to the valve plate; and Fig. 4 is a perspective view of an inner orifice cup adapted to be adjustably held within the outer orifice cup, as shown in Fig. 2.

Referring to the drawing, the numeral **10** indicates a housing, one end of which is screw-threaded as shown at **11** and the other end of which is so shaped as to provide an externally screw-threaded nipple **12** by which the control unit may be connected to a radiator inlet through the medium of an ordinary pipe nipple **14** and its associated union nut **15**. Disposed within the housing **10** is a division wall **16**, provided centrally with a valve port **17**, adjacent to which is formed a valve seat **18**, the wall **16** serving to divide the housing into high pressure and low pressure chambers **20** and **21**, respectively, the former of which is adapted to communicate with a source of steam supply, not shown, by way of a nipple-like connector element **22** with which the housing is provided and the latter of which is adapted to communicate directly with the radiator by way of the nipples **12** and **14**.

Located within the high pressure chamber **20** is a valve plate **24**, carrying a face plate **25** which is adapted to be moved into and out of seating engagement with the valve seat **18** under conditions hereinafter more particularly described. Disposed within the valve port **17** for axial movement wth relation thereto, is an orifice unit **26**, comprising a pair of cup-like orifice members **27** and **28** which are adapted to assume a nested relation as shown in Fig. 2 and are connected to the valve plate **24** by a lag screw **30**. The skirt portions of the orifice members **27** and **28** are formed, respectively, with a plurality of apertures **31** and **32**, which function collectively as an orifice, the effective area of which may be varied, by rotatably adjusting the orifice member **28** with relation to the orifice member **27**, to obtain the orifice value best suited to meet a particular need or requirement. It is to be observed that once a proper setting of the orifice member **28** has been obtained, such setting may be permanently maintained by running the lag screw **30** down into locking engagement with the bottom wall of such member.

Secured to the valve plate **24**, is a low pressure tube **34** which is of sufficient length to enable it to extend into the radiator well out of the high pressure zone, the low pressure tube being accommodated by openings **35** and **36** formed in the bottom wall of the respective orifice members **27** and **28**, the opening **36** being arcuate in character so as to permit full-range rotative adjustment of the orifice member **28** in the presence of the low pressure tube.

Formed centrally of the valve plate **24**, is a guide lug **38**, about which is disposed a com-

pression spring 40, one end of which engages the valve plate in the vicinity of its juncture with the guide lug, and the other end of which engages a pressure head or spring follower 41, the hub portion of which is provided with a central opening 42, the purpose of which will hereinafter more clearly appear.

Secured in a gas-tight relation to the valve plate 24, are a pair of concentrically disposed sylphon bellows 44, the outer one of which is secured to the outer margin of the valve plate and the inner one of which is spaced a definite distance therefrom. These bellows are also secured in a gas-tight relation to a plate-like bonnet 45, which is adapted to be attached to and held in a steam-tight position on the housing 10 by a clamp ring 46. The bonnet 45 is provided centrally with an internally screw-threaded boss 47, within which is carried a screw-threaded valve regulating stem 48, to the upper end of which a hand-wheel 50 is detachably connected by a lag screw 51. The regulating stem 48 is provided centrally with internally screw-threaded openings 52 and 54, in the former of which is carried a limit adjusting screw 55 and in the latter of which is carried a locking screw 56, it being observed that the adjusting screw is provided intermediate its ends with a shoulder 57 which is adapted to engage the pressure head 41 and is formed with a stem-like shank 58 disposed within and projecting through the central opening 42 with which the pressure head is provided.

From the foregoing description of the limit adjusting screw 55 and its associated elements, it will become apparent that the force of compression exerted by the spring 40 may be varied as desired by rotating the screw (through the aid of a suitable instrument such as a screw driver) in one direction or the other relatively to the valve regulating stem 48 and that such screw may be maintained in any position of adjustment by running the locking screw 56 (also adapted for the reception of a screw driver) down into firm engagement therewith. It is, of course, understood that access to the limit adjusting screw 55 may be had in the absence of the locking screw 56 and the leg screw 51, and that access to the locking screw may be had in the absence of the lag screw, and that the lag screw when driven home serves not only to maintain the hand-wheel 50 on the valve regulating stem 48 but also serves to guard against or at least hinder unauthorized adjustment of the compression spring 40.

Referring again to the low pressure tube 34, it may be well to here point out that its primary function is to establish direct communication between the low pressure zone of the radiator and the collapsible chamber C which is afforded intermediate the bellows 44, and to that end the valve plate 24 is provided with a duct 59, which may be formed by drilling, or otherwise forming, a radial passage 60 in the valve plate, similarly forming a vent 61 at right angles to such passage and thereafter closing the outer end of the passage as by a plug 62.

