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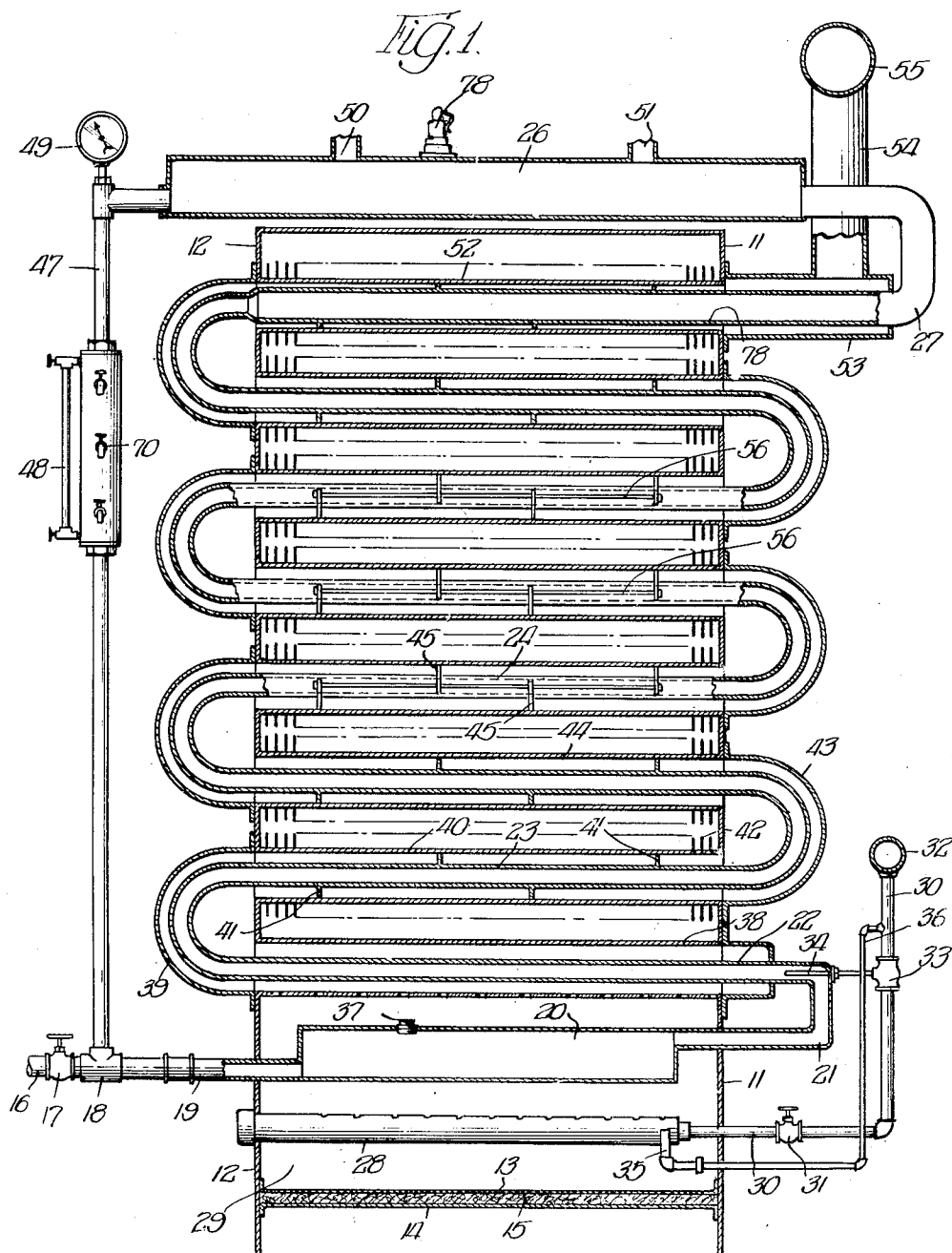
C. E. RICE

2,533,692

AIR AND WATER HEATING FURNACE

Filed Dec. 31, 1946

3 Sheets-Sheet 1



INVENTOR.

