

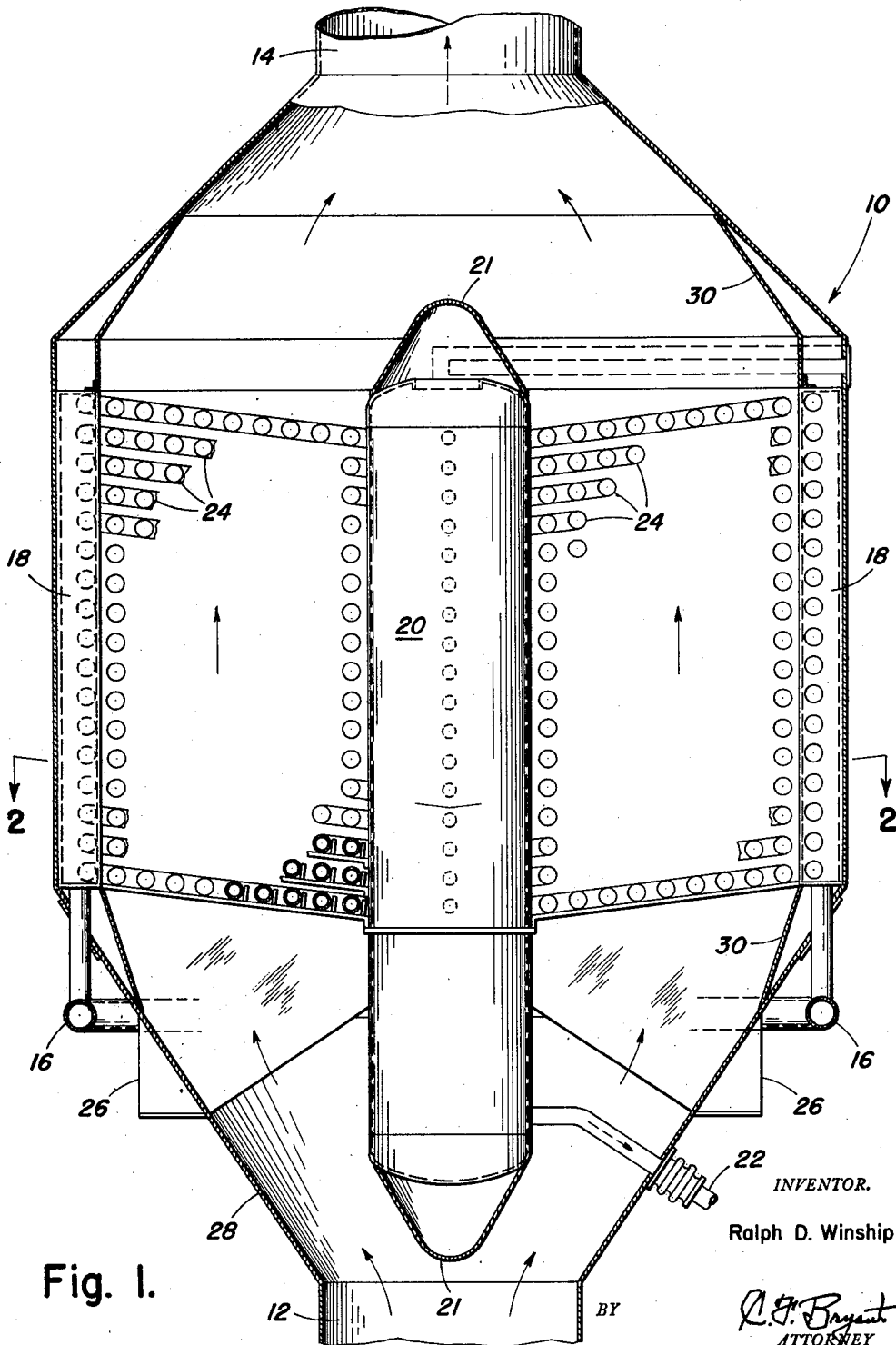
April 28, 1964

R. D. WINSHIP
LIVE STEAM REHEATER

3,130,780

Filed Dec. 29, 1960

2 Sheets-Sheet 1



April 28, 1964

R. D. WINSHIP
LIVE STEAM REHEATER

3,130,780

Filed Dec. 29, 1960

2 Sheets-Sheet 2

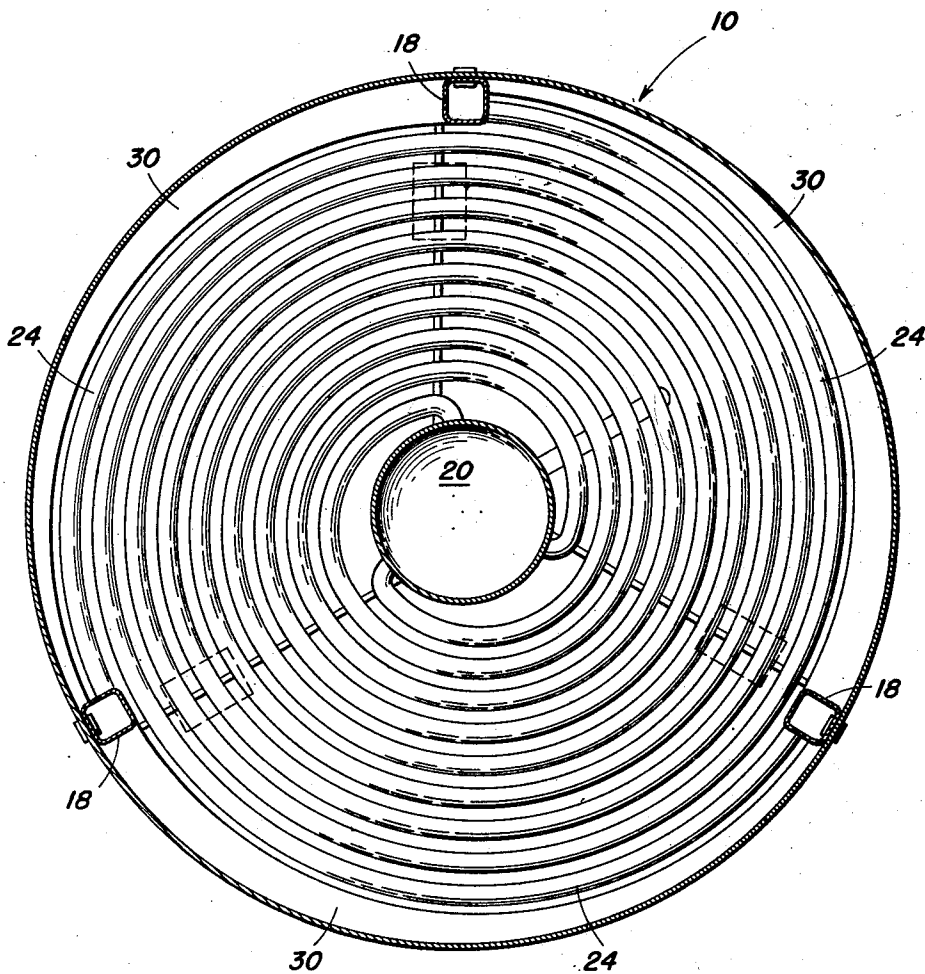


Fig. 2.

INVENTOR.

Ralph D. Winship

BY

R. D. Winship
ATTORNEY

1

3,130,780 LIVE STEAM REHEATER

Ralph D. Winship, St. Lambert, Quebec, Canada, assignor
to Combustion Engineering, Inc., Windsor, Conn., a
corporation of Delaware

Filed Dec. 29, 1960, Ser. No. 79,346

1 Claim. (Cl. 165-163)

This invention relates to a heat exchanger, whereby one fluid is passed in heat exchange relationship with another fluid. In accordance with the invention, one of the fluids is passed through rows of spiral tubes, and the other fluid is allowed to flow past these rows of spiral tubes, whereby heat is transferred from one fluid to the other.

An object of the invention is to provide a heat exchanger whereby the fluid to be heated flows there-through in a straight path, with very little pressure drop taking place.

Another object is to provide a compact heat exchanger whereby as much heat as possible is transferred from one fluid to another within a limited space.

In accordance with the present invention there is provided a vertically disposed cylindrical vessel within which is positioned a plurality of spiral tubular coils, through which coils a hot fluid medium is passed. A fluid to be heated passes through the vessel, and comes into contact with the sides of the tubular coils, thereby absorbing heat from the hot fluid contained in the tubular coils.

Other and further objects of the invention will become apparent to those skilled in the art as the description proceeds.

