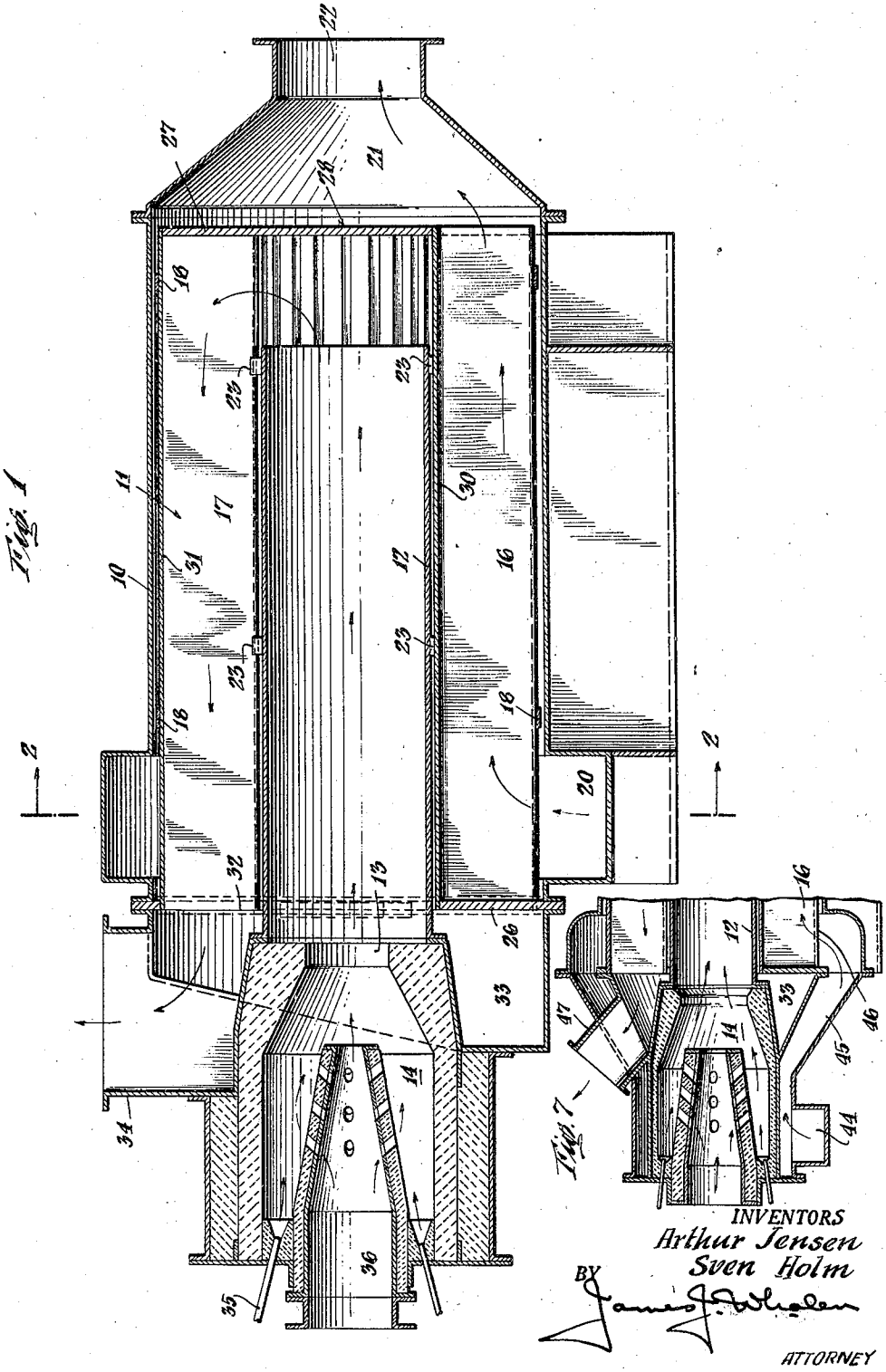
Nov. 4, 1947. A. JENSEN ET AL 2,430,227

AIR HEATER WITH CORRUGATED CORE

Filed March 10, 1944 3 Sheets-Sheet 1



INVENTORS
Arthur Jensen
Sven Holm
BY James J. O'Hagan
ATTORNEY

