

March 22, 1927.

J. M. HARRISON

1,621,881

HEATING SYSTEM

Filed Feb. 15, 1924

2 Sheets-Sheet 1

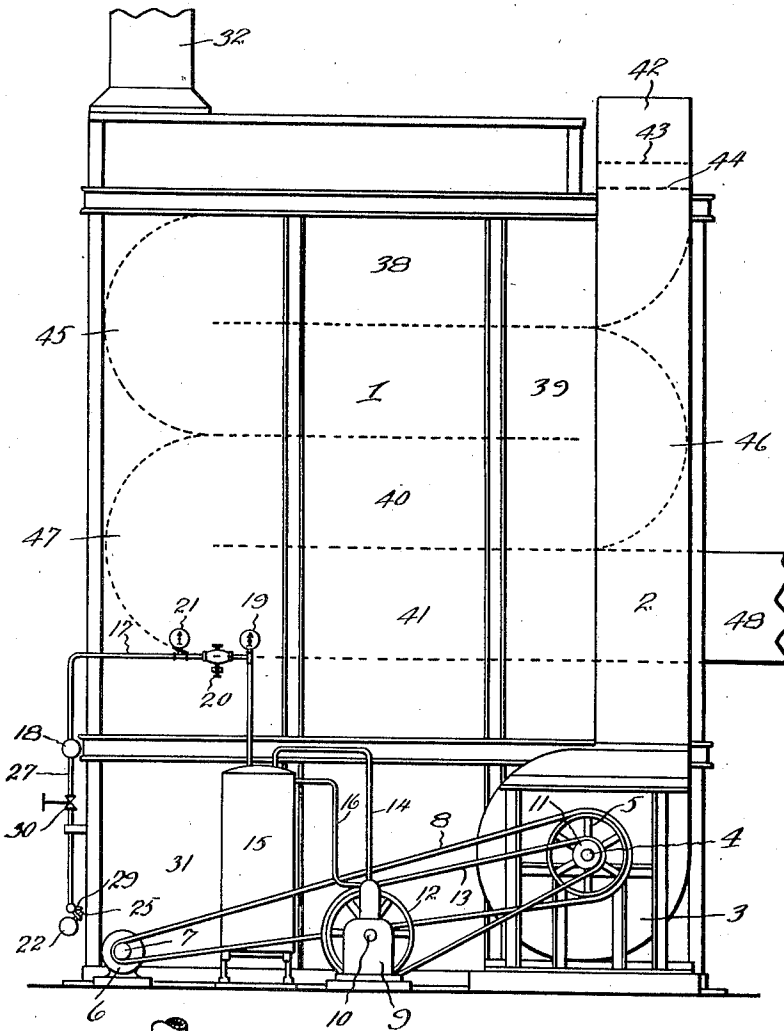


*Fig. 1*

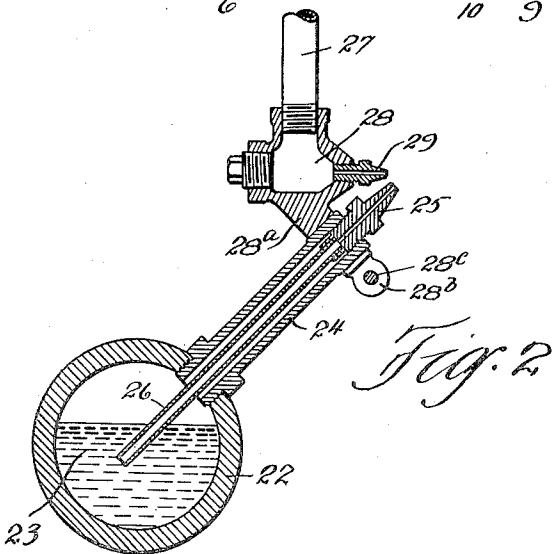


*Fig. 2*

Inventor  
James M. Harrison,  
By Stull, Bink & Met,  
Attys.

