Sept. 1, 1936. E. A. JONES 2,053,036

HEAT EXCHANGE APPARATUS

Filed June 21, 1935 2 Sheets-Sheet 1

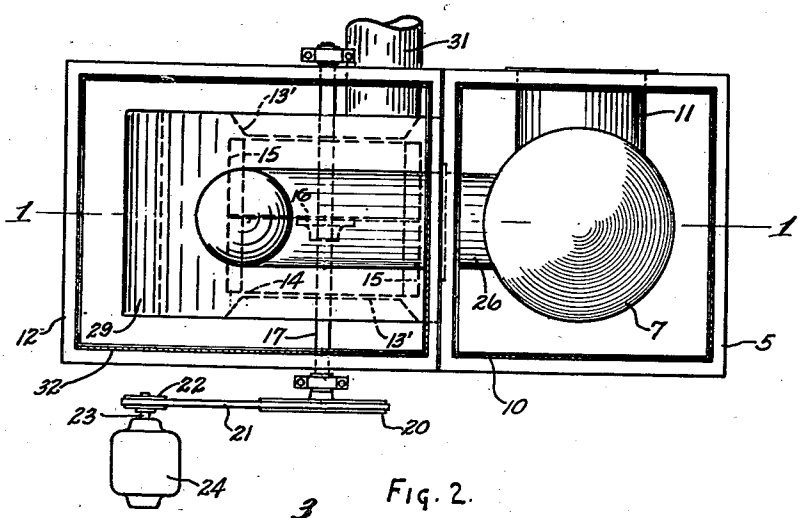

Fig. 2.

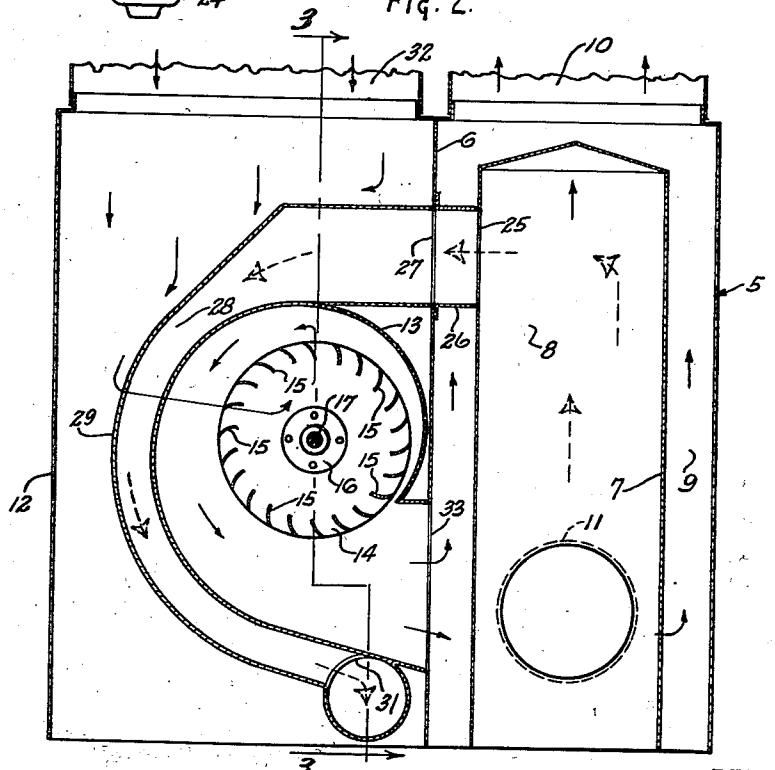

Fig. 1.