Clayton F. Rice,

BY

Wickman, Hurley, Ryan & Knight
Attys

Dec. 12, 1950

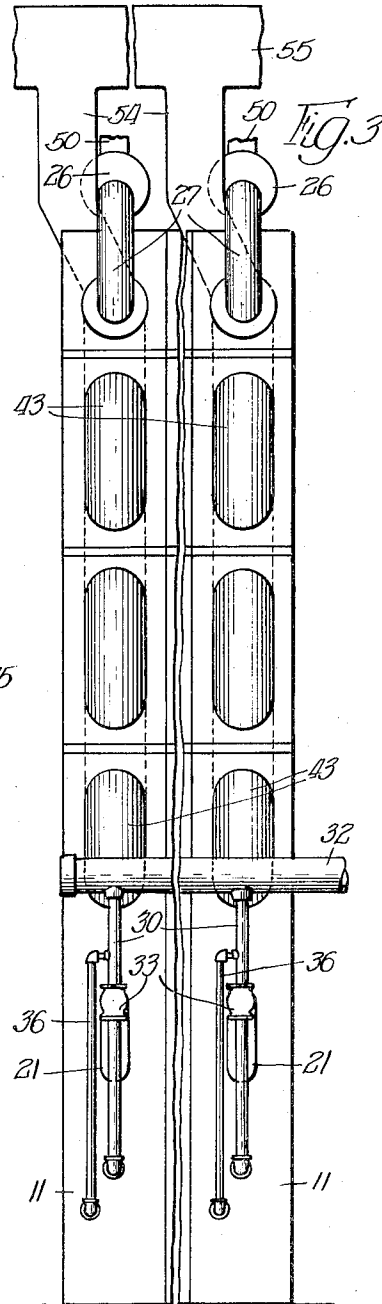
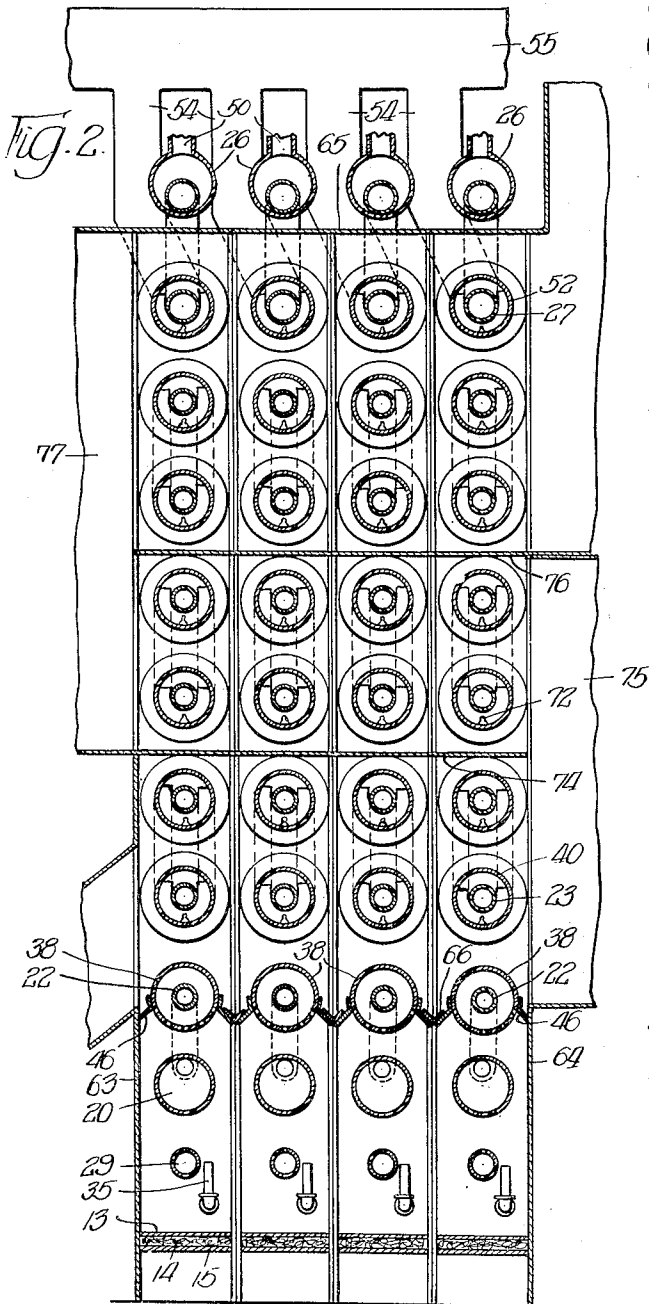
C. E. RICE

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AIR AND WATER HEATING FURNACE

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3 Sheets-Sheet 2



INVENTOR.