Nov. 4, 1947. A. JENSEN ET AL 2,430,227

AIR HEATER WITH CORRUGATED CORE

Filed March 10, 1944 3 Sheets-Sheet 2

Fig. 3

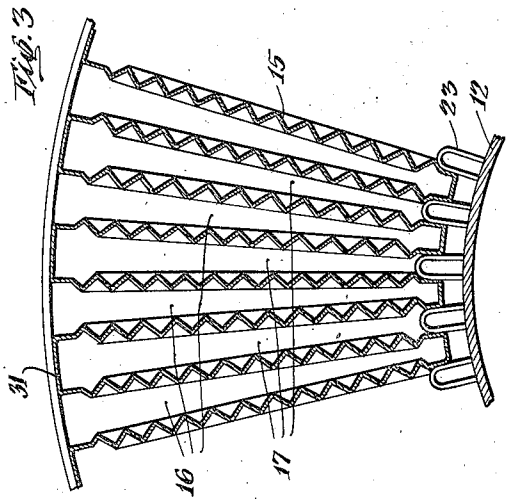


Fig. 4

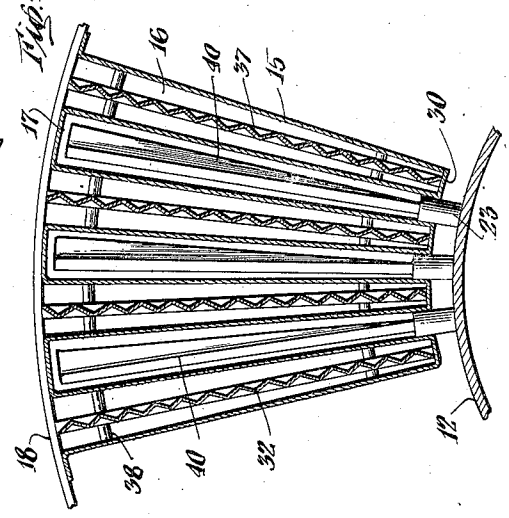
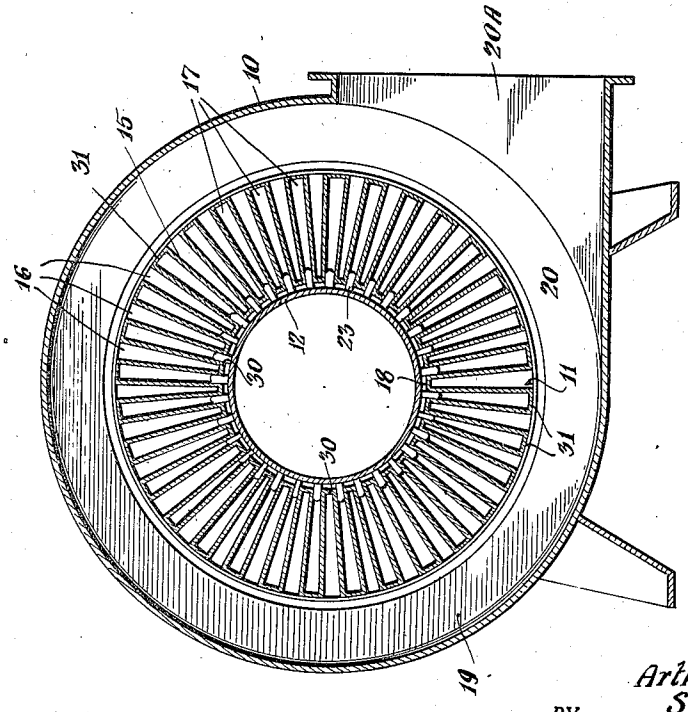


