

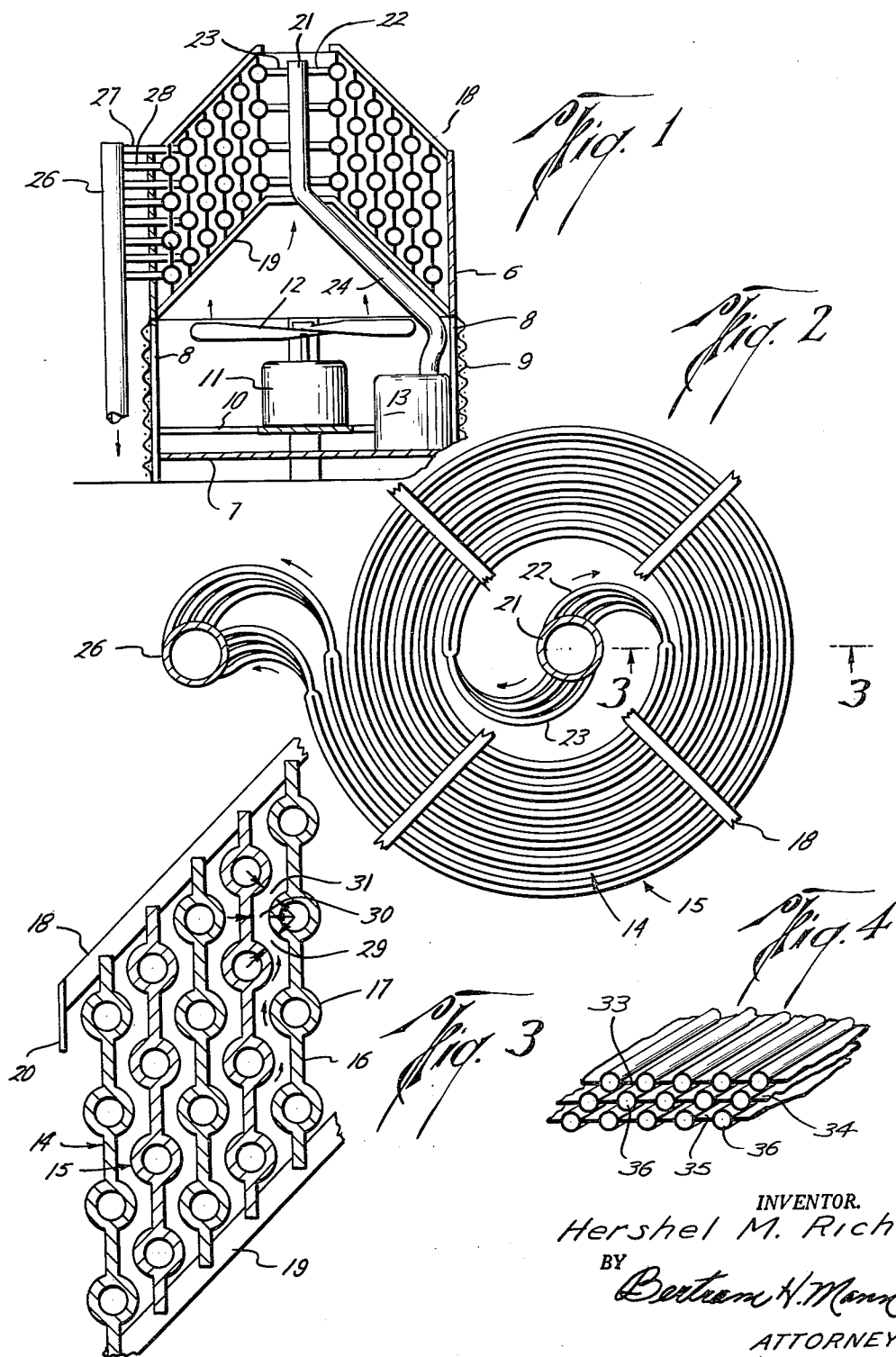
Oct. 16, 1962

H. M. RICH

3,058,722

HEAT EXCHANGER

Filed Jan. 3, 1961



1

3,058,722

HEAT EXCHANGER

Hershel M. Rich, Houston, Tex., assignor to Phil Rich Fan Mfg. Co., Inc., Houston, Tex., a corporation of Texas

Filed Jan. 3, 1961, Ser. No. 80,380
3 Claims. (Cl. 257-137)

This invention relates to heat exchangers, particularly the type which may be used as a condenser or evaporator unit in a mechanical refrigeration system and utilizing metal tubing strips.

Previous systems of this type for conducting the refrigerant have placed these coils substantially so that air in flowing therethrough is subjected to substantial compression and expansion as well as changes of direction, all of which tend to increase the static pressure within the coil during operation with resultant increase in resistance to air flow and consequent reduction in efficiency. Moreover, the contacting surfaces are not arranged for maximum contact by the flowing air.

Accordingly, it is an object of the present invention to provide a heat exchanger of the type utilizing tubing strips with juxtaposed tubes and which is substantially more efficient than previous exchangers of this type.

Another object is to provide a heat exchanger having clustered tubes and connecting webs or vanes in which the passageways for air do not have the substantially varying cross sections heretofore customary.

Another object is to reduce the amount of metal required in constructing such a heat exchanger and, therefore, the cost thereof.

Another object is to reduce the space necessary to achieve a specific amount of heat exchange.

I propose to accomplish the above results by constructing the heat exchanger of substantially conically coiled, tubing-strip material which may be formed either of parallel strips linearly expanded along restricted zones to form the tubes, or by extrusion or any other suitable process. The tubes in the strips, which are in parallel relationship, are located substantially between tubes of adjacent strip portions and these portions are spaced apart and positioned so as to form serpentine passages between the strips having substantially uniform cross sections.

