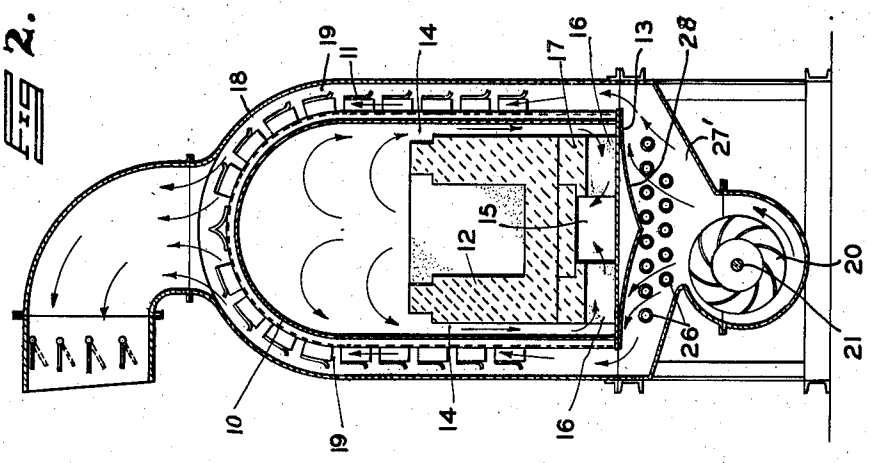
July 23, 1946. A. A. OLSON 2,404,592

DIRECT FIRED UNIT HEATER

Filed Aug. 2, 1941

Fig 2.



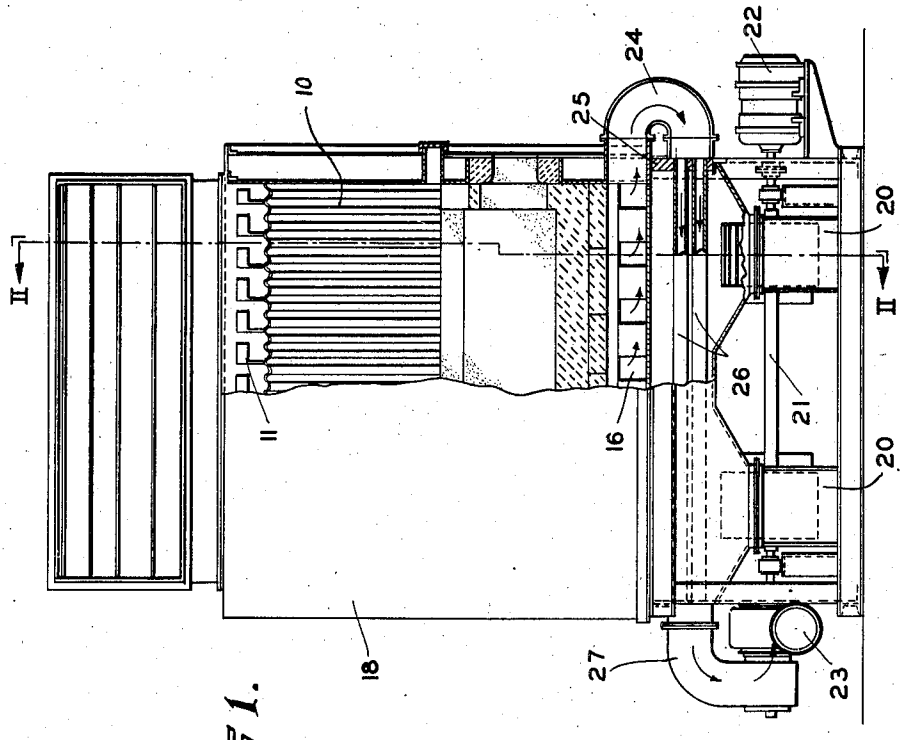


Fig 1.

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DIRECT FIRED UNIT HEATER

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2 Claims. (Cl. 126—110)

1

This invention relates to air heating furnaces and more particularly to such furnaces of the direct fired unit heater type in which the air to be heated is brought in close proximity with heat conducting and radiating surfaces which are in turn directly exposed to the combustion of the fuel employed, all the parts being grouped in a unitary and self-sufficient assembly.

The present invention relates directly to direct fired unit heaters of the general type disclosed in United States Patent No. 2,146,122 to Leif Lee and involves a specific improvement in the air heating furnace construction shown therein.