Fig. 2



INVENTORS
Arthur Jensen
Sven Holm
BY
ATTORNEY

Nov. 4, 1947. A. JENSEN ET AL 2,430,227

AIR HEATER WITH CORRUGATED CORE

Filed March 10, 1944 3 Sheets-Sheet 3

Fig. 5

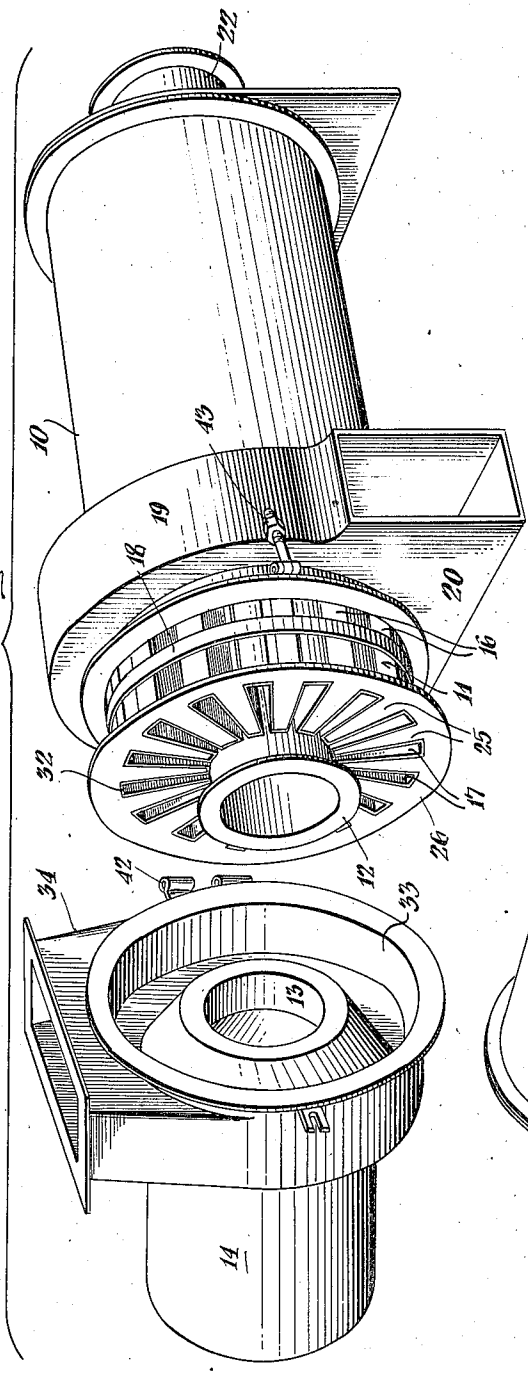
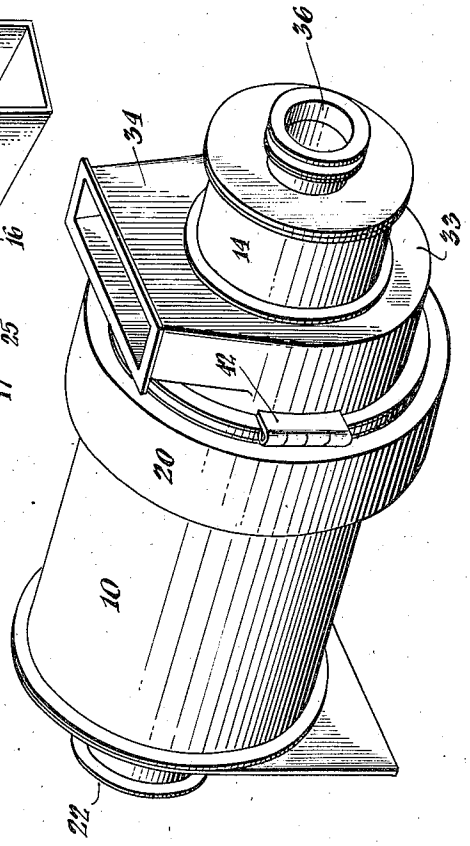


Fig. 6



INVENTORS
Arthur Jensen
Sven Holm
BY
ATTORNEY

Patented Nov. 4, 1947

2,430,227

UNITED STATES PATENT OFFICE

2,430,227

AIR HEATER WITH CORRUGATED CORE

Arthur Jensen and Sven Holm, Wellsville, N. Y., assignors to The Air Preheater Corporation, New York, N. Y.

Application March 10, 1944, Serial No. 525,880

2 Claims. (Cl. 126—99)

1

The present invention relates particularly to an improved apparatus for preheating air or other fluids by indirect contact with a heating medium such as hot gases of combustion.

The invention is directed to a plate type heat exchange apparatus that is simple in construction and which may readily be assembled or taken apart, as for the cleaning or replacement of elements thereof. The invention will be best understood upon consideration of the following detailed description of illustrative embodiments thereof when read in conjunction with the accompanying drawings in which:

Figure 1 is a longitudinal sectional view of a unitary furnace and heat exchange apparatus embodying the present invention;

Figure 2 is a transverse sectional view on the line 2–2 in Figure 1;

Figures 3 and 4 are fragmentary views on an enlarged scale showing modified forms for the heat exchange surface illustrated in Figures 1 and 2;

Figures 5 and 6 are perspective views showing the relationship between major components of the apparatus and illustrating the ease with which access may be had thereto for the purpose of inspecting, cleaning or replacing parts;

Figure 7 is a fragmentary view showing a modified construction for a portion of the apparatus as illustrated in Figure 1.

