Aug. 5, 1930. H. R. CARR 1,771,995

AIR PREHEATER

Filed Oct. 22, 1928 3 Sheets-Sheet 1

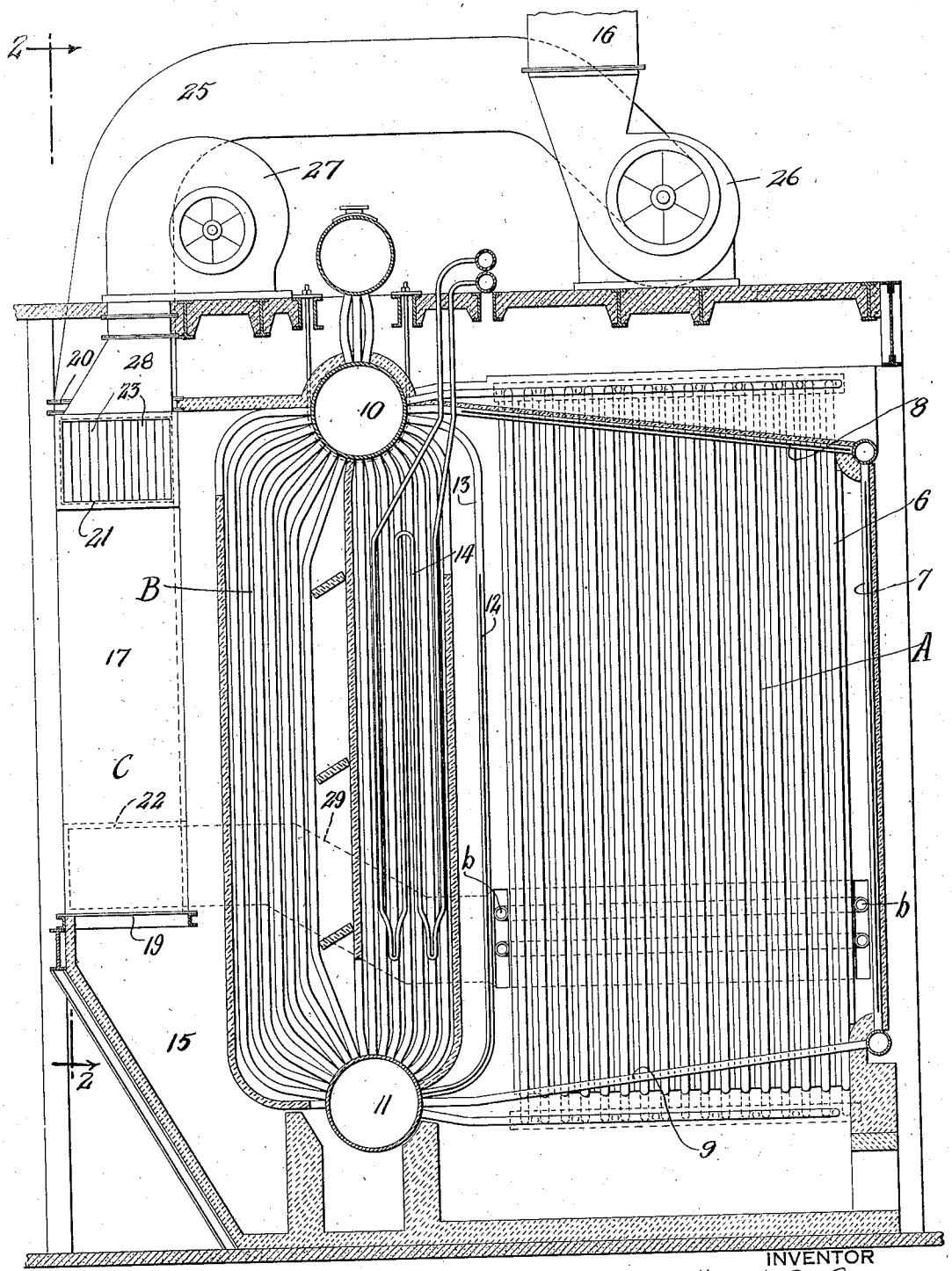


Fig. 1.