In order that the operation of the control unit may be more readily appreciated, it may be well to here point out (without in any manner limiting the invention by so doing) that, in the particular unit herein illustrated, the effective high-pressure area of the valve plate 24, or rather its associated face plate 25, and the effective low-pressure area of the valve plate, namely, the valve plate area intermediate the bellows 44, bear a three to one ratio when considered in terms of area units. Bearing in mind the fact that a substantial area differential is thus afforded, it will be understood that—

If the spring 40, assuming the limit adjusting screw 55 to have been adjusted as shown in Fig. 2 and the valve regulating stem 48 to have been moved (a distance of about one-quarter inch) from its position shown in that figure to its innermost position, is such as to exert a compression force of say four pounds per square inch, a steam pressure of four pounds or a fraction thereover will be required in the high pressure chamber 20 (assuming atmospheric pressure within the radiator, the low-pressure chamber 21 and the collapsible chamber C) to lift the face plate from the valve seat 18 and thus establish communication between the high and low-pressure chambers 20 and 21, respectively, by way of the ports 31 and 32 of the orifice unit 26. Assuming the orifice members 27 and 28 to have been adjusted to obtain a proper orifice area, according to the radiator requirements, steam will be admitted to the radiator at a predetermined rate of flow. As the pressure within the radiator builds up, such pressure is transmitted to the collapsible chamber C and is utilized in conjunction with the spring 40 to move the face plate 25 into engagement with the valve seat 18, thus severing communication between the radiator and the source of steam supply. As the pressure within the radiator drops incident, for example, to condensation, a corresponding drop in pressure is effected within the collapsible chamber C, such drop in pressure being utilized in conjunction with the action of the steam pressure within the high pressure chamber 20 to overbalance the compression force of the spring 40, and thus cause the bellows 44 to collapse to a sufficient extent to lift the face plate 25 from the valve seat 18, thereby establishing communication between the radiator and the source of steam supply. The cycle of operation just described is, of course, repeated as and when radiator conditions prompt such repetition.

From the foregoing description of the operation under conditions peculiar to the example set forth, it will be appreciated that if the valve regulating stem 48 is moved outwardly from its innermost position, the pressure differential (assuming the previously mentioned position of the limit adjusting screw 55 remains unchanged) to which the bellows will respond will become correspondingly less; or, in other words, the face plate 25 will be lifted from the valve seat 18 incident to a lesser drop in pressure within the radiator.

The foregoing description of the operation of the control unit holds true in principle for any setting of the limit adjusting screw 55, the purpose of which is to so vary the compression force of the spring 40 as to condition the unit for use with various steam pressures at the source of supply, it being observed that the greater the pressure at the source the greater may be the compression force exerted by the spring, and vice versa.

Although only one form of the invention is herein shown and described, it will be understood that various changes may be made without departing from the spirit of the invention or the scope of the following claims.

What is claimed is:

1. For use in association with a radiator of a two-pipe steam heating system, a control unit comprising a housing having an internal wall provided with a valve port and affording a valve

seat and dividing such housing into high pressure and low pressure chambers, said chambers being adapted to communicate respectively with a source of steam supply and the steam inlet end of a radiator a pressure differential-actuated valve disposed within said high pressure chamber and including a valve member, a spring tending to maintain said valve member in seated position on said seat, collapsible means adapted to yield incident to movement of said valve member in a direction away from said seat and forming a collapsible chamber sealed against atmosphere and with relation to said high pressure chamber and adapted under all conditions to communicate with said low pressure chamber, and an orifice unit carried by and movable with said valve member and including a pair of ported and relatively adjustable orifice members disposed within said valve port and forming with each other a variable orifice the effective area of which may be predetermined to proportion according to radiator requirements the rate of steam flowing to the radiator from said high pressure chamber by way of said low pressure chamber incident to movement of said valve member away from said seat.

2. For use in association with a radiator of a two-pipe steam heating system, a control unit comprising a housing having an internal wall provide with a valve port and affording a valve seat and dividing such housing into high pressure and low pressure chambers, said chambers being adapted to communicate respectively with a source of steam supply and the steam inlet end of a radiator, a pressure-differential-actuated valve disposed within said high pressure chamber and including a valve member, a spring tending to maintain said valve member in seated position on said seat, collapsible means adapted to yield incident to movement of said valve member in a direction away from said seat and forming a collapsible chamber sealed against atmosphere and with relation to said high pressure chamber and adapted under all conditions to communicate with said low pressure chamber, an orifice unit carried by and movable with said valve member and including a pair of ported and relatively adjustable orifice members disposed within said valve port and forming with each other a variable orifice the effective area of which may be predetermined to proportion according to radiator requirements the rate of steam flowing to the radiator from said high pressure chamber by way of said low pressure chamber incident to movement of said valve member away from said seat, and manually operable rotatable means for varying the pressure differential to which said valve is adapted to respond.