INVENTOR.
Edwin A. Jones,
BY
Morsell, Lieber & Morsell
ATTORNEYS

Sept. 1, 1936. E. A. JONES 2,053,036

HEAT EXCHANGE APPARATUS

Filed June 21, 1935 2 Sheets-Sheet 2

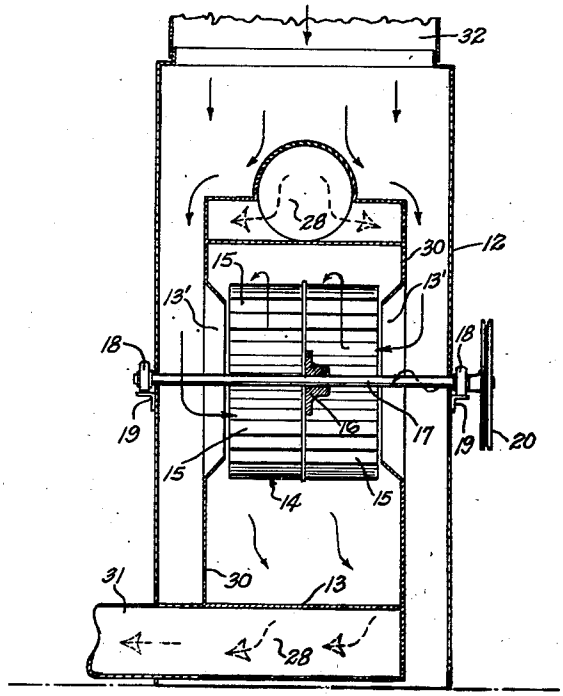

Fig. 3.

INVENTOR.
Edwin A. Jones,
BY
Morsell, Sieber & Morsell
ATTORNEYS

Patented Sept. 1, 1936 2,053,036

UNITED STATES PATENT OFFICE

2,053,036

HEAT EXCHANGE APPARATUS

Edwin A. Jones, Milwaukee, Wis., assignor to L. J. Mueller Furnace Company, Milwaukee, Wis., a corporation of Wisconsin

Application June 21, 1935, Serial No. 27,629

9 Claims. (Cl. 257—244)

This invention relates to improvements in heat exchange apparatus.

Certain forms of heat exchange apparatus, particularly warm air heating devices, employ fans for the forced circulation of the heated fluid. In an arrangement of this character the fan is positioned in a scroll within the fluid inlet and merely serves to force the cold, incoming fluid through the heating apparatus and the ducts or pipes.

It is the primary object of the present invention to provide a heat exchange apparatus including a fan mounted in a scroll, wherein the scroll serves as a heat transfer surface for fluid drawn through the scroll by the fan.

More specifically, a further object of the invention is to provide a forced fluid heating apparatus wherein hot gases of combustion flow exteriorly of the fan scroll, and incoming cold fluid flows interiorly of the scroll and is pre-heated thereby, prior to being introduced into the heating apparatus jacket for further heating and ultimate circulation, whereby the efficiency of the apparatus is greatly increased.

Another object of the invention is to provide a fan equipped, forced air heating apparatus, wherein means are provided for heating the fan scroll so that it serves to heat air being drawn into the apparatus prior to introduction into the heating jacket of the apparatus.

A further object of the invention is to provide a heating apparatus including a fan, which is inexpensive to manufacture, which is very efficient and economical in use, which is compact, and which is well adapted for the purposes set forth.

With the above and other objects in view the invention consists of the improved heat exchange apparatus, and its parts and combinations as set forth in the claims, and all equivalents thereof.

In the accompanying drawings in which the same reference characters indicate the same parts in all of the views:

Fig. 1 is a longitudinal vertical sectional view of the improved heat exchange apparatus taken on line 1—1 of Fig. 2;

Fig. 2 is a plan view of the apparatus; and

Fig. 3 is a transverse vertical sectional view taken on line 3—3 of Fig. 1.

Although the invention is shown and described herein as being embodied in a warm air heating apparatus, it should be understood that it is not the intent to thereby limit the scope of the invention, since some of the novel features are obviously generally applicable, and the principle may find general application in heat transfer apparatus, regardless of whether the fluid to be treated is to be heated or cooled.

Referring to the embodiment of the invention shown in the drawings, it will appear that a warm air furnace is indicated generally by the numeral 5 and it consists of a jacket 6 spaced from and surrounding an inner member 7 forming a combustion chamber 8. The space between the jacket 6 and the member 7 provides an annular air chamber 9 and opening from the top thereof is a warm air conduit 10, which connects with various ducts and registers (not shown), for room heating purposes. Extending through the lower portion of the jacket 6 is an off-set 11 providing access to the combustion chamber.

Associated with the furnace is a casing 12 which encloses a fan scroll 13 which is formed with thin metal walls. The sides of the scroll are formed with circular openings, as at 13', while the end wall of the scroll is curved eccentrically to provide top, end, and bottom portions. Mounted transversely of the casing 12 and within the scroll 13, alined with the scroll openings 13', is a cylindrical, hollow fan 14 of the centrifugal, air blower type. Angularly directed blades 15 are carried by peripheral portions of the fan.