INVENTOR
Hugh R. Carr
BY
Symmestvedt & Lechner
ATTORNEYS

Aug. 5, 1930. H. R. CARR 1,771,995

AIR PREHEATER

Filed Oct. 22, 1928 3 Sheets-Sheet 2

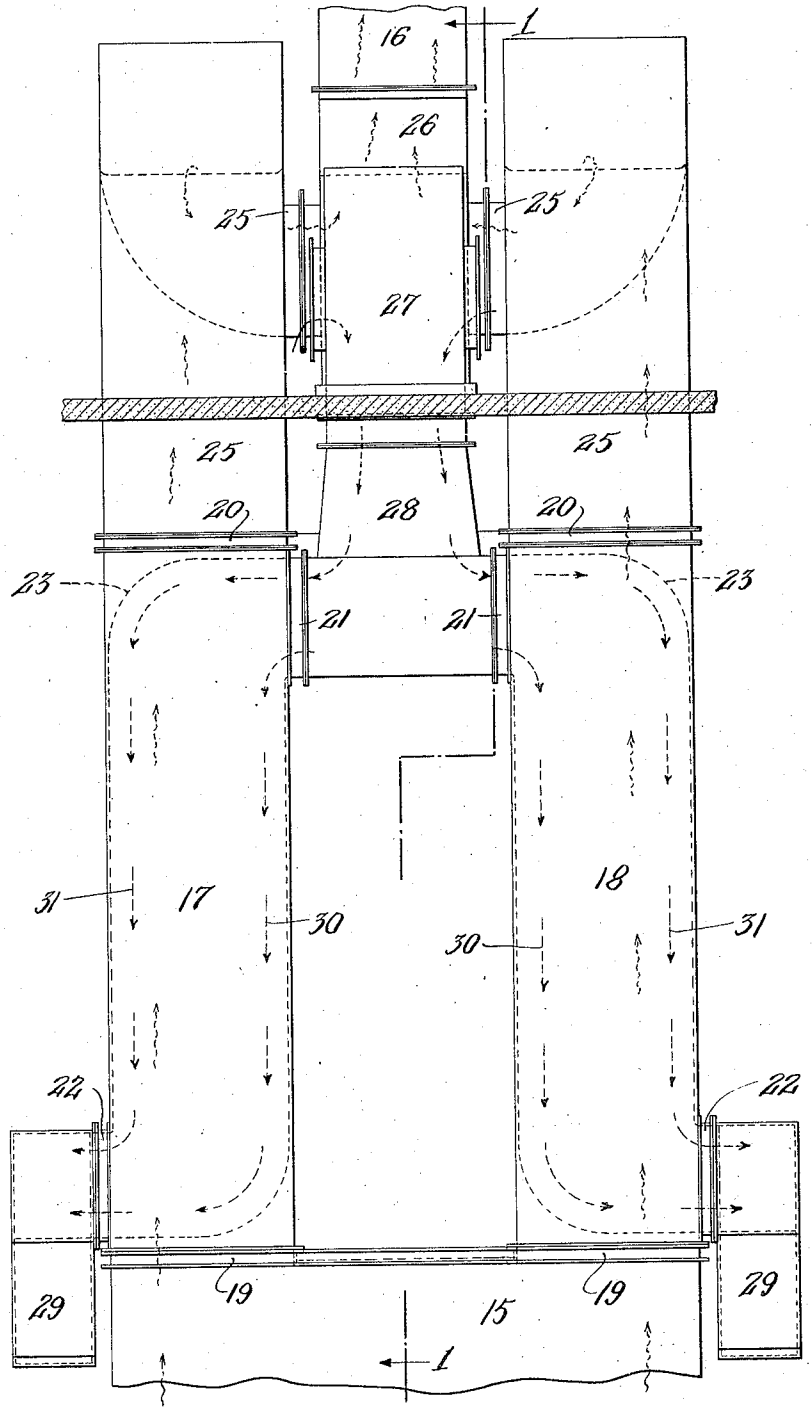


Fig. 2.

