Jan. 24, 1933. H. J. KERR 1,894,956

AIR HEATER

Filed Jan. 16, 1929

Fig. 1.

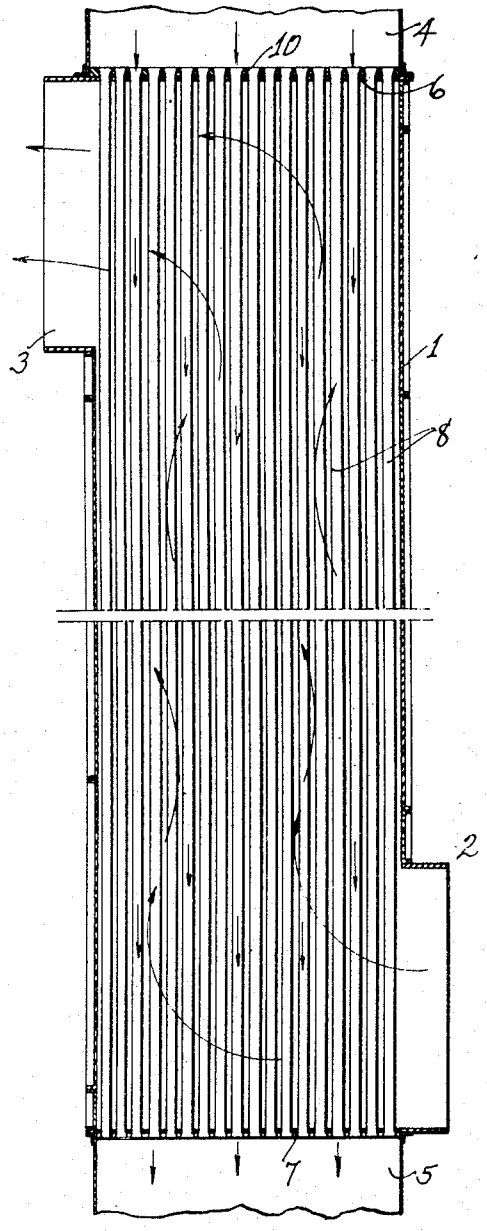


Fig. 3.

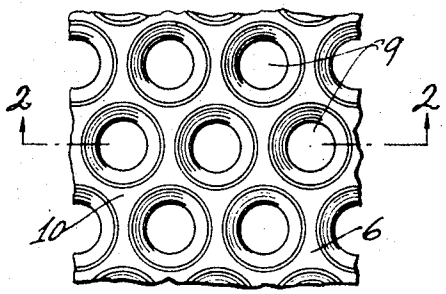


Fig. 2.

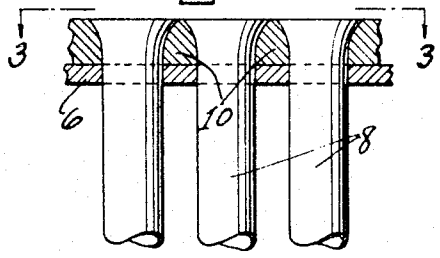


Fig. 4.

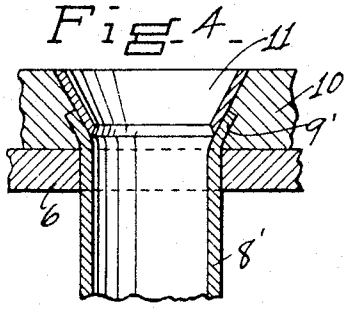
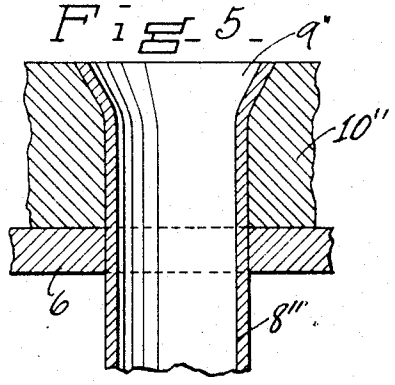


Fig. 5.



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AIR HEATER

Application filed January 16, 1929. Serial No. 333,009.

This invention relates to a tubular air heater with tube plates in which a layer or covering of refractory material is applied to the hottest plate to protect the same. The invention will be understood from the description in connection with the accompanying drawing in which Fig. 1 is a vertical section through an illustrative embodiment of the invention, Fig. 2 is a vertical section on an enlarged scale partly broken away and taken along the line 2—2 of Fig. 3, Fig. 3 is a plan view taken along the line 3—3 of Fig. 2, Fig. 4 is a vertical section on an enlarged scale partly broken away, showing a modification, and Fig. 5 is a similar section showing another modification.

In the drawing, reference character 1 indicates the casing of the air heater that is provided with a cold air inlet 2 on one side at the bottom and an outlet 3 for the heated air on the other side at the top. A hot gas inlet 4 leads downwardly to the top of the heater and an outlet 5 for the cooled gases is provided at the bottom.