In the drawings, the numeral 10 designates a casing that encloses an annular heat exchange core 11 surrounding a central tube 12 which is arranged in Figure 1 to constitute a passage for the heating gases since it communicates at its left hand end with the outlet 13 of a furnace designated as a whole by the numeral 14. The heat exchange core 11 is formed with a plurality of fluid passages extending axially of the unit with the passages divided into two groups, alternate passages forming one group and being provided for the flow of heating gas while the air to be heated flows through the intermediate passages that form the other group.

The construction of the heat exchange core 11 will be readily understood if it is considered that a metallic plate has been formed with very deep folds or corrugations and its ends brought together by wrapping it around the cylindrical tube 12 so that the sides 15 of the corrugations (Fig. 2) form two groups of separated passages 16 and 17, employed respectively in Figure 1 for the passage of the air to be heated and the heating gas. Bands 18 hold the unit in annular form. As a result of this construction the passages 16 are open

2

along their outer sides which, being located at the outer circumference of the annular unit 11, may be placed in direct communication with a scroll chamber 19 provided at one end of the apparatus for the admission of air. The passages 16 are closed off at the ends adjacent the furnace 14 as by sections 25 of a flange plate 26. Air entering through the inlet 20 of scroll chamber 19 passes in a generally radial direction into the alternate passages 16 adjacent the furnace end thereof and then flows through these passages and axially of the apparatus to an outlet chamber 21 at the end of the heating casing 10 opposite furnace 14 to be discharged through the air outlet duct 22. The intermediate passages 17 are closed at their opposite ends or adjacent the air outlet chamber 21 as by plates 27 while at the center of the heat exchange core 11 opposite the open distal end of tube 12 is a disk 28 closing off communication between the gas side of the apparatus and the air side. The passage-closing plates 27 may be in the form of spoke-like extensions of a central hub or disk 28, all complementary to the flange plate 26 shown in perspective view in Fig. 5. In cases where the furnace 14 is greater in cross section than the tube 12 the outlet end of the furnace is tapered down so that the discharge outlet 13 thereof registers with the open end of the tube 12 that forms the central gas flue of the apparatus as appears in Figs. 1 and 5. The central tube 12 or gas flue terminates short of the right hand end of the heat exchange core 11 so that the gases flowing from the tube may pass outwardly in radial directions into the passages 17 along the inner sides 30 thereof which, as may be seen in Figs. 1 and 5 open towards the center of the unit facing the periphery of the tube 12. At their outer sides the passages are closed by the parts 31 of the corrugations while the ends of these passages adjacent the furnace 14 open into a plenum chamber 33 that surrounds the discharge end 13 of the furnace and the inlet end of tube 12 with which it registers, the gases being discharged from chamber 33 through an outlet 34.

As may best be seen in Figures 2 to 4, the so-called corrugations of the heat transfer core 11 are maintained separated at their bases by spacer pins or bars 23 projecting radially from the centrally located tube 12. Figure 3 shows undulations in portions of the plate from which the heat transfer core 11 is formed so that a greater amount of heat exchange surface is provided along the lateral sides 15 of the passages. In

Figure 4 a similar effect is obtained by mounting undulated plates 37 in the passages 16, these plates being provided with transversely disposed spacers 38 projecting at the sides thereof to contact the side walls 15 of the passages 16. Fig. 4 also shows twisted bars 40 extending from the spacers 23 into the passages 17 so as to cause a turbulent flow of the gases in their movement through these passages.

In operation, fuel supplied through burners generally designated by the numeral 35 and air admitted through an air tube 36 extending centrally into furnace chamber 14 provide a supply of hot gases of combustion that are discharged from the furnace outlet 13 directly into the central tube 12 of the unit. Flowing to the opposite end of the tube 12 the gases pass radially outward into the group of passages 17 and reverse their direction to flow through these passages to the plenum chamber 33 and are finally discharged from the outlet 34. The air to be heated by means of these gases flows into the inlet 20A of the scroll chamber 20 and passing in a radially inward direction enters the group of passages 16 near the furnace end thereof and moving counterflow to the streams of heating gases pass axially along the passages 16 to the air outlet chamber 21.

As appears in Figures 5 and 6 the entire furnace 14 of the unit and the plenum chamber 33 that surrounds the discharge end of the furnace constitute a complete component which is hinged at 42 to the adjacent end of the housing 10 so that upon release of fastening dogs 43 it may be swung away to afford access to the tube 12 that forms a gas flue and also to the heat exchange core 11, both of these also forming component parts of the unit which may be entirely withdrawn from the casing 10 when the furnace has been swung to one side.