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J. M. HARRISON

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*Fig. 3*

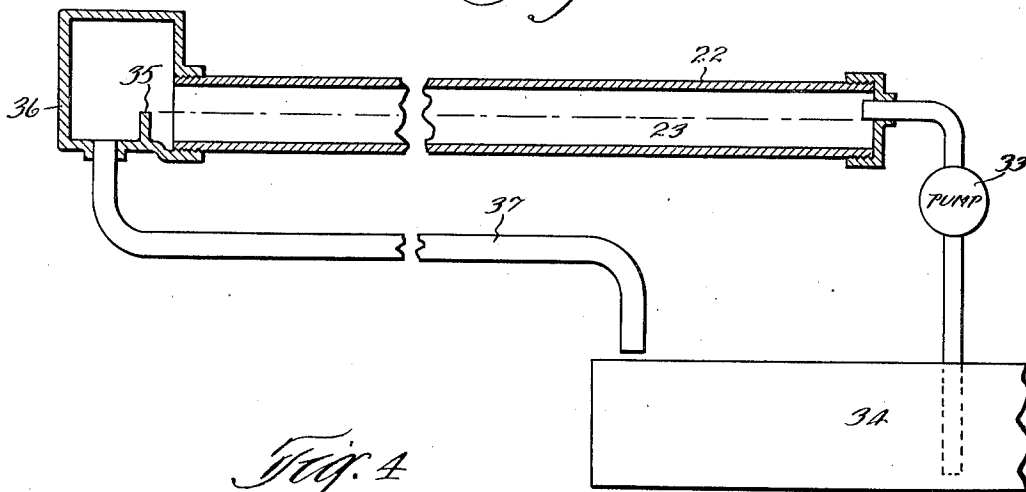


*Fig. 4*

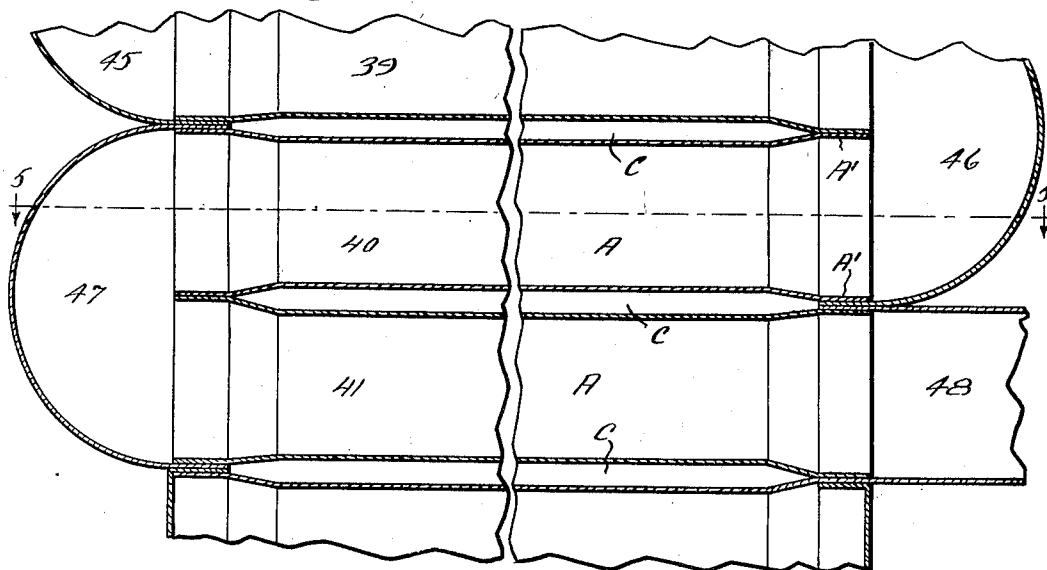
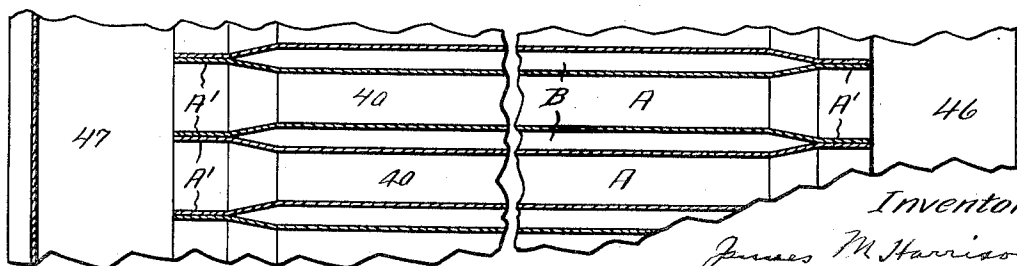


