J. C. LOYER.

HEATING SYSTEM.

APPLICATION FILED JULY 24, 1918.

1,391,394. **Patented Sept. 20, 1921.**

3 SHEETS—SHEET 1.

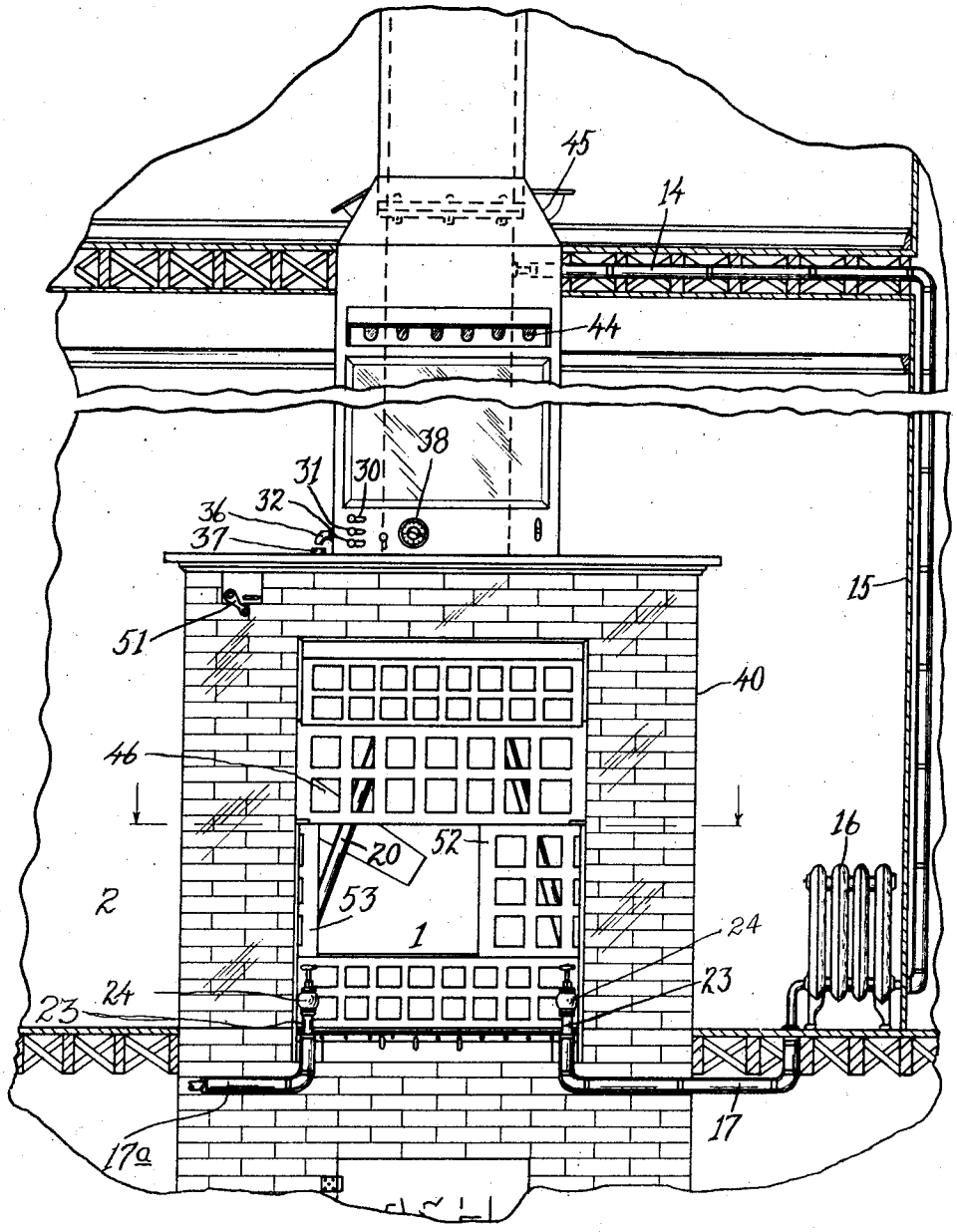


Fig. 1