The fan is mounted by means of a hub 16 carried by a central, apertured plate, and a fan shaft 17 extends axially through the fan and hub, the hub being fast on the shaft. Outer ends of the shaft are journaled in suitable bearings 18 carried by brackets 19 secured to the casing. One end portion of the shaft has fast thereon a pulley wheel 20 which is connected by a belt 21 with a pulley wheel 22 on the motor shaft 23 of an electric motor 24.

Within the upper end portion of the combustion chamber 8 there is an opening 25 for the discharge of hot gases of combustion. Extending from said opening is a pipe 26 secured to the wall of the jacket 6 and surrounding an opening 27 of similar contour. Forming a continuation of the pipe 26 is a conduit 28 extending over, around the end of, and under the fan scroll. The upper inner end portion of said conduit is formed by a short pipe section of circular cross-section which merges with the main conduit portion which is of rectangular form in cross section. The inner wall of the main portion of the conduit is formed by the curved wall of the fan scroll, while the outer wall of said conduit is formed by a similarly curved thin metal sheet 29 spaced from the inner wall. Continuations of end sheets 30, which also serve to close the scroll close the sides of the conduit. The lower end

portion of the conduit 28 has a pipe 31 extending therefrom extending through the casing 12 and connecting with a chimney or gas exhaust pipe (not shown). A cold or return air inlet pipe 32 opens into an upper portion of the casing 12.

In the use of the improved heating apparatus, the combustion chamber 8 is fired by any suitable means. The hot gases of combustion rise therein and pass outwardly through the opening 25, and into the pipe 26 and conduit 28, being eventually discharged through the lower outlet pipe 31. During operation of the apparatus the fan 14 is driven (at least periodically) and cold or return air enters the casing 12 through the inlet pipe 32. The walls of the conduit 28 are heated by the hot gases of combustion passing therethrough, and the incoming air, passing over and around the conduit, is heated thereby. Eventually this air is drawn into the cylindrical fan 14 through the open ends 13' of the fan scroll and then the air is forced outwardly, by the centrifugal action of the fan, through the spaces between the blades 15, and through the fan scroll. Inasmuch as considerable of the wall portion of the scroll is also common to the conduit 28, the said scroll transmits heat to the air therein. Ultimately this air, which becomes very materially heated, is discharged from the lower portion of the scroll, through a jacket opening 33, into the annular air chamber 9 surrounding the combustion chamber. Inasmuch as this air has already taken on considerable heat, it requires the consumption of less fuel within the combustion chamber to rapidly bring about the desired heating of the air within the chamber 9, and this air rises and is ultimately discharged through the warm air conduit 10 for room heating purposes.

It will be evident from the drawings that the conduits and chambers for hot gases of combustion are entirely sealed and separate with respect to the chambers and conduits for the incoming and heated air. Also, in both sets of conduits there are common wall portions whereby the transfer of heat is facilitated. From Figs. 1 and 3 it will be observed that the flow of air, or the fluid to be heated, is represented by full line arrows, while the flow of the hot gases of combustion, or the heating fluid, is represented by broken line arrows. It is a known fact that heat transfer is increased by velocity due to the lessening of film resistance. Heat transfer is also increased due to turbulence and impingement and in the present apparatus, both of these principles are made use of as the heat exchange surface is introduced into the air stream at the place where the highest velocity, turbulence, and impingement occurs.

The improved apparatus for the exchange of heat is susceptible of general application and is especially advantageous in forced air heating systems by virtue of the fact that little modification is required and the fan scroll, besides serving the usual functions, also transmits heat to the air and thereby increases the efficiency of the apparatus and lessens fuel consumption. It should be understood that it is not desired to limit the invention to the exact details of construction herein shown and described, for various modifications within the scope of the claims may occur to persons skilled in the art.

What is claimed as the invention is:—

1. An air heating apparatus, comprising a casing enclosing an air space and a combustion chamber, the combustion chamber being sealed from the air space, a warm air conduit extending outwardly of the casing from the air space, another casing having an air inlet pipe opening thereinto and a smoke pipe extending therefrom, a sealed hot gas conduit extending from the combustion chamber through the second casing to the smoke pipe, a fan scroll within the second casing and communicating therewith, a portion of the interior space of the scroll being enclosed by the gas conduit, a fan within said scroll, and a connection between said scroll and the air space within the first casing.