An illustrative embodiment of this invention is shown in the accompanying drawing wherein:

FIGURE 1 is a vertical sectional view of a heat exchanger of the present invention;

FIGURE 2 is a transverse sectional view taken along line 2-2 of FIGURE 1.

While the invention will be described as a live steam reheater between the high pressure and low pressure stages of a multistage turbine employing saturated steam as the heating fluid, it is to be understood that this is merely illustrative and not restrictive, and that the heat exchanger may have other uses, and the heating fluid may be a fluid other than saturated steam.

Referring now to FIGURE 1, 10 designates the heat exchanger housing, of cylindrical shape. The inlet 12 allows low pressure steam, on the order of 72 p.s.i.g., to enter the housing from a separator or the high pressure stage of a multi-stage turbine. Outlet 14 allows the low pressure steam, which has been heated in passing through the reheater, to flow to an intermediate or low pressure stage turbine, where the steam is utilized in generating power.

The "live" heating steam, or saturated steam, in this instance at 560 p.s.i.g., is introduced into the ring header 16 from any suitable source. The steam then flows through the three outer vertical headers 18 and on into the rows of substantially flat spiral tubular coils 24, where some of the heat of the saturated steam is passed to the low pressure steam flowing through housing 10. The steam, and some water formed by condensation of the steam in passing through the tubes 24, then flows to the central header, or collection header, 20. From here the fluid is passed back to its source by means of pipe 22 to be reheated.