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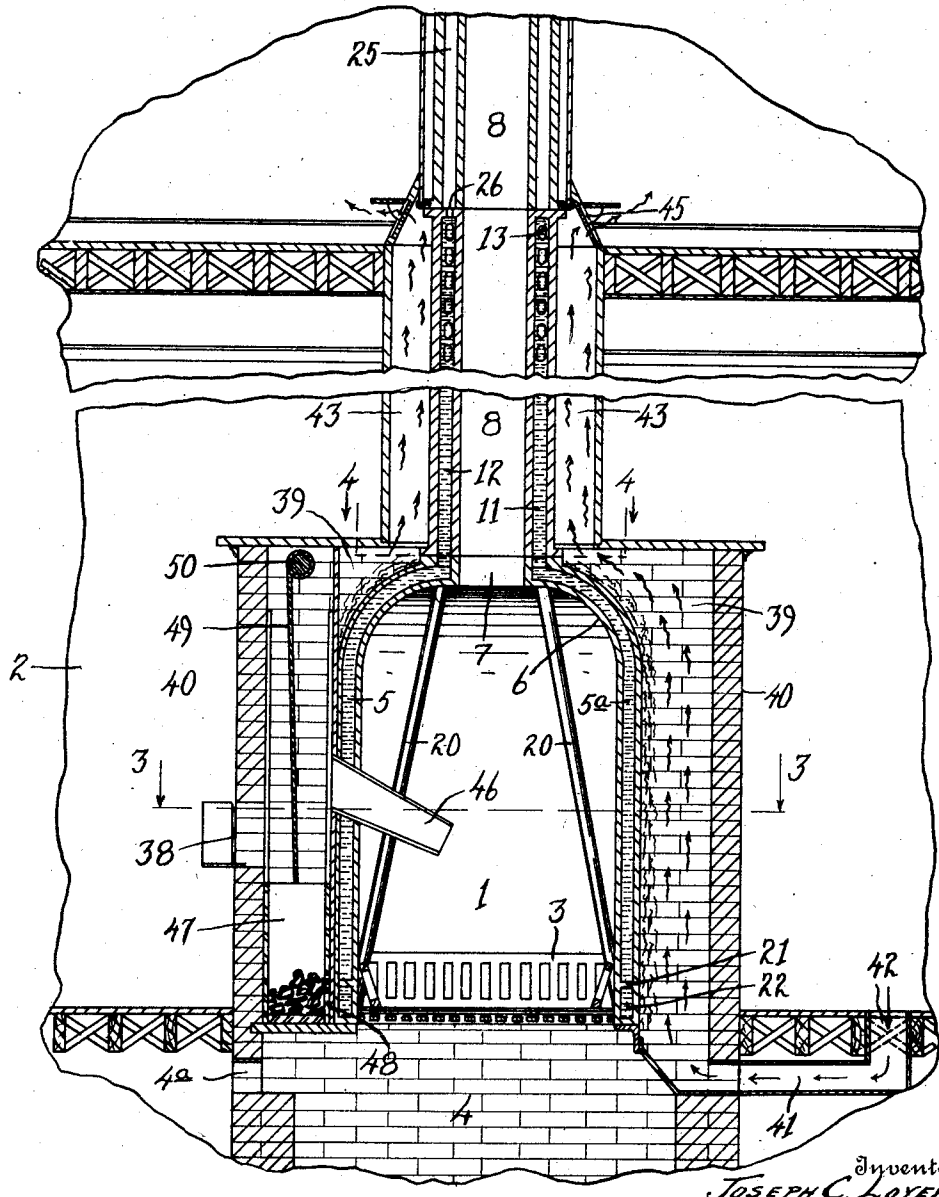


Fig. 2

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3 SHEETS—SHEET 3.