In the accompanying drawings which illustrate the invention,

FIG. 1 is a vertical central section through a simplified form of heat exchanger illustrating the invention.

FIG. 2 is a top view of the exchanger coils.

FIG. 3 is an enlarged radial section showing a portion of the tubing strip structure.

FIG. 4 is a detail section illustrating a modification.

The novel heat exchanger is formed in a suitable casing having a substantially cylindrical side wall 6 and a floor 7. Depending from wall 6 are supporting legs 8 forming intake openings covered by a screen 9. A bar or spider 10 intermediately traverses the casing and centrally supports a motor 11 operating an axial flow propeller fan 12. A compressor 13 is mounted on floor 7.

Helically coiled within the casing are a pair of integral tubing strips, generally designated 14 and 15, each having aligned web portions, as 16, and spaced parallel tube portions, as 17. The resultant conical bundle of parallel tubing strips is maintained assembled by inclined radial ribs 18 and 19 regularly grooved along their opposing edges for snugly receiving the edges of the coiled tubing strips. Radial ribs 18 and 19, in turn, are suitably secured at their outer ends to casing side wall 6, as by bent-over flanges 20.

At the upper center portion of the conical bundle there is provided a vertical header tube 21 which is connected by tubing 22 and 23 to the inner ends of the tubes in the

2

respective tubing strips 14 and 15. This header is closed at the top and connected at the bottom by means of piping 24 to compressor 13. At the outer end of the device there is somewhat schematically represented a second header 26 which is connected by tubes 27 and 28 to the outer ends of the tubing portions of the respective sheets 14 and 15. The bottom end of header 26 is connected by suitable piping to other parts of the apparatus, for instance, the expansion valve and evaporator. The arrows indicate that the device is arranged for use as a condenser, gaseous matter being introduced at the top through piping 24 and liquid being discharged at the bottom through header 26. Fan 12 is rotated by motor 12 in the direction to draw atmosphere upwardly and to discharge the same either to atmosphere after heat exchange contact with the tubing strips.

FIG. 3 best illustrates the passageways provided between the coiled tubing sheets. The tube portions 17 of each strip 14 or 15, which are equally spaced and parallel, are positioned substantially midway between the tubing portions of the adjacent strip portion or portions, and adjacent strips are spaced apart such that the clearances at cross sections 29, 30 and 31 along the serpentine path extending axially of each passageway are substantially uniform. The same is true of all portions of all the passageways extending between the strips.

FIG. 4 shows flat tubing sheets 33, 34, and 35 arranged in closely parallel relationship and with their generally elliptical tube portions 36 staggered, as in the previous form to provide substantially uniform fluid passages therebetween.

Thus, although the paths of air travel axially through the coils are serpentine, static pressure is substantially less than where the tubing portions are located substantially abreast of each other or side by side with resultant alternate compressions and expansions of the air. Furthermore, each tubing portion serves to direct the air against the adjacent vane or web portion of the adjacent strip or strips so that the traversing air substantially uniformly contacts all portions of all coils. In other words, both the primary or tube heat exchange portions 17 and the secondary vane or web portions of the heat exchanger structure function in the most efficient manner. Tests have shown that the static pressure, that is, the effective resistance or back pressure, within the novel coil, is substantially less than where the tubing portions are conventionally arranged. This permits the use of a less powerful and therefore less expensive motor in achieving maximum heat exchange value from the device. Furthermore, a reduction on the order of 50% in horizontal cross sectional dimension of the novel heat exchanger permits the use of a smaller casing and resultant reduction of cost of metal. For maximum efficiency, in terms of heat transfer per pound of metal, the vane or web portions 16 of the tubing sheet should be as thin as possible, and this advantage would be attained by forming the strips by the extrusion process rather than of stacked metal sheets welded and expanded.

While the conical arrangement of the coiled strips lends itself to the use of tubing strips of uniform width, this particular arrangement of the tubing strips is not essential. For instance, sections of the stripping may be arranged in other parallel configurations in a suitable casing of square, polygonal or other shape. Exclusive use of all modifications as come within the scope of the appended claims is contemplated.

I claim:

1. A heat exchanger comprising a casing means to propel a first fluid axially therethrough, and integral tubing-strip material mounted within said casing in radially spaced, spiral coils about the axis thereof, said material having parallel tubular elements for accommodating a

3

second fluid and connecting planar webs, the tubular elements of each coil portion being abreast the webs and interposed between the tubing elements of adjacent coil portions spaced radially therefrom whereby serpentine axial passages of substantially uniform cross-section and with continuous, substantially streamlined walls are provided between said coils.

2. A heat exchanger as described in claim 1 in which said material comprises at least one continuous sheet of said material of uniform width with its coil portions sequentially displaced axially of the casing to form a generally conical exchanger body.

3. A heat exchanger as described in claim 2 in which said casing is disposed vertically, the inner and outer coil portions of said material being located, respectively, at

4

the top and bottom of said body and said tubular portions being inclined outwardly and downwardly from said inner coil to facilitate gravity flow of fluid therethrough.

References Cited in the file of this patent

UNITED STATES PATENTS

1,476,789	Bassler	Dec. 11, 1923
1,559,213	Winterbottom et al.	Oct. 27, 1925
2,720,383	Huet	Oct. 11, 1955

FOREIGN PATENTS

3,027	Great Britain	Dec. 10, 1860
336,755	Great Britain	Oct. 23, 1930
769,929	Great Britain	Mar. 13, 1957