

Jan. 29, 1957

SHIGEYOSHI KURODA

2,779,573

AIR PREHEATER

Filed Oct. 30, 1952

2 Sheets-Sheet 1

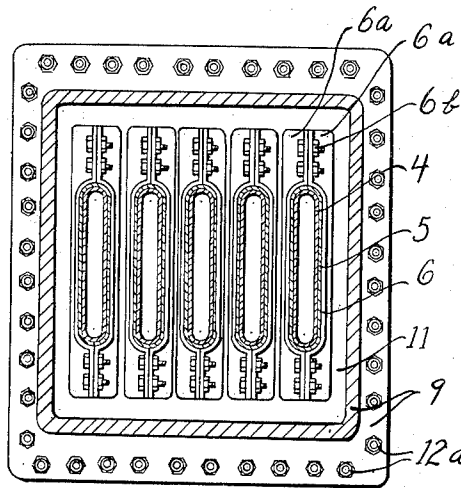


FIG. 2.

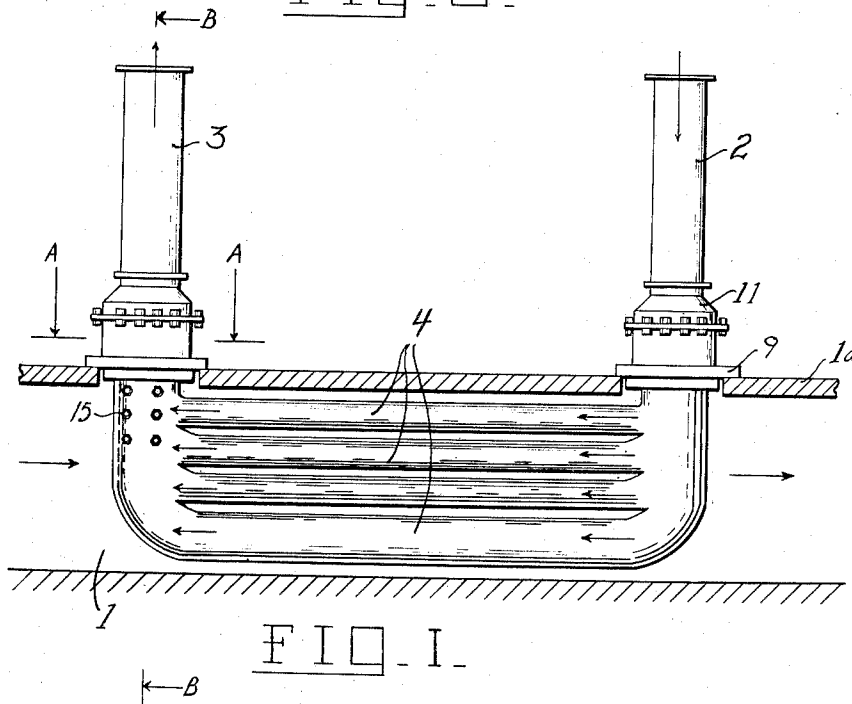


FIG. 1.