INVENTOR
Hugh R. Carr
BY
Symmestedt & Lechner
ATTORNEYS

Aug. 5, 1930. H. R. CARR 1,771,995

AIR PREHEATER

Filed Oct. 22, 1928 3 Sheets-Sheet 3

Fig. 3.

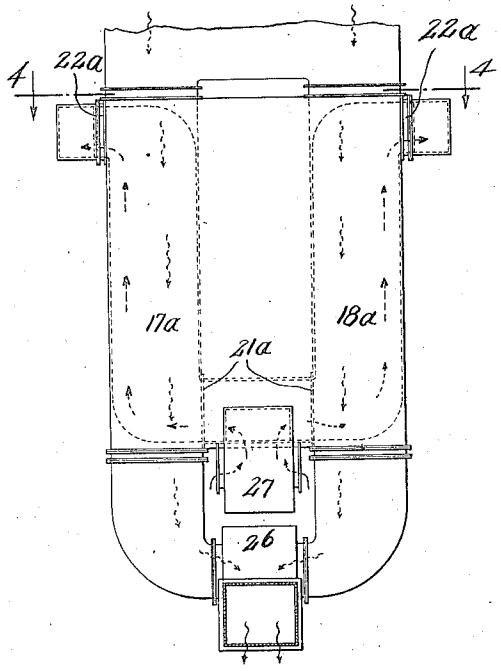


Fig. 5.

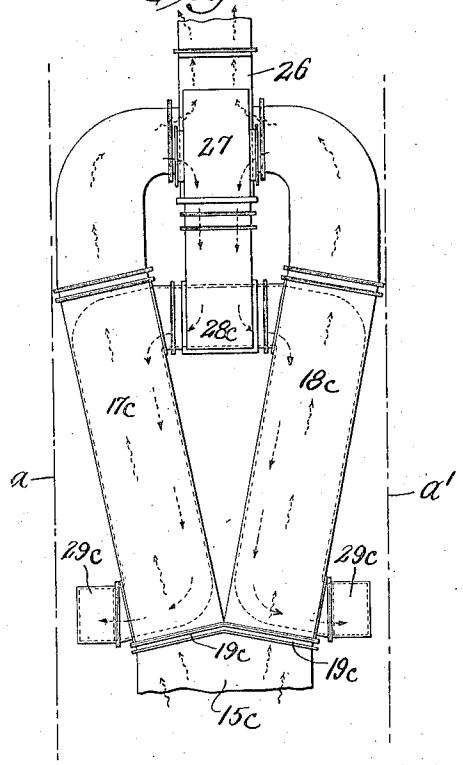
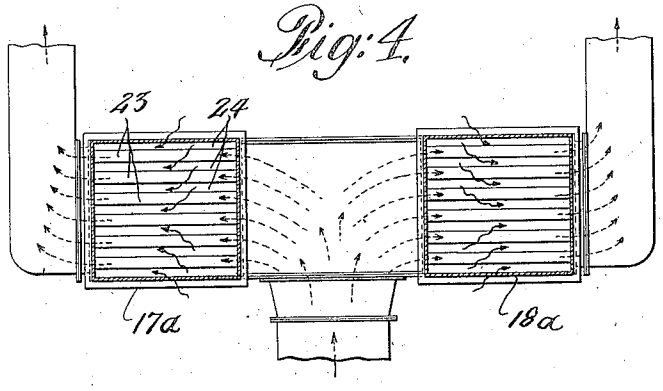


Fig. 4.