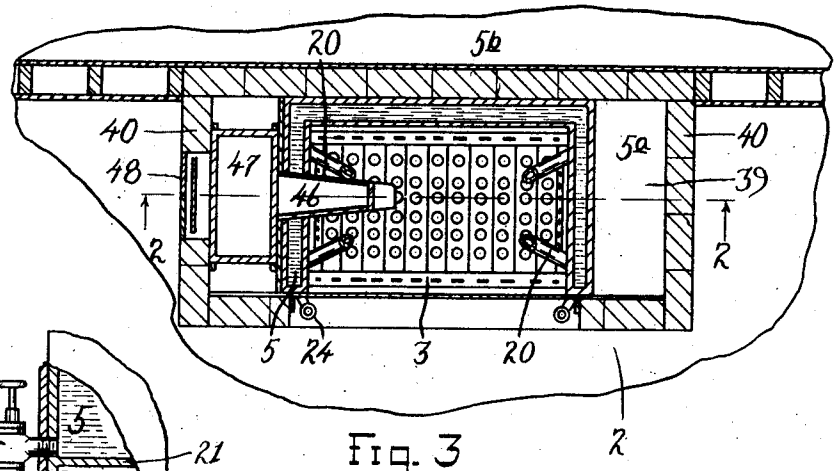


Fig. 3

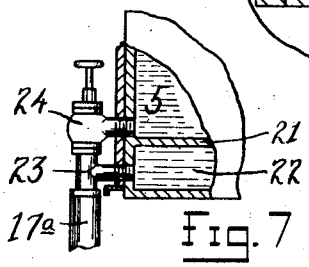


Fig. 7

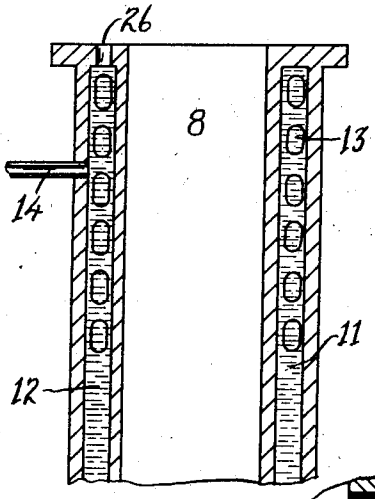


Fig. 5

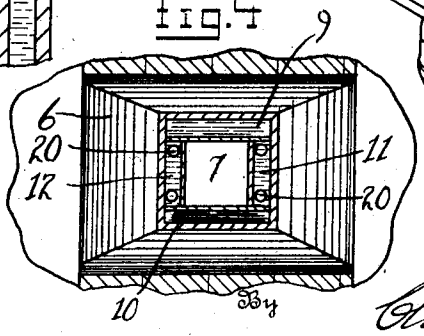


Fig. 4

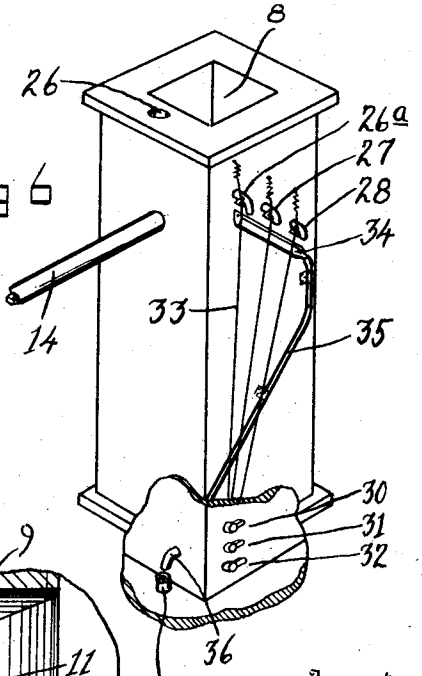


Fig 6

Witness

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UNITED STATES PATENT OFFICE.

JOSEPH C. LOYER, OF DETROIT, MICHIGAN.

HEATING SYSTEM.

1,391,394. Specification of Letters Patent. Patented Sept. 20, 1921.

Application filed July 24, 1918. Serial No. 246,481.

To all whom it may concern:

Be it known that I, JOSEPH C. LOYER, a citizen of the United States, residing at Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Heating Systems, and declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

This invention relates to heating systems for buildings and its object is to provide a combined fire-place, hot air circulating system and a hot water circulating system whereby all the available heat of a single fire may be utilized and the novel features of the invention reside in the arrangement of a fire-place with the fire walls thereof formed by water reservoirs, and a flue for the smoke and gases of combustion that is water jacketed providing water reservoirs connecting with the reservoirs about the fire pot so that the major portion of the heat of the fire may be utilized in the heating of water for a water circulating system. A further feature of the invention is involved in the arrangement of the fire pot with the water reservoirs forming a fire wall as above stated and air flues about the exterior of the water reservoirs and the smoke flue forming air circulating means. A particular feature of this invention is involved in the construction whereby the several heating systems may be embodied in a single unit whereby the maximum amount of heat of the fire is utilized in heating the room of a building. The invention in its preferred form is shown in the accompanying drawings in which—

Figure 1 is a front elevation of a fire-place and heating system embodying my invention.

