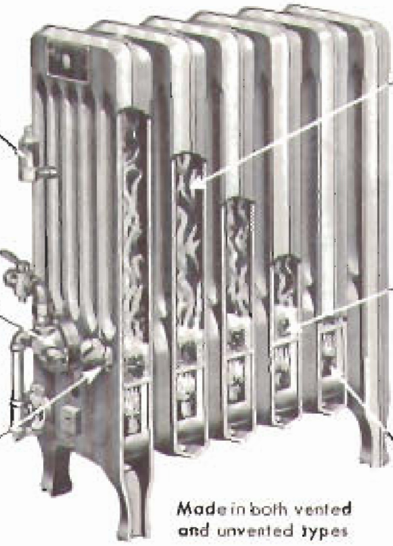
Clow Gasteam Radiators

Make Their Own Steam Heat With Manufactured, Natural, Propane or Butane Gas

1. Air valve that automatically allows air in the radiator to escape, but holds back steam.

2. Steam regulator that automatically controls the size of the gas flame to maintain uniform heat in the radiator.

3. Filling cup by means of which the water supply for the steam is replenished.



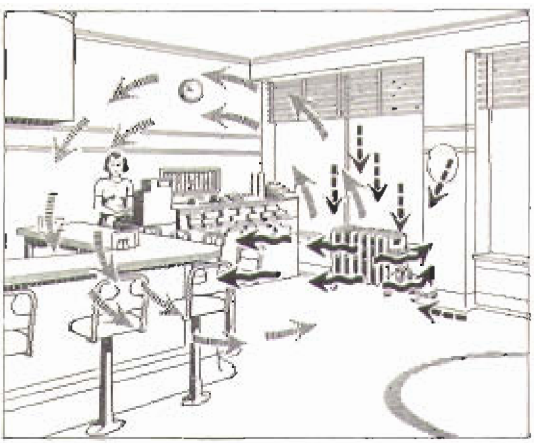
Made in both vented and unvented types

4. Steam rising in the radiator sections and evenly heating all portions of the radiator.

5. Boiling water that is heated from the gas flames below it and which supplies the steam.

6. Gas burner enclosed in a combustion chamber in the bottom portion of the radiator sections.

Clow Gasteam Radiators Combine These Features



Clow Gasteam Radiators can be located at outside walls near windows, due to their narrow shape. **Thus they stop cold drafts as they enter the room.**

COLD AIR — RADIANT HEAT — CONVECTED HEAT

- **THE SUPERIORITY OF STEAM HEATING**
- **THE FLEXIBILITY OF INDIVIDUAL ROOM HEATERS**
- **THE CLEANLINESS AND CONVENIENCE OF GAS**

THE MOST ECONOMICAL HEATING SYSTEM

The low fuel cost of Gasteam heating results from making the heat right where it is needed in each room and just in the right amount to meet the varying demands caused by changing outside temperatures, wind direction, and amount of sunshine.

REQUIRES NO BOILER, BASEMENT, OR STEAM AND WATER PIPES

Each Clow Gasteam radiator is a complete steam heating unit. The gas flame, completely enclosed in the lower part of the radiator, generates steam from a shallow layer of water and the steam completely and evenly heats the entire radiator.

COMBINES SUPERIORITY OF RADIATOR HEAT WITH FLEXIBILITY OF ROOM HEATERS

The completely independent operation of each Clow Gasteam radiator permits the installation of large enough units in each room to properly heat that room during the coldest days but, through individual control of each radiator, the heat can be regulated to just the right amount for the more moderate days of Fall and Spring.

HEAT ROOMS UNIFORMLY WITHOUT DRAFTS OR NOISE

By locating Clow Gasteam radiators underneath windows and along outside walls, the cold air from these sources is warmed before it starts across the floors. Gasteam produces a gentle circulation of warm air that, together with the direct radiant heat from the radiator surfaces, results in comfortable, pleasant and uniform heating.

THE OPERATING PRINCIPLE OF CLOW GASTEAM RADIATORS

Each Clow Gasteam Radiator is a complete steam heating unit designed to heat the room in which it is located. The steam is generated right in the radiator itself in contrast to the method in central steam heating plants where the steam is generated in a boiler generally located in a basement and the steam supplied to individual radiators by means of steel piping. The Gasteam principle of generating the steam within the radiator itself eliminates the need for a boiler, steam piping and for a basement.

The water for making the steam in a Gasteam Radiator is located in a water chamber in the lower part of the radiator sections. Directly beneath the water chamber is a gas burner. The gas flames are entirely enclosed by the lower part of the radiator sections. The heat from the gas flames boils the water and the steam rises into the radiator tubes where it condenses, giving up its heat to the room air. The water from the condensed steam returns to the water chamber where it is re-evaporated, again rising as steam to heat the radiator tubes.

No water pipe connection is required for the water chamber. Clow Gasteam Radiators require about one pint of water per section at the initial filling when radiators are installed. This is done through a filling cup with any convenient water container with a spout, such as a tea kettle. Thereafter a semi-monthly inspection and replacement of such water that has escaped through the automatic air valve is all that is required. This replacement rarely amounts to more than a pint of water.

The height of the gas flame is controlled by an automatic steam pressure regulator. When the radiator is cold and the gas lighted, the flame height is about ¾" high which brings the water to a boil in about 20 to 30 minutes. As steam pressure accumulates in the radiator the steam pressure regulator gradually lowers the flame so that from 8 to 10 lbs. steam pressure is maintained when the radiator is in full operation.

An automatic air valve permits air to leave the radiator as steam is generated. This air valve is so constructed that air will pass through it from the radiator but the steam will not escape. A steam pressure relief valve (safety valve) relieves excessive steam pressure should some abnormal condition, such as extremely high gas pressure, cause the steam pressure to rise above normal.

Pilot lighters, safety pilot valves to prevent the escape of unburned gas, and room thermostats are available accessories. They are described on a following page.

SELECTING THE PROPER TYPE OF RADIATORS

Vented or Unvented

The principal purpose of venting Gasteam Radiators is to carry the water vapor produced by the combustion of gas to the outside air. The combustion of one therm (100,000 B.t.u.) of average city gas produces 1⅛ gallons of water, except for carbureted water gas which produces only 4/5 of a gallon per therm. The combustion of one therm (approximately one gallon) of propane produces 9/10 of a gallon of water, and butane produces 7/8 of a gallon.

With vented radiators the moisture produced by the burning gas is carried to the outside of the building through vent stacks. With unvented radiators this moisture is added to the room air and provides the humidity necessary for winter heating.

As a general rule, in the selection of vented or unvented radiators for the average installation, the severity of the winter climate should be given first consideration. Where freezing temperatures rarely occur, all unvented may be used. Where freezing temperatures are common, some of the radiation should be vented. Where the temperature falls below zero, most of the radiation should be vented.

An intelligent proportioning of vented and unvented will provide healthful humidity and at the same time prevent excessive condensation on the windows.

Always take into account your state law, city ordinance, or local gas company rules pertaining to the venting of gas heating appliances before selecting the type of Gasteam Radiator to use for a specific purpose.

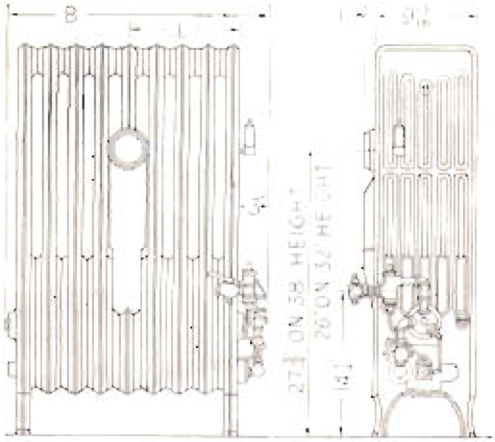
DIMENSIONS AND RATINGS OF CLOW GASTEAM RADIATORS

Six-Tube 38" Vented

Six-Tube 32" Vented

Six-Tube 22" Unvented

Six-Tube 31" Unvented



REAR VIEW END VIEW

Approximate Shipping Weights

Per Section

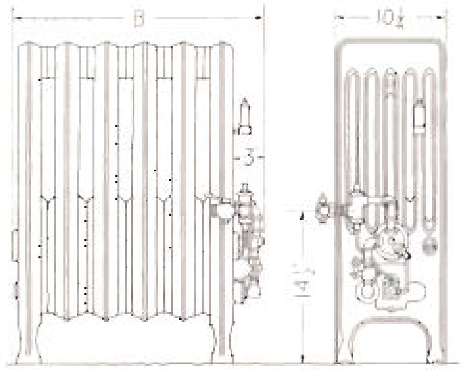
6-Tube 38" Vented = 40 Lbs.
6-Tube 32" Vented = 36 Lbs.

6-Tube 22" Unvented = 35 Lbs.
6-Tube 31" Unvented = 47 Lbs.

Size of Vent Pipe

For 32" Rad., 5 to 15 Sec. = 3"
For 32" Rad., 16 to 23 Sec. = 4"

For 38" Rad., 7 and 9 Sec. = 3"
For 38" Rad., 11 to 23 Sec. = 4"



REAR VIEW END VIEW

Vented Radiators

Number of Sections	Dimensions Inches		Six-Tube 32" High		Six-Tube 38" High	
	"B"	"L"	Equiv. Sq. Ft. Rad.	B.t.u. per Hour Delivery	Equiv. Sq. Ft. Rad.	B.t.u. per Hour Delivery
5	15½	5¾	26	6200	...	......
7	20½	8¼	35	8400	44	10600
9	25½	10¾	44	10600	56	13500
11	30½	13¼	53	12700	67	16100
13	35½	15¾	62	14900	78	18800
15	40½	18¼	71	17000	90	21600
19	50½	18¼	90	21600	114	27400
23	60½	18¼	108	26000	138	33100

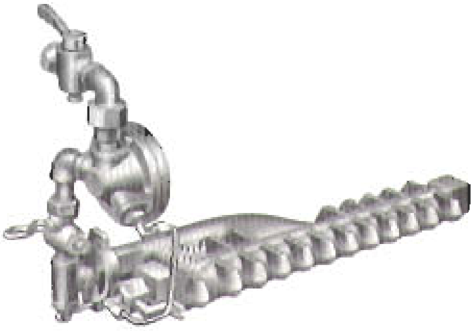
Unvented Radiators

Number of Sections	Dimension "B" Inches	Six-Tube 22" High		Six-Tube 31" High	
		Equiv. Sq. Ft. Rad.	B.t.u. per Hour Delivery	Equiv. Sq. Ft. Rad.	B.t.u. per Hour Delivery
3	13¾	25	6000	...	.....
4	17½	33	7900	49	11800
5	21¼	41	9800	61	14600
6	25	49	11800	73	17500
8	32½	63	15100	97	23300
10	40	77	18500	121	29000
12	47½	89	21400	145	34800
14	55	...	.....	179	43000

Note

Dimension "L" is always measured from the regulator end. Add 6½ inches to Dimension "B" for room temperature controls

ACCESSORIES FOR CLOW GASTEAM RADIATORS



2-Way Burner

The 2-Way Burner permits reduced heat delivery when full heating capacity is not required. The front part of the burner serves as a pilot and, also, when burning, supplies enough heat to warm the front part of the radiator.

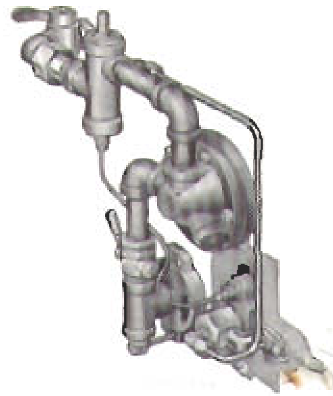
2-WAY BURNER
AND
AUTOMATIC CUT-OFF VALVE

Both are required when **radiators are** used with **Propane or Butane** Gas.

Optional

when **manufactured or natural** gas is used.

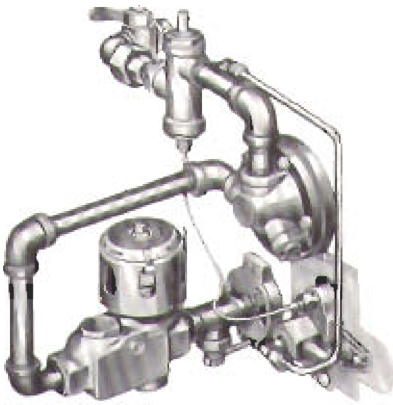
The addition of an automatic cut-off valve to the Clow 2-way burner provides a means of automatically shutting off all gas flow to both the front and rear portions of the burner in case the gas is not burning at the front portion which serves as the pilot lighter.



2-Way Burner and Automatic Cut-Off Valve

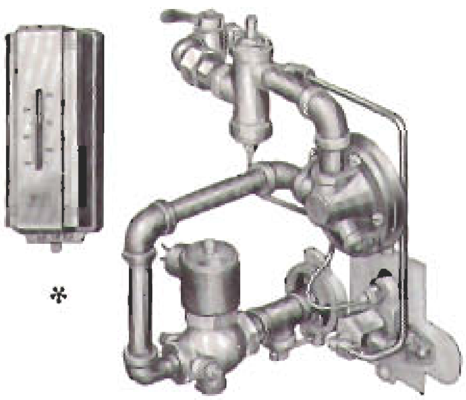
ROOM THERMOSTATS

Room temperature control can be used with Clow Gasteam radiators to meet conditions where manual control of the radiators is not convenient.



Non Electrical Combined Type

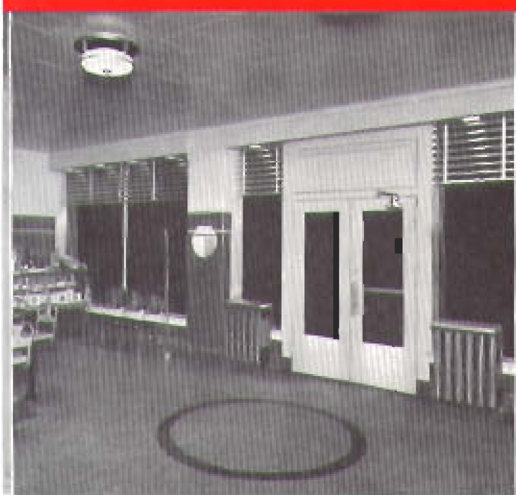
The Non Electrical Combined Type room temperature control (requires no electrical connection) for individual radiators. Thermostat setting controls room temperature by regulating gas flow to main burner. The automatic cut-off valve shuts off all gas to radiator if for any reason the pilot flame goes out.

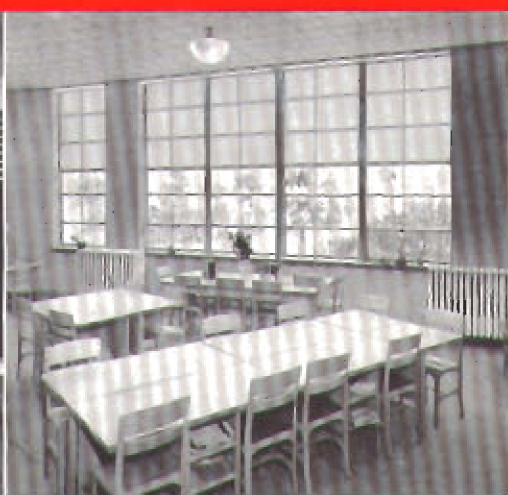


Electrical Remote Type

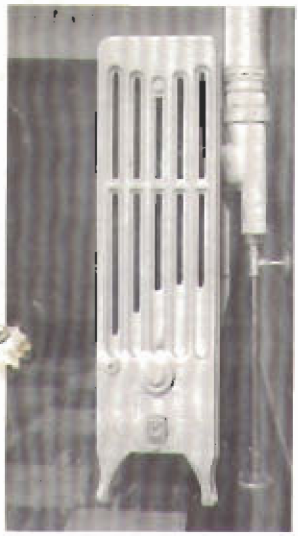
The Electrical Remote Type room temperature control requires connection to the lighting circuit. A wall thermostat, properly located, will provide very accurate temperature regulation of the air in a room by controlling the amount of gas supplied to the radiator through the magnetic gas valve.

*One wall thermostat will control several radiators (one to four). Each radiator must be fitted with a magnetic gas valve, 2-way burner, and automatic cut-off valve which stops the flow of all gas to the radiator if for any reason the pilot flame is not burning. These controls are shown in illustration above at right.





SUGGESTIONS FOR VENTING CLOW GASTEAM RADIATORS



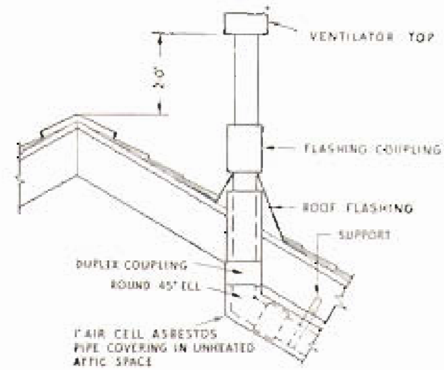
Connecting 3" Metalbestos Vent to Gasteam Radiator with Clow A-6755 Drip Tee and short Transitenipple.

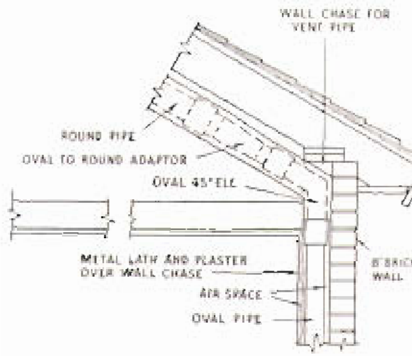
General Venting Recommendations

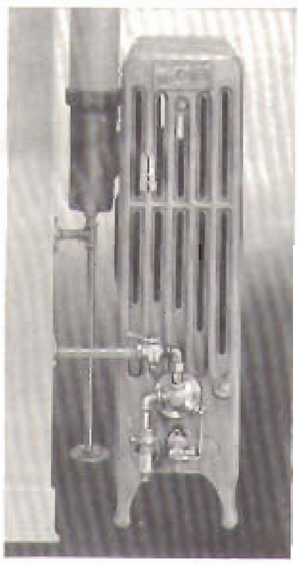
1. Never use smaller vent pipe than indicated under "Dimensions and Ratings of Clow Gasteam Radiators." See inside center page.
2. Always start vent vertically from radiator, even if vertical rise can only be a few inches.
3. Pitch horizontal runs upward from radiator ½" per foot.
4. Length of horizontal run should never exceed height of vent stack.
5. Avoid bends in vent pipe as much as possible and use 45° instead of 90° bends if possible.
6. Drip all vent stacks concealed in outside walls, or any stack with more than 5-ft. exposed outdoors. Run drip into ground or to drain.
7. Use double metal pipe, or pipe insulated with air cell asbestos where vent is outdoors or in unheated space.
8. Extend vent 2 feet above any object within 20 feet of it.

Note:

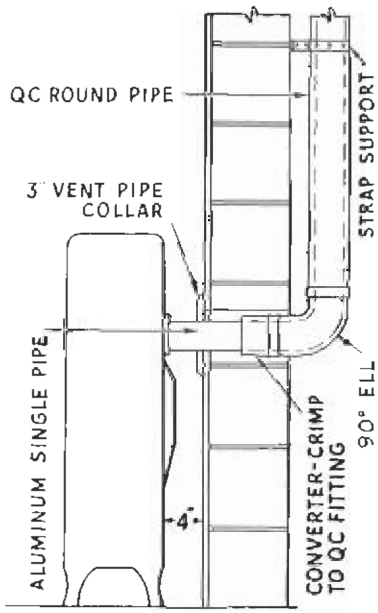
City building codes vary considerably in different localities. Always consult your local ordinances before using suggestions in this folder.



