July 4, 1950 H. F. HAGEN 2,513,644

HEAT EXCHANGER

Filed Dec. 6, 1945 2 Sheets-Sheet 1

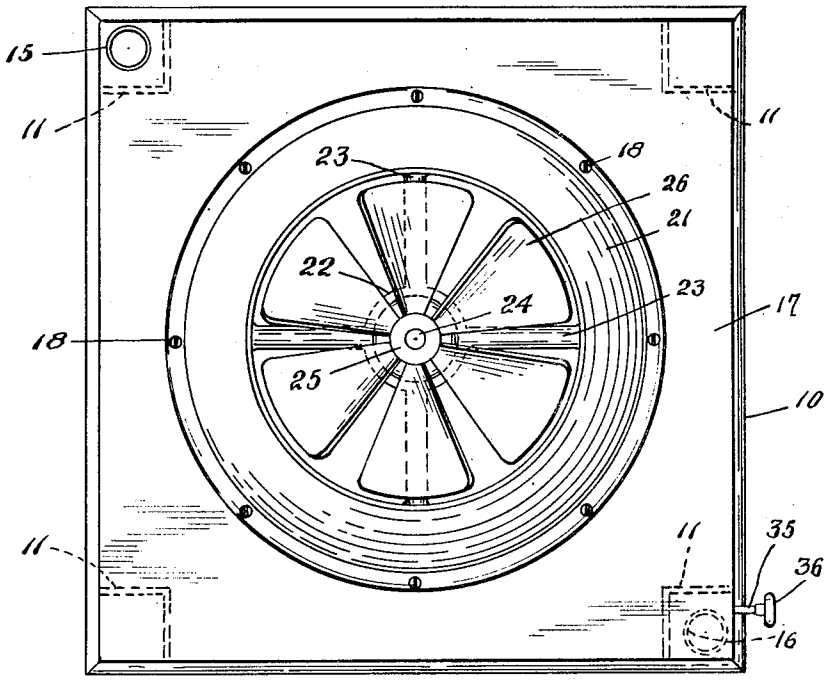


Fig. 1.

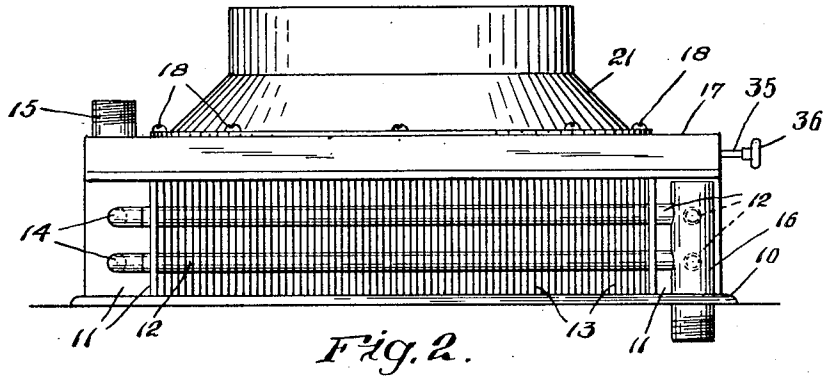


Fig. 2.

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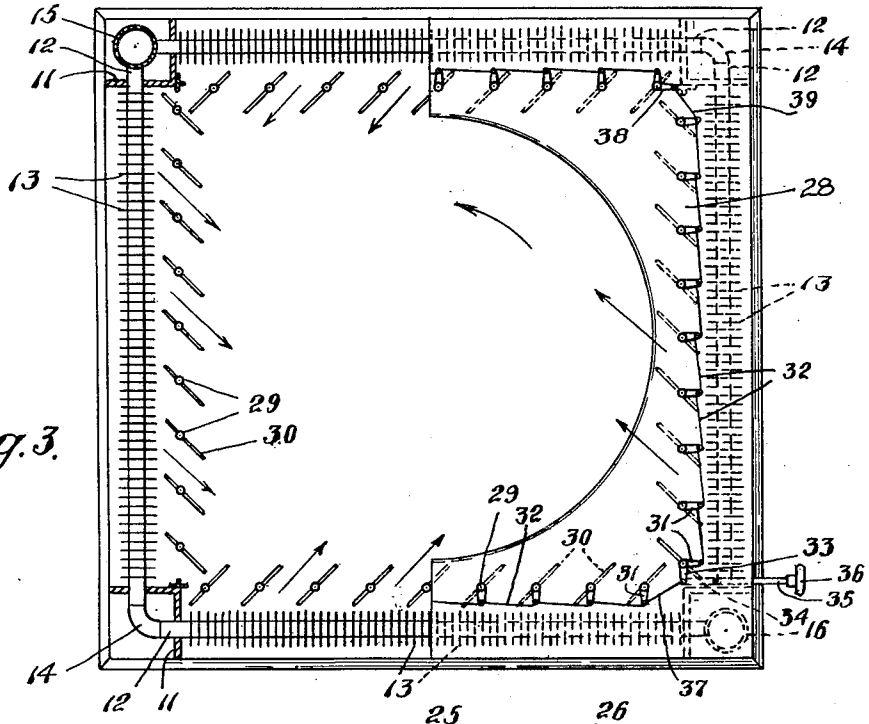


Fig. 3.