In Figure 7 the air to be heated enters a scroll chamber 44 at the outer end of furnace 14 and flows through a plenum chamber 45 surrounding the outer part of the furnace in a direction axially of the apparatus to enter the outer ends 46 of the passages 16 which are left partly open for this purpose. With this form the plenum chamber 33 for the spent gases has a discharge conduit 47 that extends outwardly through the plenum chamber 45 where air first enters the apparatus.

With the construction described, the amount of heat transfer surface may be readily adapted to varying requirements. This is so because not only may the length of the heat exchange cores be altered to suit circumstances but even in a unit of determined exterior dimensions a larger or smaller number of passages may be used in spaced relation about a central tube of determined size. The relative heat exchange capacity of the unit may also be varied as by replacing a core having plane surfaces on the passage walls with a core having undulated plates as shown in Figure 3 or by adding fillers 37 and/or agitators 40 as shown in Figure 4. The latter function not only to create turbulence of the gases but also as fin-like extensions of the surface of the central tube 12 through which the gas flows.

The construction of the heat exchanger of several component units including housing, heat exchange core, central tube and furnace together with hinging of the latter to the housing enables ready access to the parts for cleaning, repair or replacement with other components having different heat transfer capacities.

While illustrative embodiments of the invention have been shown and described in detail, it will be understood that there are many changes and variations that may be made without departing from the invention and therefore it is desired and intended to include all such changes and variations within the scope of the appended claims.

What we claim is:

1. In heating apparatus; a casing; an annular heat exchange core slidably mounted in said casing and formed with two groups of alternately disposed corrugations extending longitudinally of the casing; means closing one end of the passages of one group and which open along the sides at the periphery of said core; means closing the opposite ends of corrugations of the other group which open along the sides facing the longitudinal axis of said core, said casing in surrounding said core forming longitudinal passages with the corrugations that open towards its periphery; means forming chambers at opposite ends of said casing each in communication with the open ends of the passages of a respective one of the two groups; means closing off the central part of said core at one end to preclude communication with the chamber at said end of the casing; a removable tubular conduit disposed centrally within said core to form passages with said other group of corrugations, said conduit extending from one end of said core to a point short of its end adjacent said closure for placing said conduit in communication with said passages; means forming a chamber adjacent one end of said casing extending around said core and communicating at the periphery of said core with the passages of said one group adjacent the closed ends thereof; a furnace unit mounted at one end of said casing and having an outlet at one end adjacent the casing; means placing the outlet of said furnace in communication with one of said groups of passages; and a hinged connection between said casing and furnace unit whereby the latter may be swung away from the end of said casing to permit withdrawal of said tubular conduit and/or core therefrom.

2. In heating apparatus; a casing; a heat exchange core fitting in said casing and formed with a central passage along its longitudinal axis and two groups of alternately disposed corrugations extending longitudinally of the casing; means closing alternate corrugations at opposite ends, the corrugations of one group being open along the sides at the periphery of said core and being disposed in alternation with corrugations of the other group which are open along the sides facing the longitudinal axis of said core, said casing in surrounding said core forming longitudinal passages with the corrugations that open towards its periphery; means closing off the central part of said core at one end; a tubular conduit disposed within said core to form passages with said other group of corrugations, said conduit extending centrally through said core from its opposite end to a point short of said one end for placing said conduit in communication with the passages that face the axis of said core adjacent their closed ends; a furnace unit mounted at one end of said casing and having an end outlet adjacent the casing; means forming a tubular extension of the outlet of said furnace in registration with the open end of said tubular conduit opposite the closure for said core; means

forming a gas outlet chamber communicating with the open ends of the passages of the group that face the axis of said chamber, said chamber surrounding the tubular extension of said furnace and constituting an integral part of the furnace unit; means forming chambers at opposite ends of said casing in communication with the passages that face the periphery of said core at their open ends and at the periphery of said core, respectively; and detachable means connecting said casing and furnace unit whereby the latter may be moved with said gas outlet chamber away from the end of said casing to permit withdrawal of said tubular conduit and/or core therefrom.

ARTHUR JENSEN.
SVEN HOLM.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,288,028	Richardson	June 30, 1942
280,455	Cutler	July 3, 1883
610,037	Evans	Aug. 30, 1898
540,028	Roelker	May 28, 1895
2,087,393	Wilson	July 20, 1937
574,447	Pettibone et al.	Jan. 5, 1897

FOREIGN PATENTS

Number	Country	Date
7,809	Sweden	Feb. 20, 1896
606,018	Germany	Nov. 23, 1934