INVENTOR:
SHIGEYOSHI KURODA

BY

Richardson, David and Nordon
ATTY'S

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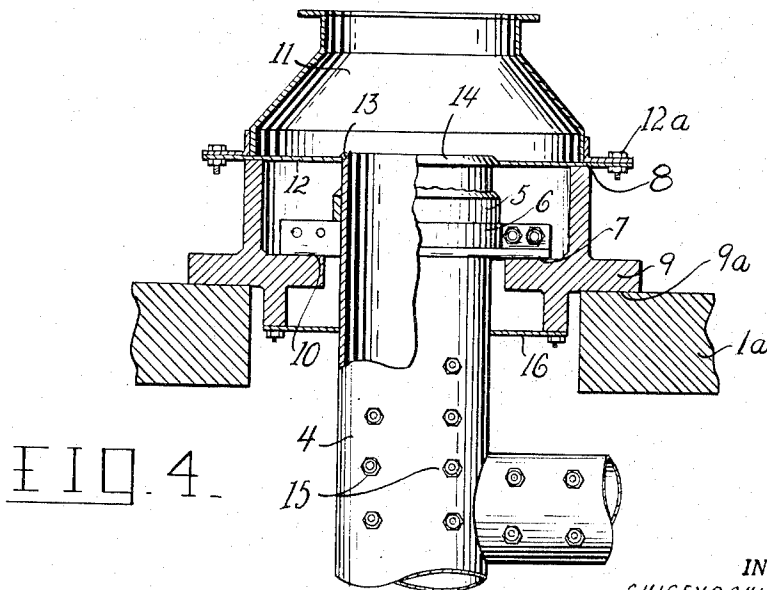
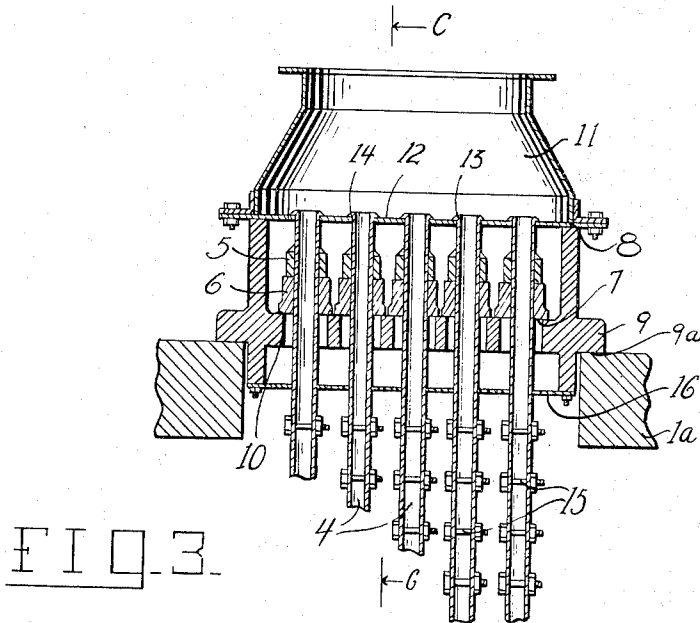
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INVENTOR:
SHIGEYOSHI KURODA
BY
Richardson, David and Gordon
ATTY'S

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AIR PREHEATER

Shigeyoshi Kuroda, Yoyogi, Shiyuya-ku, Tokyo, Japan,
assignor to Nippon Kokan K. K. (Nippon Steel Tube
Co. Ltd.), Tokyo, Japan, a corporation of Japan

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5 Claims. (Cl. 257—241)

The present invention relates to heat exchangers or preheaters for the combustion air used in furnaces, and more particularly to preheaters of this type in which the preheater or heat exchanger transfers heat from the flue gas produced by the furnace to the combustion air supplied thereto.

Among the objects of the invention is the provision of an air preheater or heat exchanger of this character in which the dimensional changes in the device produced by temperature changes in the flue, and particularly the large changes which occur when the furnace is started or stopped, are prevented from setting up stresses in the heat exchanger. The construction of the preheater of the present invention includes gastight expansion joints which prevent the occurrence of such stresses.

A further object of the invention is to provide a preheater or heat exchanger of this character in which ducts are provided within which the heat exchange takes place, these ducts being constructed with walls of relatively thin thermally conductive material, the ducts being reinforced by suitable means such as bolts.

Another object of the invention is the provision of a heat exchanger of this character which includes means for the prevention of gas leakage between the flue and the air ducts of the preheater.

A further object of the invention is to provide a heat exchanger of this character in which the ducts are shaped to avoid the production of turbulence or eddies in the flowing flue gas.

Still another object of the invention is the provision of ducts which are formed to resist and to minimize aerodynamic stresses produced by the flowing flue gas.

Other and further objects will become apparent upon reading the following specification together with the accompanying drawing forming a part hereof.

Referring to the drawing:

Fig. 1 is a side view in elevation of an embodiment of the invention.

Fig. 2 is an enlarged plan sectional view taken along the line A—A of Fig. 1.

Fig. 3 is an enlarged fragmentary sectional view in elevation taken along the line B—B of Fig. 1, looking in the direction of the arrows.

Fig. 4 is a sectional view in elevation taken along the line C—C of Fig. 3, looking in the direction of the arrows.

Referring to the drawing, Fig. 1 shows a heat exchanger or preheater according to the invention disposed in a horizontally extending section of a flue 1, and comprising an air inlet duct 2 and an air outlet duct 3 interconnected by a plurality of flat heat exchanging ducts 4. The direction of flue gas flow is indicated by the arrows, the air inlet 2 being disposed downstream in the flue with respect to the air outlet 3, the air outlet 3 thus being nearer to the furnace (not shown) than the air inlet 2.

