W. F. KEENAN, JR.

AIR HEATER FOR FURNACES.

APPLICATION FILED JULY 24, 1920.

1,421,247.

Patented June 27, 1922.

2 SHEETS—SHEET 1.

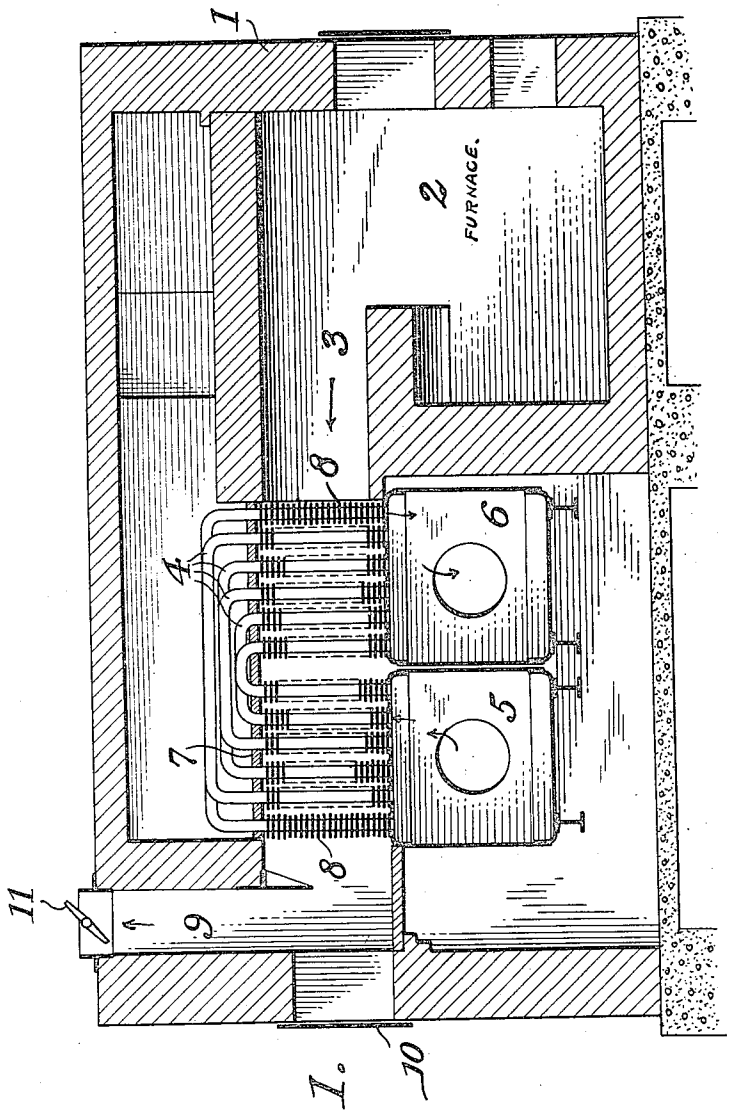


Fig. 1.

INVENTOR

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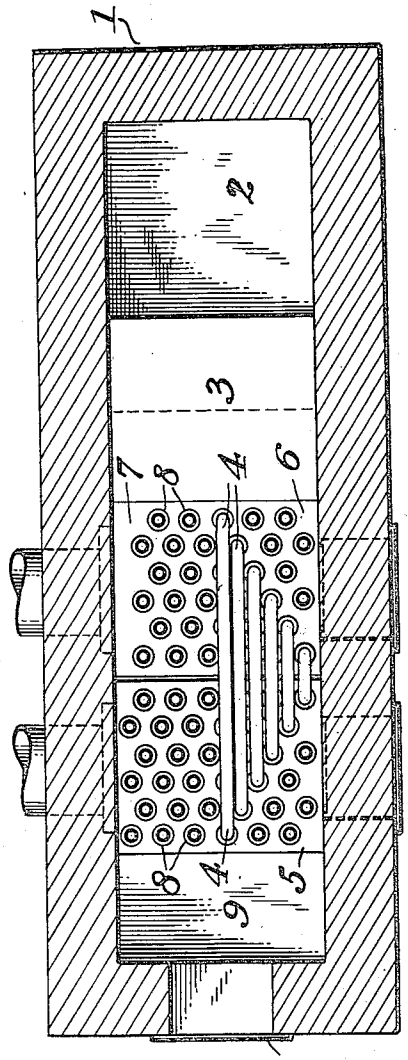


Fig. 2.

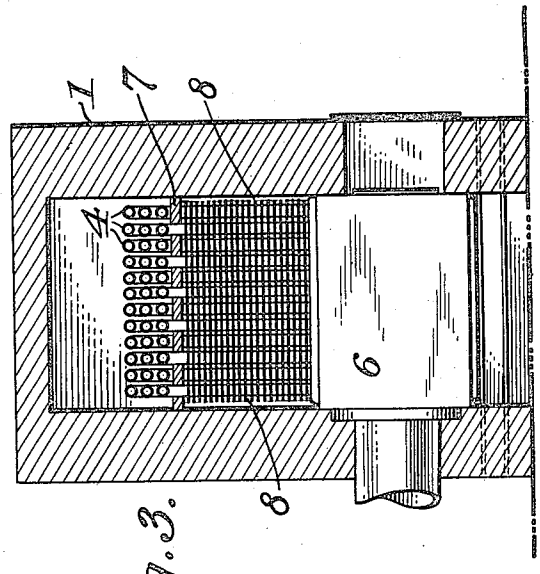


Fig. 3.