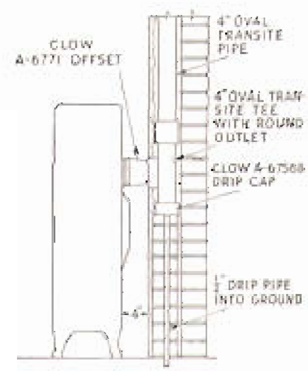




Connecting 4" Round Transite Vent Pipe to Gasteam Radiator with Clow A-6759 Drip Tee.



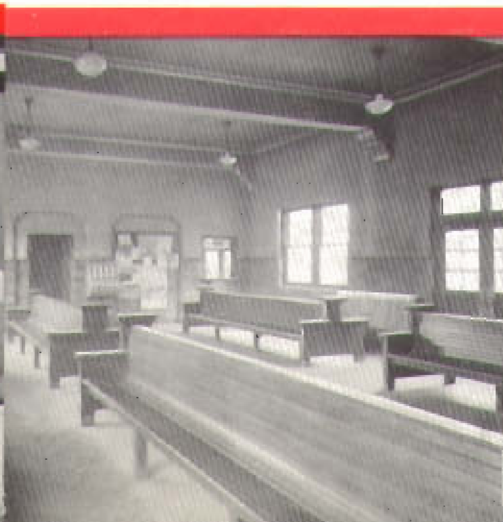
Connecting Gasteam Radiator to round Metalbestos vent pipe exposed outdoors.



NOTE

Clow Offset compensates for variation in height of vent opening from floor.

Venting through pitched roof with Transite pipe concealed in wall.



SIMPLIFIED METHOD FOR ESTIMATING RADIATION REQUIREMENTS FOR COMPLETE HEATING OF BUILDINGS

To estimate the amount of Clow Gasteam Radiation necessary to heat a given space—

1. Multiply the length, width and height of room in feet and divide by 200
2. Multiply width and height of exposed glass surface in feet and divide by 3
Doors with half glass should be figured as all glass.
3. Multiply length and height of exposed walls in feet, deduct glass, and divide by 10
4. Multiply length and width of ceiling in feet (if there is unheated space above) and divide by 10
5. Multiply length and width of floor in feet (if above unheated space) and divide by 20

If any part of building measures so many feet and inches, figure the next highest footage, use no fractions; for example, if a room is 8 feet 5 inches high or wide, figure it as 9 feet.

The above totals added together will give the amount of radiation required to produce 70 degrees temperature in zero weather if radiators are operated continuously. Where heat is used in daytime only, or for a few hours at a time, add 20% to the radiation calculated.

EXAMPLE OF ESTIMATING RADIATION REQUIRED FOR A STORE

Calculations

long wide high — cubic feet
30′ x 15′ x 10′ = 4500 ÷ 200 = 22 sq. ft.

Glass:
2 @ 5′ x 8′ = 80
1 @ 3′ x 5′ = 15
Doors:
2 @ 3′ x 7′ = 42
= 137 sq. ft. glass ÷ 3 = 46 sq. ft.

Exposed Walls:
1 @ 30′ x 10′ = 300
2 @ 15′ x 10′ = 300
= 600 sq. ft. minus 137 sq. ft. glass
463 sq. ft. net ÷ 10 = 46 sq. ft.

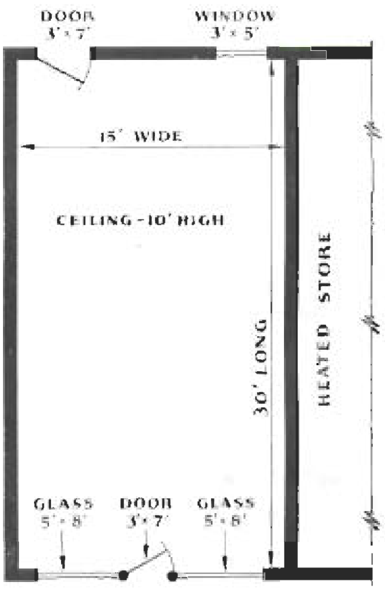
Floor:
30′ x 15′ = 450 ÷ 20 = 22 sq. ft.

Ceiling (roof)
30′ x 15′ = 450 ÷ 10 = 45 sq. ft.

181 sq. ft.
Plus 20% for intermittent heat 36 sq. ft.
TOTAL RADIATION NECESSARY TO HEAT STORE TO 70 DEGREES 217 sq. ft.

For temperature rises other than 70° F., multiply the radiation calculated, by the constant immediately below the required temperature rise in the following table.

For temperature rise in degrees F. of	40	50	60	75	80
Multiply calculated radiation by	.57	.71	.86	1.07	1.14



One Story Brick Building
Wood Floor on Concrete with
Cinder Fill on earth

SIZING CLOW GASTEAM RADIATORS FOR AUXILIARY HEATING

For Spring and Fall Heating—in Summer cottages, in homes with central heating plants—use radiators of about ⅔ the size required for complete heating.

For Basement rooms—where a central furnace does not provide enough heat—Radiators about ⅓ the size required for total heat are sufficient.

For cold spots—near the doors in Restaurants, Drugstores, etc.—anywhere there is a cold draft—use 50 to 75 sq. ft. radiators. These rarely need to be vented.

For Sun-porches, attic rooms, etc.—where the central furnace is not connected—calculate the heating requirements for complete heat and size the Gasteam Radiators accordingly.

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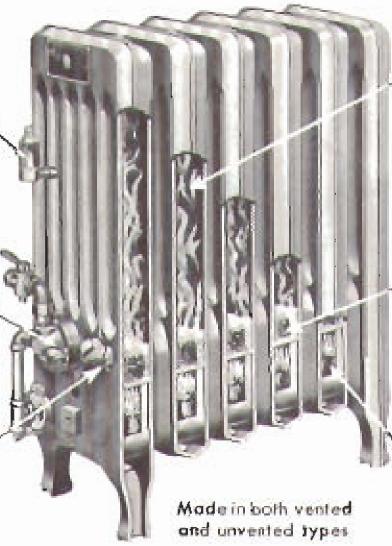

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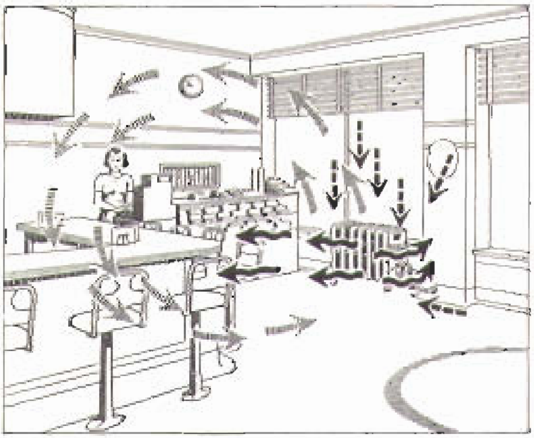

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Manufactured by James B. Clow & Sons • • • 201-299 North Talman Avenue, Chicago 80, Illinois

Form C-9-3-54

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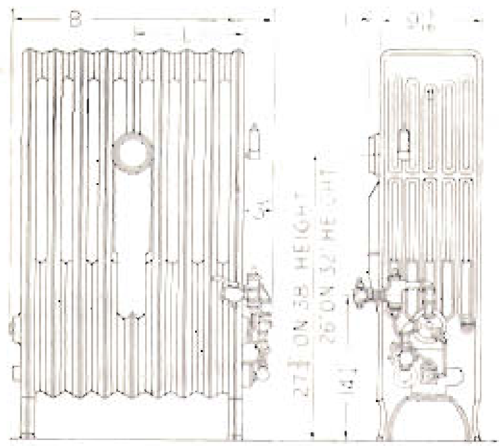
Six-Tube 32″ Vented

Six-Tube 22″ Unvented

Six-Tube 31″ Unvented



REAR VIEW

END VIEW

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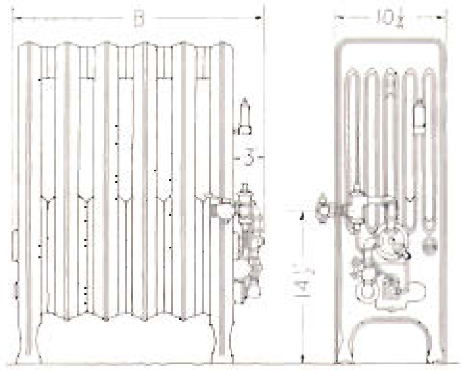

REAR VIEW

END VIEW

Vented Radiators

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7	20½	8¼	35	8400	44	10600
9	25½	10¾	44	10600	56	13500
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15	40½	18¼	71	17000	90	21600
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23	60½	18¼	108	26000	138	33100

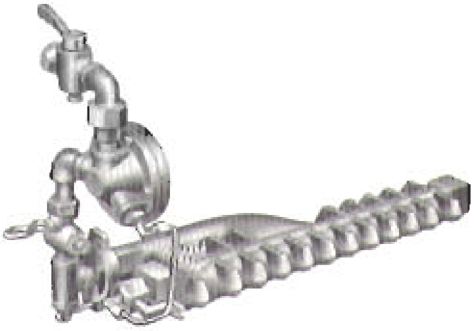
Unvented Radiators

Number of Sections	Dimension "B" Inches	Six-Tube 22″ High		Six-Tube 31″ High	
		Equiv. Sq. Ft. Rad.	B.t.u. per Hour Delivery	Equiv. Sq. Ft. Rad.	B.t.u. per Hour Delivery
3	13¾	25	6000	. . .	. . . . .
4	17½	33	7900	49	11800
5	21¼	41	9800	61	14600
6	25	49	11800	73	17500
8	32½	63	15100	97	23300
10	40	77	18500	121	29000
12	47½	89	21400	145	34800
14	55	. . .	. . . . .	179	43000

Note

Dimension "L" is always measured from the regulator end. Add 6½ inches to Dimension "B" for room temperature controls

ACCESSORIES FOR CLOW GASTEAM RADIATORS



2-Way Burner

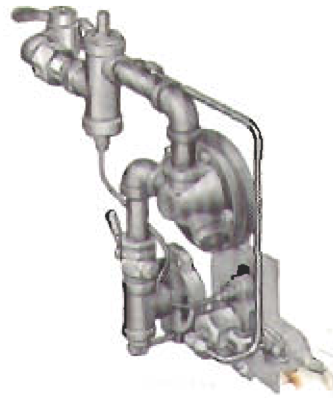
The 2-Way Burner permits reduced heat delivery when full heating capacity is not required. The front part of the burner serves as a pilot and, also, when burning, supplies enough heat to warm the front part of the radiator.

2-WAY BURNER AND AUTOMATIC CUT-OFF VALVE

Both are required when radiators are used with Propane or Butane Gas.

Optional when manufactured or natural gas is used.

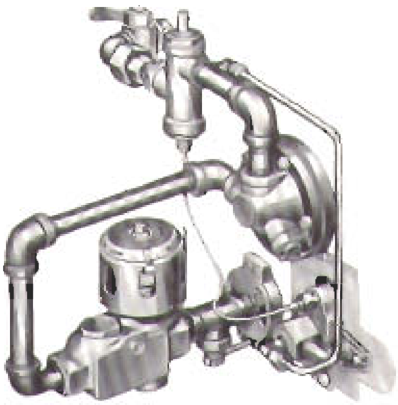
The addition of an automatic cut-off valve to the Clow 2-way burner provides a means of automatically shutting off all gas flow to both the front and rear portions of the burner in case the gas is not burning at the front portion which serves as the pilot lighter.



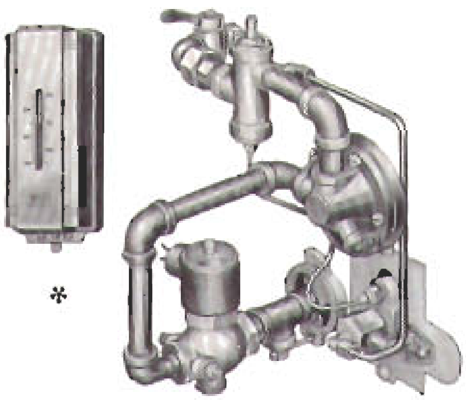
2-Way Burner and Automatic Cut-Off Valve

ROOM THERMOSTATS

Room temperature control can be used with Clow Gasteam radiators to meet conditions where manual control of the radiators is not convenient.



Non Electrical Combined Type



*

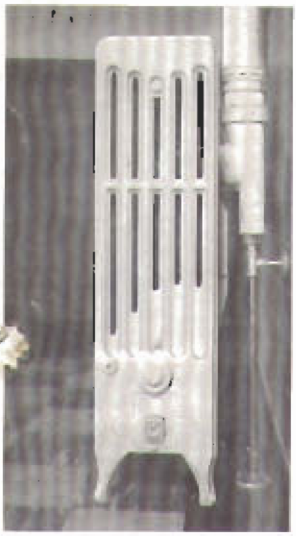
Electrical Remote Type

The Non Electrical Combined Type room temperature control (requires no electrical connection) for individual radiators. Thermostat setting controls room temperature by regulating gas flow to main burner. The automatic cut-off valve shuts off all gas to radiator if for any reason the pilot flame goes out.

The Electrical Remote Type room temperature control requires connection to the lighting circuit. A wall thermostat, properly located, will provide very accurate temperature regulation of the air in a room by controlling the amount of gas supplied to the radiator through the magnetic gas valve.

*One wall thermostat will control several radiators (one to four). Each radiator must be fitted with a magnetic gas valve, 2-way burner, and automatic cut-off valve which stops the flow of all gas to the radiator if for any reason the pilot flame is not burning. These controls are shown in illustration above at right.

SUGGESTIONS FOR VENTING CLOW GASTEAM RADIATORS



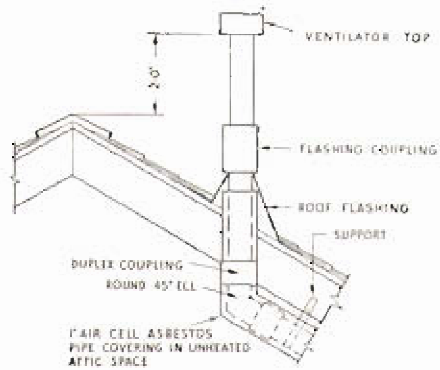
Connecting 3" Metalbestos Vent to Gasteam Radiator with Clow A-6755 Drip Tee *and short Transitenipple.*

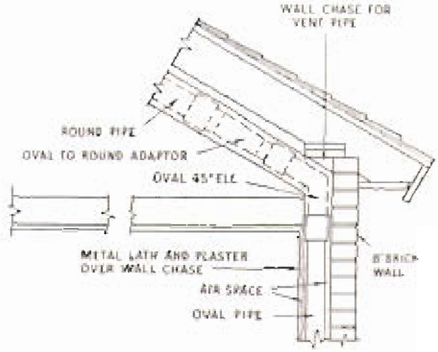
General Venting Recommendations

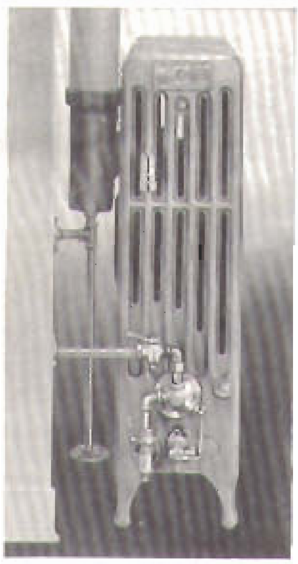
1. Never use smaller vent pipe than indicated under "Dimensions and Ratings of Clow Gasteam Radiators." See inside center page.
2. Always start vent vertically from radiator, even if vertical rise can only be a few inches.
3. Pitch horizontal runs upward from radiator ½" per foot.
4. Length of horizontal run should never exceed height of vent stack.
5. Avoid bends in vent pipe as much as possible and use 45° instead of 90° bends if possible.
6. Drip all vent stacks concealed in outside walls, or any stack with more than 5-ft. exposed outdoors. Run drip into ground or to drain.
7. Use double metal pipe, or pipe insulated with air cell asbestos where vent is outdoors or in unheated space.
8. Extend vent 2 feet above any object within 20 feet of it.

Note:

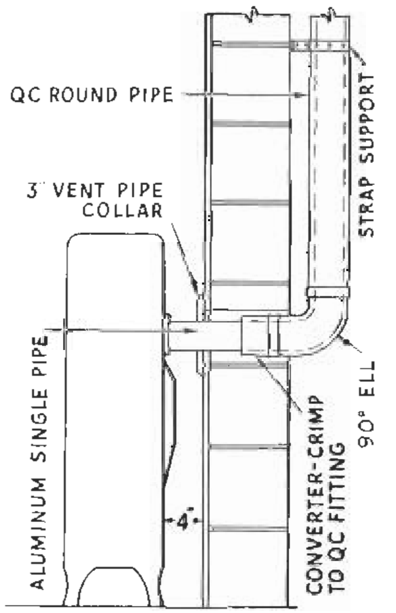
City building codes vary considerably in different localities. Always consult your local ordinances before using suggestions in this folder.



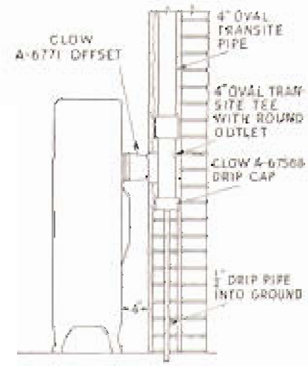




Connecting 4" Round Transite Vent Pipe to Gasteam Radiator with Clow A-6759 Drip Tee.



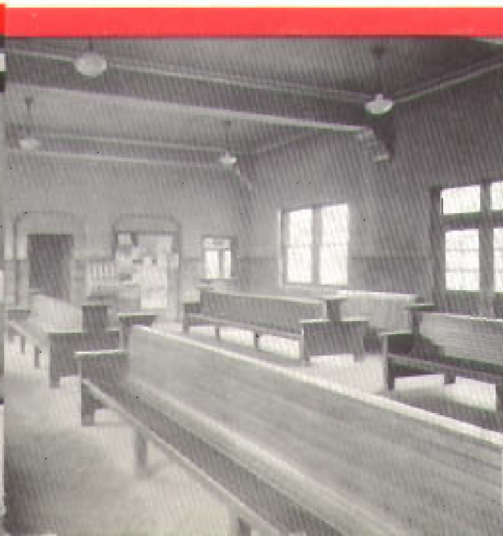
Connecting Gasteam Radiator to round Metalbestos vent pipe exposed outdoors.



NOTE

Clow Offset compensates for variation in height of vent opening from floor.

Venting through pitched roof with Transite pipe concealed in wall.



SIMPLIFIED METHOD FOR ESTIMATING RADIATION REQUIREMENTS FOR COMPLETE HEATING OF BUILDINGS

To estimate the amount of Clow Gasteam Radiation necessary to heat a given space—

1. Multiply the length, width and height of room in feet and divide by 200
2. Multiply width and height of exposed glass surface in feet and divide by 3
Doors with half glass should be figured as all glass.
3. Multiply length and height of exposed walls in feet, deduct glass, and divide by 10
4. Multiply length and width of ceiling in feet (if there is unheated space above) and divide by 10
5. Multiply length and width of floor in feet (if above unheated space) and divide by 20

If any part of building measures so many feet and inches, figure the next highest footage, use no fractions; for example, if a room is 8 feet 5 inches high or wide, figure it as 9 feet.