Fig. 2 is a vertical section showing the water circulating system, taken substantially on lines 2—2 of Fig. 3.

Fig. 3 is a horizontal section taken on lines 3—3 of Fig. 2.

Fig. 4 is a horizontal section taken on lines 4—4 of Fig. 2.

Fig. 5 is an enlarged section of the upper ends of the surface flue.

Fig. 6 is a detail in perspective of the upper end of the surface flue showing the means employed to determine the height of water in the water reservoir about the flue.

Fig. 7 is a detail of the connection of the return line with the water reservoir.

In the embodiment of the invention here shown, a fire-place 1 of conventional type is utilized, having the usual opening into the room 2 in which it is located. The fire-place is provided with a grate 3 of ordinary type at or near the floor line and this grate opens into an ash pit 4 therebelow. The fire pot and grate may be of any desired type as a dumping and shaking grate of any character adaptable for the purpose. Air for producing a draft may flow from the basement through an opening 4^a provided in the wall of the fire place into the ash pit and thus beneath the grate. An air supply 41 may here be provided to take air from the floor of the room in which the fire place is located or from any other room as may be desired.

Extending upward from and about the fire pot 3 on three sides thereof and forming the fire walls therefor, are the metal water reservoirs 5, 5^a, and 5^b, which converge at the top forming a dome 6. These water reservoirs are utilized in place of the regular fire brick for the walls of the fire place and absorb the heat from the fire. The fire place being open at the front as indicated in Fig. 2, the device has all the usual functions of the ordinary fire place exposing the fire to view through the open front and to a certain extent heating the room in which the fire place is located.

Preferably at the center of the dome portion 6 of the water reservoirs is an opening 7 connecting with the smoke flue 8. This smoke flue is preferably of metal and is preferably four-sided as shown in Fig. 6. This flue is water jacketed as indicated in Fig. 4, providing four separate chambers 9, 10, 11 and 12 extending the length of the smoke flue. The vertical chamber 9 is connected with the rear water reservoir 5^b and the vertical chamber 11 connects with the top of the reservoir 5^a and the vertical chamber 12 connects with the top of the reservoir 5 which surround and are connected together as indicated in Fig. 3. The vertical chamber 10 about the smoke flue receives its supply from the reservoirs 5 and 5^a. Both the fire pot and combustion chamber are water jacketed as is also the smoke flue and these chambers form the water reservoirs for the hot water system.

By constructing a metal smoke flue as shown water jacketed and connecting with

the water reservoirs of the fire pot a chimney is provided which is no more expensive than the usual chimneys for a furnace or grate and the expense of water circulating system is reduced to a minimum in that only a single return line is required in conjunction with these reservoirs which extend to the roof of a building or at least to the ceiling of the upper rooms of a building, the hot water line being provided by the vertical chambers of the smoke flue. These chambers, as will be understood from Fig. 4 are separate chambers from the dome of a fire-place and are connected only at the top at which point the walls separating the chambers 9, 10, 11 and 12 are apertured as shown at 13 in Figs. 2 and 5. The supply line 14 for the radiator 16 is connected with the upper end of the vertical chambers as indicated in Figs. 1, 5 and 6 and, by connecting the vertical chambers at the top, the return line may be connected at any side of the flue. Such line is shown in Fig. 1 as extending between the ceiling of the lower room and floor of the upper room and downward back of the side wall 15 and connecting with a radiator 16 which may be in any room, but for convenience of illustration is here shown in the same room as the fire-place. The pipe leading to the radiator is preferably insulated to conserve the heat of the water and the radiator is connected at the discharge end with a pipe line 17 leading into the bottom of a water reservoir 5 of the fire pot.

The pipe line 17ª may be similar in all respects to the pipe line 17 on the opposite side of the fire place and be connected with a radiator or radiators and supply line in the same general manner as the pipe line 17 is provided with a supply line 14 and radiator 16 shown at the right of Fig. 1. The pipe line 17ª, respective radiators, and supply line would therefore form a circulating system independent of the line 17 and its radiator, both lines being connected to a common reservoir. Water may be supplied to the system by the usual city pressure line (not here shown) connected with the reservoir as is usual with hot water systems.

If several radiators are utilized the water flows from one radiator to the next succeeding radiator and from the last radiator of the line to the pipe 17 or 17ª on the opposite side of the fire-place as shown in Fig. 1.