Clayton E. Rice,

BY

William H. Hays, Jr. & Hays, Jr.
Attorneys

Dec. 12, 1950

C. E. RICE

2,533,692

AIR AND WATER HEATING FURNACE

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Fig. 4

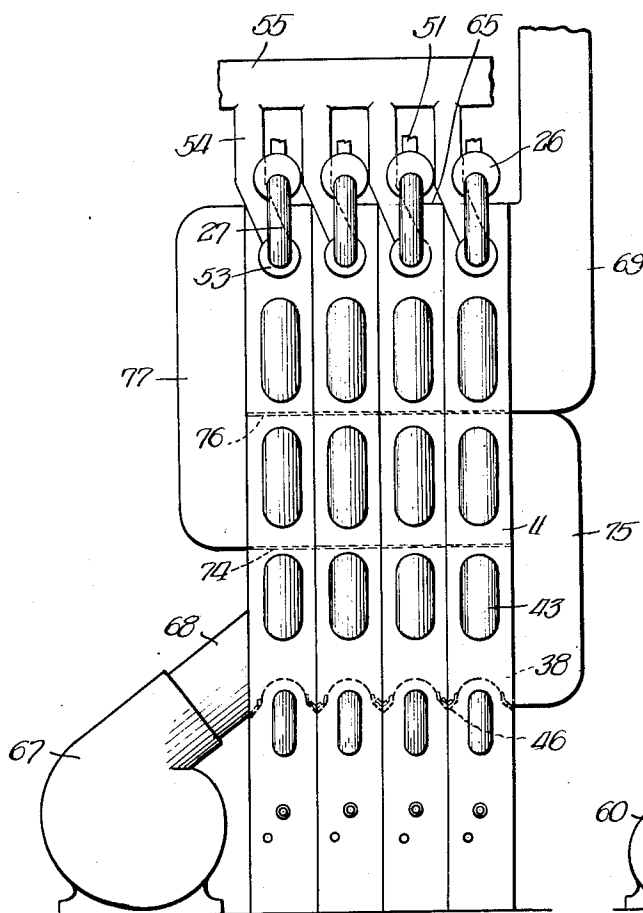
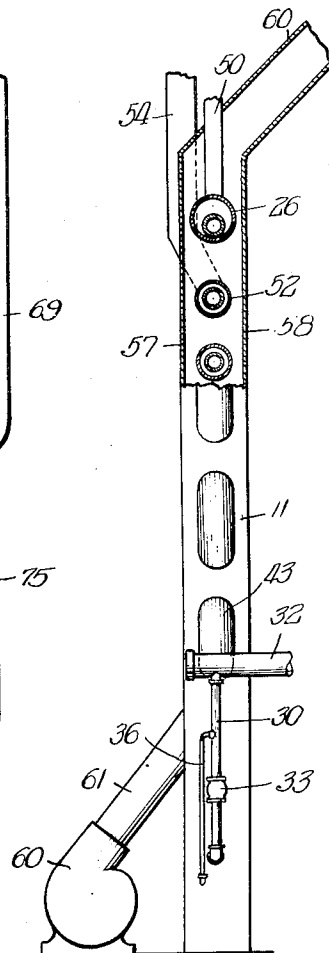


Fig. 5



INVENTOR.

Clayton E. Rice,
BY

William H. Byron & Eugene
Chicago

UNITED STATES PATENT OFFICE

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AIR AND WATER HEATING FURNACE

Clayton E. Rice, Chicago, Ill.

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1 Claim. (Cl. 126—101)

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This invention relates to a new and improved heating system and more particularly to apparatus whereby the heat derived from burning fuel serves to raise the temperature of both water and air for heating purposes.

The apparatus for carrying out this heating method comprises a boiler by which water is heated either to produce steam for steam heating or to a temperature less than that necessary for steam generation so that it may be used for hot water heating. In addition to this water heating, I provide means whereby air may be heated simultaneously so that a very high percentage of the heat contained in the products of combustion is absorbed for useful work and stack temperatures are low.

My construction involves the use of relatively small, self-contained units which may be assembled in any desired number to provide heating for buildings or spaces of different sizes.

It is an object of the present invention to provide new and improved heating apparatus adapted to absorb a high percentage of the heat in flue gases or products of combustion.