As illustrated in FIGURE 1, the tubes 24 are angled, or inclined slightly downward towards the central header 20, for the purpose of allowing any condensation to drain from the tubes 24 into the central header 20, thus minimizing the inside film thickness.

2

Also, each spiral coil consists of three tubes, one extending between each of the three outer headers 18 and the central header 20, as best illustrated in FIGURE 2. Although three outer headers 18 are shown, any number can be used. The number of outer headers will be determined by the pressure drop which is allowable in the live steam reheater. The length of each tube extending between the vertical headers is the same. The tubes 24 can be of any desired shape, with fins or without fins, depending on other circumstances.

The housing 10 rests on and is supported by feet 26, there being three in number. These feet 26 also support the three vertical headers 18, and the central header 20.

The rows of tubes 24 are positioned such that the tubes lie directly above one another, thereby forming a passage for the low pressure steam between them. In this manner, with an in-line tubing arrangement, there is very little pressure drop of the low pressure steam as it flows through the spiral coils of tubes. The tubes are so arranged that the total area of space between the tubes, through which space the low pressure steam flows, is at least as great as the area of the inlet 12 and the outlet 14, to minimize the pressure drop. Also, the central header 20 is of such a length that the areas just above and below it are at least as large as the inlet and outlet.

The housing 10 is formed with frustoconical portions 28 near the openings 12 and 14 to give the flow a streamlined effect. The upper and lower portions of the central header 20 are also rounded and tapered for the same reason. Filler baffles or deflectors 30 are secured in place between the headers 18, both above and below the cylindrical portion of the housing, to further streamline the flow of the low pressure steam therethrough; and to effectively utilize the total heat transfer surface. From the above construction, it is possible to pass low pressure steam, on the order of 72 p.s.i.g., through the reheater with less than one p.s.i. pressure drop. This is of the utmost importance in a multi-stage turbine system, and enables a greater efficiency of the turbine system to be accomplished.

In operation of the heat exchanger of this invention saturated steam is passed through the rows of spiral coiled tubes 24, flowing from the outer vertical headers 18 to the central header 20. The lower portion of the central header 20 can be utilized as an integral hot well, if desired, thus eliminating the need for an external hot well, or storage vessel for the hot condensate. Low pressure steam enters the housing 10 through inlet 12, flows between the rows of spiral tubes 24, where it absorbs heat from the saturated steam within the tubes, and then passes out through outlet 14.

Access is provided to the central header through openings 12 and 14, for maintenance and cleaning purposes, for example. Also, access to the small headers 18 can be provided for by forming covered hand holes in the housing 10 near the headers.

While I have illustrated and described a preferred embodiment of my invention, it will be understood that minor changes in construction and arrangement of parts may be made without departing from the spirit and scope of the invention as claimed. Furthermore a gas, steam, or water can be used as the heating medium, and also as the heated medium. It is therefore intended that all matter contained in the description or shown in the accompanying drawing be interpreted as illustrative and not in a limiting sense.

I claim:

A heat exchanger comprising a substantially cylindrical housing having an axial opening at the bottom thereof, a second axial opening at the top thereof, the upper and lower portions of said housing being of frustoconical

3

cal shape, a plurality of first headers extending vertically within the housing and being adjacent to the walls of said housing, a second vertical header positioned along the axis of the said housing, the upper and lower portions of said second header being of frustoconical shape, a plurality of substantially horizontal spiral tubes extending between said first headers and said second header, thereby forming a plurality of vertically spaced spirals, said tubes being slightly inclined downwardly from each of said first headers to said second header, each successive coil of each spiral being substantially equally spaced from the next adjacent coil throughout the entire cross-sectional area between the cylindrical housing and the second header, baffle means positioned within the housing adjacent to the walls of the housing, and extending circumferentially between each first header and the next adjacent first header, said baffle means preventing fluid from flowing through the housing between the first headers where no tubes exist, so that all of the fluid flowing through the housing must pass in close proximity to some portion of each spiral, an inlet for each of said first headers, an outlet from said second header, the total cross-sectional area between said spiral tubes in said

4

housing being at least as great as the total cross-sectional area of either the top or bottom openings in said housing, the length of said second header being such that the cross-sectional flow area throughout the housing is at least as great as the cross-sectional flow area of either the top or bottom openings in said housing, whereby the fluid flowing through the tubes is in heat exchanger relationship to the fluid flowing between the top and bottom openings of said housing, and very little pressure drop of the fluid flowing through the housing is encountered.

References Cited in the file of this patent

UNITED STATES PATENTS

653,360	Ofeldt	July 10, 1900
1,738,088	Wadsworth	Dec. 3, 1929
1,758,643	Baetz	May 13, 1930
1,965,749	Pierce	July 10, 1934
2,270,665	Wheller	Jan. 20, 1942

FOREIGN PATENTS

183,410	Germany	Apr. 13, 1907
---------	---------	---------------