3. For use in association with a radiator of a two-pipe steam heating system, a control unit comprising a housing having an internal wall provided with a valve port and affording a valve seat and dividing such housing into high pressure and low pressure chambers, said chambers being adapted to communicate respectively with a source of steam supply and the steam inlet end of a radiator, a pressure-differential-actuated valve disposed within said high pressure chamber and including a valve member, a spring tending to maintain said valve member in seated position on said seat, collapsible means adapted to yield incident to movement of said valve member in a direction away from said seat and forming a collapsible chamber sealed against atmosphere and with relation to said high pressure chamber and adapted under all conditions to communicate with said low pressure chamber, an orifice unit carried by and movable with said valve member and including a pair of ported and relatively adjustable orifice members disposed within said valve port and forming with each other a variable orifice the effective area of which may be predetermined to proportion according to radiator requirements the rate of steam flowing to the radiator from said high pressure chamber by way of said low pressure chamber incident to movement of said valve member away from said seat, manually operable rotatable means for varying the pressure differential to which said valve is adapted to respond, and means carried by said rotatable means and adjustable relatively thereto for rendering said valve responsive in its opening operation to various predetermined effective pressures.

4. For use in association with a radiator of a two-pipe steam heating system, a control unit comprising a housing having an internal wall provided with a valve port and affording a valve seat and dividing such housing into high pressure and low pressure chambers, said chambers being adapted to communicate respectively with a source of steam supply and the steam inlet end of a radiator, a pressure-differential-actuated valve disposed within said high pressure chamber and including a valve member, a spring tending to maintain said valve member in seated position on said seat, collapsible means adapted to yield incident to movement of said valve member in a direction away from said seat and forming a collapsible chamber sealed against atmosphere and with relation to said high pressure chamber and adapted under all conditions to communicate with said low pressure chamber, an orifice unit carried by and movable with said valve member and including a pair of ported and relatively adjustable orifice members disposed within said valve port and forming with each other a variable orifice the effective area of which may be predetermined to proportion according to radiator requirements the rate of steam flowing to the radiator from said high pressure chamber by way of said low pressure chamber incident to movement of said valve member away from said seat, and manually operable rotatable means for varying the pressure differential to which said valve is adapted to respond and comprising a screw-threaded valve regulating stem adapted to be moved longitudinally from one position of adjustment to another and to vary the compression force of said spring.

5. For use in association with a radiator of a two-pipe steam heating system, a control unit comprising a housing having an internal wall provided with a valve port and affording a valve seat and dividing such housing into high pressure and low pressure chambers, said chambers being adapted to communicate respectively with a source of steam supply and the steam inlet end of a radiator, a pressure-differential-actuated valve disposed within said high pressure chamber and including a valve member, a spring tending to maintain said valve member in seated position on said seat, collapsible means adapted to yield incident to movement of said valve member in a direction away from said seat and forming a collapsible chamber sealed against atmosphere and with relation to said high pressure chamber and adapted under all conditions to communicate with said low pressure chamber, an orifice

unit carried by and movable with said valve member and including a pair of ported and relatively adjustable orifice members disposed within said valve port and forming with each other a variable orifice the effective area of which may be predetermined to proportion according to radiator requirements the rate of steam flowing to the radiator from said high pressure chamber by way of said low pressure chamber incident to movement of said valve member away from said seat, manually operable rotatable means for varying the pressure differential to which said valve is adapted to respond and comprising a screw-threaded valve regulating stem adapted to be moved longitudinally from one position of adjustment to another and to vary the compression force of said spring, and means for rendering said valve responsive in its opening operation to various predetermined effective pressures and comprising a limit adjusting screw disposed axially of said regulating stem for varying the compression force of said spring independently of said stem.