The arrangement of the ducts at the air inlet 2 and the air outlet 3 is the same. Each duct 4 is provided with an external collar 5 fixedly connected thereto, as by welding. Each collar 5, at its lower edge, rests upon a duct holder

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6. The duct holder 6 is made up of two symmetrical sections 6a held together by bolts 6b, the under side of each duct holder 6 being provided with a flat machined contact surface 7 which rests upon a similar flat machined contact surface 10 of a supporting member 9 forming a gastight sliding connection therewith. Supporting member 9 is provided with a lower flanged portion 9a provided with perforations and seating within an aperture provided in the flue, thus resting upon the upper wall 1a of the flue 1.

The ducts 4, at each end, terminate within an air chamber 11 which is provided at its under side with a flat closure member shown as a plate 12 secured thereto by bolts 12a. The flat under side of closure plate 12 rests upon the upper machined contact surface 8 of the supporting member 9, forming a sliding gastight connection therewith.

The upper ends of the ducts 4 extend through openings 13 in closure plate 12, and the upper ends of the ducts 4 which extend into air chamber 11 are turned over to form laterally extending edges 14 which project upon and rigidly fixed to the upper surface of closure plate 12 in a gastight manner by welding.

Each of the flat air ducts 4 is reinforced between its sides by transversely extending means such as the bolts 15. The bolts 15 may include spacers placed between the walls of each duct, or they may comprise shouldered studs with threaded ends so that the side walls of the ducts 4 are securely held in fixed spaced relationship.

Secured to the under side of supporting member 9 is an apertured plate 16 which acts as a dust shield, preventing ash carried by the flue gas from entering the supporting member 9 and being deposited on the contact surfaces 10 which would tend to impair the sliding gastight connection between the duct holders 6 and the supporting member 9.

In operation, as the temperature of the flue gas heating the preheater changes, and particularly when the flue gas temperature increases when the furnace is started, or falls as the furnace cools off after it is stopped, the accompanying expansion or contraction of the longitudinal portions of the ducts 4 causes the machined under surfaces 7 of the duct holders 6 to slide over the machined upper surfaces 10 of the supporting member 9, remaining therewith. Moreover, the weight of the ducts provides a constant pressure therebetween and insures gastight engagement without danger of creating stresses in the ducts.

Having thus described an embodiment of my invention, what I desire to secure by Letters Patent is defined in the appended claims.

1. A heat exchanger of the class described, comprising a horizontally extending flue provided with a pair of horizontally spaced apertures; a pair of supporting members seating in said apertures, respectively, in sliding contact with said flue and communicating with the interior of said flue, said supporting members being provided with a plurality of perforations each bounded by a first contact surface; a pair of air chambers operatively connected to said supporting members and communicating with the interior of said flue; and a plurality of heat exchanging flat tubular ducts of relatively thin thermally conductive material, each of said ducts including a horizontal portion disposed within said flue out of contact with the interior thereof and a pair of end portions extending at an angle relative to said horizontal portion, each of said end portions extending through a perforation of a respective supporting member to terminate within the respective air chamber, each of said end portions being provided with a second contact surface in gastight sliding contact with a corresponding first surface of one of said supporting members, whereby relative expansion between said flue and said horizontal portions of said ducts is compensated for by the sliding gastight contact between said first and second contact surfaces, while relative expansion of said

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end portions of said ducts causes the horizontal portions of said ducts to be displaced within the interior of said flue while still remaining out of contact with the latter.

2. A heat exchanger as defined in claim 1, each of said air chambers including a closure plate in sliding gastight contact with its respective supporting member and provided with a plurality of openings, each of said end portions of said ducts extending through a respective opening of one of said closure plates and extending into said air chamber.

3. A heat exchanger as defined in claim 2, the terminals of said end portions being turned out to ensure gastight contact between said ducts and said closure plates.

4. A heat exchanger as defined in claim 3, wherein the planes of contact between said first and second contact surfaces and between said closure plates and said supporting members are parallel to each other and to the axis of said flue.

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5. A heat exchanger as defined in claim 1, including reinforcing means disposed transversely of said ducts for preventing lateral deformation thereof.

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