The above totals added together will give the amount of radiation required to produce 70 degrees temperature in zero weather if radiators are operated continuously. Where heat is used in daytime only, or for a few hours at a time, add 20% to the radiation calculated.

EXAMPLE OF ESTIMATING RADIATION REQUIRED FOR A STORE

Calculations

long wide high — cubic feet
30′ x 15′ x 10′ = 4500 ÷ 200 = 22 sq. ft.

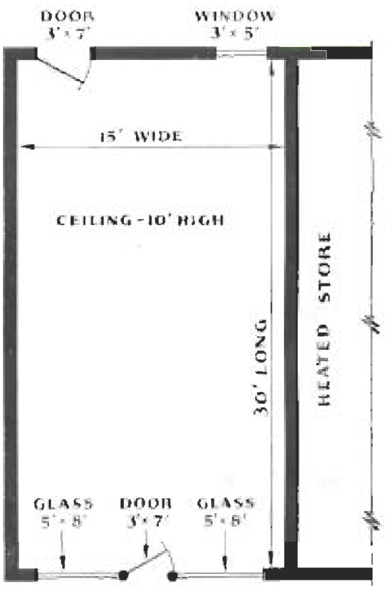
Glass:
2 @ 5′ x 8′ = 80
1 @ 3′ x 5′ = 15
Doors:
2 @ 3′ x 7′ = 42
= 137 sq. ft. glass ÷ 3 = 46 sq. ft.

Exposed Walls:
1 @ 30′ x 10′ = 300
2 @ 15′ x 10′ = 300
= 600 sq. ft. minus 137 sq. ft. glass
463 sq. ft. net ÷ 10 = 46 sq. ft.

Floor:
30′ x 15′ = 450 ÷ 20 = 22 sq. ft.

Ceiling (roof)
30′ x 15′ = 450 ÷ 10 = 45 sq. ft.

181 sq. ft.
Plus 20% for intermittent heat 36 sq. ft.
TOTAL RADIATION NECESSARY TO HEAT STORE TO 70 DEGREES 217 sq. ft.



One Story Brick Building
Wood Floor on Concrete with
Cinder Fill on earth

For temperature rises other than 70° F., multiply the radiation calculated, by the constant immediately below the required temperature rise in the following table.

For temperature rise in degrees F. of	40	50	60	75	80
Multiply calculated radiation by	.57	.71	.86	1.07	1.14

SIZING CLOW GASTEAM RADIATORS FOR AUXILIARY HEATING

For Spring and Fall Heating—in Summer cottages, in homes with central heating plants—use radiators of about 2/3 the size required for complete heating.

For Basement rooms—where a central furnace does not provide enough heat—Radiators about 1/3 the size required for total heat are sufficient.

For cold spots—near the doors in Restaurants, Drugstores, etc.—anywhere there is a cold draft—use 50 to 75 sq. ft. radiators. These rarely need to be vented.

For Sun-porches, attic rooms, etc.—where the central furnace is not connected—calculate the heating requirements for complete heat and size the Gasteam Radiators accordingly.

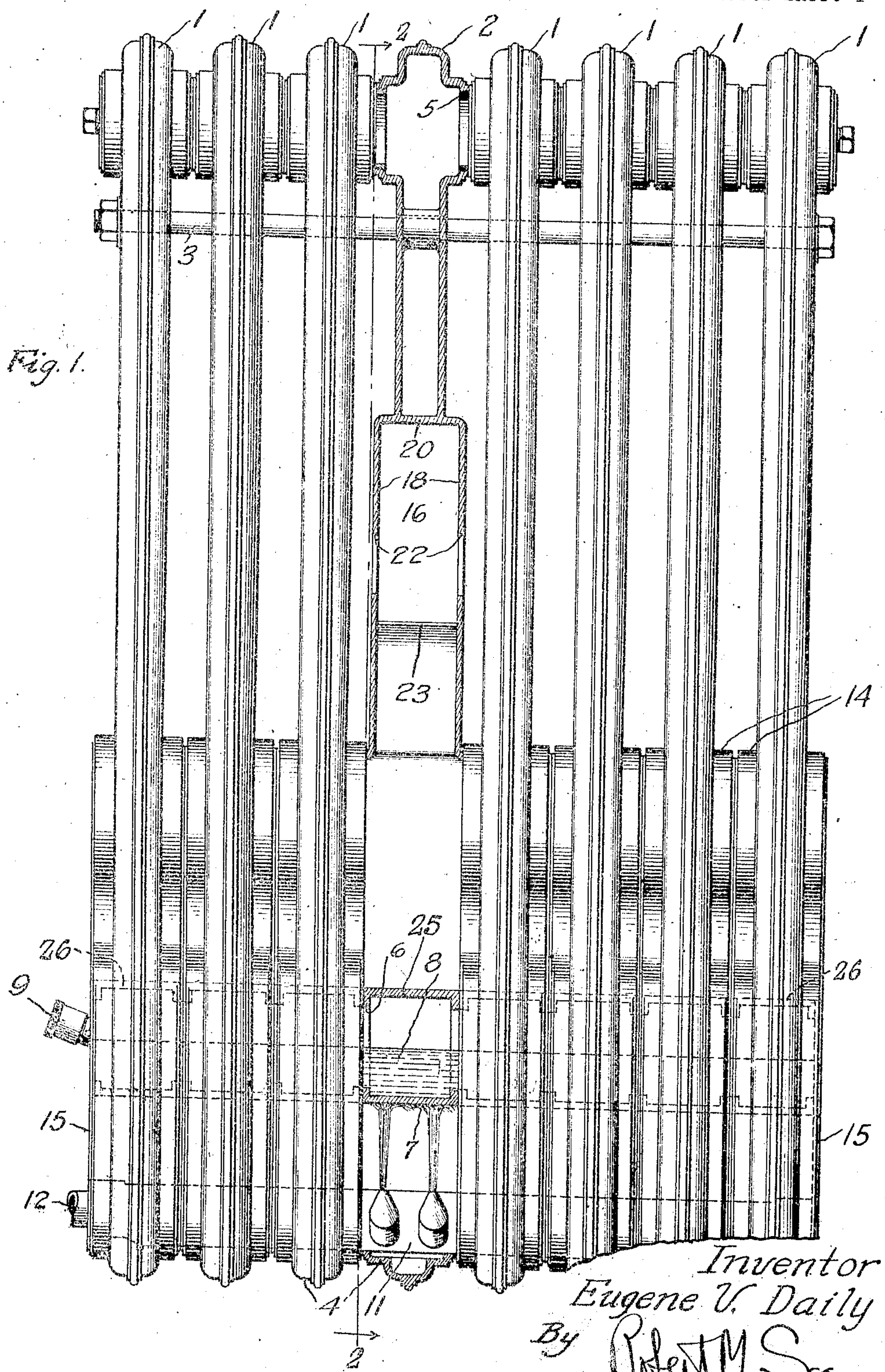
April 13, 1926. **1,580,651**

E. V. DAILY

RADIATOR

Filed August 28, 1922 2 Sheets-Sheet 1

Fig. 1.



Inventor
Eugene V. Daily
By Robert M. Sox Atty.

April 13, 1926. **1,580,651**

E. V. DAILY

RADIATOR

Filed August 28, 1922 2 Sheets-Sheet 2

Fig. 2.

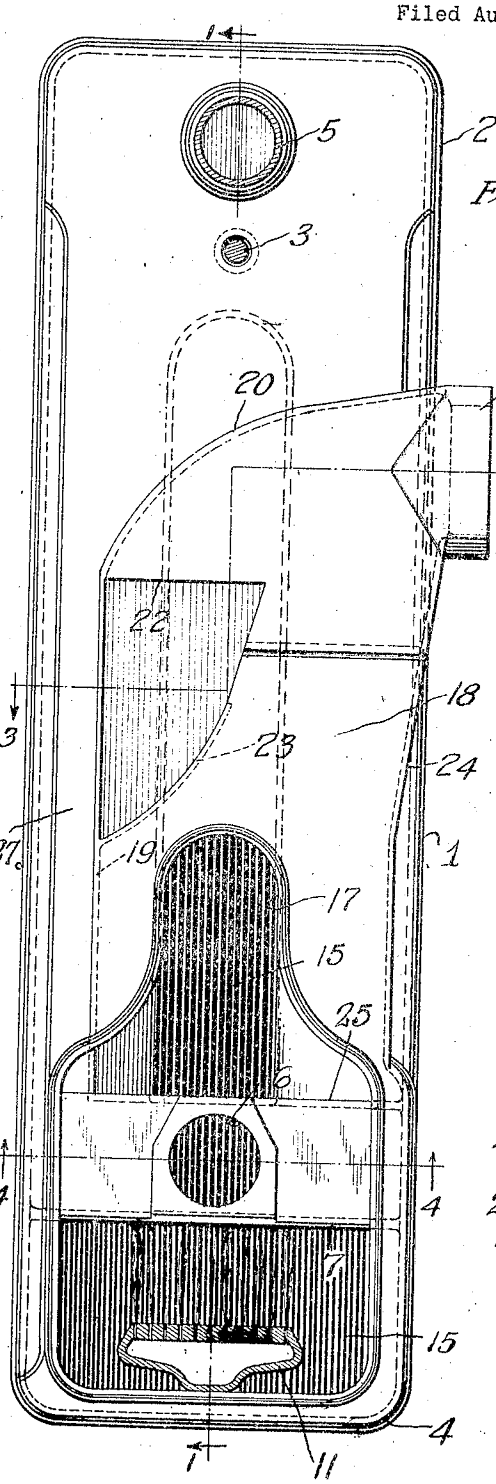


Fig. 3.

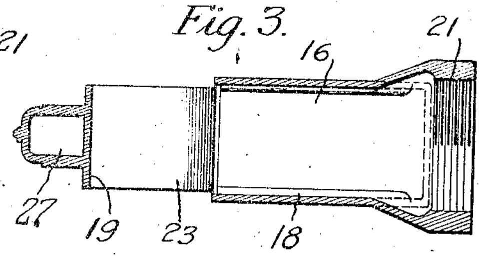
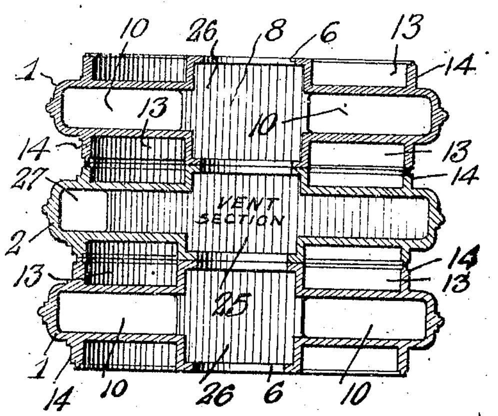


Fig. 4.



Inventor
Eugene V. Daily
By Robert M. Sss Atty.

Patented Apr. 13, 1926. **1,580,651**

UNITED STATES PATENT OFFICE.

EUGENE V. DAILY, OF CHICAGO, ILLINOIS, ASSIGNOR TO JAMES B. CLOW & SONS, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

RADIATOR.

Application filed August 28, 1922. Serial No. 584,715.

To all whom it may concern:

Be it known that I, EUGENE V. DAILY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Radiators, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

The present invention relates to radiators in which the heating medium is heated by a gas burner incorporated in the radiator and its object is the provision of means properly to vent the gases from the burner.

In the drawings,—

Figure 1 is a front elevation of a radiator embodying the invention, taken on the line 1—1 of Figure 2 with a vent section shown in section.

Figure 2 is a section on the line 2—2 of Figure 1.

Figure 3 is a section on the line 3—3 of Figure 2.

Figure 4 is a section of the vent section and two radiator sections on the line 4—4 of Figure 2.

The radiator is composed of a plurality of similar radiator sections 1 and a vent section 2, preferably disposed at the center of the radiator, the several sections being secured together by a tie-rod 3. Each radiator section 1 is formed near the bottom with a transverse plate 7 forming the floor of a water chamber 8 opening into hollow columns 10 at the front and rear of the section, the chamber 8 being closed between columns by a roof 26. The vent section 2 is formed with a plate 7 corresponding with the plates 7 of the radiator sections but a single column 27 rises from the water chamber at the front of the vent section and the roof 25 of the water chamber in the vent section extends from the rear wall of the column 27 to the rear wall of the section. The column 27 in the vent section opens out to the full width of the vent section above the wall 20 (Figures 1 and 2) hereafter described. In each radiator section the front and rear columns 10 open into each other at the top of the section in the usual manner. When a plurality of radiator sections 1 and a vent section 2 are assembled into a radiator, the columns 10 and 27 communicate with each other at the top of the radiator through openings 5 and the water chambers 8, from which the columns rise, communicate with each other through openings 6. Water may be supplied to the common water chamber of the radiator through a pipe normally closed by a cap 9.

Each radiator section 1 and the vent section 2 is formed with a laterally projecting wall 14, the walls of adjacent sections fitting each other edgewise. The walls 14, in conjunction with the walls of the sections proper, form a closed bottom 4 for the radiator, thus providing a common combustion chamber closed at the opposite ends of the radiator by plates 15, the walls forming spaces 13 for the passage of products of combustion around the water chamber 8. A gas burner indicated generally at 11 extends through the common combustion chamber and is connected through a pipe 12 with any source of fuel. Any of the well known fuel and air mixing devices (not shown) may be connected in the fuel supply line adjacent the portion of the pipe 12 shown, in order to supply the burner with the proper mixture of fuel and air.

The vent section 2 is formed with a chamber 16 which communicates by openings 17 in its opposite sides with the combustion chamber. It is apparent, therefore, that the gases rising from the burner throughout the length of the radiator will be forced to flow lengthwise of the radiator through the chamber formed by the walls 14 into the vent section and upwardly into the chamber 16.

The chamber 16 of the vent section 2 is formed with side walls 18, a vertical front wall 19, and a curved top wall 20 which extends from the top edge of the wall 19 to the upper edge of a flue opening 21 in the rear wall of the section. The rear wall of the chamber is substantially vertical up to the level of the top of the openings 17 but above that level the wall is formed with a portion 24 inclining rearwardly to the lower edge of the fuel or flue opening connection 21 forms an outlet from the interior of the chamber. A suitable flue pipe may be connected with the flue or flue opening connection 21 to provide an outlet for the escape of products of combustion.

Unless provision be made to avoid it a back draft into the chamber 16 may extinguish the flame of the burner, while if the upward draft through the flue be excessive that also may extinguish the flame by "lifting the frame off of the burner". For these reasons the side walls 18 of the chamber 16 are formed near their front edges with openings 22 to atmosphere, the openings 22 extending substantially from the level of the top edges of the opening 17 to the level of the lower edge of the flue opening 21. The rear edges of the openings 22 are curved as illustrated in Figure 2 and a transverse baffle 23 extends across the chamber 16 from the curved edge of one opening 22 to the curved edge of the other opening. The baffle 23 has only about half the vertical height of the opening 22 and its top edge lies substantially in the same vertical plane as the center lines of the openings 17.

In the operation of the radiator water in the common chamber 8 stands at about the level shown in Figure 1 and steam circulates through the columns 10 of the radiator sections 1, the column 27 of the vent section 2, and the space above the wall 20 in the vent section 2 into which the column 27 opens. The gases from the burner are prevented from escaping into the room and are forced to flow longitudinally of the radiator into the chamber formed in the vent section. As the gases rise in this chamber they are directed by the rearwardly extending baffle 23 and the rearwardly inclined rear wall 24 directly to the flue or outlet opening in the flue opening connection from the chamber. If the draft through the flue bcomes excessive air will be pulled in from the room through the openings 22 over the top edge of the baffle 23 so that the burner at the base of the sections will not be affected. If, on the other hand, a back draft through the flue occurs, the downwardly flowing air will be directed by the curved wall 20 and the baffle 23 outwardly into the room through the openings 22, carrying with it the products of combustion, so that the burner will not be extinguished. Consequently the gases rising from the burner will be properly vented at all times while the flame will burn evenly and uniformly without extinguishment or interference either by excessive draft or by back draft.

Having thus described my invention, what I claim as new is:—

1. A vent section for a gas-fired radiator comprising, a walled chamber for the reception of products of combustion, a wall of said chamber having a flue opening, one wall of said chamber having an opening to the atmosphere at a point in the chamber remote from the wall having the flue opening, and a baffle below the second recited opening extending upwardly from the wall adjacent thereto toward the flue opening.

2. A vent section for a gas-fired radiator comprising, a walled chamber for the reception of products of combustion, means connected with a wall of said chamber for connection of a flue therewith, one wall of said chamber at a point spaced from said means having an opening therethrough, a baffle below said opening extending upwardly from the wall adjacent said opening toward said means, and a top wall extending downwardly from above said means over the baffle to the top edge of said opening in the chamber wall.

3. A vent section for a gas-fired radiator comprising, a walled chamber providing an inlet at the bottom of the chamber for reception of products of combustion, a wall of the chamber having a flue opening to the rear of the chamber and above the said inlet, a wall of said chamber having an opening to the atmosphere therethrough at a point remote from said flue opening and above the said inlet and below the said flue opening, and a baffle connected to the wall at the bottom of said atmospheric opening and extending upwardly toward said flue opening.

4. A vent section for a radiator of the character described comprising, a walled chamber having a plurality of inlets for combustion products through a portion of the walls thereof, a rear wall of the said chamber having an opening above said inlets, the walls of the chamber having openings to the atmosphere spaced from the opening in said wall to the rear of said chamber and above the said inlets and below the said rear wall opening, a baffle between the walls between said openings to the atmosphere and extending from a line to the rear thereof, toward the front of said chamber and connected to the walls of said chamber adjacent the bottom of said openings, said baffle extending upwardly toward said rear wall opening, and a portion of the top wall of said chamber spaced above said baffle and extending downwardly, from the rear wall of said chamber above the said rear wall opening, to the front wall of said chamber adjacent the top of the said openings to the atmosphere.

5. A vent section for a radiator of the character described comprising, a walled chamber having registering inlets through portions of the wall thereof, a flue opening in the wall of the chamber remote from and above the said inlets, the wall of the chamber having openings to the atmosphere at points remote from said flue opening, ano on a line above the said inlets and below the said flue opening, a baffle connecting the lower edges of the second said openings and extending upwardly toward the said flue opening, the wall of the chamber having the flue opening therein being inclined downwardly and forwardly from the flue opening, and a wall spaced above the baffle and extending downwardly from the flue open-

ing to the wall forming the top edges of the second said openings.

6. A gas-fired radiator comprising, a single vent section, and a plurality of radiator sections connected on opposite sides of the vent section, the sections being formed to provide a common passage for a heating medium, and a closed combustion space at the bottom of the radiator, the vent section having a chamber extending upwardly from the combustion space, a gas burner extending longitudinally through the combustion space, the rear wall of the chamber above the combustion space having a flue opening, the side walls of the chamber having openings to the atmosphere adjacent the front wall of the chamber above the combustion space and below the flue opening, and a baffle connecting the side walls at the front edges of the openings to the atmosphere and extending upwardly toward the flue opening.

7. A gas-fired radiator comprising, a single vent section and a plurality of radiator sections connected on opposite sides of the vent section, the sections being formed to provide a common passage for a heating medium and a common closed combustion space at the bottom of the radiator, the vent section having a chamber extending upwardly from the combustion space, a gas burner extending longitudinally through the combustion space, the rear wall of the chamber above the combustion space having a flue opening, the side walls of the chamber adjacent its front wall, above the combustion space and below the flue opening, having openings to the atmosphere, a baffle connecting the side walls at the front edges of the openings to the atmosphere and extending upwardly toward the flue opening, and a wall spaced above the flue opening and extending to the front of the chamber adjacent the front edges of the openings to the atmosphere.