6. For use in association with a radiator of a two-pipe steam heating system, a control unit comprising a housing having an internal wall provided with a valve port and affording a valve seat and dividing such housing into high pressure and low pressure chambers, said chambers being adapted to communicate respectively with a source of steam supply and the steam inlet end of a radiator, a removable hood carried by said housing, a pressure-differential-actuated valve disposed within said high pressure chamber and including a valve member, a pair of sylphon bellows connected to said hood and to said valve member and adapted to yield incident to movement of said valve member in a direction away from said seat and forming a collapsible and expansible chamber sealed against atmosphere and with relation to said high pressure chamber and adapted under all conditions to communicate with said low pressure chamber, a spring disposed intermediate said valve member and said hood and tending to maintain said valve member in seated position on said seat, a screw-threaded valve regulating stem carried by said hood and adapted to be moved longitudinally from one position of adjustment to another and to vary the compression force of said spring and correspondingly vary the pressure differential to which said valve is adapted to respond, said valve member, said bellows, and said spring being insertable and removable from said housing as a unitary structure incident to attaching said hood to and removing it from said housing.

7. For use in association with a radiator of a two-pipe steam heating system, a control unit comprising a housing having an internal wall provided with a valve port and affording a valve seat and dividing such housing into high pressure and low pressure chambers, said chambers being adapted to communicate respectively with a source of steam supply and the steam inlet end of a radiator, a removable hood carried by said housing, a pressure-differential-actuated valve disposed within said high pressure chamber and including a valve member, a pair of sylphon bellows connected to said hood and to said valve member and adapted to yield incident to movement of said valve member in a direction away from said seat and forming a collapsible and expansible chamber sealed against atmosphere and with relation to said high pressure chamber and adapted under all conditions to communicate with said low pressure chamber, a spring disposed intermediate said valve member and said hood and tending to maintain said valve member in seated position on said seat, a screw-threaded valve regulating stem carried by said hood and adapted to be moved longitudinally from one position of adjustment to another and to vary the compression force of said spring and correspondingly vary the pressure differential to which said valve is adapted to respond, and a limit adjusting screw disposed axially of said regulating stem for varying the compression force of said spring independently of said stem whereby said valve is rendered responsive in its opening operation to various predetermined effective pressures, said valve member, said bellows, and said spring being insertable and removable from said housing as a unitary structure incident to attaching said hood to and removing it from said housing.

8. For use in association with a radiator of a two-pipe steam heating system, a control unit comprising a housing having an internal wall provided with a valve port and affording a valve seat and dividing such housing into high pressure and low pressure chambers, said chambers being adapted to communicate respectively with a source of steam supply and the steam inlet end of a radiator, a removable hood carried by said housing, a pressure-differential-actuated valve disposed within said high pressure chamber and including a valve member, a pair of sylphon bellows connected to said hood and to said valve member and adapted to yield incident to movement of said valve member in a direction away from said seat and forming a collapsible and expansible chamber sealed against atmosphere and with relation to said high pressure chamber and adapted under all conditions to communicate with said low pressure chamber, a spring disposed intermediate said valve member and said hood and tending to maintain said valve member in seated position on said seat, a screw-threaded valve regulating stem carried by said hood and adapted to be moved longitudinally from one position of adjustment to another and to vary the compression force of said spring and correspondingly vary the pressure differential to which said valve is adapted to respond, and an orifice unit carried by and movable with said valve member and including a pair of ported and relatively adjustable orifice members disposed within said valve port and forming with each other a variable orifice the effective area of which may be predetermined to proportion according to radiator requirements the rate of steam flowing to the radiator from said high pressure chamber by way of said low pressure chamber incident to movement of said valve member away from said seat, said orifice unit, said valve member, said bellows, and said spring being insertable and removable from said housing as a unitary structure incident to attaching said hood to and removing it from said housing.

9. For use in association with a radiator of a two-pipe steam heating system, a control unit comprising a housing having an internal wall provided with a valve port and affording a valve seat and dividing such housing into high pressure and low pressure chambers, said chambers being adapted to communicate respectively with a source of steam supply and the steam inlet end of a radiator, a removable hood carried by said housing, a pressure-differential-actuated valve disposed within said high pressure chamber and

including a valve member, a pair of sylphon bellows connected to said hood and to said valve member and adapted to yield incident to movement of said valve member in a direction away from said seat and forming a collapsible and expansible chamber sealed against atmosphere and with relation to said high pressure chamber and adapted under all conditions to communicate with said low pressure chamber, a spring disposed intermediate said valve member and said hood and tending to maintain said valve member in seated position on said seat, a screw-threaded valve regulating stem carried by said hood and adapted to be moved longitudinally from one position of adjustment to another and to vary the compression force of said spring and correspondingly vary the pressure differential to which said valve is adapted to respond, a limit adjusting screw disposed axially of said regulating stem for varying the compression force of said spring independently of said stem whereby said valve is rendered responsive in its opening operation to various predetermined effective pressures, and an orifice unit carried by and movable with said valve member and including a pair of ported and relatively adjustable orifice members disposed within said valve port and forming with each other a variable orifice the effective area of which may be predetermined to proportion according to radiator requirements the rate of steam flowing to the radiator from said high pressure chamber by way of said low pressure chamber incident to movement of said valve member away from said seat, said orifice unit, said valve member, said bellows, and said spring being insertable and removable from said housing as a unitary structure incident to attaching said hood to and removing it from said housing.