*Fig. 5*

Inventor  
James M. Harrison,  
By *Full, Burt & West,*  
Attys.

Patented Mar. 22, 1927.

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# UNITED STATES PATENT OFFICE.

JAMES M. HARRISON, OF CLEVELAND, OHIO, ASSIGNOR OF ONE-HALF TO HARRY P. McCANN, OF CLEVELAND, OHIO.

## HEATING SYSTEM.

Application filed February 15, 1924. Serial No. 693,007.

This invention relates to air-heating apparatus or systems and more especially to means for controlling the supply of air and combustible heating fluid to such apparatus or systems. The invention has for its general object to provide an apparatus or system of this character wherein the flow of combustible fluid will be regulated in a most efficient manner; also to provide an apparatus or system wherein there will be no danger of explosions through the accumulation of unconsumed combustible fluid in the combustion chamber or combustion spaces; also to provide an apparatus or system wherein the supply of combustible fluid to the combustion chamber or spaces is so related to the supply of the air to be heated that the former supply will be positively discontinued by the discontinuance of the latter supply, thus preventing waste of the combustible fluid and injury to the air-heating flues or chambers.

In the drawing, Fig. 1 represents an elevation of an air-heating system or apparatus embodying my invention; Fig. 2 a detail in section of one of the oil burners employed therein; Fig. 3 a longitudinal sectional view through the oil distributing tank or header, showing diagrammatically and in elevation the manner of supplying oil thereto and of maintaining a predetermined head or level of oil therein; Fig. 4 a detail in vertical section, and Fig. 5 a detail in horizontal section (corresponding to the line 5-5 of Fig. 4), through a part of the apparatus or system.

Describing the parts by reference characters, 1 denotes the casing of an air heater, which heater comprises preferably vertical series of horizontally arranged air-heating flues, with intermediate vertical flues or spaces for products of combustion, preferably such as shown, described and claimed in my application No. 507,604, filed October 14, 1921. The air-heating flues are supplied with cold air from a distributing duct 2, the air being forced into said duct by means of a blower 3 having a fan therein (not shown) the shaft whereof is indicated at 4, said shaft being provided with a pulley 5, by means of which and a motor 6, a pulley 7 and a belt 8, the said shaft is driven.

9 denotes an air compressor, the shaft 10 whereof is driven from the fan shaft 4 by means of a pulley 11 on the latter shaft, a

pulley 12 on the former shaft, and a belt 13. From the compressor, a pipe 14 delivers the compressed air into a compression tank 15, said tank being provided with an automatically operating unloader, including the pipe 16, for maintaining in the tank 15 the maximum pressure for which the header is designed.

From the tank 15, a pipe 17 leads to an air header 18. This pipe is provided with a gauge 19 (which shows the pressure in the tank 15) with a pressure reducing valve 20, and with a gauge 21 which shows the pressure in the header 18, as determined by the valve.

Below the header 18 is an elongated reservoir or header 22 containing liquid fuel 23. From this header projects a suitable number of upwardly inclined pipes 24, each having its upper end internally threaded to receive and support a nozzle 25 from which a pipe 26 projects downwardly into the liquid fuel.