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UNITED STATES PATENT OFFICE.

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AIR HEATER FOR FURNACES.

1,421,247. Specification of Letters Patent. Patented June 27, 1922.

Application filed July 24, 1920. Serial No. 398,680.

To all whom it may concern:

Be it known that I, WALTER F. KEENAN, Jr., a citizen of the United States, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Air Heaters for Furnaces, of which the following is a full, clear, and exact description.

In certain arts it is necessary to produce and supply highly heated air in very considerable volume and at substantially uniform temperature, but the means heretofore used for this purpose have proved inadequate and uneconomical. The primary object of my present invention is to provide a better means for raising the air in the required volume and at the proper pressure, to the desired temperature, and it consists, broadly, in such disposition of the air conveying tubes or channels that while having the proper length to permit of the maximum absorption of heat, they will be exposed to approximately the same heating effect whereby the average temperature of the issuing air will be the same from all of them.

In explanation of this, let us assume a series or bank of tubes through which air to be heated is passed and that such bank of tubes is arranged in a passage for hot gases from a suitable furnace. It is manifest that without special provision to the contrary, those tubes which are nearest the source of heat will deliver hotter air than those which are more remote therefrom, and this is undesirable.

To avoid this objection I so arrange the tubes that each shall pass through the heating current of gas at two points, of such temperature that their average shall always be the same. From this it results that the total or aggregate amount of heat absorbed by such tubes as a whole will be the same.

This invention may be carried out in various ways, but in the drawings hereto annexed I have shown a typical form of heating device in which the principle of operation above stated is most effectively and perfectly carried out.

Fig. 1 is a vertical longitudinal section of the improved device.

Fig. 2 is a horizontal section of the same, and

Fig. 3 is a vertical cross section.

In carrying out this invention I use any suitable form of furnace 1 burning solid fuel, gas or oil and comprising a fire or flame chamber 2, and an upper lateral chamber 3 to prevent direct access of the flames to the heat absorbing tubes.

The air tubes are designated by the numeral 4; each tube is approximately U-shape, its legs crossing the passage 3 at two points. The cold air is introduced into an inlet box or header 5 with which one end of each tube is connected and taken off from the box or header 6, with which the opposite ends of all the tubes connect. The central horizontal portions of the tubes preferably extend across a heat-resisting wall or partition 7.

Those portions of the tubes 4 which are immediately exposed to the heat are enclosed in a casing composed of cast-iron rings 8 which increase the heat-absorbing surface and serve as a protection to the tubes proper. All of the tubes, it will be observed, are in multiple, whereby a passage of large area for the air is afforded and the pressure required for forcing the air through greatly reduced.

The tubes which have one leg in that portion of the passage nearest the fire, and where the temperature is highest, have their other legs in that portion most remote from the fire or where the temperature is lowest. The next and the succeeding rows of tubes are similarly arranged, so that the average heating effect upon all of the tubes will be approximately the same. The inner or shortest tubes, for example, pass through the passage 3 at two points of nearly the same temperature, but which will average up the same as the two points nearest and most remote from the source of heat.

The hot gases after sweeping the bank of tubes and imparting their heat thereto, pass off by a flue 9 which may be provided with an inspection door 10 and a draft-regulating damper 11.

The specific construction of the furnace, except in the respects above noted, is largely immaterial. This also applies to the materials employed in its construction, but in any case the principle of construction hereinabove set forth should be carefully observed. If, for example, all of the tubes 4 were of the same dimensions and connected corresponding points in the two boxes or headers, it is manifest that the only way

to prevent excessively uneven heating of the air therein would be to create by some appropriate means a whirling or eddying of the air in the boxes.

What I claim as my invention is:—

1. An air heater comprising a passage for the hot gases, a bank of U-tubes for the air to be heated with their parallel legs crossing said passage and so disposed that each tube of the bank will be exposed to the same aggregate effect of the hot gases as any of the other tubes.

2. An air heater comprising a bank of tubes arranged in a passage for hot gases, each tube of the bank crossing said passage at two points, the temperatures at which average the same as the average at the points of crossing of any other tube.

3. An air heater comprising a bank of U-tubes connected in multiple with inlet and outlet headers, and crossing a passage for hot gases, each tube having one leg near the source of heat and the other remote therefrom, so that the temperatures at the two points of crossing will average the same.

4. An air heater having a passage for the hot gases, a bank of U-tubes, the parallel legs of which cross said passage at two points, means outside the passage for supplying to the legs more remote from the furnace air to be heated and similar means for receiving the heated air from the other legs, the said tubes being of different lengths and so connected to the said means that each is exposed to the same aggregate heating effect and delivers air heated to the same temperature.

In testimony whereof I hereto affix my signature.

WALTER FRANCIS KEENAN, Jr.