INVENTOR
Hugh R. Carr
BY
Symmestvedt & Lechner
ATTORNEYS

Patented Aug. 5, 1930 1,771,995

UNITED STATES PATENT OFFICE

HUGH R. CARR, OF NEW YORK, N. Y., ASSIGNOR TO INTERNATIONAL COMBUSTION ENGINEERING CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE

AIR PREHEATER

Application filed October 22, 1928, Serial No. 314,035, and in Germany April 4, 1928.

This invention relates to improvements in air preheaters such as are used in connection with furnaces and subject to the heat of the waste gases.

One of the primary objects of my invention is to provide an air heater which may be installed in places where the usual forms of heater could not be effectively installed because of space limitations and the like.

Another object of my invention is to provide a heater of the character described in which effective distribution of the air through the heater is obtained.

A more specific object of my invention is the provision of a split air preheater having central admission of air and outside discharge.

How the foregoing, together with such other objects and advantages as may hereinafter appear, or are incident to my invention, are realized, is illustrated in preferred form in the accompanying drawings, wherein—

Fig. 1 is a sectional elevation through a boiler installation showing an application of my improved air preheater, the section through the air preheater being taken on the line 1—1 of Fig. 2.

Fig. 2 is a rear view of the air preheater, the section being taken substantially on the line 2—2 of Fig. 1.

Fig. 3 is a view similar to Fig. 2 but illustrating a modification of my invention.

Fig. 4 is a plan section taken on the line 4—4 of Fig. 3, and

Fig. 5 is a view similar to Fig. 2 illustrating another modification of my invention.

The boiler installation illustrated in Fig. 1 comprises, in general, a combustion chamber A having its side, front and top walls defined by the rows of finned water tubes 6, 7 and 8, respectively. A row of tubes 9 extends across the bottom of the combustion chamber, the tubes being spaced sufficiently apart to permit gravitating ash to pass freely therebetween. At the rear of the combustion chamber is arranged a boiler unit B which comprises an upper drum 10, a lower drum 11, and a plurality of tubes connecting the drums. Suitable baffling is provided to cause the gases to take a tortuous path amongst the tubes of the boiler unit B. The front row of connecting tubes 12 constitutes the rear wall of the combustion chamber A, and it is to be noted that the tubes of this row are provided with fins terminating short of the upper drum 10 so as to provide an outlet 13 for the gases of combustion. A superheater 14 may be located in one of the passes of the boiler unit B.

After leaving the boiler unit B the gases pass downwardly into the space 15, then upwardly through an air preheater C, and from thence pass to the stack or flue 16.

A plurality of burners *b* are employed for introducing pulverized fuel and air into the combustion chamber, the burners preferably being located in the lower portion of the combustion chamber and at the corners thereof.

The air preheater C is what may be termed a split heater and comprises two sections 17 and 18, i. e., the casing structure of the heater is divided into two sections. Each section is provided with a bottom gas inlet 19, a top gas outlet 20, a side air inlet 21 and a side air outlet 22. Each section is also provided with means for dividing its interior into a plurality of gas passages and a plurality of air passages.

In this instance I have illustrated for this purpose a plurality of hollow plate-like members 23 which are spaced apart to provide passages 24 therebetween (see Fig. 4). As shown, the passages 24 are for the gases and the hollow plates are for the air. While I have described the passage as being provided by spaced hollow plate-like members, it is to be understood that I also contemplate employing spaced round tubes for this purpose.

Referring now more particularly to Fig.

2, it will be seen that the gases from the chamber 15 pass into the sections 17 and 18 through the gas inlets 19 which are common to the plurality of gas passages in the sections. The gases leave the plurality of passages through the common gas outlets 20, from which outlets conduits or manifolds 25, 25, lead to the intake of the induced draft fan 26. From the fan the gases are exhausted into the stack 16.

The air which is passed through the heater is introduced by means of a forced draft fan 27 which discharges into a conduit 28 constituting a common intake for the air inlets 21, 21 of the sections. It is to be noted that the sections 17 and 18 are so relatively disposed that the sides thereof having the air inlets 21 face each other, and that they are spaced sufficiently apart to provide room for the common intake conduit 28.