To facilitate the heating of the water in the water reservoirs 5 which are connected as shown on three sides of the fire-place, I have provided the water tubes 20 extending from the lower end of the side water reservoirs to the lower end of the chambers 11 and 12 on opposite sides the smoke flue. These tubes lie at an angle to the vertical and the tubes on two sides of the fire-place converge toward the center and extend over the fire as shown in Fig. 2. Preferably the water reservoirs 5 and 5ª on opposite sides of the fire-place only are provided with these tubes and these reservoirs 5 and 5ª are provided at the bottom with a wall 21 dividing the reservoirs into two parts, the lower part 22 of which is open to the lower end of the tubes. The tubes are thus supplied from the lower small chamber or reservoir 22 and water becoming heated in the said chamber and said tubes will flow upward into the chambers 11 and 12 on opposite sides of the flue as will be understood from Fig. 4. These chambers 22 must necessarily be supplied with water; otherwise the chambers and lower ends of the tubes will burn out by reason of the direct contact with the fire in the fire pot. Particularly for this reason the return pipes 17 and 17ª leading from the last radiator of the respective line to the reservoirs opens directly into this chamber 22 by means of a T connection 23 shown in detail in Fig. 7. This T connects with the line 17ª at one end and the opposite end connects with the body of a valve 24 which is connected with the reservoir 5 or 5ª. The line 17 connects with its chamber 5ª and the chamber therebeneath in the same general manner as the line 17ª is connected with the chambers 5 and 22 as will be readily understood from examination of Figs. 1 and 7. If the valve 24 in either of lines 17 or 17ª be closed the water flowing through the said lines will be discharged into the respective lower chamber 22 in each instance. When the radiators are in use in either line 17 or 17ª the valve 24 of either line may be open or closed but when the flow through either line is stopped by the closing of the line, as in the shutting off of a radiator, the valve 24 of that line should be opened to permit a flow of water from the main reservoir with which it is connected to the companion chamber 22. Thus if the fire-place has the water reservoir on one side only connected with a radiator line, the valve 24 for the reservoir on the opposite side of the fire-place should have the valve opened to provide circulation for the chamber 22. This chamber 22 and pipes connected therewith heat more quickly than the water in the main parts of the reservoir and thus the chambers about the smoke flue have this warmer water directly supplied thereto at the bottom and the radiator system therefore heats more rapidly than would be the case without the use of the water tubes and auxiliary chambers 22.

As heretofore stated, the water chambers about the smoke flue extend to the ceiling or above of the highest room of the building in which the apparatus is placed and to provide for an escape of steam, the water chambers open into an exhaust discharge

flue 25 provided above the ceiling of the highest room as will be understood from Fig. 2. In that figure the water chambers about the smoke flue are shown as extending above the ceiling of the first floor but it is to be understood that the said water reservoirs may extend upward through several rooms. In the case of a house these water reservoirs should extend at least to the attic and may if desired, extend above the roof through which the smoke flue projects. The single room illustrated in Fig. 2 is illustrative of the construction used in any case and the exhaust flue 25 opens above the roof (not here shown). Steam or water passing into the exhaust flue through the aperture 26 provided at the top of the water chambers passes to the outside of the building and thus no pressure may be developed in the system other than the pressure of the height of the column of liquid in the water reservoirs. These water reservoirs being as high as the building or the rooms therein to be heated, the hot water pipe 14 should be connected to the top thereof so that water may flow through the return line and the radiators therein by gravity.

At the top where the four reservoirs about the smoke flue are connected together, are provided the water gages 26, 27 and 28 as shown in Fig. 6. These are here shown as of simple type in the nature of a faucet having a valve connecting with the operating handles 30, 31, and 32, within easy reach just above the fire-place as shown in Fig. 1. The valves are connected to the operating handles by means of similar rods or wires 33. Water from these gages is delivered into the trough 34 discharging into the pipe 35 and this pipe opens into the room just above the fire-place as shown at 36. The end of this pipe discharges into a second pipe 37 which may discharge into the fire pot or discharge exteriorly of the building if desired. By arranging the discharge end 36 of the pipe 35 slightly above the open end of the pipe 37, water flowing through the pipe 35 may be observed by the person operating the levers 30, 31, or 32 for the water gages. These gages, as will be readily understood from the Fig. 6, are located at different heights and if, on opening the lower gage 28 for instance, no water flows through the pipe end 36, then additional water must be provided in the system to insure flow through the hot water line 14. A pressure gage 38 should also be provided opening into one of the reservoirs surrounding the smoke flue to indicate the pressure of the system. Should the fire be built when the system is not supplied with an adequate supply of water steam would be produced in such quantity as to be indicated on the pressure gage, but by reason of the vent aperture 26, however, no pressure of dangerous character may be developed in the system.