Tube plates 6 and 7 are provided at the upper and lower ends, respectively, of the air heater and are shown as being connected by rows of straight parallel tubes 8. These tubes are illustrated as being round, but tubes of other shapes may be used. The invention is also applicable to plate air heaters.

With the gases flowing downwardly, as illustrated, the upper plate 6 is to be protected from the excessive heat. The upper ends of the tubes 8 extend through the plate 6 a sufficient distance to allow their ends to be belled and thus provide a sort of Venturi effect for the entering gases. Heat insulating material 10 is installed on the top side of the plate 6 between the belled extensions 9 of the tubes 8, and these extensions aid in keeping the heat insulating material in place. This heat insulating material may, for example, be refractory material that is applied in a plastic state between the belled extensions of the tubes. The upper surface of the layer or covering of heat insulating material 10 is flush with the upper ends of the tubes 8. In case the gases pass through the tubes in the opposite direction the heat insulating material would be applied to the other tube plate.

In the modification shown in Fig. 4 the upper ends of the tubes 8′ extend only short distances beyond the upper surface of the plate 6 and are belled outwardly as indicated at 9′. Conical ferrules 11 are installed in the belled portions 9′ of the tubes, and may be welded thereto at intervals, if desired. The portion of the ferrules of least diameter is equal to the inner diameter of the tubes. The insulating layer 10 is provided as indicated above.

In the modification shown in Fig. 5, the tubes 8″ extend greater distances beyond the upper side of the plate 6 and are belled outwardly as indicated at 9″ near their ends, with a thicker layer 10″ of insulating material applied to the plate.

I claim:—

1. In an air heater, tubes, tube plates, a layer of heat insulating material on one of said plates, and extensions on said tubes passing through said layer having internal diameters as large as the internal diameters of said tubes.

2. In an air heater, tubes, tube plates, a layer of heat insulating material on one side of said plates, and extensions on said tubes passing through said layer having internal diameters as large as the internal diameters of said tubes, said extensions being belled at their ends.

3. In an air heater, tubes, tube plates, a layer of heat insulating material on one of said plates, and extensions on said tubes passing through said layer having internal diameter as large as the internal diameter of said tube, said extensions flaring outwardly at the outside surface of said layer.

4. In an air heater having a cold air inlet and a hot air outlet, tubes, tube plates, a refractory covering for one of said plates, and flared extensions on said tubes passing through said covering.

5. In an air heater, having a cold air inlet and a hot air inlet tubes, tube plates, a refractory covering for one of said plates, and flared extensions on said tubes passing through said covering, said extensions being

sufficiently far apart to permit introduction of the covering between the flared portions when in a plastic state.

6. In an air heater, a tube plate, a layer of heat insulating material adjacent the tube plate, tubes extending therethrough expanded to bell form to facilitate the entrance of fluid to the tubes and provide a keying means for the layer of heat insulating material adjacent the tube plate.

7. In a heat exchanger, a tube plate, a layer of heat insulating material adjacent the tube plate, tubes extending therethrough expanded to bell form, the bell portion providing a keying means for the layer of heat insulating material adjacent the tube plate.

8. In an air heater, a tube plate, a layer of heat insulating material adjacent the tube plate, tubes with ferrule extensions thereon extending through the plate expanded to bell form to facilitate the entrance of fluid passing through said tubes and provide a keying means for a layer of heat insulating material surrounding the expanded portions.

9. In a heat exchanger, a tube plate, a layer of heat insulating material adjacent the tube plate, tubes with ferrule extensions thereon extending through the plate expanded to bell form, the bell portion providing a keying means for a layer of heat insulating material surrounding the expanded portion.

10. In an air heater associated with a gas passage, a plurality of tubes connected to tube plates, tubes extending through the plates having ends expanded to bell form to facilitate the entrance of fluid to the tubes and to provide a keying means for a layer of heat insulating material covering one of said plates, and an air inlet and outlet associated with said gas passage so that air admitted to the inlet passes along said tubes on its way to the outlet.

11. In a heat exchanger, a chamber arranged to receive a heating fluid, a plate member extending across said chamber in the path of said heating fluid and formed with a series of openings therein, a plurality of conduit elements in said chamber for said heating fluid having unrestricted end portions passing through said openings and projecting beyond the outer side of said plate member, a layer of protective material surrounding the projecting portions of said conduit elements and contacting with the outer side of said plate member, the projecting portions of said conduit elements being constructed to hold said protective material against the outer side of said plate member, and inlet and outlet connections to said chamber at the inner side of said plate member for the fluid to be heated.

HOWARD J. KERR.

CERTIFICATE OF CORRECTION.

Patent No. 1,894,956. January 24, 1933.

HOWARD J. KERR

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows; Page 1, line 96, claim 5, strike out the comma, and line 97 for "inlet" read "outlet,"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 28th day of March, A. D. 1933.

M. J. Moore.

(Seal) Acting Commissioner of Patents.