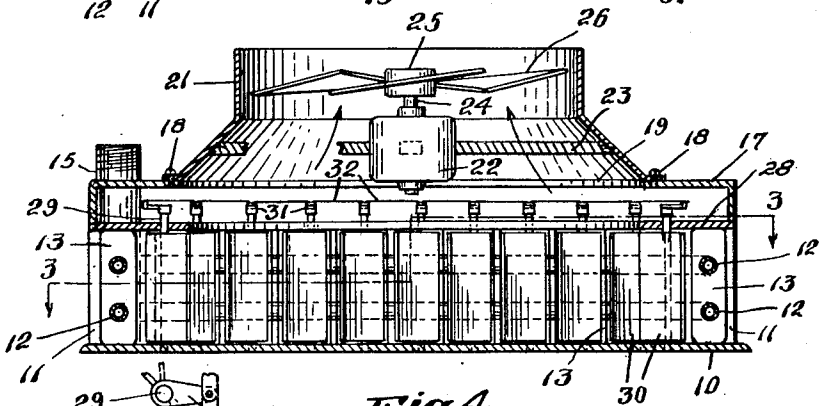


Fig. 4.

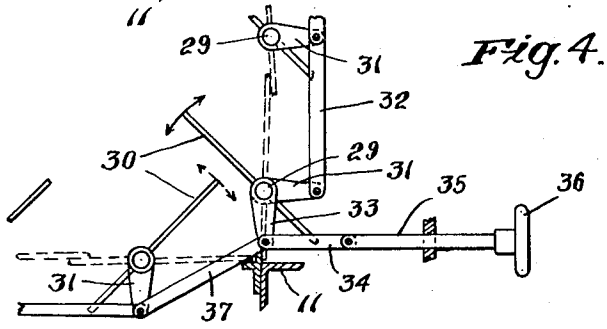


Fig. 5.

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UNITED STATES PATENT OFFICE

2,513,644

HEAT EXCHANGER

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Application December 6, 1945, Serial No. 633,130

1 Claim. (Cl. 257—137)

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This invention relates to heat exchangers, and relates more particularly to heat exchangers in which liquids are cooled by the indirect contact of air forced by fans against the heat exchange surfaces.

The volume of air required for cooling a heat exchange surface varies with the temperature of the surface, and with the degree of cooling desired. In prior heat exchangers, the volume of air moved by the fans thereof, has been varied by adjustment of dampers in the path of the air. While such dampers have been effective in varying the air volumes, they have been inefficient since the power required by the fans has remained the same at minimum air volumes as at maximum volumes.

A feature of this invention resides in the provision of heat exchange tubes in the inlet passage of the fan of a heat exchanger, and in the provision of adjustable spin vanes around the inlet passage between the fan and the tubes. Adjustment of the vanes provides variable air volumes with fan power consumptions proportional thereto.

In some locations such, for example, as in the oil producing fields and in oil refineries, it is customary to expose the heat exchangers for cooling liquids, directly to the outdoor air. The heat exchange tubes of such exchangers have usually been arranged in single vertical banks, and their cooling action has been greatly affected by the velocity and direction of the wind.

Another feature of this invention resides in the provision of spaced heat exchange tubes in vertical rows around the open center of a heat exchanger having an imperforate base, and having an axial flow fan, with vertical shaft, arranged centrally above the tubes. The effectiveness of this heat exchanger remains the same when located outdoors, regardless of the direction and the velocity of the wind.

An object of the invention is to reduce the power required by the fans of heat exchangers when reduced air volumes are desired.

Another object of the invention is to provide a heat exchanger which when placed outdoors, is not affected by changes in the direction and the velocity of the wind.

The invention will now be described with reference to the drawing, of which:

Fig. 1 is a plan view looking downwardly upon a heat exchanger embodying this invention;

Fig. 2 is a side elevation of the exchanger of Fig. 1;

Fig. 3 is a sectional plan view, with the section taken along the lines 3—3 of Fig. 4;

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Fig. 4 is a side elevation in section of the heat exchanger of Figs. 1–3, and

Fig. 5 is an enlarged view of several of the spin vanes and their adjusting members as used in the heat exchanger.