As heretofore stated, an air space 39, shown in Fig. 2, is provided back of the water reservoirs on opposite sides of the fire box. This space is provided by building the walls 40 of the fire-place a sufficient distance from the water reservoirs on opposite sides as shown in Fig. 3. These air chambers at the bottom may be supplied by air through a cold air duct 41 opening through the floor of the room as shown in Fig. 2 at 42. This is here shown as being in the same room as the fire place but it is to be understood that the flue 41 may open into any room in the building heated by the system. The hot air chambers 39 about the fire box open at the top into vertical auxiliary chambers or flues 43 formed around the water reservoirs of the smoke flues and these vertical flues 43 may be provided at any portion of their height with registers 44 opening into the room near the ceiling as shown in Fig. 1 or they may open into an upper room through registers 45 as shown in Fig. 1.

It is to be understood that these air ducts may extend upward through several rooms, each room being provided with a register which may be opened or closed in a convenient manner to allow or prevent the heated air passing thereinto. By this arrangement of air chambers and flues about the water reservoirs, a hot air system is provided operating in conjunction with the hot water system.

Fuel may be introduced into the fire box in any desired manner without departing from the spirit of this invention. A convenient method of introducing fuel into the fire box is by means of a chute 46 extending through one reservoir 5 and opening into the air chamber 39 as shown in Fig. 2. In the said chamber is a fuel box 47 into which a quantity of fuel may be placed through the door opening 38 formed in the external wall 40 of the fire-place. The box 47 has an opening 48 on the inner side thereof and the box is connected by means of a cord 49 with a windlass 50 which may be operated by a crank 51 in the front of the fire-place as shown in Fig. 1. By turning the crank, the cord is wound on the windlass 50 and the fuel box raised and contents thereof discharged through the chute 46 into the fire box. Any convenient method however, may be employed to deliver fuel to the grate.

The fire place is here shown as being open on one side only and may be provided with sliding grates 52 and 53 to partially screen the said opening. This fire place front may be of any desired type and the grates 52 and 53 are here shown as panels that may be moved to each side to directly expose the

fire to view. The construction and design of the fire place front however may be varied in any suitable way to conform to the design of the fire-place.

By the arrangement of the heating system as shown the general appearance and utility of a fire-place is secured showing the open fire, which to a certain extent heats the room in which it is located. By forming the fire walls of metal water reservoirs as described the heat of the fire is utilized to heat the water for use in radiators in the same or other rooms and by the provision of the air chambers and flues heated air may also be supplied to the same or other rooms. The combination of the hot air and hot water systems with the fire place economizes the heat of the fuel whereby the maximum amount of heat of the fire is utilized and dispenses with the usual heating plants necessarily located in the basements where the heat is largely wasted by radiation. By the arrangement here shown buildings unprovided with basements may install a system fully as the present hot air and hot water systems requiring a basement installation and may be installed as cheaply as any of the present known hot water or hot air systems and may be arranged to burn any type of fuel.

By positioning the fire place on the first floor of a building, the fire is in convenient position to be observed and cared for with a minimum amount of labor.

What I claim and desire to secure by Letters Patent of the United States is—

1. In a heating system for buildings, the combination of a fire box formed of hollow metal walls providing water reservoirs converging at the top, the top having an opening, a smoke flue connected with the said opening, water reservoirs provided about the smoke flue and opening into the converging ends of the said hollow fire box walls, tubes on each side of the interior of the fire box, the tubes on one side being connected with the bottom of the hollow side walls and extending upward and connecting with the same side directly below the connection with the flue reservoir on that side, the pipes on opposite sides of the box converging at the top, and a grate at the bottom of the said fire box.

