

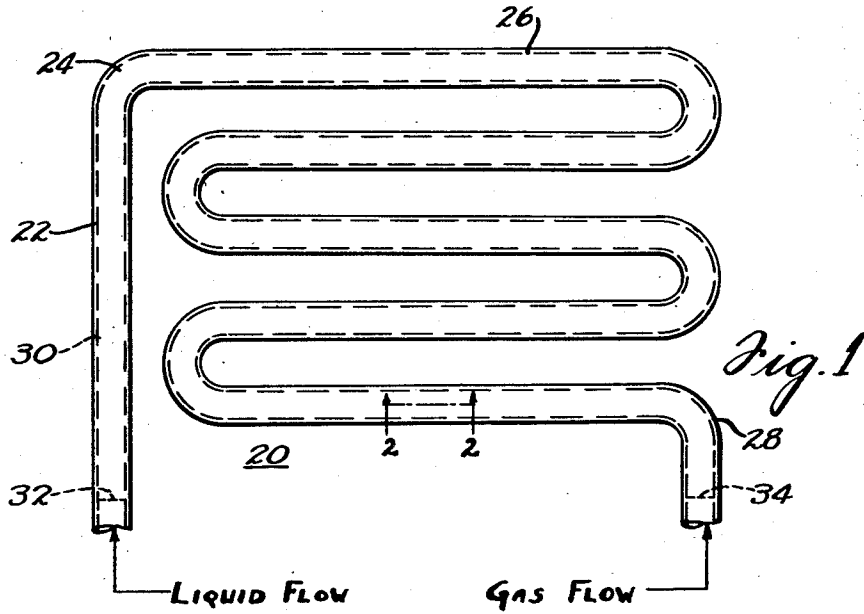
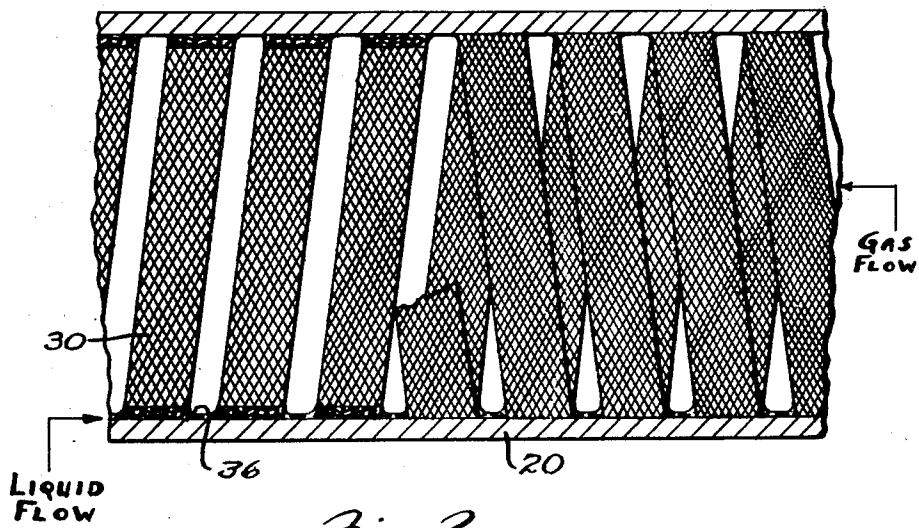
Aug. 21, 1951

R. S. GAUGLER

2,565,221

REFRIGERATING APPARATUS

Filed April 6, 1946



INVENTOR.
Richard S. Gaugler
BY
Spencer Hardman and John
attorneys

UNITED STATES PATENT OFFICE

2,565,221

REFRIGERATING APPARATUS

Richard S. Gaugler, Dayton, Ohio, assignor to
General Motors Corporation, Dayton, Ohio, a
corporation of Delaware

Application April 6, 1946, Serial No. 660,228

3 Claims. (Cl. 261-104)

1

This invention relates to heat transfer apparatus such as for example, may be used in absorption refrigerating apparatus.

In absorption evaporators it has been customary to place wire screens or wire cloth within the evaporator tubing against the walls thereof to expose liquid above the liquid level in contact with the walls of the tubing. The screens could not be conveniently applied to the bent or curved portions of the tubing either before or after the bending and as a result they have been applied only to the straight portions thereof. This limits the area of the capillary surface which may be exposed in contact with the walls of the tubing and therefore limits the total effective evaporating surface.

It is an object of my invention to provide a heat transfer apparatus with a simple inexpensive resilient form of capillary means which may be applied to containers of a wide variety of configurations in firm contact with the interior walls thereof.

It is another object of my invention to provide a heat transfer apparatus with a simple inexpensive resilient form of capillary means which may be applied to an intermediate form of the container and which can be bent along with the bending of the container.

It is another object of my invention to provide a heat transfer apparatus with a simple inexpensive resilient form of capillary means which may be applied to straight tubing which thereafter can be bent to the desired configuration without damage or without displacing the capillary means.

These objects are attained by forming braided wire sleeving into a flat resilient ribbon and coiling it into the helix after which it is inserted into the tubing and uncoiled one coil at a time so that it presses firmly against the interior wall of the tubing. After this, the tubing is bent to a serpentine shape or any other shape desired. The flexibility of the ribbon makes it possible for it to conform to the shape of the tubing after the bending and remain tightly against the interior wall of the tubing without any substantial displacement. The liquid to be evaporated flows and collects in the bottom of the tubing and saturates the flat ribbon providing a liquid surface of large area from which the liquid evaporates.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accom-

2

panying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a plan view, partly diagrammatic, of an absorption refrigeration evaporator or other heat transfer apparatus embodying one form of my invention; and

Fig. 2 is a sectional view taken along the line 2-2 of Fig. 1.