It is a further object to provide a construction in which the heat is transferred both to water and to air for space heating or industrial heating purposes.

It is also an object to provide a multiple unit construction which may be assembled in any desired number for conjoint use to heat any specific area.

It is another object to provide a multiple unit construction in which the different units may be used selectively in desired numbers dependent upon the amount of heat required.

It is an additional object to provide a construction which is simple in design and operation and adapted for commercial production and use.

Other and further objects will appear as the description proceeds.

I have shown certain preferred embodiments of my invention in the accompanying drawings, in which—

Figure 1 is a vertical section taken from front to back of a single heating unit;

Figure 2 is a vertical section extending across a plurality of units;

Figure 3 is a front face view, partly broken away, showing a plurality of units;

Figure 4 is a front face view, partly broken away, on a reduced scale showing a plurality of units with associated hot air conduits; and

Figure 5 is a view similar to Figure 4, but showing a single unit, partly in section.

Referring first to Figure 1, the construction comprises units having front wall plates 11 and rear wall plates 12 which extend vertically. The lower portions of the plates 11 and 12 are joined adjacent their lower ends by horizontal plates 13 and 14 between which is placed insulation 15

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to retain heat and also to prevent damage to the supporting floor. The water supply line 16 is controlled by valve 17 and is connected through T 18 to feed pipe 19 and to the lower water drum 20 which is supported on the end plates 11 and 12. This drum 20 is provided with the fusible safety plug 31. The drum 20 is connected by the U 21 extending through plate 11 to the serpentine pipe 22 which has a number of horizontal passes and joins the upper drum 26 through the upper U 27.

The unit is shown as heated by means of the gas burner 28 which is located in the combustion chamber 29 and is fed through pipe 30, controlled by valve 31, from gas header 32. An automatic valve 33 is located in pipe 30, this valve having a thermostatic element 34 extending into U 21 and into contact with the water therein. The pilot light 35 is connected to pipe 30 by pipe 36 at a point behind valve 33. The particular type of burner and control shown is illustrative only and its details form no part of the present invention. Any suitable form of burner or heating means may be used in connection with the heating unit and the apparatus shown is of standard construction.

As shown in Figure 2, a fire tube 38 with lateral flanges 46 secured thereto is located above the lower pass of pipe 22. The lower portion of this tube 38 between flanges 46 is perforated to receive the products of combustion which pass through return fitting 39 and into the large pipe 40 which encloses the second pass 23 of pipe 22. The pipe 40 carries arcuate baffles 41 which are alternately placed above and below the pipe pass 23, the baffles being secured together by rods 56. These baffles 41 cause the flue gases to take a tortuous path in pipe 40 and increases the heat transfer both through the water carrying pass 23 and through the outer wall of pipe 40 to the air which surrounds it. The baffles 41 also serve to maintain the smaller pipe properly centered in the larger flue 40. These baffles 41 are notched at their top and bottom portions, as shown at 45 in Figure 2, to prevent gas pockets. The pipe 40 is provided with fins 42 to increase the heat transfer to the air around the pipe.

A return fitting 43 at the front end of the unit is similar to the fitting 39 and returns the flue gases to the next pass 44 of the flue pipe which is similar to pipe 40. This pipe 44 encloses the next pass 24 of water pipe 22 and is provided with the baffles 45 similar to baffles 41. The construction is similar in the additional passes of the pipe 22 containing water or steam and their surrounding pipes carrying the flue gases or products of combustion.

The top pass 78 of the water tube has been made larger than the lower passes to provide a smaller space for passage of the flue gases in the top pass 52 of the fire tubes. This is provided to partially choke or slow down the flow of the flue

gases so as insure proper transfer of heat to the water or steam in the water tubes. It will be apparent that the flue gases will be much cooler at this point and consequently will be much reduced in volume so that a substantial reduction in flue area may be provided without adversely affecting the draft and flow to the stack.

The upper drum 26 is connected to the balancing water pipe 47 which joins the T 18. This pipe 47 carries a water column when the boiler is used for steam production or vapor heating and is provided with the water gauge 48 and the gauge cocks 70. A pressure gauge 49 which may be graduated to show steam pressure or, if the boiler is used for hot water heating, may be graduated in feet to show the extent to which the heating system is filled with water. The drum 26 is also provided with the pressure relief valve 78 which may be of any usual construction.