2. In a heating system for buildings, the combination of a fire box formed of hollow metal walls converging at the top and providing water reservoirs, the top having an opening, a smoke flue connected therewith, water reservoirs provided about the flue opening into the converging ends of the said hollow fire box walls, the fire box being open on one side, a pair of tubes each connected to a side wall at the bottom and converging toward the top opening into the upper end of the said hollow wall directly beneath the opening of the flue reservoir, a water circulating system connected with the upper end of the smoke flue reservoirs and the bottom of the fire box reservoir adjacent the said tubes, and an inclosing casing for the said fire box and flue reservoirs providing air conduits.

3. In a heating system, a rectangular fire box formed of three hollow metal walls and being open on the fourth side, a grate formed at the bottom of the box, the two opposite side walls of the fire box being formed with an auxiliary chamber at the bottom and the said walls converging at the top, water tubes on each side connecting the companion auxiliary chamber with the upper converging end of the hollow wall on that side, there being an opening provided at the upper end of the chambers, a smoke flue connected with the said opening, water reservoirs about the said flue opening respectively into the said converging ends of the side walls, a valved conduit leading from each auxiliary chamber into the bottom of the companion hollow side wall, and a return line for each valved conduit connected with the top of the smoke flue chambers, and a radiator in each return line.

4. In a heating system for buildings a fire box having fire walls formed of hollow metal providing water reservoirs, the water reservoirs converging at the top, a smoke flue opening into the fire box at the top, the smoke flue having water reservoirs thereabout opening into the fire box reservoirs, water tubes connecting with the bottoms of the fire box reservoirs and opening into the flue reservoirs at the bottom, a return line connecting with the top of the flue reservoirs and the bottom of the fire box reservoirs, and radiators in said return line forming a part thereof.

5. In a heating system for buildings, a fire box formed of hollow metal providing water reservoirs, the said reservoirs having division walls near the bottom providing separate auxiliary chambers, the reservoirs on opposite sides converging toward the center at the top, water tubes connecting with the auxiliary chamber at the bottom of the water reservoir and extending upward at an angle toward the center and opening into the reservoirs at the top, a smoke flue opening into the fire box, water chambers surrounding the smoke flue in communication with the fire box reservoirs, the said water tubes opening into water reservoirs at the lower end of the flue reservoirs whereby the heated water flows directly into the flue reservoirs, a return line connected with the top of the flue reservoirs and the bottom of the fire box reservoirs, the said return line at the bottom opening into both chambers of the fire box reservoirs, a valve in the said return line between the two points of

communication with the chambers of the fire box reservoirs, said valve when opened, allowing water to flow from the main reservoir into the said auxiliary chamber.

6. In a heating system, a fire box formed of hollow metal walls providing water chambers, the chambers having a division wall near the bottom to provide a lower auxiliary water chamber and an upper main chamber, a return line in communication with the upper ends of the reservoirs and with the bottom main chamber and auxiliary chamber, a valve in the line between the two parts of the reservoirs whereby when the return line is closed the valve may be opened to allow circulation between the main chamber and the auxiliary chamber, water tubes connecting the said auxiliary chamber with the upper ends of the main reservoir and extending at an angle over the fire box, the water chambers having a vent to atmosphere whereby excess pressure may not be developed in the water system.

7. In a heating system for buildings, a fire box formed of converging hollow walls providing water reservoirs, the reservoirs on each side having a dividing wall near the bottom providing auxiliary reservoirs, valved conduits each providing a passageway from a main reservoir to the companion auxiliary reservoir, and tubes on each side of the fire place connecting with the respective auxiliary reservoir at the bottom and with the companion main reservoir at the top, the tubes converging at the top.

8. In a heating system for buildings, a fire box formed of converging hollow fire walls providing water reservoirs, the reservoirs at each side of the fire place having a dividing wall near the bottom providing an auxiliary reservoir, conduits each providing a passageway from each main reservoir to the companion auxiliary reservoir, a valve in each conduit for closing the main reservoir to the auxiliary reservoir, a plurality of tubes at each side of the fire place connecting with the respective auxiliary reservoir at the bottom and the companion main reservoir at the top, the tubes converging at the top, a smoke flue opening into the fire place, chambers thereabout providing water reservoirs opening into the main reservoirs at the top directly over the upper ends of the tubes, a radiator, a supply line therefor connecting with the top of the smoke flue reservoir, and a return line connected with the valved conduit and opening directly into the auxiliary reservoir.

In testimony whereof, I sign this specification.

JOSEPH C. LOYER.