The heat exchanger illustrated, consists of the imperforate base 10 having the upwardly extending structural angles 11 supported thereon. The sides of the angles 11 are perforated for receiving the two superimposed rows of horizontally extending tubes 12.

The tubes 12 have the extended surface fins 13 thereon, and extend into the supply and return headers 15 and 16. The tubes 12 of each row are interconnected by the elbows 14.

The upper wall 17 of the exchanger is supported upon the angles 11, and has the central circular opening 19 around which the fan casing 21 is attached by the screws 18.

The electric motor 22 is supported centrally within the casing 21 by the spaced arms 23 which are attached to the inner surface of the casing as by welding, and has keyed to the upper end of its vertically extending shaft 24, the hub 25 to which are attached the axial flow fan blades 26.

The annular intermediate wall 28 extends inwardly between the upper wall 17 and the angles 11, and is supported therebetween. The pivot shafts 29 of the spin vanes 30 are journalled for rotation in the intermediate wall 28 and in the base 10, and are arranged with their axes extending in lines which extend parallel to the tubes 12 inside the heat exchanger, as best illustrated by Fig. 3 of the drawing. The arms 31 are keyed to the shafts 29 so as to rotate therewith, and are interconnected by the links 32.

One of the shafts 29 also has attached thereto the arm 33 which, in turn, is attached to the crankarm 34 of the control lever 35. The lever 35 has on its outer end, the hand grip 36 for manual adjustment of the spin vanes 30 as will be described. The arm 33 is also pivoted to one end of the link 37, the other end of which is pivoted to the adjacent arm 31.

Others of the shafts 29 at the corners of the heat exchanger have arms 38 attached thereto and which are pivoted to corresponding ends of the links 39 which, in turn, are pivoted at their other ends to adjacent arms 31.

In operation, the liquid to be cooled is circulated through the tubes 12, and the fan blades 26 draw air over the surfaces of the tubes. The tubes extend around all four sides of the heat exchanger whereby a change in the direction of the wind to which the heat exchanger may be exposed results in the wind striking the same

heat exchange surface area. Changes in the velocity of the wind can be compensated for by adjustment of the spin vanes 30 as will be described.

When the spin vanes 30 extend perpendicular to the axes of the tube 12, they have no spin inducing effect upon the air and the air volume is maximum. When placed in angular positions with respect to the axes of the tubes 12, they cause the air passing therebetween to spin in the direction of rotation of the fan blades 26 as illustrated by the arrows of Fig. 3. The degree of angularity determines the degree of spin and the corresponding degree of reduction in the air volume as disclosed in detail in my U. S. Patents Nos. 1,846,863 and 1,989,413.

When it is desired to reduce the volume of air passing over the surfaces of the tubes 12, the handgrip 36 is moved inwardly causing the lever 35 and the crankarm 34 to rotate, through the arm 33, the pivot shaft 29 to which same is attached. The other pivot shafts 29 are simultaneously rotated through the interconnecting links 32 and 37 and the arms 31 to which same are attached. This rotation of the pivot shafts 29 causes the spin vanes 30 to be rotated towards positions parallel to the axes of the tubes 12 whereby spin is induced in the air entering the fan blades 26, the degree of spin and the corresponding degree of air volume reduction being proportional to the distance the handgrip 36 is moved inwardly.

Drawing the handgrip 36 outwardly causes, through the linkage described in the foregoing, the spin vanes 30 to be rotated to points of less or no spin thereby increasing the volume of air entering the fan blades 26.

While the adjustment of the spin vanes has been disclosed as being manual, any conventional thermostat could, of course, be used to adjust the vanes automatically if that is desired.

While one embodiment of the invention has been disclosed for the purpose of illustration, it should be understood that the invention is not limited to the exact apparatus and arrangement of apparatus illustrated, as modifications thereof may be suggested by those skilled in the art, without departure from the essence of the invention.

What is claimed is:

A heat exchanger comprising a casing having an imperforate base, a wall spaced from said base and extending substantially parallel thereto, said wall having a central circular opening therein, heat exchange tubes between said base and said wall and arranged symmetrically around said opening, spin vanes between said base and said wall and pivoted on axes extending perpendicular thereto, said vanes being located alongside said tubes and between same and said opening, an axial flow fan having an inlet passage aligned with said opening and having walls defining said passage connected to said casing, said fan being located on the opposite side of said opening from said base, and means for adjusting said vanes for varying the volume of air moved by said fan over the surfaces of said tubes.

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