The upper drum 26 is provided with the outlet pipes 50 and 51 through which steam or hot water, depending upon the operation of the boiler, is drawn off for use. The topmost pass 52 of the outer pipe carrying the flue gases or products of combustion is connected to the housing 53 which is connected by pipe 54 to flue 55. This flue 55 is connected to a stack or chimney which has not been shown.

A single unit heater has been shown in Figure 5. The unit has the side walls 57 and 58 which extend upwardly to form a housing about the upper drum 26. A hot air pipe 60 leads from the housing to carry the heated air to a distribution system where it may be used for any desired purpose such, for example, as space heating or industrial drying. Air to be heated is forced into the heater housing by fan 61 and passes through pipe 61 which joins the housing immediately above the fire wall 38.

A multiple unit system is shown in section in Figure 2 and in elevation in Figure 4. The assembly has side walls 63 and 64 which enclose the group of units and has a transverse top wall 65 which extends below the drums 26. The spaces between the fire walls 38 may be closed by angle irons 66 so as to prevent entry of flue gases into the air space. Air to be heated is forced into the air chamber by fan 67 through passage 68 and the hot air is carried from the opposite side of the upper portion of the chamber through passage 69.

In the preferred form of construction means are provided to cause the air to take a definite tortuous path over the fire tubes and fins when a multiple unit heater is used such as shown in Figures 2, 3 and 4. As shown in Figure 4, the air passes from passage 68 across the housing to the right above the lower fire tube 38 and below a horizontal wall 74 formed of a sheet of metal resting on the top of the fins 42 carried by the fire tubes immediately below the wall. A return housing 75 at the right carries the warmed air up and around the right end of wall 74 and it passes to the left over wall 74 and below a similar wall 76. The return housing 77 on the left returns the air above wall 76 and below the top wall 65 to the outlet housing 69.

It will be apparent that the construction comprises a plurality of identical units so that a heating plant of any desired capacity may be assembled. Thus, one standard type of unit may be used when assembling heating plants for large or small areas. This greatly reduces production costs and also reduces the stock of

units which need be carried on hand for distribution or replacement.

A further feature of the unit type of construction is that any desired proportion of the units may be used. Where the apparatus is used for space heating, only a portion of the units may be used in mild weather. In industrial heating applications, the number of units in use may be varied in proportion to the work load.

The construction shown may be assembled in any desired manner. The water tube may comprise a plurality of sections welded or brazed together. The tube may comprise standard pipe sections and pipe fittings. The end fittings joining the ends of the fire tubes are preferably removable. The baffles which support the water tube in the fire tubes may be connected together by means of spacing rods. Thus, they may be removable from the front or back of the unit when the end fittings or housings are removed. This will facilitate cleaning the fire flues. The entire outside and particularly the lateral walls of the unit or assembly may be covered with any usual type of insulation.

While I have shown certain preferred embodiments of my invention, these are to be understood to be illustrative only as it is capable of variation to meet differing conditions and requirements, and I contemplate such modifications as come within the spirit and scope of the appended claims.

I claim:

A heating apparatus assembly comprising a plurality of units, said units comprising relatively narrow front and back walls connected at their lower portions by a fire wall dividing the space between the front and back walls into a lower combustion chamber and an upper air heating chamber, side walls for the heating assembly joining the outer edges of the outer front and back wall units and fire wall units, a top wall connecting the front, back and side walls, a fire tube assembly in each unit communicating at its lower end with the combustion chamber and having a plurality of forwardly and rearwardly extending passes in the upper air heating chamber, said fire tube passes being spaced apart to provide air passages therebetween, a water tube assembly in each unit including at least one pass extending within the combustion chamber and a plurality of passes extending within fire tube passes in the upper chamber, means for introducing air into the lower portion of the air heating chamber through a side wall, baffles in the air heating chamber extending alternately from each side wall toward the other in staggered relation between fire tube passes, and means for withdrawing heated air from the upper portion of the assembly.

CLAYTON E. RICE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
113,197	Nichols	Mar. 28, 1871
456,004	Shackleton	July 14, 1891
641,911	Wilkins	Jan. 23, 1900
1,140,239	Barth	May 18, 1915
1,280,071	Musser	Sept. 24, 1918
2,004,391	Price	June 11, 1935
2,053,780	Price	Sept. 8, 1936
2,286,665	Blair	June 16, 1942