From the header 18 extend pipes 27, one for each nozzle 25. Each pipe 27 has at its lower end a chamber 28 carrying a nozzle 29 which extends in operative aspirating relation to a nozzle 25, the chamber having an extension 28<sup>a</sup> which receives the upper end of the corresponding pipe 24 therewithin; the lower end of this extension is split and provided with a pair of lugs 28<sup>b</sup> each having an aperture for a screw 28<sup>c</sup> which draws the parts together, with the nozzles 25 and 29 in proper relation to each other. Each pipe 27 is provided with a valve 30. The burners constituted by the parts 25 and 29 discharge into a combustion chamber 31 below the air heating flues or elements thereabove and with which the duct 2 communicates. The products of combustion ascend from the chamber 31 through the flues provided therefor between the air-heating flues or elements and are discharged into the stack 32.

It is desirable, if not important, that the head or level of the oil 23 in the reservoir 22 should be constant. In order to secure this result, a pump 33 supplies oil from a suitable storage tank 34 to the reservoir or header 22, preferably through one end of the latter. Adjacent its opposite end this reservoir is provided with a dam 35, located within a chamber 36. The pump will ordinarily supply oil somewhat in excess of the

capacity of the burners, so that surplus oil will flow over the dam 35 into the chamber 36 and be returned by a pipe 37 to the storage tank 34, for re-use. This arrangement insures the maintenance of a predetermined level of oil in the reservoir or header 22. The pump 33 may be driven by any suitable means.

The air heater shown herein comprises horizontal series of heating elements, with interposed combustion flues, four such series being indicated in Fig. 1 and designated by the numerals 38, 39, 40 and 41. Each series comprises a plurality of air heating elements placed side by side and forming a horizontal series. Each element is preferably formed of sheet metal and is substantially rectangular in section, its vertical dimension being greatly in excess of its horizontal dimension, whereby narrow vertically-arranged air flues are formed. These flues or elements have each outwardly flared ends A', which ends are adapted to contact with the ends of the sides of adjacent flues or elements in the same series and with the ends of the top and bottom walls of the flues or elements in the series above and below the same. This results in providing vertical flues B for products of combustion between the flues or elements A; also in providing horizontal flues C above and below the flues or elements A and communicating with the flues B, thus allowing for a circulation of the products of combustion and heated gases between and around the air-heating flues.

The upper end of the duct 2 communicates with a header 42 which extends across the top of the casing 1, the upper wall of the header being inclined downwardly, the rear end of such upper wall being shown at 43 and the bottom wall of the header being shown at 44. This header supplies air to the right hand ends of the elements A of the series 38. This series is connected by a pass hood 45 with the next series 39, and this series is connected by a pass hood 46 with the series 40, while the last mentioned series of heating elements is connected by a pass hood 47 with the bottom series 41. From this bottom series, a pipe 48 carries the air to the point of use.

With the parts constructed and arranged as described, it will be evident that, as long as air is being forced through the heating flues or elements A, the compressor will also be operating to maintain a proper pressure of air at the nozzles 29 to ensure the feeding of liquid fuel through the nozzles 25; but that, practically as soon as the operation of the motor, fan, or compressor is stopped, there will be no supply of fuel to the combustion chamber; the capacity of the tank 15 is so small that, in practice, as soon as the compressor stops, the pressure of air

falls so quickly that the fuel supply and the flame within the combustion chamber will be cut off within a few seconds. Furthermore while the system is at rest, it will be impossible to light the burners; the fan must be started before the liquid fuel can be atomized and fed to the combustion chamber by the nozzles 25. It follows that there can be no accumulation of unconsumed liquid fuel in the combustion chamber, as no fuel can be supplied thereto except in connection with the supply of the air which atomizes the fuel and forms a combustible mixture therewith; and there can be no heating of the walls of the air flues or chambers except when air is being circulated therethrough, and hence there can be no danger of burning out such walls. The system or apparatus, while simple in construction, is remarkably efficient in operation.

While my system, as shown herein, is intended for the heating of air, it will be evident that it may be used for the heating of other gaseous or aeriform fluids, if desired.

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

1. The combination, with an air heater, of a combustion chamber in operative relation thereto, means for supplying air to said heater, air-pressure-creating means, connections for driving the same, a tank, a pipe leading from such pressure-creating means to said tank, means for maintaining a predetermined maximum pressure in said tank, a header, a pipe leading from said tank to said header and means for maintaining a predetermined pressure in said header, a reservoir for liquid fuel, means for maintaining a predetermined level of fuel in said reservoir, nozzles extending from and communicating with said reservoir and arranged above the level of liquid fuel therein, an aspirating nozzle arranged in operative relation to each of the first mentioned nozzles, and pipes connecting such aspirating nozzles with said header.