In the air heating furnace shown in the said patent, combustion of the fuel takes place in an arched-shaped combustion chamber and the exhaust passages for the products of combustion are so arranged that the gases are caused to move downwardly along the side walls of the chamber beyond and below the combustion zone and in uniformly distributed relation throughout the length of the side walls of the combustion chamber. Thus, the gaseous products of combustion are blanketed along either side wall and moved relative thereto in wiping contact. Following the contour of the arched-shaped combustion chamber and substantially uniformly spaced therefrom is an outer casing which restricts the flow of the air to be heated in close proximity and/or wiping contact with the outer surfaces of the walls of the combustion chamber and for maximum efficiency, the flow of air about the side walls of the chamber is likewise substantially uniformly distributed throughout the length of the walls. This feature of operation is accomplished by properly disposing the air moving means employed and by properly designing and arranging the air inlets and outlets for the spaces between the inner and outer casings of the furnace, including the interconnection between the air moving means and the spaces. Although the air moving means is normally employed to force the air through the spaces by positive pressure, it is sometimes desirable to locate the moving means adjacent the exit passage of the spaces thereby creating a negative pressure in the spaces for the purpose of drawing the air therethrough. Also, for the accomplishment of the objects generally stated, it is more practical to employ air moving means of the turboblower or squirrel cage type, rotatable about an axis extending generally parallel with the principal axis of the furnace chamber and in the case of furnaces of substantial capacity at least, it is desirable to employ two or more blowers spaced substantially uniform along the said axes. In this

2

way uniform distribution of the air along the longitudinal extent of the above mentioned spaces is facilitated.

The primary object of the invention is to increase the over-all efficiency of a direct fired air heating furnace of the general type outlined above and this object is accomplished in accordance with the invention by incorporating heat exchanging or economizer tubes in the unitary assembly, which tubes are positioned longitudinally of the furnace and serve to conduct the gaseous products of combustion as the latter issue from the combustion chamber casing through the longitudinally extending air stream created by the operation of the air moving means.

A further and more specific object of the invention is the provision in a direct fired air heating furnace of the general type mentioned above of an improved arrangement for conducting the products of combustion away from the combustion chamber and of an improved arrangement for distributing the air to be heated as it approaches the heating spaces between the inner and outer furnace casings whereby the efficiency of operation of the furnace is increased.

These and other objects and advantages of the invention will become apparent from a consideration of the following detailed specification and the accompanying drawing wherein there is illustrated a preferred embodiment of the invention.

In the drawing:

Figure 1 is a view in side elevation of a representative embodiment of the invention, parts being broken away to better illustrate the internal construction of the furnace; and

Figure 2 is a transverse section through the furnace along the line II—II of Figure 1.

Referring to the drawing which illustrates a representative embodiment of the invention, reference numeral 10 indicates a combustion chamber casing which is generally inverted U-shaped in section, as shown in Figure 2, and which is preferably provided with circumferentially extending corrugations to increase the heat exchanging surfaces. Secured, preferably by welding, to the outer surface of the casing 10 are a plurality of deflecting fins 11 which are operative to deflect the air moving upwardly along the side walls of the casing into intimate wiping contact with the outer surfaces of the walls. Positioned within the lower portion of the casing 10 is an elongated fire box 12 constructed of refractory brick and supported on the floor plate 13 of the casing 10. As indicated in Figure 2, the side walls of the fire box 12 are spaced in-

wardly from the side walls of the casing 10 to provide thin elongated passages 14 for the downward passage of the products of combustion in wiping contact with the inner surfaces of the side walls of the casing 10. Extending longitudinally under the fire box 12 is a duct 15 which communicates with the passages 14 through evenly spaced apertures 16 provided in the fire box supporting walls 17.

An outer casing 18 having its walls adjacent to but uniformly spaced from the walls of the casing 10 is provided to form restrictive passages 19 on either side of the furnace for the air to be heated. Casing 18 extends throughout the length of the inner casing 10 and it should be apparent that the air to be heated moves through the furnace in thin blanket formation along either side of the furnace. This type of air flow, in conjunction with the opposing blanket flow of the products of combustion along the inner surfaces of the said walls of the casing 10, provides an efficient heat transfer and has resulted in substantial success in numerous commercial embodiments, some of which have been constructed in very large capacities.

While in the embodiment specifically illustrated, the air flow through the furnace is divided into parallel paths, one on either side of the furnace, it should be obvious that the passages 19 may be employed in series, as indicated in the prior patent referred to above, and that if desired, the direction of air flow through the heating unit may be reversed. In either construction, power means is employed to circulate the air through the passages either by pressures above or below atmospheric pressure and in the embodiment specifically illustrated, the air moving means comprises a pair of spaced squirrel cage type of blowers 20 mounted on a common shaft extending longitudinally below the furnace proper. This shaft, indicated by reference numeral 21, is driven by motor 22. Also driven by shaft 21 is an exhaust fan 23 which is operative to withdraw the products of combustion from the casing 10.