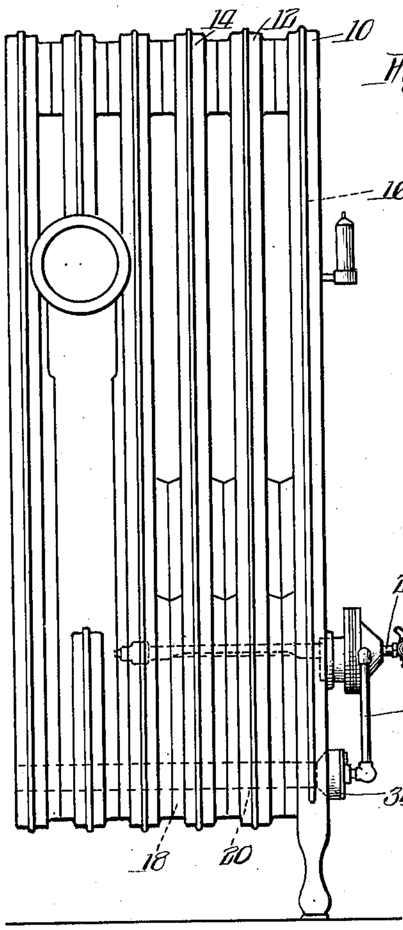
In witness whereof, I hereunto subscribe my name this 23rd day of August, 1922.

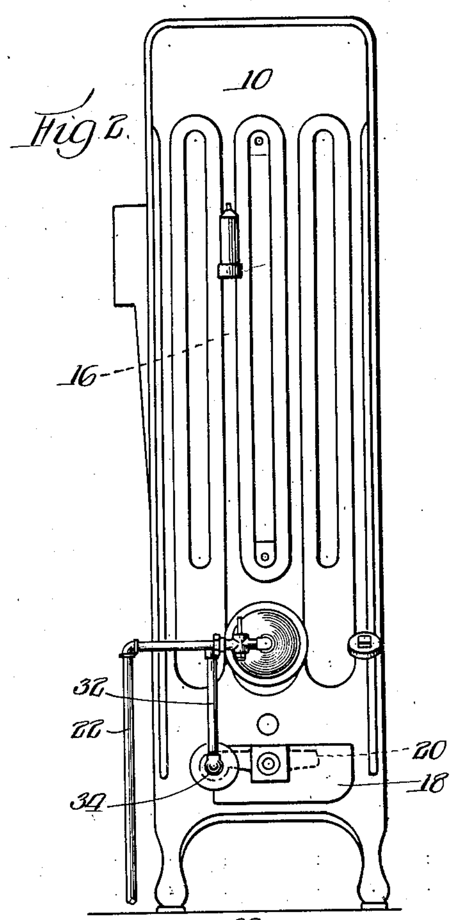
EUGENE V. DAILY.

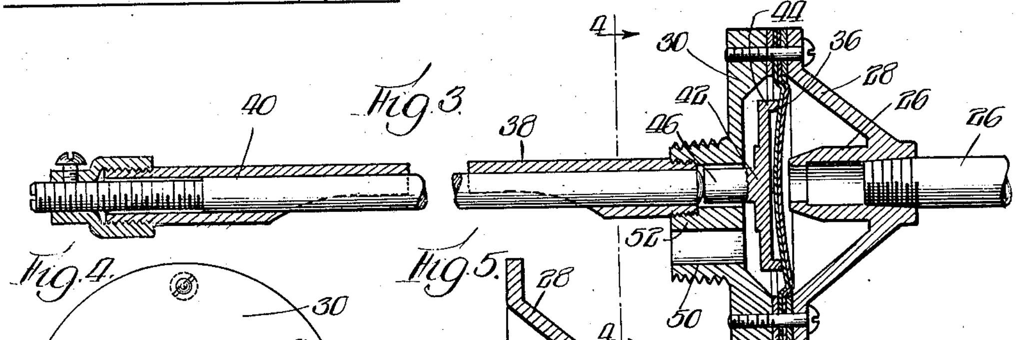
Jan. 6, 1931. G. C. CARNAHAN 1,788,048

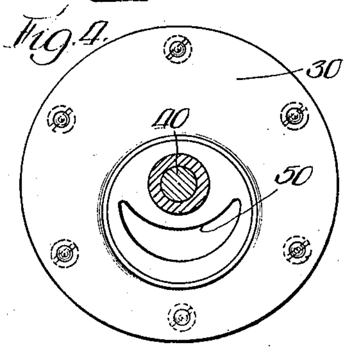
RADIATOR FUEL CONTROL

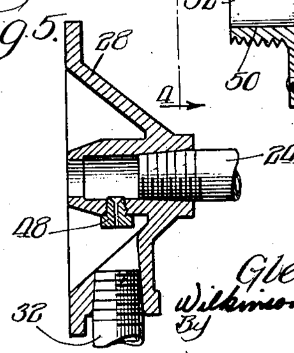
Filed Dec. 13, 1929 2 Sheets-Sheet 1











Inventor:
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RADIATOR FUEL CONTROL

Filed Dec. 13, 1929 2 Sheets-Sheet 2

Fig. 6.

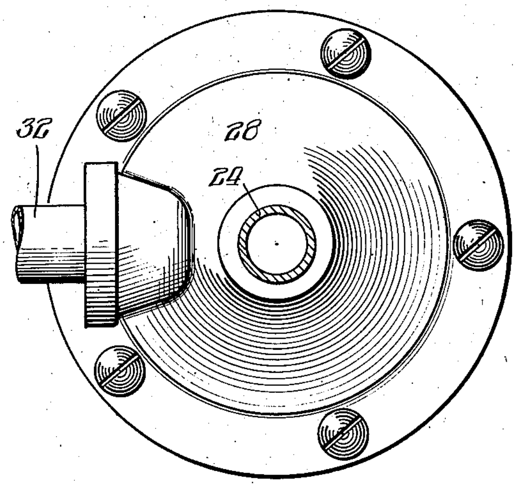


Fig. 7.

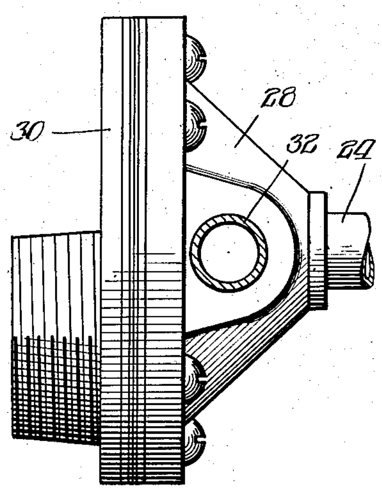
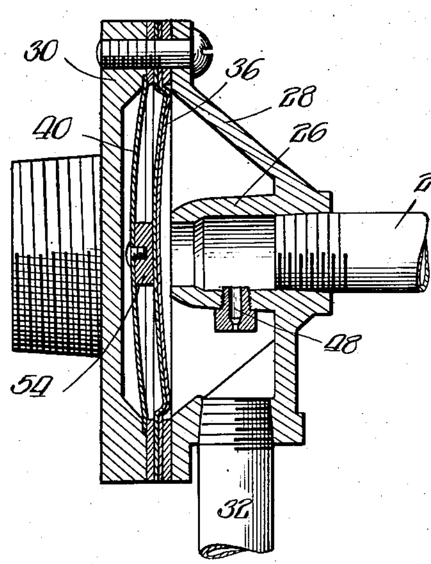


Fig. 8.



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attys.

Patented Jan. 6, 1931 1,788,048

UNITED STATES PATENT OFFICE

GLEN C. CARNAHAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO JAMES B. CLOW & SONS, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

RADIATOR FUEL CONTROL

Application filed December 13, 1929. Serial No. 413,806.

This invention relates to heaters of the type that generally employ a fluid fuel, such as a liquid or gas, as contrasted with a solid fuel, and is illustrated herein as embodied in a gas-fired steam radiator.

Radiators of this class comprise generally a hollow shell having a water space in the upper portion thereof and a burner space in the lower portion thereof. Upon ignition of the fuel at the burner, heat is imparted to the portion of the radiator containing water thereby transforming the latter into steam and imparting heat to the space surrounding the radiator. It sometimes happens that the steam pressure in the radiator would become unduly high if it were not equipped with a device to regulate the flow of fuel to an amount that will just maintain a desirable steam pressure once it is attained. With this in view radiators long in use have been equipped with a valve for controlling the admission of fuel to the burner and the action of the valve has been governed by variations occurring in the steam pressure within the radiator. Fuel controls of this character are in successful use today, but like all other devices of their kind they are subject to beneficial improvement.

To illustrate the demand for an improved control, it is necessary only to recite a certain condition that may arise in the use of a gas-fired steam radiator and which may operate harmfully in spite of the pressure controlled valve, now in use. If the fuel at the burner of a cold radiator containing no water is ignited, the flame will in time cause the metallic shell of the radiator to become highly over-heated in the absence of water, as no steam pressure can be generated which normally would regulate the supply of fuel. Therefore the dry radiator will become hotter and hotter until harmful and sometimes disastrous results take place.

With the foregoing in view it is an object of the present invention to provide a radiator of the class described with means responsive to variations in temperature conditions within the radiator, both in the presence as well as in the absence of steam, for governing the supply of fuel thereto. In the illustrated embodiment of the invention the radiator is provided with a fuel supply line and a valve is interposed in the line for controlling the passage of fuel therethrough. In accordance with the present invention a thermostatic element is extended into the radiator and is operatively connected with the valve in such a manner that upon the temperature in the radiator rising to a certain point, in the absence of water and steam pressure the thermostatic element will expand sufficiently to partially close the valve and thereby regulate the fuel supply to the radiator and prevent the radiator from overheating in the absence of water for steam generating purposes.

Another equally important feature of the present invention consists in combining efficiently and simply, in a single structure, a means responsive both to variations in temperature and pressure within the radiator for controlling the admission of fuel thereto. By means of such a provision the fuel controlling valve operates when either the temperature or the pressure within the radiator reaches the desired point, and thereby guards against the outstanding disadvantageous tendencies of the present day radiator to overheat when no water is contained therein, which can be generated into steam pressure and which will operate the valve controlling the fuel.

Other important objects and features of the invention will become apparent from a reading of the following specification in the light of accompanying drawings in which,

Fig. 1 is a rear elevational view of the end portion of a gas-fired steam radiator equipped in accordance with the present invention,

Fig. 2 is a right end view of the radiator illustrated in Fig. 1,

Fig. 3 is a detailed view of the fuel control device,

Fig. 4 is a sectional view taken along the line 4—4 of Fig. 3,

Fig. 5 is a detailed view of a portion of the device illustrated in Fig. 3,

Fig. 6 is a detailed view of the outside casing of the control device,

Fig. 7 is an outside view of a portion of the control device, and

Fig. 8 is a modified form of the apparatus shown in the earlier figures.

As shown in the drawings, the radiator is composed of a number of sections, 10, 12, 14, etc., which are suitably joined together and when so joined form a hollow upper water chamber 16, and a lower burner chamber 18. In operation the fuel at a burner 20, located in the burner chamber, is ignited and the heat therefrom converts into steam the water that is located in the upper portion of the radiator. As heretofore pointed out, it occasionally happens that the water becomes too low and the metallic shell of the radiator may be unduly heated. To overcome this disadvantage the present invention contemplates equipping the radiator with a fuel control device which will now be described.

Fuel flowing to the radiator passes through a supply or entrance conduit composed of the pipe sections 22 and 24. As shown in Fig. 3, the fuel leaves the open end of the entrance passageway 24 (the latter terminates in a nozzle portion 26), and enters a chamber formed by a hollow cup-shaped shell 28 and a base 30. Leading from the shell 28 is an exit passageway or conduit 32 which communicates through an air-mixing valve 34 with the burner 20. Under ordinary conditions fuel flowing through the supply conduit 24 enters the chamber defined by the shell 28 and base 30 and thence flows to the burner directly, through the exit passageway 32. The chamber defined by the members 28 and 30, is provided with a central partition or valve 36, consisting of a plurality of thin and flexible concave-convex disks. Normally the disks occupy the position illustrated in Fig. 3 in which the open end of the supply passageway 24 and nozzle 26 is disposed in spaced relationship to the valve, thereby permitting the incoming fuel to flow from the nozzle 26 through the exit passageway 32. The valve is arranged, however, to be actuated upon by fluctuations in steam pressure of predetermined magnitude, occurring in the water chamber of the radiator. To provide for regulation in the absence of water and steam pressure a hollow sleeve 38 extends rearwardly from the base member 30 and contains a thermostatic element 40. The member 40 has a coefficient of expansion greater than the casing 38 in which it is enclosed, in order that upon heat being applied to the casing 38 and the element 40, the latter will expand more rapidly than the casing, causing the inner end of the thermostatic element 40 to move in the direction of the valve 36. It will be appreciated that if the thermostatic element bore directly upon the rear surface of the valve a considerable amount of movement would be required to move the valve from an open to a closed position. In order to decrease the amount of movement necessary to perform this operation there is interposed between the valve and the inner end of the thermostatic element 40, a cup-shaped plunger 42 having an outer circular rim portion 44 adapted to engage the marginal portion of the plurality of thin and flexible concave-convex valve disks 36 and a seat 46 arranged to be engaged by the inner end of the thermostatic element. The amount of movement required to close the valve through the arrangement just described is far less than that which would otherwise be required and thus the efficiency of the device is enhanced and assured.

From so much of the description as has already been given it will be understood that in the operation of the radiator the control device being disposed in the water or steam chamber of the radiator will be exposed to variations in temperature occurring therein in the absence of water in the radiator with the result that when a predetermined degree of temperature is reached the thermostatic element 40 will expand sufficiently to move the plunger 42 in the direction of the valves 36, to close the latter. It would be undesirable if the movement of the valve 36 to a closed position completely cut off the fuel supply and extinguished the flame, because later, upon cooling, the thermostat would once more contract and allow the concavo-convex valve 36 again to assume its normal position and raw unburned fuel would then flow into the radiator and be liberated from the burner. Accordingly the device is provided with means for by-passing a small quantity of fuel when the valve is closed.

The by-pass permits the fuel to burn with a low flame and in such quantity that will not bring the temperature of the radiator to an undesirable degree. Thus, as shown in Fig. 5, the nozzle 26 of the incoming passageway 24 is provided with a plug 48 having a small central passageway therethrough. From an inspection of this figure in connection with Fig. 3 it will be seen that when the valve occupies a closed position, enough of the fuel may flow from the entrance passageway 24 through the plug 48 to the exit passageway 32 to insure against the burner being extinguished.

It has heretofore been stated that the present invention aims to combine with the means for controlling, through variations occurring in steam pressure within the radiator, the entrance of fuel to the radiator, an additional means for governing thermostatically the admission of fuel.

To permit steam pressure to actuate the valve, the base section 30 of the valve chamber is provided with a passageway 50 (Fig. 4) leading into the interior of the radiator. This passageway is formed in a screw-threaded plug 52 which serves to hold the control device in assembled position within the radiator.

In the operation of this latter feature of the invention, pressure variations of a predetermined magnitude pass through the passageway 50 and engage the rear of the flexible valve 36, moving the latter into engagement with the open end of the entrance passageway 24. It will be appreciated that the size of the opening 50, the linear coefficient of expansion of the thermostatic element 40, and the degree of flexibility of the valve 36 are all factors in determining the predetermined magnitudes of pressure and temperature which will cause the valve 36 to seat itself and the supply of fuel to be diminished.

Turning now to Fig. 8, there is shown a somewhat modified type of structure in which the thermostatic element 40 takes the form of a bi-metallic disk which, upon being heated, flattens out and presses, by means of a button 54, the valve 36 into engagement with the open end of the entrance passageway 24, in exactly the same manner that has hereinbefore been described with reference to the earlier figures.

It is to be understood that, although this invention has been illustrated and described in connection with a gas-fired steam radiator (shown in the drawings as a vented radiator) the invention may be employed with equal feasibility and success in connection with heaters of different kinds and types, and is not to be limited to the style of heater illustrated. Furthermore it is to be understood that changes and modifications in design and construction may from time to time be made by those skilled in the arts without departing in the slightest from the true scope of the invention as set forth in the appended claims. As an example of such a modification, the range of movement of the valve 36 may be so increased that it will vary the incoming supply of fuel upon any desired degree of change of temperature pressure conditions within the radiator, thereby providing a precise and delicate control.

Having described the invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A radiator of the class described, having, in combination, a burner, a conduit for supplying fuel to the burner, a valve in the conduit for governing the amount of fuel supplied, a thermostatic element associated with the valve and adapted to be acted upon by heat variations within the radiator to control the operation of a valve, and a passageway leading from the valve chamber into the interior of the radiator whereby pressure variations within the radiator are transmitted to the valve.

2. A heater of the class described, comprising, in combination, a burner, a conduit for supplying fuel to the burner, a valve for governing the passage of fuel through the conduit, a thermostatic element associated with the radiator and adapted to close the valve when a predetermined degree of heat is generated within the radiator, a passageway leading into the valve chamber for communicating to the valve pressure variations occurring in the radiator, and means for by-passing a small amount of fuel around the valve when the latter is closed whereby extinguishment of the burner is prevented.

3. A device for controlling the fuel supply in radiators and the like comprising, in combination, a fuel entrance passageway, a fuel exit passageway, a flexible diaphragm member normally disposed in spaced relationship to the open end of one of the passageways and responsive to variations in temperature and pressure in the radiator to close the open end of said passageway.

4. A device for controlling the fuel supply in radiators and the like comprising, in combination, a fuel entrance passageway, a fuel exit passageway, a concavo-convex flexible diaphragm member normally disposed in spaced relationship to the open end of one of said passageways, and means for contracting the diaphragm into a position closing the open end of said passageway, said means comprising an expansible bar and a cup-shaped member adapted to be moved upon expansion of the bar; the cup-shaped member having a rim for engaging the marginal portion of the diaphragm, and a seat to be engaged by the expansible bar.

5. A radiator of the class described, having, in combination, a burner, a conduit for supplying fuel to the burner, and a valve interposed within the conduit for governing the amount of fuel delivered to the radiator, said valve comprising, a casing, and control means within the casing responsive to changes in temperature and pressure within the radiator.

6. A radiator of the class described, comprising, in combination, a burner, a conduit for supplying fuel to the burner, and control means for governing the amount of fuel delivered to the burner through the supply conduit, said control means being responsive to variations in both temperature and pressure occurring within the radiator and comprising a heat responsive device located interiorly of the radiator.

Signed at Chicago, Illinois, this 2nd day of December, 1929.

GLEN C. CARNAHAN.