Although my invention may be applied to containers of a wide variety of shapes it is most easily applied to the most common application, namely to tubing. Fig. 1 illustrates a typical application in which the tubing 20 is provided with a straight section 22 connected by a 90 degree bend 24 with the serpentine sections 26 which are composed of straight sections connected by 180 degree bends and ending with a 90 degree bend 28. In the past, wire screens have been placed in the tubing at the points where the straight sections were to remain, after which the proper bends were made to form the tubing to the desired configuration as shown in Fig. 1. In this type of evaporator liquid is fed into one end of the tubing and covers only a small portion of the bottom of the tubing. The liquid, however, is drawn up and wets the screens to provide an increased liquid surface, which increases the rate of evaporation.

In the partial pressure absorption apparatus the inert gas was circulated through the tubing in the opposite direction. However, the increased surface improves the performance in both types of absorption refrigerating apparatus. With this arrangement, however, the amount of refrigeration performed in the portions having 90 degree and 180 degree bends is very small, since the wire screens cannot conveniently be applied to these portions.

According to my invention, I provide the capillary means in the form of a helix of flat resilient wire ribbon 30. The ribbon 30 is preferably made of single braided wire sleeving having 48 ends of steel weaving wire with one end up. This sleeving is preferably pulled and then flattened and coiled into a helix. While the tubing is still straight this flattened sleeving is uncoiled within the tubing one coil at a time so that each coil is pressed tightly against the inner surface of the tubing with one of the flat sides pressing against the wall surface.

The coils of the helix may be made as close together as desired, but preferably they should be spaced sufficiently so that they do not overlap when the tubing is bent. I find that for

3

the configuration shown in Fig. 1 it is desirable to allow a space between each coil which is slightly less than one-half the width of the flat ribbon. The braided sleeving in reality forms two thicknesses of wire gauze in flat area contact with each other, and with one outer side pressing tightly against the wall of the tubing. This helix of flattened wire sleeving extends from the point 32 at the inlet end continuously through the tubing 20 to the point 34 at the outlet end of the heat transfer apparatus. The tubing is bent on any suitable forming machine to the shape desired, such as is shown in Fig. 1, without any difficulty caused by the presence of the wire ribbon within, since the resilient wire ribbon is extremely flexible and will readily conform itself to the change in shape required by the bending.

In use, the liquid to be evaporated is fed into the tubing at one end and flows along the bottom of the tubing as indicated by the reference character 36 until it is evaporated. This liquid wets the bottom of each coil of the helix of wire ribbon 30 and the two adjacent tightly packed sheets of wire gauze forms a capillary structure which attracts the liquid to be evaporated, such as ammonia. This causes the ribbon to be saturated all along the tubing as far as the liquid supply holds out. In the case of inert gas machines the gas is preferably circulated through the tubing in the opposite direction to the liquid flow and the liquid evaporates from the flat exposed surface of the ribbon as well as from the edges thereof into the inert gas. If no inert gas is used, the liquid merely evaporates because of the reduced vapor pressure caused by the removal of vapor from the tubing. A small fillet of liquid forms at the edge of the wire ribbon so that very little surface is not wetted with liquid. The surface is increased by the surface provided by the edges of the wire ribbon and some turbulence is provided by the irregular wall surface formed by the coils and the spaces between.

The heat transfer is improved by having the coils tightly in contact with the outer walls since the heat passing through the walls of the tubing passes directly to the liquid in the coils of wire ribbon. Due to this excellent heat transfer and the large liquid surface the evaporator has a high heat transfer capacity and a high efficiency.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. Heat transfer apparatus including a member having tubular portions with turns therein, said tubular portions being only partially filled with liquid, and capillary means in the form of

4

a flexible resilient flat ribbon containing a plurality of layers of wire gauze extending substantially helically throughout the convolutions of the tubular portions with the flat surface of the ribbon in a substantially surface contact with the interior surface of the tubular portions, the bottom of each turn of the helix dipping into the liquid to saturate the capillary means by capillary action to provide an exposed liquid holding surface of large area above the surface of the liquid.

2. Heat transfer apparatus including a member having tubular portions with turns therein, said tubular portions being only partially filled with liquid, and capillary means in the form of a flexible resilient flat ribbon containing a plurality of layers of wire gauze extending substantially helically throughout the convolutions of the tubular portions with the flat surface of the ribbon in a substantially surface contact with the interior surface of the tubular portions, the bottom of each turn of the helix dipping into the liquid to saturate the capillary means by capillary action, said flat ribbon covering the major portion of the interior surface through that part of the tubular portions through which it extends to provide an exposed liquid holding surface of large area above the surface of the liquid.

3. Heat transfer apparatus including a container only partially filled with liquid, and capillary means in the form of parallel spaced portions of flattened wire sleeving extending from said liquid in flat contact with the interior surface of the container, said capillary means having capillary flow throughout in all directions for exposing liquid above the normal liquid level in heat exchange relation with the walls of the container, the portions of flattened wire sleeving covering the major portion of the interior surface of the container through which the flattened sleeving extends to provide an exposed liquid holding surface of large area above the surface of the liquid.

RICHARD S. GAUGLER.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,604,779	McDermet	Oct. 26, 1926
1,983,295	Kohler	Dec. 4, 1934
2,068,955	Kritzer et al.	Jan. 26, 1937
2,122,504	Wilson	July 5, 1938
2,295,988	Brace	Sept. 15, 1942
2,300,579	Lenning	Nov. 3, 1942
2,307,947	Payne	Jan. 12, 1943