The air inlets 21 are common to the plurality of air passages in the sections as are also the air outlets 22. Hence, air introduced by means of the forced draft fan 27 passes through the inlets 21 to the plurality of air passages and from thence through the outlets 22 which are in the opposite side of the sections from the inlets and finally is passed to the point or points desired through suitable conduits 29. In this instance I have illustrated the conduits 29 as leading to the burners for the purpose of introducing preheated air into the combustion chamber at the burners.

By providing a split air heater in which the air enters in the middle, passes through the heater, and passes out at the outside, i. e., passes out through outlets arranged in the sides opposite to the sides having the inlets, even distribution of air through the heater is obtained, and this makes for efficient heat transfer. This will be readily understood by referring to the rows of arrows 30 and 31 in Fig. 2 from which it will be seen that all of the air passing through the heater has the same distance to travel, in consequence of which even distribution and heating are effected.

My improved air preheater adapts itself very well for use in installations where the space left for the heater is rather limited because the heater need be no wider than the number of heating elements, i. e., hollow plates or the like, required to give the necessary amount of pre-heat. This is made possible because the common air intake is central of the heater, and within its thickness, and the outlet ducts are at the ends. As the heating elements run parallel with the back of the furnace access may be had thereto from the aisles at the sides of the furnace in cases where the heater must occupy the entire space in back of the boiler. The arrangement is thus adapted for use in places where, because of space limitations, it is either impossible to provide a usual form of heater of adequate size or to provide connections for the usual forms of heaters in a manner to insure maximum effectiveness of such heaters. The necessity for diffusers is obviated, the heater itself functioning as its own diffuser.

It is to be noted that in a heater arrangement constructed in accordance with my invention the fan 27 may be conveniently located in the space between the gas discharge ducts 25, 25 leading from the section 17 and 18 to the induced draft 26. The fans 26 and 27 may be mounted on a support above the boiler such as the building structure from which the boiler unit B is hung. The duct arrangement for the fans is very simple. Also the conduits 29 leading to the burners are of very simple form due to the convenient locations of the air outlets in the sections 17 and 18.

In the modification illustrated in Figs. 3 and 4, I have shown the air inlets 21^a adjacent the bottom of the sections 17^a and 18^a and the air outlets 22^a adjacent the top. In this case the waste gases enter the heater at the top and leave at the bottom.

In the modification of Fig. 5 I have shown the sections 17^c and 18^c inclined, i. e., the bottom portions of the section are brought together and the top portions are spaced apart. The common intake 28^c is located in the space between the sections. By bringing the lower ends of the sections together spaces are provided at the sides for the location of the delivery conduits 29^c so that a very compact heater not only as to thickness, as previously described, but also as to width, is provided. The conduits 29^c by this arrangement are kept within the width of the heater as will be clear from the dot and dash lines a and a' which may be considered as indicating the location of the side walls of a narrow installation. This arrangement, because of bringing the gas inlets 19^c together, may also be advantageously employed where the gas duct or chamber 15^c is relatively narrow.

It is to be understood that I also contemplate having the heater arranged so the air may enter at the sides and leave at the center, in which case the air outlets 22 would become inlets and the air inlets 21 would become outlets.

In all forms it will be seen that the construction is simple and the number of connections required reduced to the minimum.

I claim:

A split air preheater of the waste gas type comprising two sections each having means providing a plurality of gas passages interspersed with air passages, a gas inlet at one end, a gas outlet at the other end, an air inlet in one side adjacent one end, and an air outlet in the opposite side adjacent the other end, said gas inlets and outlets being common to the plurality of gas passages, and said air

inlets and outlets being common to the air passages, said sections being inclined with their adjacent edges at the ends having the air outlets close together and with a substantial space therebetween at the ends having the air inlets and the sections being so positioned that the air inlets face each other an air intake manifold common to the air intakes and located in said space, and air outlet manifolds for the air outlets.

In testimony whereof I have hereunto signed my name.

HUGH R. CARR.