F. L. RICE.

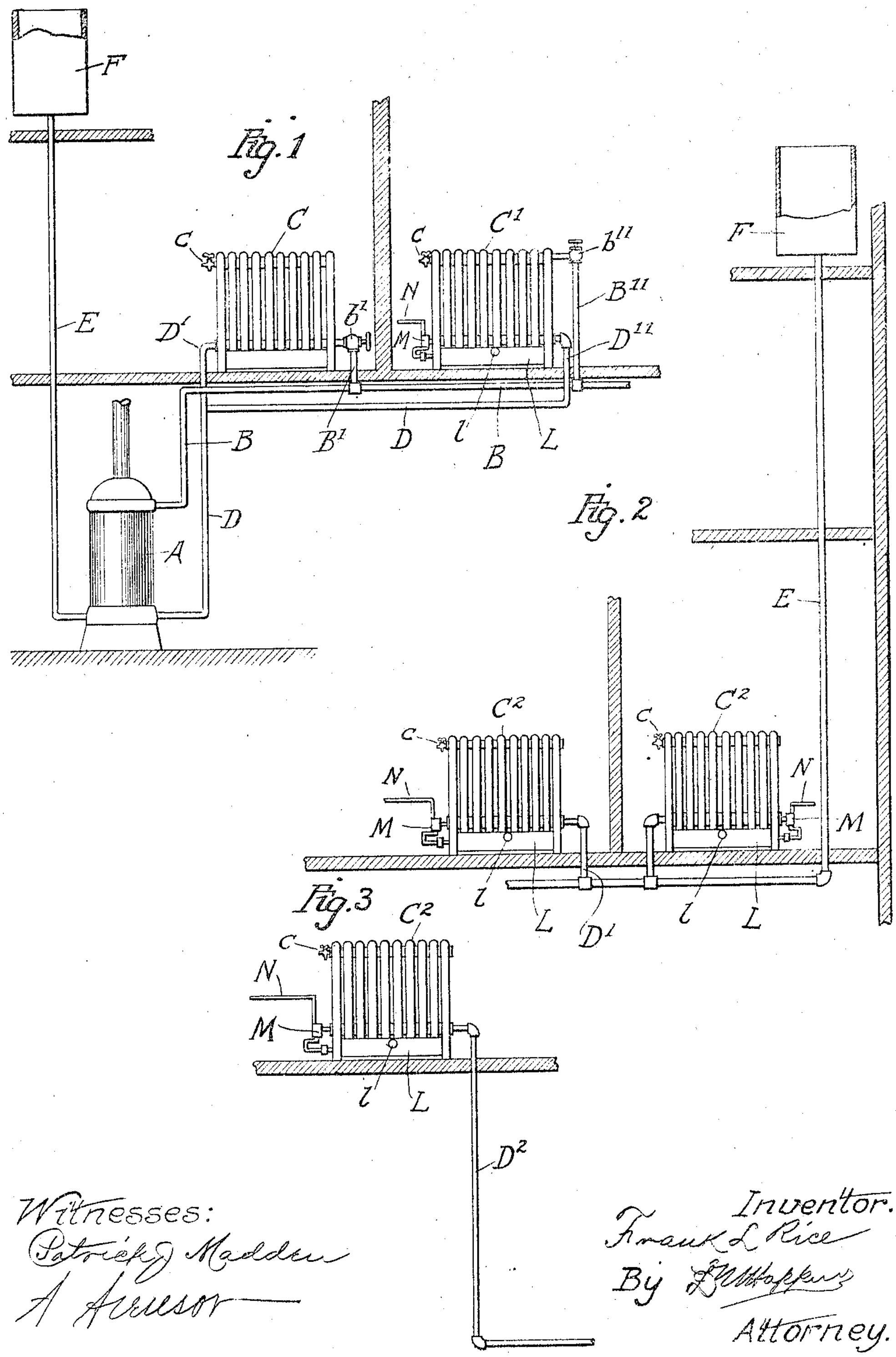
HEATING SYSTEM.

APPLICATION FILED MAY 13, 1909.

1,057,454.

Patented Apr. 1, 1913.

2 SHEETS—SHEET 1.



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HEATING SYSTEM.

APPLICATION FILED MAY 13, 1909.

1,057,454.

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2 SHEETS—SHEET 2.

Fig. 4

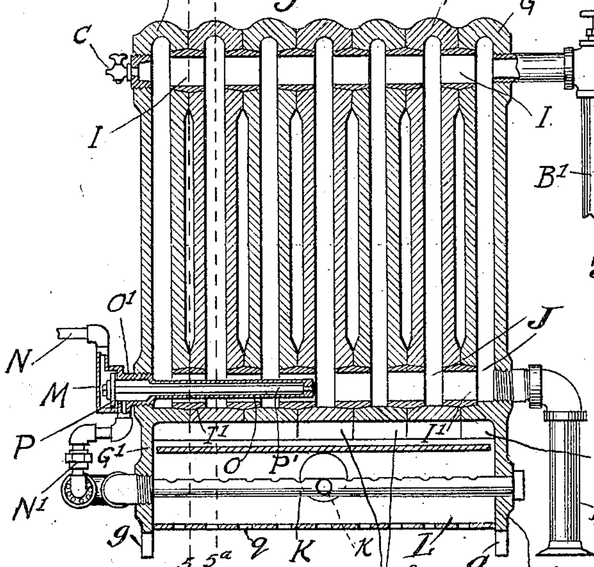


Fig. 6

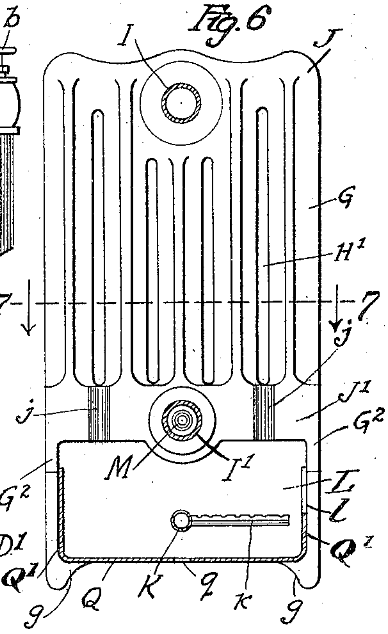


Fig. 5.

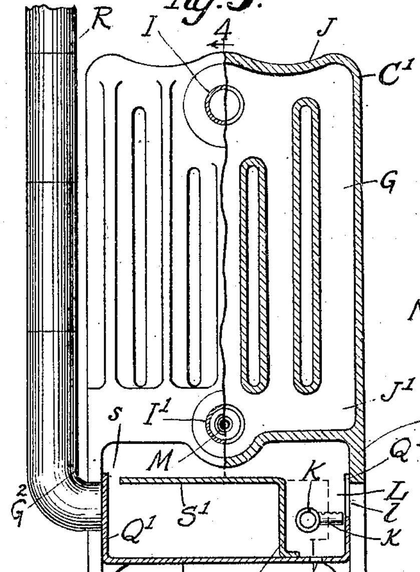
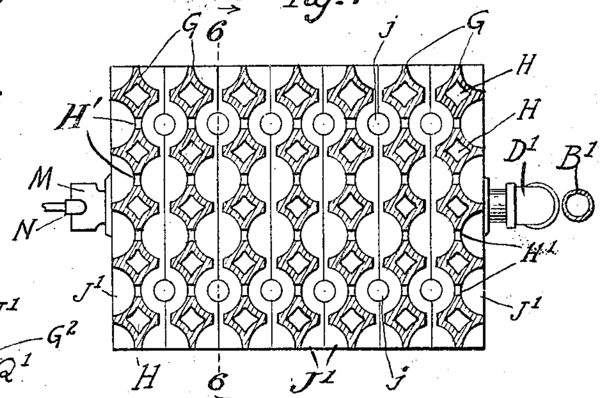


Fig. 7



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UNITED STATES PATENT OFFICE.

FRANK L. RICE, OF CHICAGO, ILLINOIS, ASSIGNOR TO JAMES B. CLOW & SONS, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

HEATING SYSTEM.

1,057,454. Specification of Letters Patent. Patented Apr. 1, 1913.

Application filed May 13, 1909. Serial No. 495,592.

To all whom it may concern:

Be it known that I, FRANK L. RICE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Heating Systems, of which the following is a specification.

In its entirety, the present invention relates to a system, including radiators, for heating a building by the use of either steam or hot water as a circulating medium.

Generally stated, the invention relates in part to the system as a whole, and in part to the construction of radiators adapted for use in the system for accomplishing the general object of the invention which is to automatically regulate the temperature of each radiator independently of every other radiator of the system.

While, as before stated, the invention in its entirety relates to both the system and the construction of the radiators, the present application covers, by its claims, only the novel features of the system, the novel features of the radiator being made the subject of and covered by a companion application filed July 29, 1911, Serial #641,338.

I am aware that prior to my invention it was old to provide a heating system, in which either steam or hot water could be used as a circulating medium, comprising a main heater or boiler (hereinafter called a boiler) one or more radiators located at any desired points, a system of pipes including a supply pipe leading from the top of the boiler to the radiator or radiators return pipes leading from the radiator or radiators back to the lower portion of the boiler, an expansion tank communicating more or less directly with radiator or radiators and a gas burner arranged in proximity to each of the radiators for heating it, such systems being provided with valves for controlling the circulation of the heating medium. With such a system any one of the radiators may be heated from the main boiler alone, independently of its individual gas heater, or it may be heated by its individual gas heater independently of the boiler or it may be heated both by the boiler and its individual gas heater and by handling or manipulating the system in these various ways the temperature of each radiator may be controlled within certain limits. For example, in mild or chilly weather when it is desired to take the chill off of a particular room, the radiator in it may be heated by its individual gas heater, without making use of the main boiler. Again in moderately cold weather, when it is desired to heat practically the whole building at an equable temperature, the main boiler may be used without making use of the gas heaters of individual radiators. Again there may be and usually is a room (or rooms) of a building which in extremely cold weather is not adequately heated by the main boiler and in such cases the heating of the radiator in it by the main boiler may be augmented by the additional use of its individual gas heater. But even with these provisions, all of which must be controlled manually and none of which is automatic, it is impossible to uniformly maintain any given room at a given temperature and prevent its fluctuation.

I am also aware that the main boilers in such systems have been provided with thermostatic regulators of various constructions directly exposed to and regulated by the temperature of the circulating medium in the boiler and as a result of this the temperature of the circulating medium as it enters the system is regulated and will be more or less uniformly maintained throughout the entire system, disregarding the gradual dissipation of the heat of the circulating medium as it travels out from and back to the boiler. But even with such a regulator there is no provision for separately and independently regulating the temperature of each individual radiator, in order to meet the requirements and conditions which exist in the different rooms in which the radiators are placed respectively. Furthermore whether the boiler be provided with a regulator or not, it is seldom desirable in only chilly weather to maintain heat in the boiler, because this necessarily entails a waste.

I am also aware that in heating systems in which a number of radiators without individual heaters were incorporated in a system of circulating pipes leading out from and back to the boiler whereby all of said radiators were heated by steam generated in the boiler it was old to provide each radiator with an individual thermostatic regulator whereby the temperature of the radiator as produced by the heater was automatically regulated. But so far as I am aware such system had no provision for either entirely dispensing with the use of the boiler and individually heating any given radiator.

I am aware that individual radiators, having no provision whatever for incorporating them in a circulating system, have been provided with individual heaters or gas-burners both with and without automatic regulators operated by fluid-pressure, for controlling the supply of fuel to the burners and that in those cases where such pressure-operated regulators were used, they were directly exposed to and operated by the pressure of the fluid in the radiator itself, so that the pressure of the fluid varied with its temperature, and, in turn, regulated the quantity of fuel supplied to the burner, so that the regulator was operated by pressure produced by the expansion of a fluid as distinguished from being operated by the pressure produced by the expansion of the thermostatic element of the regulator, said element, according to the present invention, being in direct contact with the heat circulating medium within the radiator.

While admitting all the foregoing, still, I believe myself to be the first to propose to provide a heating system having a system of pipes, a plurality of radiators and an expansion tank incorporated in said pipe system, each radiator having an individual heating burner located in proximity to it and a thermostatic regulator directly exposed to and operated by the circulating medium within the radiator for automatically controlling the supply of gas or other combustible fluid to the burner whereby the temperature of the radiator is self-regulated and whereby the radiator may be used in either of three ways, namely; first, by supplying it with heat from the main boiler alone; second, by supplying it with heat from its individual heater alone; third, by supplying it with heat by both the main boiler and its individual heater together.

To provide a practical and efficient radiator that will meet all of these requirements is the object of the present invention and to this end the said invention consists in the features of novelty that are hereinafter described with reference to the accompanying drawings, which are made a part of this specification, and in which:

Figure 1 is an elevation of a heating system adapted for use with either steam or hot water as the circulating medium, in which two radiators, one of which has all of the several features of the invention, are incorporated. Fig. 2 is a heating system of modified construction in which two radiators embodying the invention are incorporated. Fig. 3 is an elevation of a heating system under still another modification in which only one radiator embodying the invention is incorporated. Fig. 4 is a vertical longitudinal section, on a larger scale, of a radiator embodying the invention in its preferred form, the plane of the section being indicated by the line 4—4, Fig. 5. Fig. 5 is a vertical transverse section thereof in two planes which are indicated by the lines 5—5 and 5^a—5^a, respectively, Fig. 4. Fig. 6 is a vertical section of a radiator of modified construction and embodying only some features of the invention, the plane of the section being indicated by the line 6—6, Fig. 7. Fig. 7 is a horizontal section thereof on the line 7—7, Fig. 6.

The system shown in Fig. 1 comprises a main heater or boiler, A, a supply pipe, B, leading from the upper part of the boiler and connected through branch pipes, B′ and B″, with one or more radiators, C and C′, located upon a floor or level higher than that of the boiler, a return pipe, D, leading from the bottoms of the radiators to the bottom of the boiler, a pipe, E, leading upward from the bottom of the boiler, and an open expansion tank, F, located at a level higher than the highest radiator, with which the pipe, E, communicates. The radiators of the system shown in Fig. 1 are of different constructions and are differently connected up in the circulating system. In the case of the radiator, C, the branch supply pipe, B′, enters the bottom of the radiator and is provided with a valve *b′*, while in the case of the radiator C′ the branch supply pipe B″ enters the top of the radiator and is provided with a valve *b″*. In both instances the branches D′ and D″, respectively, of the return pipe D lead from the bottoms of the radiators and in the case of the radiator C the supply and return branches enter the radiator at opposite ends, respectively, while in the case of the radiator C′ they both enter the radiator at the same end. These are, however, details with which the present invention is not concerned and here it may be observed that either steam or hot water may be used as a circulating medium with either of these two forms of radiators.

The system shown in Fig. 2 differs from that shown in Fig. 1 in that it has provision for only a single pipe connection, D^2, and this pipe connection forms a continuation of the pipe E leading to the elevated expansion tank F, no main boiler being used either in the pipe connection between the radiator and the expansion tank, or elsewhere.

The system shown in Fig. 3 has but a single radiator C^2 precisely like those shown in Fig. 2 and the single pipe connection with the radiator leads to a street main, or other source of water supply, under pressure, no elevated expansion tank being used. In each instance the radiator is provided at the top with a vent valve *c* of any desired construction which valve is manipulated in such manner as may be necessary in order to meet the requirements accordingly as steam or hot water is used as a circulating medium. In each instance the return pipe will permit the back-flow of water from the radiator in order to compensate for any injurious excess pressure that may be produced within the radiator as a result of over heating, and hence each of the pipe connections, D′, D″ or D^2, as the case may be, has more than one function. The pipe connections D′ and D″ of Fig. 1 serve as a return pipe in a continuous circulating system and also as a relief pipe for compensating for excess pressure. In the latter instance the water will be forced out of the radiator at the bottom thereof into and through the main boiler and thence upward to the expansion tank. The pipe connections D^2 of the systems shown in Figs. 2 and 3 serve as inlets into the radiators and also as relief pipes, the water expelled from the radiators in the system shown in Fig. 2 being forced back into the pipe connection with the elevated expansion tank, while in the system shown in Fig. 3 it is forced back into the supply main so that in neither instance can the pressure in the radiator exceed the pressure of the hydrostatic column produced by the elevated expansion tank or the pressure in the water supply main.

The form of radiator which is preferred in carrying out the present invention, is that shown at C′ in Figs. 1, 4 and 5. Its provision for pipe connections enables it to be used in any of the systems above described, and when properly equipped with its individual heater and with its individual thermostatic regulator the temperature of each and every room may be individually regulated to a nicety. It is made up of a number of loops or sections, G, each of which comprises one or more hollow columns, H, and the several sections are connected at top and bottom respectively through the medium of sleeves or nipples I and I′. Where each section comprises more than one column the columns of each section are connected at top and bottom respectively by headers J and J′ thereby providing for a complete circulation of the circulating medium within the radiator. The several sections have vertical openings, H′, between the several columns so as to facilitate the circulation of air around the several columns for the purpose of carrying off the heat radiated by them.

Each of the individual heaters above mentioned has a gas burner, K, arranged beneath the radiator, a combustion chamber, L, in which the gas burner is located and a thermostat, M, controlled by the temperature of the radiator for in turn controlling the temperature of the radiator itself by regulating and controlling the supply of gas to the burner, the gas being supplied to the burner by a pipe N—N′. The thermostat is constructed of a tube, O, closed at its inner end and having at its outer end an enlarged casing, O′, which carries a seat for a valve, P, between the branches N and N′ of the gas supply pipe. This valve is carried by a rod, P′, located in the interior of the pipe or tube O and has its inner end permanently secured to the inner end of the said tube or pipe, the tube or pipe O and the rod P′ being made of materials of different expansibility, the tube being of greater expansibility and more sensitive to the heat than is the rod, so that, the tube being permanently secured at its outer end to the end section of the radiator, its expansion and contraction will carry the rod inwardly and outwardly, and thereby move the valve toward and from its seat, respectively. The thermostat thus constructed preferably enters the lower header J′ of the end section of the radiator and passes into and through any desired number of the nipples I′ which connect the lower headers, but the invention, in its broadest aspect, is not limited to a thermostat of this particular construction, arrangement or location. On the contrary, the invention comprehends, in its broadest aspect, a thermostat of any construction, arrangement or location so long as it is directly exposed to the heat of the radiator for controlling the flow of gas to the burner whereby the temperature of the radiator is self regulated.

The burner itself consists of a tube arranged longitudinally beneath the lower headers of the several sections of the radiator and provided with perforations for the escape of gas, at which the gas burns, the burner being preferably provided with an igniting jet *k*, at which the gas is ignited through an opening *l* in the front of the combustion chamber.

Preferably the combustion chamber is constructed as shown in Figs. 4 and 5. As there shown the lower headers J′ have flat vertical meeting surfaces and their under surfaces which are flush with each other throughout the entire length of the radiator, form the top wall of the chamber. The end sections of the radiator have depending webs G′ which form the end walls of the chamber, and the several intermediate sections have at front and back depending webs G^2, which form the upper portions of the front and rear walls of the chamber. The bottom of the chamber is formed by a sheet metal plate Q which is provided, beneath the burner, with a series of perforations *q* for admitting atmosphere to the burner, and the bottom sheet has upwardly extending portions Q′ which lie against the inner surfaces of the webs G^2 and complete the front and rear walls of the chamber, lugs *g* being formed on the webs G′ of the end sections, at front and back, to form supporting feet and also to form shoulders for supporting the sheet metal plate of which the front, back and bottom of the combustion chamber are formed.