10. For use in association with a radiator of a two-pipe steam heating system, a control unit comprising a housing having an internal wall provided with a valve port and affording a valve seat and dividing such housing into chambers, said chambers being adapted to communicate respectively with a source of steam supply and the steam inlet end of a radiator, a removable hood carried by said housing, a valve unit disposed within one of said chambers and including a valve member adapted to seat on and to be unseated from said valve seat, a sylphon bellows connected to said hood and to said valve member, a spring disposed intermediate said valve member and said hood and tending to maintain said valve member in seated position on said seat and adapted to yield incident to movement of said valve member away from said seat under the action of a predetermined steam pressure exerted on said valve member, and an orifice unit carried by and movable with said valve member, said orifice unit being disposed within said valve port.

11. For use in association with a radiator of a two-pipe steam heating system, a control unit comprising a housing having an internal wall provided with a valve port and affording a valve seat and dividing such housing into chambers, said chambers being adapted to communicate respectively with a source of steam supply and the steam inlet end of a radiator, a removable hood carried by said housing, a valve unit disposed within one of said chambers and including a valve member adapted to seat on and to be unseated from said valve seat, a sylphon bellows connected to said hood and to said valve member, a spring disposed intermediate said valve member and said hood and tending to maintain said valve member in seated position on said seat and adapted to yield incident to movement of said valve member away from said seat under the action of a predetermined steam pressure exerted on said valve member, and an orifice unit carried by and movable with said valve member, said orifice unit being disposed within said valve port and including a pair of ported and relatively adjustable orifice members forming with each other a variable orifice the effective area of which may be predetermined to proportion according to radiator requirements the rate of steam flowing to the radiator by way of said port and said chambers incident to movement of said valve member away from said seat.

12. For use in association with a radiator of a two-pipe steam heating system, a control unit comprising a housing having an internal wall provided with a valve port and affording a valve seat and dividing such housing into chambers, said chambers being adapted to communicate respectively with a source of steam supply and the steam inlet end of a radiator, a removable hood carried by said housing, a valve unit disposed within one of said chambers and including a valve member adapted to seat on and to be unseated from said valve seat, a sylphon bellows connected to said hood and to said valve member, a spring disposed intermediate said valve member and said hood and tending to maintain said valve member in seated position on said seat and adapted to yield incident to movement of said valve member away from said seat under the action of a predetermined steam pressure exerted on said valve member, an orifice unit carried by and movable with said valve member, said orifice unit being disposed within said valve port, and means for varying the compression force of said spring to render said valve member operable at different predetermined steam pressure values.

13. For use in association with a radiator of a two-pipe steam heating system, a control unit comprising a housing having an internal wall provided with a valve port and affording a valve seat and dividing such housing into chambers, said chambers being adapted to communicate respectively with a source of steam supply and the steam inlet end of a radiator, a removable hood carried by said housing, a valve unit disposed within one of said chambers and including a valve member adapted to seat on and to be unseated from said valve seat, a sylphon bellows connected to said hood and to said valve member, a spring disposed intermediate said valve member and said hood and tending to maintain said valve member in seated position on said seat and adapted to yield incident to movement of said valve member away from said seat under the action of a predetermined steam pressure exerted on said valve member, an orifice unit carried by and movable with said valve member, said orifice unit being disposed within said valve port and including a pair of ported and relatively adjustable orifice members forming with each other a variable orifice the effective area of which may be predetermined to proportion according to radiator requirements the rate of steam flowing to the radiator by way of said port and said chambers incident to movement of said valve member away from said seat, and means for varying the compression force of said spring to render said valve member operable at different predetermined steam pressure values.

JNO. T. MIDYETTE, JR.

CERTIFICATE OF CORRECTION.

Patent No. 2,079,915. May 11, 1937.

JOHN T. MIDYETTE, JR.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 19, for "of" second occurrence read to; line 28, for "or" read of; and line 32, for "values" read valves; page 2, first column, line 47, for "leg" read lag; and page 3, first column, line 30, for "provide" read provided; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of July, A. D. 1937.

Henry Van Arsdale

(Seal) Acting Commissioner of Patents.