2. The combination, with an air heater, of a combustion chamber in operative relation thereto, a liquid fuel reservoir arranged outside said chamber, nozzles communicating with said reservoir and extending therefrom above the liquid fuel therein, aspirating and atomizing nozzles cooperating with the first-mentioned nozzles and adapted to lift the liquid fuel to the delivery ends of the first mentioned nozzles and to atomize such fuel and deliver the mixture to said combustion chamber, means for forcing air through said heater, and means, operative by such air-forcing means, for supplying aspirating and atomizing fluid to the second set of nozzles.

3. The combination, with an air heater, of a combustion chamber in operative relation thereto, means for forcing air through said

heater, a liquid fuel burning device comprising a reservoir for liquid fuel and means for maintaining a predetermined level of liquid fuel therein, a nozzle communicating with such reservoir and extending above the level of the liquid fuel, means for aspirating fuel from said nozzle and for delivering the same into said combustion chamber, and connections between the air-forcing means and the fuel-aspirating means for operating the fuel-aspirating means only through the air-forcing means.

4. The combination, with an air heater, of a combustion chamber in operative relation thereto, means for forcing air through said heater, a liquid fuel burning device comprising a reservoir for liquid fuel, a nozzle communicating with such reservoir and extending above the level of the liquid fuel, means for aspirating fuel from said nozzle and for delivering the same into said combustion chamber, and connections between the air-forcing means and the fuel-aspirating means for rendering the aspirating means operative only in conjunction with the air-forcing means.

5. The combination, with an air heater, of a combustion chamber in operative relation thereto, means for forcing air through said heater, a pressure-creating device, means driven by the air-forcing means for operating said device, fluid fuel burner mechanism, means for supplying fluid under pressure from said device to said burner mechanism, and means for maintaining under a predetermined pressure the fluid supplied to said mechanism.

6. The combination, with an air heater, of a combustion chamber in operative relation thereto, means including a fan shaft for supplying air to said heater, a compressor and means for driving the same from said fan shaft, a tank, a pipe leading from said compressor to said tank, means for maintaining a predetermined maximum pressure in said tank, a header, a pipe leading from said tank to said header and means for maintaining a predetermined pressure in said header, a res-

ervoir for liquid fuel, nozzles extending from and communicating with said reservoir and arranged above the level of liquid fuel therein, an aspirating nozzle arranged in operative relation to each of the first-mentioned nozzles, and pipes connecting such aspirating nozzles with said header.

7. The combination, with an air heater, of a combustion chamber in operative relation thereto, a liquid fuel reservoir, nozzles communicating with said reservoir and extending therefrom above the liquid fuel therein, aspirating and atomizing nozzles cooperating with the first mentioned nozzles and adapted to supply atomized fuel to said combustion chamber, means for maintaining a predetermined level of liquid fuel within said reservoir, means for forcing air through said heater, and means, operative in conjunction with such air-forcing means, for supplying aspirating and atomizing fluid to the second set of nozzles.

8. The combination, with an air heater, of a combustion chamber in operative relation thereto, means for forcing air through said heater, pressure-creating mechanism, means driven by the air-forcing means for operating said mechanism, a plurality of atomizing devices for supplying liquid fuel to said chamber, means for supplying fluid under pressure from the pressure-creating mechanism to the said devices, and means for maintaining under a predetermined pressure the fluid supplied to such devices.

9. The combination, with an air heater, of means for forcing air therethrough, one or more fluid-fuel supply and burning devices for heating the air heater, and means including a fluid pressure-creating device for forcing fuel to the former device or devices, and connections between the air-forcing means and the last-mentioned means whereby the last-mentioned means is operative only in conjunction with the air-forcing means.

In testimony whereof, I hereunto affix my signature.

JAMES M. HARRISON.