The combustion chamber shown in Figs. 6 and 7 is constructed precisely as above described, excepting that as shown in Figs. 6 and 7 the lower headers J′ are provided in their meeting faces with oppositely located grooves *j*, so that when the adjacent headers are placed in contact with each other these grooves form vertical passages through which the heated air or products of combustion may pass upward between the several sections of the radiator and thereby increase the surface exposed to the heated products of combustion which pass upward through said passages and between the several columns of the radiators and eventually escape from the radiator into the room, while as shown in Figs. 4 and 5 the lower header-sections have bottom surfaces that are flush with each other, as above described, so that the heated products of combustion cannot escape upward through the radiator. In this instance the products of combustion are carried off by a stack or flue R communicating with the back of the combustion chamber. If the burner were centrally located where the exhaust stack or flue is used, the tendency of the exhaust flue would be to draw the heated products of combustion directly away from the burner and thereby prevent its intimate contact with the bottoms of the lower header-sections. To prevent this the burner is located near the front wall of the combustion chamber and a deflector of appropriate shape is arranged between it and the intake end of the flue. This deflector comprises a vertical portion S in the nature of a bridge wall located immediately behind the burner and a horizontal portion S′ extending from the top of the bridge wall, rearward, to within a short distance of the wall of the combustion chamber, leaving a slight space *s* through which the products of combustion may pass downward from the space above the deflector in order to reach the flue.

What I claim as new and desire to secure by Letters Patent is:

1. A heating system having, in combination, a system of circulating pipes and, incorporated therein, a main boiler, an expansion tank, and a plurality of radiators, an individual heater arranged in proximity to each of said radiators, and a thermostatic regulator for controlling the supply of fuel to each of said individual heaters, said thermostatic regulators being located in proximity to their respective radiators so as to be directly exposed to and operated by the heat thereof, whereby the temperature of the radiator is self-regulative.

2. A heating system having, in combination, a system of circulating pipes and, incorporated therein, a main boiler, an expansion tank, and a plurality of radiators, an individual heater arranged in proximity to each of said radiators, and a thermostatic regulator for controlling the supply of fuel to each of said individual heaters, the thermostatic elements of the regulators being in direct contact with the heat circulating medium within the radiators, respectively, whereby the regulator responds quickly to changes in the temperature of said circulative medium.

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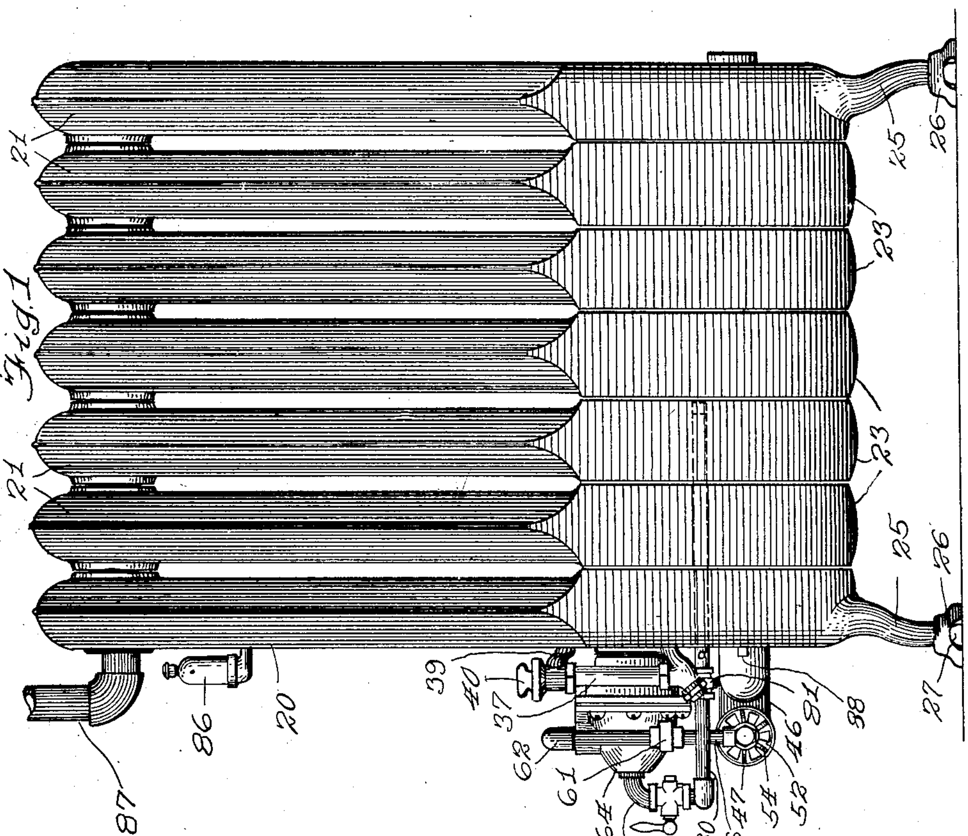
F. L. RICE.

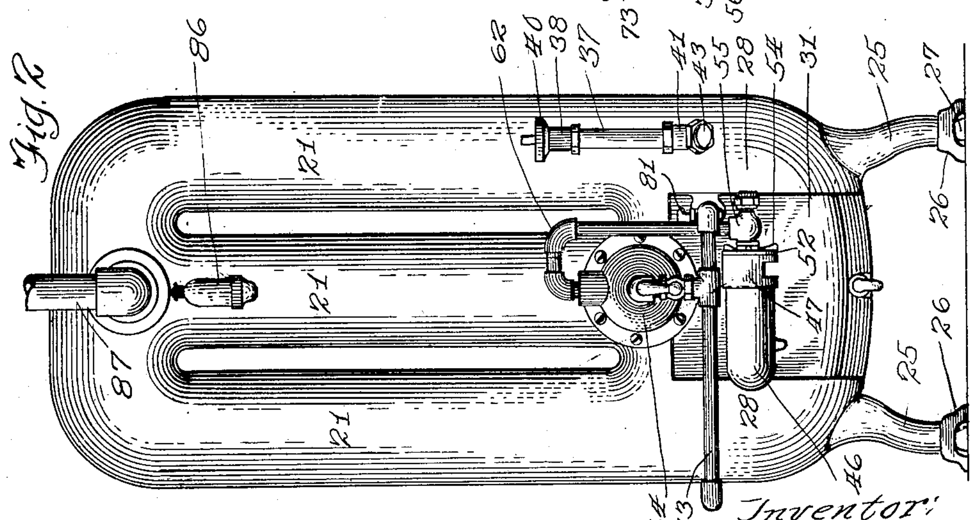
RADIATOR.

APPLICATION FILED DEC. 11, 1915.

1,342,509. Patented June 8, 1920.

4 SHEETS—SHEET 1.





Inventor:
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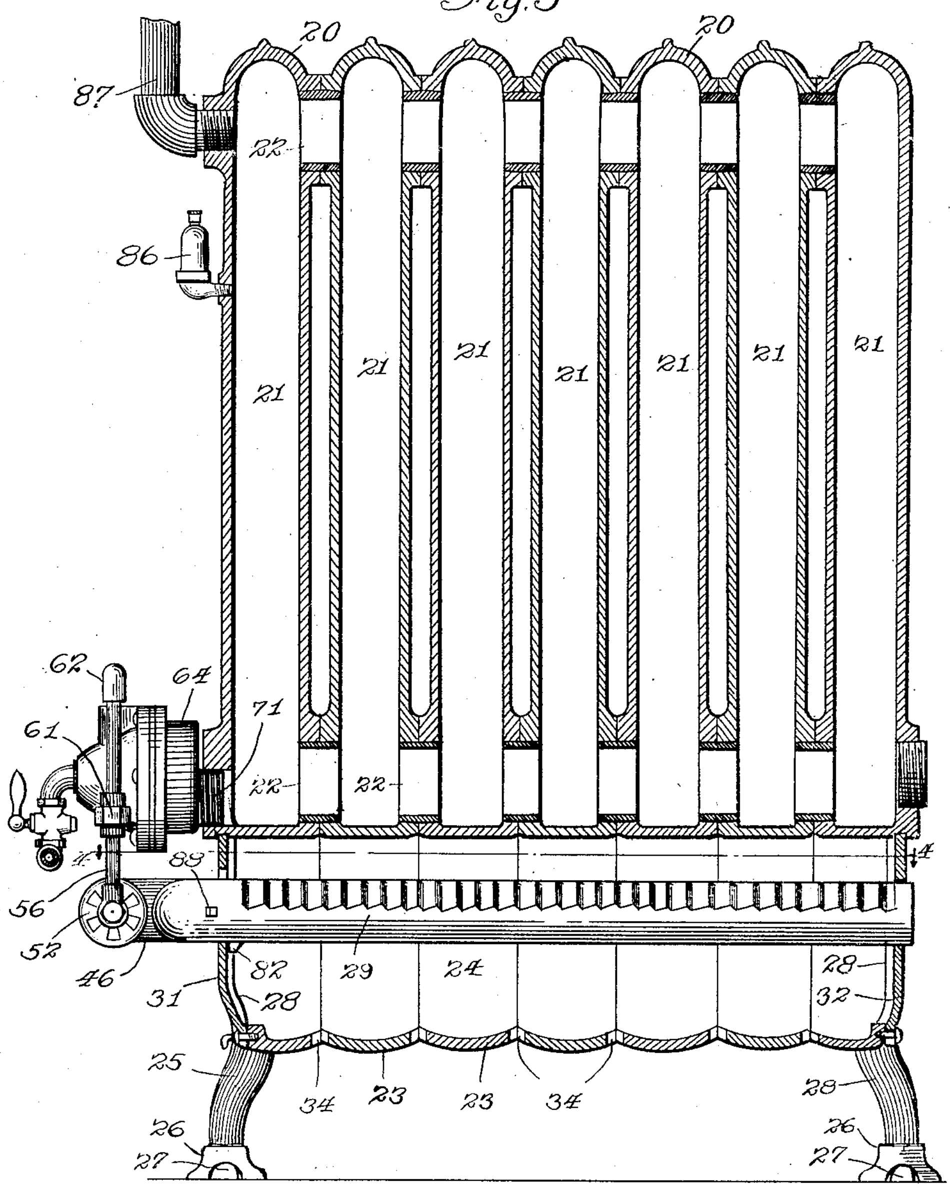
By Heidman & Street
Att'ys.

F. L. RICE.
RADIATOR.
APPLICATION FILED DEC. 11, 1915.

1,342,509. Patented June 8, 1920.

4 SHEETS—SHEET 2.

Fig. 3



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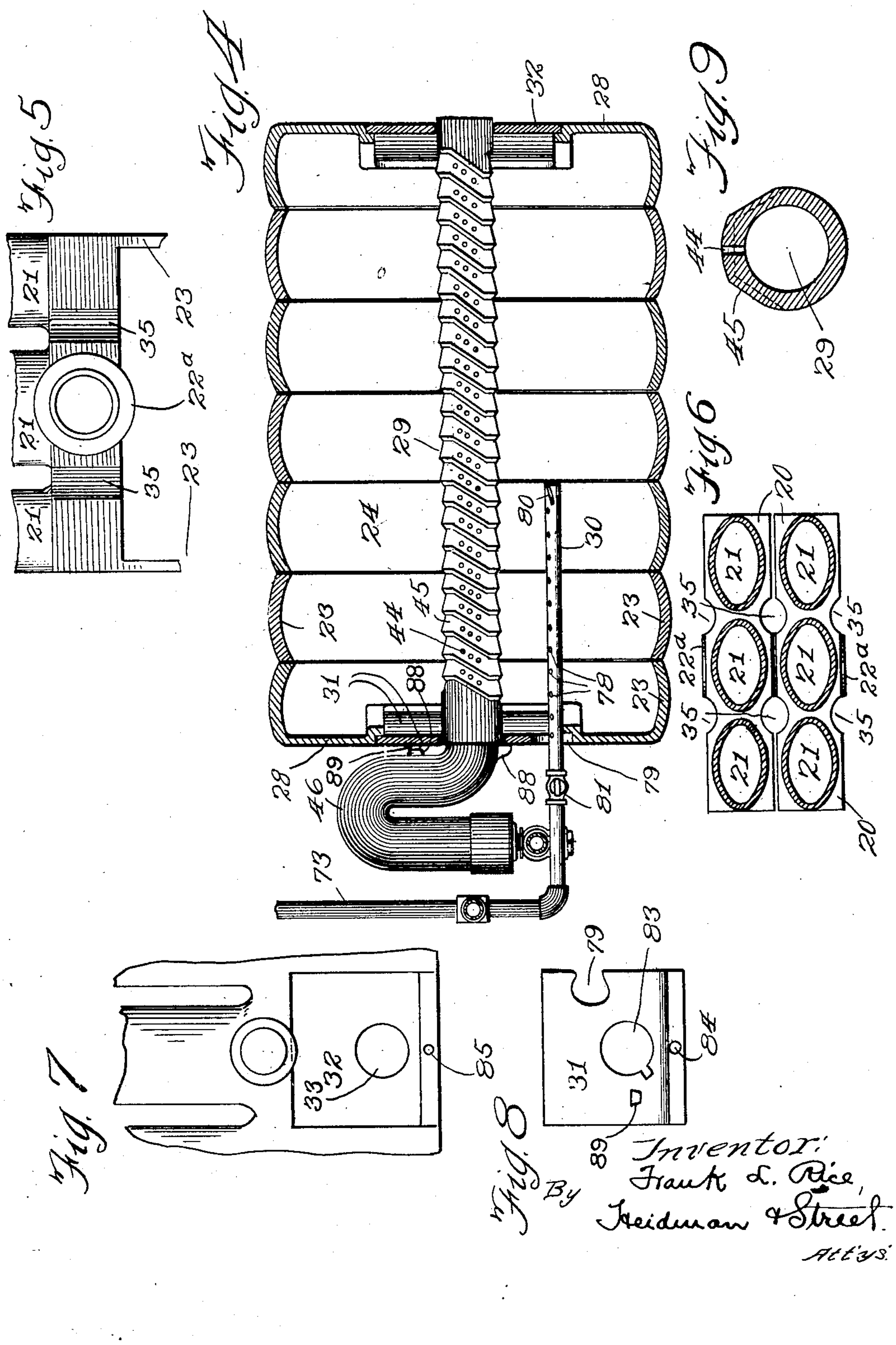
APPLICATION FILED DEC. 11, 1915.

1,342,509. **Patented June 8, 1920.**

4 SHEETS—SHEET 3.



F. L. RICE.
RADIATOR.
APPLICATION FILED DEC. 11, 1915.

1,342,509. **Patented June 8, 1920.**

4 SHEETS—SHEET 4.

Fig. 13

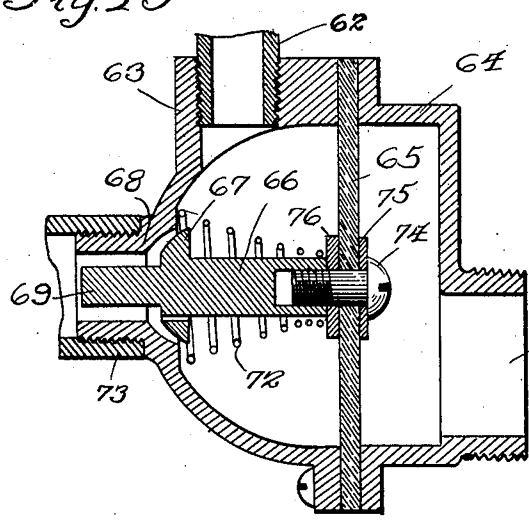


Fig. 14

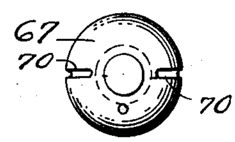


Fig. 10

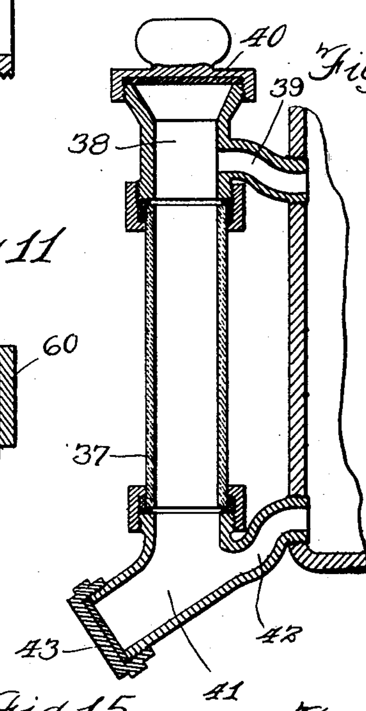


Fig. 11

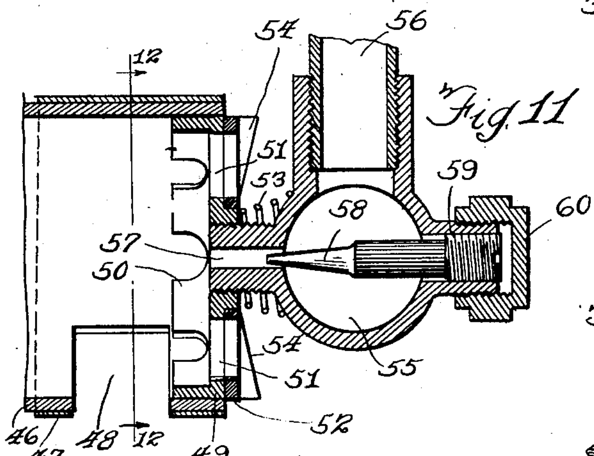


Fig. 12.

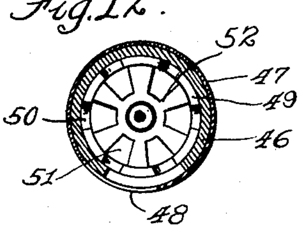


Fig. 15

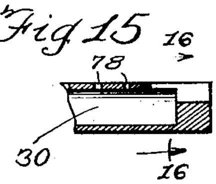
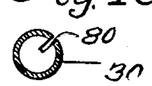


Fig. 16



Inventor.
Frank L. Rice,
By Heidman & Street
Attys

UNITED STATES PATENT OFFICE.

FRANK L. RICE, OF CHICAGO, ILLINOIS, ASSIGNOR TO JAMES B. CLOW & SONS, A CORPORATION OF ILLINOIS.

RADIATOR.

1,342,509. Specification of Letters Patent. **Patented June 8, 1920.**

Application filed December 11, 1915. Serial No. 66,289.

To all whom it may concern:

Be it known that I, FRANK L. RICE, a citizen of the United States, and resident of Chicago, in the county of Cook, and State of Illinois, have invented certain new and useful Improvements in Radiators, of which the following is a description, reference being had to the accompanying drawings, which form a part of my specification.

My invention comprehends the provision of a radiator especially intended to be used independently of any other heating system, namely a radiator which, in itself, constitutes a heating unit, either as a water or steam radiator; the construction being such, however, that it may be connected up with an auxiliary radiator located at a higher level or plane and arranged to receive the heating medium from the first mentioned or main heating unit.

A further object of my invention is to provide a radiator or heating unit of the type mentioned adapted more especially for the employment of gas as a fuel; with the combustion chamber formed integral with the radiator and so constructed as to obviate the tendency to "back flash," and whereby a more perfect combustion is obtained.

Another object of my invention is to provide a construction wherein the burner will induce the air which enters the combustion chamber to circle or flow about the burner in such manner as to obtain a very efficient mixture of the air with each individual gas-jet or flame issuing from the burner; the burner and combustion chamber being so constructed as to not only permit ready access to the chamber, but also enable the easy removal of the burner when occasion requires, without dismantling or in any way interfering with the radiator proper.

A further object of my invention is to provide a construction having flues or ports for the passage of the heat-units from the combustion chamber, whereby the heated air is allowed to pass about the respective sections of the radiator so as to obtain a more efficient heating unit devised to provide a maximum quantity of heat with a minimum quantity of gas or fuel; the heat-unit conducting-flues or ports being so arranged as to be completely surrounded by the water-containing portion of the radiator; while the supporting members or pedestals for the radiator are so constructed that they will permit complete circulation of air therethrough, and therefore will be air-cooled, so that scorching or injury of the floor will not result.