In accordance with the illustrated embodiment of the invention, a duct 24 extends downwardly along one end of the furnace and communicates with the central duct 15 which is positioned below the fire box 12. A portion of duct 24 consists of a header 25 from which extends a plurality of heat exchanging tubes 26 which, as shown, extend longitudinally of the furnace across the air inlet to the passages 19. The opposite ends of the tubes 26 open into a collector 27 on the opposite end of the furnace and the inlet to the exhaust fan 23 is connected with the collector 27 whereby the products of combustion are drawn through the tubes 26 before passing out of the furnace.

Referring to Figure 2, it should be apparent that the tubes 26 are substantially uniformly spaced transversely of the furnace and lie in the plenum chamber 27 extending upwardly and outwardly from the outlets of the blowers 20. Immediately above tubes 26 is a generally V-shaped diverter 28 which serves to divide the air stream moving through the plenum chamber 27' into two equal parts, one for each side of the furnace. As shown, the wings of the divider 28 are curved upwardly and outwardly to facilitate the accomplishment of this objective.

It should now be apparent that I have provided certain improvements in direct fired unit heaters which accomplishes the objects initially set out.

By reason of the fact that in the particular type of furnace to which the invention is especially applicable, the air stream is of substantially uniform density throughout the longitudinal extent thereof the positioning of the heat exchanging or economizer tubes in the air stream and in a direction longitudinally of the furnace results in certain definite advantages relating to economy and efficiency which should be obvious. It should be understood that various changes may be made in the illustrated embodiment of the invention without departing from the spirit or scope of the invention. For example, in addition to the alternatives mentioned above, the tubes 26 may be positioned between the inner and outer casings in either a single group or in separated groups and further, it is contemplated that the tubes may be so designed or alternatively suitable deflecting surfaces may be secured to the tubes so that the deflecter fins, i. e. the fins 11 which are attached to the inner casing, may be dispensed with while retaining the high efficiency of this type of furnace. Reference should therefore be had to the appended claims in determining the scope of the invention.

What I claim is:

1. An air heating furnace comprising a casing generally inverted U-shaped in section defining a combustion chamber, a fire box within the lower portion of said casing and having side walls adjacent to but uniformly spaced from the side walls of said casing to provide a thin restrictive but wide passage for heating gases on either side of said furnace, duct means below said fire box and connected with said passages throughout the width thereof thereby insuring uniform flow in said passages throughout the extent thereof, an outer casing for said furnace adjacent to but uniformly spaced from said first mentioned casing providing a wide passage for a thin blanket of air on either of the sides of said furnace, an air inlet extending throughout the width of each of said air passages at the bottom thereof, an air outlet extending throughout the width of said last mentioned passages at the top thereof, means to circulate a uniform volume of air through said last mentioned passages, means forming an air chamber below said inlets, a plurality of heat exchanging tubes positioned in said chamber and extending throughout the width of said passages whereby the air flowing into said inlets flows over said tubes substantially at right angles thereto, said tubes connecting with said duct means to conduct the products of combustion away from said duct means, means to distribute the air flowing into said chamber substantially uniformly throughout the length of said tubes, means to conduct air to be heated into said chamber, and a V-shaped air stream divider positioned in said chamber centrally below said first mentioned casing, said divider extending longitudinally throughout the length of said casing and having its wings terminated substantially at the lower ends of the side walls of said first mentioned casing whereby air entering said space will be divided equally between said inlets, said heat exchanging tubes being positioned symmetrically about and immediately below said divider.

2. An air heating furnace comprising a casing generally inverted U-shaped in section defining a combustion chamber, an outer casing adjacent to but uniformly spaced from said first mentioned casing providing a wide passage for a thin blanket of air on either of the sides of said furnace, an air inlet extending throughout the width of each

of said air passages at the bottom thereof, an air outlet extending throughout the width of said last mentioned passages at the top thereof, means to circulate a uniform volume of air through said air passages, means forming an air chamber below said inlets, a plurality of heat exchanging tubes positioned in said chamber and extending throughout the width of said inlets whereby the air flowing into said inlets flows over said tubes substantially at right angles thereto, said tubes connecting with said combustion chamber to withdraw the products of combustion therefrom, means to distribute the air flowing into said

chamber substantially uniformly throughout the length of said tubes, and a V-shaped air stream divider positioned centrally below and extending longitudinally throughout the length of said first mentioned casing and having its wings terminated substantially at the lower ends of the side walls thereof whereby air entering said space will be divided between said inlets, said heat exchanging tubes being positioned immediately below said divider in symmetrically divided relation.

ARTHUR A. OLSON.