2. A forced circulation warm air heating apparatus, comprising a casing enclosing an air space and a combustion chamber, the combustion chamber being sealed from the air space, a warm air discharge conduit extending outwardly of the casing from the upper portion of the air space, another casing adjacent the first casing and having a return air pipe opening thereinto and a hot gas discharge pipe extending therefrom, an elongated, eccentrically curved, hot gas conduit extending from the upper portion of the combustion chamber into and through the second casing and connecting with said hot gas discharge pipe, the curvature of portions of said conduit within the second casing defining and forming the major wall portions of a fan scroll, the interior of said fan scroll being in communication with the interior of the second casing, a centrifugal, air-blower fan rotatably mounted within the fan scroll, and a communication between the interior of the fan scroll and the air space within the first casing.

3. In a gas to gas heat exchange apparatus, a centrifugal fluid impelling device having a casing, means cooperating with a portion of said casing to form a downwardly directed duct, means permitting the introduction of a heat transfer fluid into the upper end of the duct and its passage out of the lower end of the duct after its travel through the duct for heat transfer purposes, and an outer casing enclosing all of said members and having a cool air inlet and an air outlet extending from the impelling device casing.

4. An apparatus for producing simultaneous fluid flow and heat exchange, comprising a casing having a fluid inlet and forming a main chamber and having spaced walls there-within forming an inner chamber and a duct, with wall portions of the inner chamber and duct in common and the duct and inner chamber being sealed from one another, the inner chamber being in communication with the main chamber and having a fluid outlet extending externally of the casing, and a fluid impelling device movably mounted within said inner chamber, the fluid impelling device being adapted to draw fluid into the casing and through the inner chamber for heat exchange with a fluid adapted to flow through said duct.

5. In a heat exchange apparatus, members forming a hollow fluid chamber and a fan chamber, the hollow fluid chamber being sealed with respect to another fluid surrounding the same, a fan within said fan chamber to pass the latter fluid around the walls forming the first mentioned chamber and through the fan chamber, means for passing a heat transfer fluid through said first mentioned chamber, and a casing surrounding all of said members and having a fluid inlet and a fluid outlet, the latter communicating only with the fan chamber.

6. In a gas to gas heat exchange apparatus, a hollow container having a gas inlet and a gas

outlet, a combustion chamber, members within the container forming a hollow gas chamber, sealed from the interior of the container and in communication with the combustion chamber, and a fan chamber communicating with the interior of the container and with the gas outlet, a fan within the fan chamber to pass gas into the container and into and through the fan chamber, and means for passing a heat transfer gas through said gas chamber.

7. In a gas to gas heat exchange apparatus, a hollow container having a gas inlet and a gas outlet, a combustion chamber, members within the container forming a hollow gas chamber, sealed from the interior of the container and in communication with the combustion chamber, and a fan chamber communicating with the interior of the container and with the gas outlet, certain of the wall portions of the gas chamber and fan chamber being common, a fan within the fan chamber to move gas into the container and into and through the fan chamber, and means for passing a heat transfer gas through said gas chamber.

8. In a heat exchange apparatus, a hollow container having a gas inlet and a gas outlet, a combustion chamber, members within the container forming a hollow fluid chamber, sealed from the interior of the container and in communication with the combustion chamber, and a fan chamber communicating with the interior of the container and with the gas outlet, certain of the wall portions of the fluid chamber and fan chamber being common and the walls of the fluid chamber including said common wall portions serving as heat transfer surfaces, a fan within the fan chamber to cause gas to flow within the container and into and through the fan chamber, and means for passing a heat transfer fluid through said fluid chamber.

9. In a heat exchange apparatus, a casing, a combustion chamber enclosed thereby, a unitary member forming both a conduit and a fan scroll, the conduit being in communication with the combustion chamber, the fan scroll having an inlet communicating with the atmosphere and also having a discharge duct, a fan movably mounted within the scroll for drawing air over the conduit and into the scroll, the conduit being adapted to contain a heat transfer medium received from the combustion chamber of a temperature different from that of the air drawn thereover, and means for conducting the air to remote points following heat exchange.

EDWIN A. JONES.