My invention also contemplates a construction wherein the supply of fuel or gas will be automatically regulated by the pressure of the heating medium within the radiator, in which the means, whereby the radiator or heating unit is supplied with water, is so formed as to not only enable the operator to determine the water-level within the radiator, but will also permit the radiator to be easily and thoroughly drained and cleaned.

The above enumerated purposes and advantages, together with other advantages inherent in the construction, will be more fully comprehended from the following detailed description of the drawings wherein:—

Figure 1 is a side elevation of my improved construction, shown provided with a portion of a pipe which may or may not be employed for connection with a radiator located at an upper level.

Fig. 2 is an end elevation of the construction shown in Fig. 1, looking at the same from the left hand or mixing chamber side thereof.

Fig. 3 is a vertical sectional view of the construction shown in Fig. 1.

Fig. 4 is a cross-sectional view taken on the line 4—4 of Fig. 3, looking downwardly.

Fig. 5 is a detail view illustrating the lower header and a portion of a radiator-section; with the combustion chamber wall shown partly broken away.

Fig. 6 is a sectional plan view taken transversely through a pair of the radiator-sections, in order to more clearly disclose the construction of the heat-unit passages or flues disclosed in Fig. 5.

Fig. 7 is a detail view in elevation of a portion of a section and one of the end plates for closing the end of the combustion chamber, towit, the plate at the right hand side in Fig. 4, which may be termed the outer end plate.

Fig. 8 is a detail view of the end plate for the opposite end of the combustion chamber, namely the plate for closing what may be termed the inner or mixing-chamber end.

Fig. 9 is a cross-sectional view of the burner.

Fig. 10 is a detail view of the water glass, inlet and drain; the same being shown in vertical section.

Fig. 11 is a detail sectional view of the inlet end of the mixing chamber showing *the gas and air-regulating valves.*

Fig. 12 is a sectional view in elevation of the mechanism shown in Fig. 11, taken on the line 12—12 of Fig. 11, looking in the direction of the arrows.

Fig. 13 is a cross-sectional view of the fuel or gas supply controlling means.

Fig. 14 is a detail view of the fuel or gas supply-controlling valve disclosed in Fig. 13, shown in front or end elevation.

Fig. 15 is a detail sectional view of one end of the pilot.

Fig. 16 is a sectional view taken on the line 16—16 of Fig. 15, looking in the direction of the arrows.

In the particular exemplification of my invention as disclosed in the drawings, the heating unit or radiator comprises a series of sections 20, each of which preferably consists of a plurality of vertically disposed columns; the sections disclosed in the illustration comprising three columns 21 which unite both at the top and bottom by means of suitable headers.

Each section 20, both at its top and bottom, is provided with openings, at a central point intermediate of the sides of the sections, arranged to receive suitable nipples 22, 22 whereby communication between adjacent sections is effected both at the top and bottom of the sections, thus providing a radiator or heating unit adapted for use either as a hot water heater or steam heater.

Each section 20 comprises an integral casting provided at its bottom with a substantially semi-circular extension 23, formed integral with the section, so that the grouped or assembled sections with their respective extensions will provide a combustion chamber 24 integral with the radiator or heating unit. All of the sections are similar in construction with the exception, of course, of the end sections, which are provided with the standards or legs 25, 25, preferably formed integral with the lower combustion chamber extension of the end sections, so as to support the radiator or heating unit at a level above the floor; the standards or legs 25, in the particular exemplification of my invention, being shown supported by pedestals 26. The pedestals 26 are provided with channels 27 passing therethrough so as to permit air to pass through the channels and about the pedestals, thereby providing what may be termed air-cooled pedestals, see Figs. 1 and 2.

The end sections are provided with an outer side wall 28, 28 for closing the ends of the combustion chamber 24. These side walls 28 are provided with suitable openings to permit of the insertion of the burner 29 and pilot 30; the openings in the end walls 28 being closed by suitable end-plates 31 and 32, respectively, as disclosed in Figs. 8 and 7; plate 31 being intended for the opening *in the outer side wall 28 through which the* burner is inserted, while end-plate 32 is intended for the opening in the outer side wall 28 of the opposite end section; being provided with suitable means for supporting the end of the burner, as, for example, the opening 33, shown in Fig. 7, which receives the end of the burner, as shown in Figs. 3 and 4.

The combustion chamber extensions 23 of the respective sections 20 are each provided with grooves or notches 34, see Fig. 3, preferably arranged in the sides or abutting edges of the extensions, where the notches in the different sections will register with the notch or groove in the adjacent combustion chamber extension and thereby provide a series of air openings in the bottom of the combustion chamber, as shown.

The nipple-receiving openings in the bottom headers of the respective sections may be surrounded with slight ridges or ribs, as can be seen at 22ᵃ in Fig. 5, so as to maintain the sections in a slightly separated relation, as shown more clearly in Fig. 6. With this construction, additional inlets for air to the combustion chamber are not only provided, but space between the headers of adjacent sections for the upward passage of the heat-units is obtained, so that the headers or water-containing portions of the sections will be more quickly heated.

The wall of the bottom header of each section 20 is provided with one or more vertically disposed grooves 35, as shown in Fig. 5; the grooves 35 of adjacent sections arranged to register with each other so as to provide vertically disposed flues indicated at 35 in Fig. 6. The flues 35 convey the heated air from the combustion chamber upward around the columns of the sections, thereby assisting in the rapid heating of the water. With the flues arranged at the point described, they are surrounded by a water-space or jacket, as shown in Fig. 6; a flue being arranged intermediate of each column, as disclosed in Figs. 5 and 6.

One of the end sections 20 is provided with a combination water-glass, filling cup and drain, for the purpose of supplying the radiator with a suitable quantity of water, and in order that the state or stage of the water can always be determined. This combined member is preferably secured to the wall of the lower header of one of the outer sections, and comprises the glass-portion 37, removably secured to the inlet casting or cup 38, which communicates with the lower header of the radiator, by means of the tube-portion 39, see Fig. 10; with the outer end of the member 38 being closed by a suitable cap 40 preferably arranged to screw into place.

The lower end of this combination member is provided with a casting or member 41 having a tube-portion 42 which communicates with the lower portion of the lower header of the outer or end-section 20 of the radiator. The lower end of member or casting 41 is preferably offset in the sloping manner, shown in Fig. 10, so as to bring its orifice into a plane beneath the plane of the lower portion of the bottom header of the radiator, and at the same time substantially in line or parallel with the tube-portion 42 in order to permit the insertion of a wire or other suitable means for cleaning out the radiator or bottom header thereof. By placing the orifice of member or casting 41, as described, the radiator may be completely drained of all its water and thoroughly cleaned. The outer end or orifice of member or casting 41 is normally closed by a suitable cap 43 arranged to screw onto the outlet end of member 41, as shown.

The burner 29, more clearly shown in Figs. 3 and 4, has its elongated or straight portion provided with a series of perforations 44 arranged in groups, as shown in Fig. 4, the perforations being preferably arranged in the offset or staggered manner disclosed. Each group of perforations 44 is arranged on a different facet of the burner; the upper surface of the burner being provided with a series of facets, as shown at 45 in Fig. 4, which are preferably slightly curved, as more clearly shown in Fig. 9. The facets 45 are produced by staging or off-setting successive portions of the burner; the different stages being sloped downwardly so as to produce a serrated surface; one end of a facet being in a lower plane than the beginning or other end of the facet, as can be seen in Fig. 4. By arranging the upper and side walls of the burner, as described, a series of channels are provided which are preferably arranged in the diagonal manner shown on the upper surface of the burner so as to correspond with the offset or staggered arrangement of the various groups of perforations 44; while the facets on the sides of the burner are preferably arranged to provide grooves or channels disposed at right angles to the longitudinal axis of the burner and therefore at an angle to those on the upper surface of the burner. This construction and arrangement of the channels insures a proper flow and distribution of air, the channels inducing the air to flow along the grooves or channels formed in the walls of the burner, to-wit, along the various walls produced by the serrated formation, causing the air to mix with the various gas-jets of each group. This arrangement or construction and slight curving of the upper surface or facet causes air to mix with the intermediate jet as well as with the end jet of the respective groups.

The outer end of burner 29 terminates in an enlarged bent or goose-neck portion 46 which causes the gas to flow in a curved path before delivery to the burner proper and induces a more complete mixture of the air and gas before it reaches the series of various groups of perforations 44.

By bending the mixing chamber 46 back upon itself in the goose-neck manner shown, any tendency to flash back, either because the gas-supply is diminished, or for other reasons, will be obviated.

The inlet end of the mixing chamber 46 has its side wall provided with an enlarged slot or semi-circular opening; and the end of the mixing chamber is provided with the ferrule 47, rotatively mounted thereon. The member 47, in turn, is provided with an opening or slot 48, adapted to register with the opening at the end of the mixing chamber when the ferrule member 47 is rotated, thereby controlling the size of the air-port or inlet and providing an auxiliary air-regulating member or valve, whereby air is supplied in addition to the air valve later described. This auxiliary valve, it has been found in practice, tends to steady the flame issuing from the burner.

The inlet end of the mixing chamber 46 is provided with a main air-regulating valve, comprising the stationary member or portion 39, see Fig. 11, which is adapted to be inserted in the end of the mixing chamber 46; the flange portion of member 49, which enters the mixing chamber, being preferably notched or cut away at predetermined points, as shown at 50, for the sake of lightness in construction and at the same time so as not to interfere with the auxiliary air inlet controlled by the ferrule member 47. The member 49, on its outer face, is provided with a series of radially disposed openings 51, which are adapted to be closed or covered by the solid or spoke portions of the rotatable disk-member 52, which is firmly held against the face of the stationary member 49 by means of a suitable spring 53. The frictional relation between members 49 and 52, caused by spring 53, will maintain member 52 in its adjusted position, whereby the desired quantity of air for the mixing chamber is obtained. Member 52 is preferably provided with the wing or finger portions 54 whereby rotatable member 52 may be easily operated. It is understood, of course, that the openings in member 52, between its radially disposed spokes, are preferably of a size substantially equal to the size of the openings 51 in stationary member 49, so that the rotation of member 52 will either entirely or partially close the openings 51, depending upon the extent of rotation of member 52, thereby regulating the flow of air into the mixing chamber 46.

Concentrically arranged with the air-valve just described is a gas-inlet member 55 which is connected with a gas line 56. Gas-inlet member 55 is provided with a port 57 which is controlled by the needle-valve 58 which has screw-threaded relation with member 55, as shown at 59, so that the adjusted position of the needle-valve 58 will be maintained. After the needle-valve 58 has been adjusted, so as to permit the proper flow of gas through port 57, the screw end of needle-valve 58 is inclosed by a suitable cap 60 which is preferably screwed onto the extension of member 55, as shown in Fig. 11, so that the needle-valve 58 may not be readily tampered with.

The gas line 56 is shown connected by a suitable union 61, see Fig. 1, to the pipe 62 which connects with the regulating mechanism, shown in detail in Fig. 13. The regulating mechanism comprises a suitable housing 63 having a removable cap portion 64. Mounted between the housing 63 and cap-portion 64 is a diaphragm 65, preferably composed of resilient material such as composition rubber, and the like; the diaphragm being held in place by the same means whereby cap-member 64 is secured to the housing 63. The diaphragm 65 has secured to it at a central point a valve member 66 provided with a conical head 67 conforming to the tapered outlet end 68 of the housing 63 which communicates with pipe 62. Valve member 66 is preferably provided with an extension or stem 69 beyond the head-portion 67. The head-portion 67 is provided with several grooves or notches 70, 70, see Fig. 14, which will permit a small quantity of gas to flow from pipe 73 into housing 63 after the valve is forced to its seat by the diaphragm 65 through pressure in the radiator.

The cap-portion 64 is provided with an inlet 71, preferably offset as shown in Fig. 13, which is adapted to be connected with the adjacent radiator section, as shown in Fig. 3. As the pressure in the radiator increases, it will affect the diaphragm 65 and flex or force the same against the action of spring 72 located in the pressure mechanism housing 63, causing the valve 66, with its head 67, to be forced to its seat, thereby shutting off the flow of gas through pipe 73 except for the small quantity of gas which may continue to flow through the shallow grooves 70 in the face of the conical head 67 of the valve 66. The supply of gas, which is conveyed to housing 63 by supply-pipe 73, being shut off to the extent made possible by the valve 66, necessarily diminishes the supply of gas for the mixing chamber, reduces the flame issuing from the burner until the pressure in the radiator diminishes sufficiently to permit the diaphragm member 65 to return to the normal position, shown in Fig. 13, to which position it will also be brought through the action of spring 72.

The valve member 66 is secured to diaphragm 65 by means of the screw 74 which passes through diaphragm 65 and enters a tapped hole in the end of valve member 66; metallic washers 75 and 76 being preferably employed on opposite sides of the diaphragm, as shown in Fig. 13.

The gas supply line 73 also connects with a suitable pilot 30 which consists of the tubular member (see Fig. 4), provided with a series of perforations 78. The pilot is arranged in the combustion chamber 24, passing through the opening 79 provided in the end-plate 31, shown in Fig. 8. The inner end of the pilot 30 is closed by a suitable plug. The inner end of the pilot is also provided with a longitudinally disposed slot 80. The construction of pilot disclosed will not only provide a series of small jets issuing from the openings 78, toward the burner 29, but will also throw a long jet or flame extending toward the opposite end of the burner 29, resulting in all of the ports, or groups of ports, 44 in the burner to be quickly and simultaneously ignited, thereby obviating the escape of unconsumed gas. The flow of gas to the pilot is closed off by means of the valve 81.

By offsetting the inlet 71 in cap-portion 64, I am enabled to have the inlet opening 71 in line with the lowermost portion of the lower header of the radiator, thereby permitting the water to drain or flow out of the regulator and into the lower header, from whence it may be drained by the drain previously described, which will prevent any possibility of water remaining in the regulator where it might freeze during cold weather when the radiator is not in use.

The various sections 20 of the radiator may be brought up flush against each other, or they may be slightly separated by small bosses formed on the upper and lower headers of the respective sections, and thereby provide slight spaces or passages for the circulation of air about the respective sections and their columns. The sections of the radiator may be secured together by any suitable means, in addition to the nipples, so as to provide a rigid construction.

The end plates 31 and 32 are secured in place by means of a single screw for each plate which is intended to extend through the perforations 84 and 85 of plates 31 and 32, respectively.

It is evident from the construction shown and described that access to the combustion chamber may be readily had by simply removing the single screw in each plate which permits the end plates to be removed. The burner may also be easily taken out of the combustion chamber for cleaning, repairs, and the like, by simply unscrewing the one union connection hereinbefore referred to, namely the union connection 61. This permits the burner to be removed without in any way disconnecting the radiator or without removing either end plate of the combustion chamber.

The curved mixing chamber 46, herein described, is preferably located to the outside of the combustion chamber and insures not only the proper mixture of air and gas, but also economy in fuel.

The radiator, or rather one of the sections 20 thereof, is provided with a suitable air-valve 86, see Fig. 3, located at a proper point to permit the exit of air from the radiator without permitting leakage of steam.

I have chosen to illustrate my radiator, or rather one of the sections thereof, provided with a pipe 87, see Fig. 3, which may be employed if it is desired to convey some of the heat units or rather some of the heating medium to a radiator located on an upper level. This permits a single generating unit or radiator to provide the necessary heat for different rooms or different floor level. Where such connection is not desired, it will be understood, of course, that the pipe 87 may be eliminated and the opening in the radiator end section closed with a suitable cap or other suitable means.

The burner is shown provided with a lip or lug 82 which is adapted to pass through the notch formed in the opening 83 of end plate 31, when the burner is inserted into place. After the lug has passed through the notch the burner is partially rotated into proper position, so as to present its ports upwardly. Such movement or rotation of the burner will move the lip or lug 82 out of register with the notch and prevent the withdrawal of the burner. In order to maintain the burner in its proper position, or rather to determine the proper extent to which the same should be rotated, I provide the mixing chamber portion thereof with the lugs 88, one of which is adapted to rest on the stop or lug 89 formed on end plate 31. The lugs 88 will prevent the too far insertion of the burner, while one of the lugs 88 and stop or lug 89 prevent the too far rotation of the burner about its own axis and therefore insure the proper positioning of the burner in the combustion chamber, and also properly support the burner against any tendency to rotate by reason of the mixing chamber formation, as is clearly evident from the construction shown.

I have shown and described what I believe to be the simplest and best form of my invention, but it will be understood, of course, that the construction may be varied in certain details without, however, departing from the spirit of my invention, and I do not wish to be understood therefore, as limiting myself to the exact construction shown and described.

What I claim is:—

A radiator composed of a plurality of sections provided with hollow columns and a bottom header, each section being provided with a continuous open-sided shell formed integral with the front and rear walls of the lower part of the section and disposed beneath said bottom header so as to provide an integral sectional combustion chamber, said shell-formations being arranged to extend beyond the sides of the respective radiator-sections so as to permit the shell-formations to abut against each other, the abutting edges of said shell-formations being provided with registering notches whereby a series of air ports for said chamber are provided, the end sections of the radiator being each provided with an end wall formed integral with the open-sided shell-formation of said end sections, said end walls of the end sections being provided with openings, removable means for closing said openings, said removable means being provided with burner-receiving openings, in combination with an elongated burner arranged in said combustion chamber through said openings in said means and extending from end section to end section of the radiator, and means for supporting said burner in position.

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Witnesses:
GEORGE HEIDMAN,
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June 15, 1937. J. A. BYERS ET AL 2,083,985

VALVE CONTROL FOR GAS BURNERS

Filed Feb. 4, 1935

Fig.1.

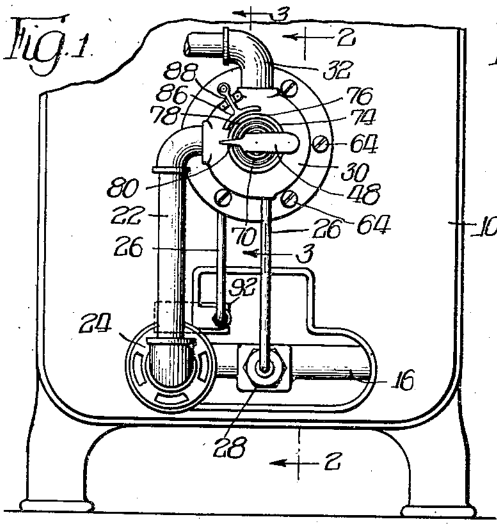


Fig.2.

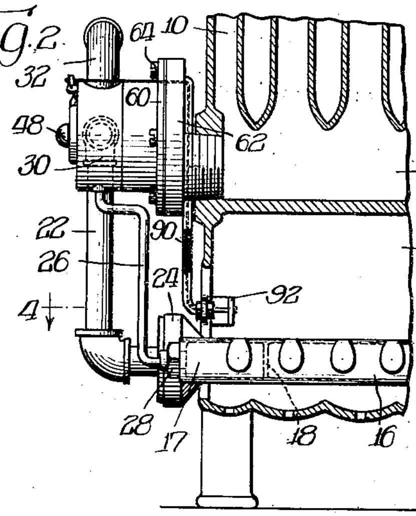


Fig.3.

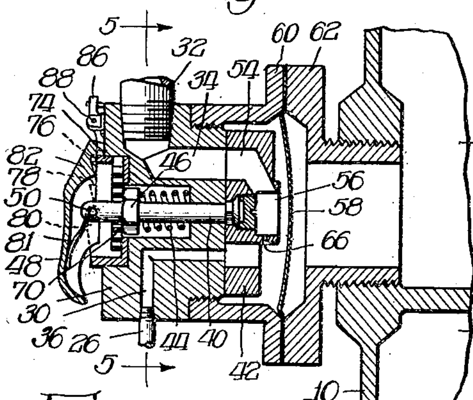


Fig.4.

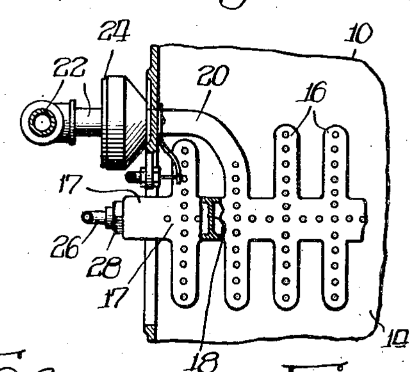


Fig.5.

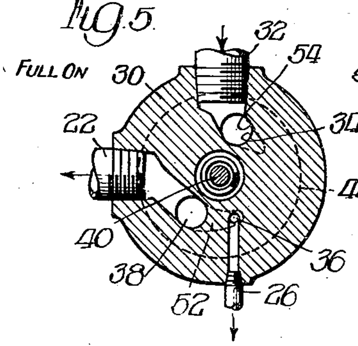


Fig.6

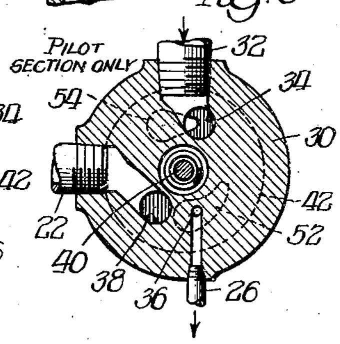
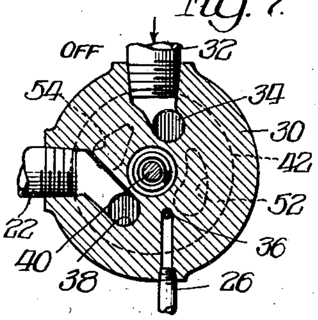


Fig.7.



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Patented June 15, 1937

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UNITED STATES PATENT OFFICE

2,083,985

VALVE CONTROL FOR GAS BURNERS

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Application February 4, 1935, Serial No. 4,764

8 Claims. (Cl. 277—51)

This invention relates primarily to gas burning steam radiators, although in some of its broadest aspects it may be suitable for gas burners used in other connections. It has long been the practice in radiators of the type described to provide a gas burner below a body of water enclosed within a radiator and to control the supply of gas to said burner by means of a diaphragm controlled by the pressure of steam within the radiator, said diaphragm operating against a port in a valve block, a small by-pass being provided to prevent the flame at the burner from being completely extinguished upon closing of the port by the diaphragm when there is a predetermined rise in pressure in the radiator.

Although this arrangement was very satisfactory for the most part, some improvement therein is desired for giving greater satisfaction during the season when the weather is quite changeable between comfortable temperatures and temperatures when substantial heat is needed. In such weather it is somewhat undesirable to keep the whole burner burning because the radiator gives off too much heat, and if the gas flow is reduced to the desired volume, suitable for mild weather, by means of a manually controlled gas cock, the small amount of gas is divided between a large number of jets, there is danger that upon a temporary drop in pressure, the flames, or some of them, will go out. The desirability of overcoming this difficulty has been recognized for some time, but the necessity of overcoming this in a manner which did not introduce additional dangers, and which was commercially feasible has heretofore prevented satisfactory solution of the problem. The possibility by confining the gas supply to a few jets to act as a pilot flame when there is no desire for substantial heat, may have been recognized, but practical and satisfactory means for accomplishing this result have not been known.

In the illustrated form, the invention includes two burner parts, preferably a single burner divided by an internal partition, and a manually opened valve for connecting the gas supply either to both the said burners or to one of said burners, or for cutting off the gas supply, said valve automatically closing except when the latch is made operative by a thermostatic member heated by the burner flame. The latch, and the tendency of the valve to close itself incidentally prevent the valve from being left in a position which partially opens a gas supply port, thereby avoiding the dangers which are inherent in an inadequate supply of gas. There is also illustrated a conventional form of steam pressure controlled diaphragm, which, however, cooperates with the valve already described to maintain a given pressure of steam when both burners are used.

With these and various other objects in view, the invention may consist of certain novel features of construction and operation, as will be more fully described and particularly pointed out in the specification, drawing and claims appended hereto.

In the drawing, which illustrates an embodiment of the device, and wherein like reference characters are used to designate like parts—

Figure 1 is an elevational view of the invention;

Figure 2 is a vertical sectional view taken substantially along the line 2—2 of Figure 1;

Figure 3 is a horizontal sectional view taken substantially along a broken line 3—3 of Figure 1, but with the valve turned to open position;

Figure 4 is a horizontal sectional view taken substantially along the line 4—4 of Figure 2; and

Figures 5, 6, and 7 are vertical sectional views taken substantially along the line 5—5 of Figure 3 but showing the valve disk in three successive positions.

Although our invention may take many forms, only one has been chosen for illustration. According to this form any conventional radiator 10 suitable for use as a gas fired radiator may be used. It includes a water and steam chamber 12 and a combustion chamber 14. Within the combustion chamber 14 is located a burner which is divided as by a partition 18 into a main burner section 16 to the right thereof, as seen in Figures 2 and 4, and an auxiliary or pilot burner section 17 to the left thereof, as seen in said figures. Of course for some aspects of this invention two separate burners may be used instead of one divided burner. Likewise, instead of having a pilot section of the type shown, there may be a more ordinary pilot burner. The pilot section is preferred, however, because it is more efficient in providing a small amount of heat such as is usually desired when any pilot flame at all is necessary.

The main burner section is supplied with gas through the mixing pipe 20 and main burner supply pipe 22 between which there is the usual air admixture valve 24. Gas is supplied to the pilot section through the pilot supply pipe 26, preferably passing through an air admixture valve 28. The air admixture valves 24 and 28 may be of any desired type or types, being illustrated diagrammatically only. The main burner pipe

22 and the pilot supply pipe 26 both communicate with a valve block 30 as does a main feeder pipe 32 which communicates with a gas supply system in any desired manner. As is seen best in Figure 3, the main feeder pipe 32 communicates with the passage 34 in the valve block 30 which passage opens onto the flat face of the block 30, this opening being called a valve port. The pilot supply pipe 26 communicates in a similar manner with a similar but preferably smaller passage 36 opening through a port on the same face of the valve block 30, and the main burner supply pipe 32 communicates with the passage 38 also similar to passage 34 but slightly smaller if desired. This passage 38 also opens through a port on the same face of the valve block 30. These ports forming part of the passages 36 and 38 may be called delivery ports. Operating in the valve block 30 and passing therethrough is a valve shaft 40 at one end of which is secured as shown, a valve disk 42 which has a flat face engaging and operating on the flat face of the valve block 30. The valve disk 42 is pressed into snug contact with the valve block 30 by a spring 44 which bears at one end against the valve block and at the other end against a nut 46 threaded or otherwise rigidly secured on the shaft 40. Also secured to the outer end of the shaft 40 is a handle 48 which for reasons described hereinafter, is preferably pivoted to the shaft 40 as by a pin 50.

The valve disk 42 is preferably provided with two elongated openings 52 and 54, the shapes of which on the contact face of the disk are best shown by the dotted lines in Figure 7. The valve disk has three operative positions to which it is restricted by means described below. The "full on" position is illustrated in Figure 5, in which it is seen that the opening 54 is aligned with the passage 34, and the opening 52 is aligned with both the passages 38 and 36. Thus gas can flow from the feeder pipe 32 through the feeder passage 34, through the opening 54 in the valve disk 42, back through the opening 52 in valve disk 42, and out through passages 38 and 36; the gas flowing through passage 38 continuing through the main burner supply pipe 22 to the main burner section 16, and the gas flowing through the passage 36 continuing through the pilot supply pipe 26 to the pilot burner section 17.

The second position of the valve disk 42 is illustrated in Figure 6, from which it is seen that the opening 52 in the valve disk has moved away from the passage 38 so that that passage is now closed by the valve disk. The opening 52 however remains in alignment with the passage 36 and therefore the passage to the pilot burner section remains open. Also the opening 54 remains in partial alignment with the passage 34 so that the supply of gas is continued. Since only a small amount of gas is used in this position, the portion of the opening 54 which in this position is aligned with the passage 34 may be of reduced size, as shown. Likewise, the portion of the opening 52 which is aligned with the passage 36 in Figure 5 may be reduced in size, as shown, since its capacity need be no greater than that of passage 36. In Figure 7 it is seen that neither the opening 52 nor the opening 54 is aligned with any of the three passages 34, 36 and 38, and therefore these three passages are all closed by valve disk 42.

The passage 54 terminates at one end in a special valve port 56 in front of which operates the resilient and flexible diaphragm 58. This diaphragm is held in place between the ring 60 and the ring 62. The ring 62 is secured to the radiator and communicates with the steam and water compartment, and the ring 60 is secured to the ring 62 in any suitable manner, as by the screws 64, and supports the valve structure. The ring 60 and the diaphragm 58 together comprise what may be called the valve head, since they restrain the flow of gas to the channels permitted by the valve disk.

The operation of the diaphragm 58 is conventional when the valve is in the "full on" position. The natural resiliency of this diaphragm forces it to the position shown in Figure 3. As steam pressure is built up within the radiator the diaphragm 58 is sprung toward the port 56 and at a predetermined steam pressure closes said port. To prevent this from completely extinguishing the burner flame, a by-pass 66 is provided through the side of the port 56. According to the prior practice, which is followed by this invention, when the valve disk is in the position shown in Figure 5, the restricted supply of gas passing through the by-pass 66 is supplied to the entire burner, with the result that the flames throughout the burner are reduced.

For various reasons, chiefly, the desirability of burning less gas, at certain times, in a radiator, than is practicable if the gas is distributed to all the burner jets, it is desired to modify this arrangement. This is accomplished by the present invention by moving the valve disk to the position shown in Figure 6, in which the entire restricted supply of gas is supplied through the pilot supply pipe 26 to the pilot section of the burner. It will be readily seen that an amount of gas which would burn extremely low when scattered over the whole burner will give an excellent, constant and safe flame if confined to the pilot section of the burner. As a matter of fact, it is possible to keep a safe flame with much less gas than is required by the entire burner.

The pilot burner could of course be confined to a single jet, but the position of the partition 18 is preferred so that a small amount of heat will be given whenever the pilot flame is burning. It should be understood that it is the custom to turn the radiator off entirely whenever the weather is warm enough so that there is no likelihood of heat being desired within a few hours. On the other hand, in fairly cold weather the diaphragm 58 rarely closes the port 56 entirely so that the need of restricting the flow of gas to the pilot section does not arise. It is therefore in the slightly chilly weather that there is considerable need for a pilot light, and in this slightly chilly weather there is usually a desire for a slight amount of heat as well as for a pilot light. The pilot section of this invention answers both of these requirements and the valve of this invention makes the use of such pilot section practical, satisfactory and safe.

In connection with making the radiator safe, there are two outstanding needs. The first is to cause the valve to close automatically if the supply of gas should cease, or if the flame should be extinguished for any reason. The second is to prevent the valve from being left in a position which opens any port inadequately, i. e., to prevent the valve from supplying to either section of the burner an inadequate amount of gas for safe combustion. The valve heretofore described lends itself to the accomplishment of these two features by the addition of relatively simple and inexpensive devices thereto. Furthermore, these devices for the most part serve both functions at once.

A coil spring 70 is secured at one end to the valve shaft 40 and at the other end to the valve block 30, being under such tension as to cause the closing of the valve disk whenever the movement of the valve disk is not especially restrained. It should be understood that the functions of the springs 44 and 70 may, if desired, be performed by a single spring.

Means for latching the valve disk in either of the positions of Figure 4 or Figure 5, and also for limiting its closing movement to the position shown in Figures 7 is found in collar 74 formed or rigidly secured on the valve block 30. The collar 74 is provided with notches 76 and 78 as well as with a stop 80. The handle 48 is urged by a spring 81 to the position with respect to its shaft shown in Figure 3, in which the nose 82 of the handle forms a latch fitting into the notches 76 and 78. However, the handle may be tilted to a position which will free it from said notches but preferably not to a position which will free it from the stop 80. It should also be mentioned that in each notch the side against which the spring urges the handle is preferably higher than the other side thereof, so that there will be no danger of the latch 82 undesirably skipping over a notch. There may be gradual decline from the pressure-receiving edge of notch 76 to the bottom of notch 78.

With the structure thus far illustrated, it is seen that unless the valve disk 42 is in one of the three positions of Figures 5, 6 or 7, at which positions the latch 82 rests against one of the stops, either the notch 76 and notch 78, or the stop 80, the spring 70 will cause the valve disk to rotate in a closing direction until the latch 82 reaches the first stop. Thus it is impossible for the valve to be left in any position other than the positions shown in Figures 5, 6, and 7. In other words, it is impossible for the valve disk to be left in any position inadequately opening any port therein.

The means for causing the valve to close if the flame fails is found in the features just described, together with the trip lever 86 which is pivoted to the valve block 30 as at 88. This pivoted lever is operated by a Bowden wire 90, or similar device which in turn is operated by a bi-metallic strip 92 located in a position to be heated by the flame of the pilot section whenever the pilot section is lit. The bi-metallic strip should be heavy enough in order to have the requisite strength, and its movement in either direction may, if desired, be opposed by a spring associated with the trip lever 86. The nose 82 of the handle 48 which forms the latch previously described extends slightly beyond the collar 74, as shown best in Figure 3, and when the valve is in either of the open positions this nose extends over the trip lever 86 so that when the trip lever is pivoted it tilts the handle 48, thus releasing the latch 82 from the notch 76 or the notch 78.

In lighting the gas at the burner, the valve is turned to one of the positions shown in Figures 5 and 6 and held there by hand while applying a flame to the pilot section of the burner, and held enough longer for the flame from this pilot section of the burner to heat the bi-metallic strip 92 sufficiently so that it operates the Bowden wire and thus tilts the trip lever 86 to an inactive position, at which time the spring on the handle 48 will cause it to tilt to a latching position and hold the valve disk either in the position shown in Figure 6 or the position shown in Figure 5, whichever may be desired. If the pilot light goes out the tendency of the bi-metallic strip 92 on cooling to assume its normal position, operates the Bowden wire and causes a tilting of the trip lever 86 to its active position, thereby releasing the latch 82 from the notches 76 and 78 so that the spring 70 causes the valve to move to the closed position.

It is to be understood that many other embodiments of the invention, including some in improved form, will be apparent, and in the course of time more will be devised by those skilled in the art. It is not desired that this invention be limited to the details described, for its scope includes all such forms or improvements as come within the spirit of the following claims, construed as broadly as the prior art will permit.

What is claimed is:

1. A disc valve for controlling the supply of gas to a pilot and main burner including a valve body having a gas delivery passage, a supply passage for the pilot and a supply passage for the main burner, a valve disc rotatably mounted on the valve body and having openings therein for alignment with the passages to thereby open the same, the opening associated with the delivery passage tapering in the direction of its length and terminating in a valve port located to the rear of the valve disc, and said valve port having a by-pass whereby the supply passages are connected with the delivery passage through the valve port when the same is opened and are connected through the by-pass when said valve port is closed.

2. A disc valve for controlling the supply of gas to a pilot and main burner including a valve body having a gas delivery passage, a supply passage for the pilot and a supply passage for the main burner, a valve disc rotatably mounted on the valve body and having openings therein for alignment with the passages to thereby open the same, the opening associated with the delivery passage tapering in the direction of its length and terminating in a valve port located to the rear of the valve disc, said tapering opening permitting a gradual closing of the delivery passage upon turning of said valve disc, and said valve port having a by-pass whereby the supply passages are connected with the delivery passage through the valve port when the same is opened and are connected through the by-pass when said valve port is closed.

3. A disc type valve for controlling the supply of gas to a pilot and main burner, including a valve port having a delivery passage, a supply passage for the pilot and a supply passage for the main burner, a valve disc for opening and closing said passages, said valve disc having a valve port provided with a by-pass, and means responsive to steam pressure for regulating the supply of gas to said supply passages when the valve disc is located so as to open said passages, said means comprising a diaphragm adapted to open and close said valve port, whereby said supply passages are connected with the delivery passage through the valve port when the same is open and are connected through the by-pass when said port is closed.

4. A disc type valve for controlling the supply of gas to a pilot and main burner, including a valve port having a delivery passage, a supply passage for the pilot and a supply passage for the main burner, a rotatable valve disc having an opening for association with the delivery

passage and having another opening for association with the supply passages, a valve port located to the rear of the valve disc and communicating with the opening for the delivery passage, said valve port being provided with a by-pass for delivering gas to the supply passages when said delivery port is closed, said valve body and valve disc having flat contacting faces, and resilient means for retaining said contacting faces in engagement.

5. A disc type valve for controlling the supply of gas to a pilot and main burner, including a valve port having a delivery passage, a supply passage for the pilot and a supply passage for the main burner, a rotatable valve disc having an opening for association with the delivery passage and another opening for association with the supply passages, a valve port located to the rear of the valve disc and communicating with the opening for the delivery passage, said valve port having a by-pass, and means responsive to steam pressure for regulating the supply of gas to said supply passages when the disc is located so as to open said passages comprising a diaphragm adapted to open and close the valve port, whereby said supply passages are connected with the delivery passage through the valve port when the same is open and are connected through the by-pass when the valve port is closed.

6. A disc type valve for controlling the supply of gas to a pilot and main burner including a valve body having a gas delivery passage, a supply passage for the pilot and a supply passage for the main burner, a valve disc rotatably mounted on the valve body and having a pair of elongated openings therein, one opening having association with the delivery passage and the other opening having association with the supply passages, whereby said valve disc opens and closes said passages upon rotation thereof, the opening associated with the delivery passage tapering in the direction of its length permitting delivery of a reduced gas supply when the tapered end of the opening is aligned with the passage, said valve disc being between full open and closed positions when located to deliver said reduced gas supply, in which position said other opening is located in alignment with the pilot passage only, the supply passage to the main burner being completely closed.

7. A disc type valve for controlling the supply of gas to a pilot and main burner including a valve body having a gas delivery passage, a supply passage for the pilot and a supply passage for the main burner, a valve disc rotatably mounted on the valve body and having a pair of elongated openings therein, one opening having association with the delivery passage and the other opening having association with the supply passages, whereby said valve disc opens and closes said passages upon rotation thereof, the opening associated with the delivery passage tapering in the direction of its length permitting delivery of a reduced gas supply when the tapered end of the opening is aligned with the passage, and means biasing said valve disc into a position where all the passages are closed.

8. A disc type valve for controlling the supply of gas to a pilot and main burner including a valve body having a gas delivery passage, a supply passage for the pilot and a supply passage for the main burner, a valve disc rotatably mounted on the valve body and having a pair of elongated openings therein, one opening having association with the delivery passage and the other opening having association with the supply passages, whereby said valve disc opens and closes said passages upon rotation thereof, the opening associated with the delivery passage tapering in the direction of its length permitting delivery of a reduced gas supply when the tapered end of the opening is aligned with the passage, resilient means biasing said valve disc into a position where all the passages are closed, and a latch for retaining the disc in full open position and in an intermediate position wherein said valve delivers a reduced gas supply.

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