

Sept. 21, 1937.

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2,093,825

REFRIGERATING COIL

Filed May 7, 1936

2 Sheets-Sheet 1

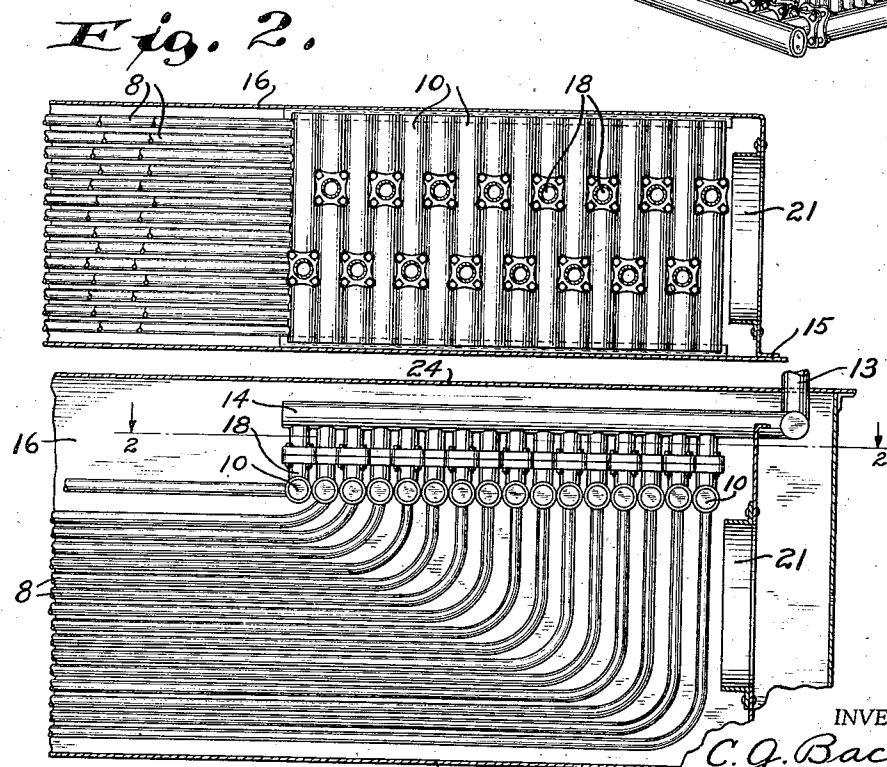
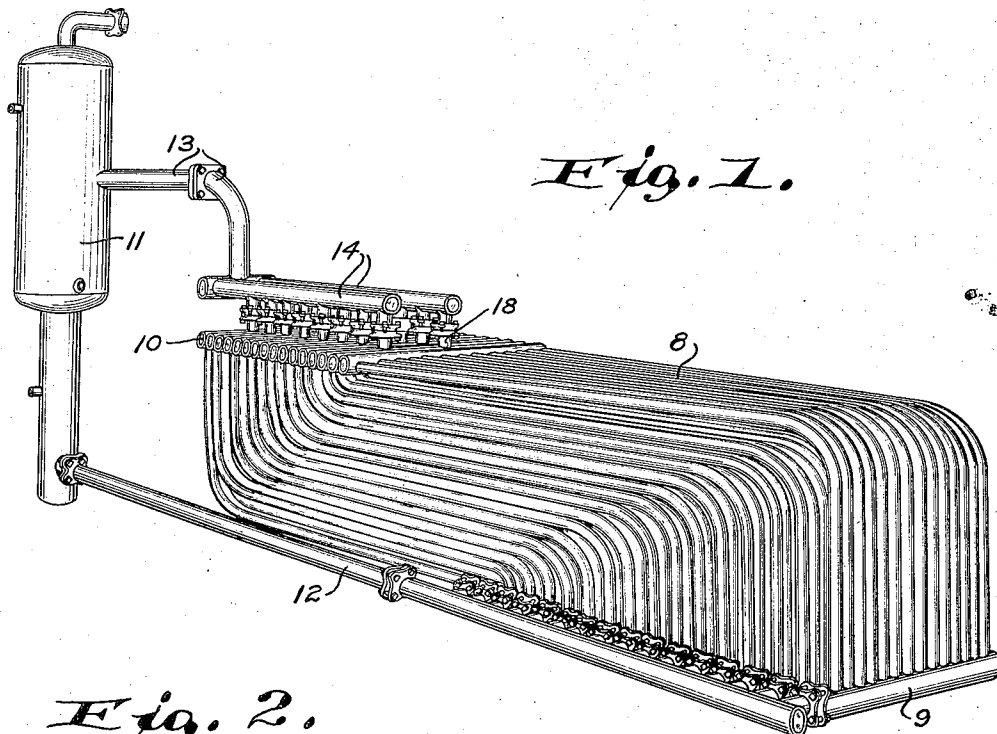


Fig. 3.

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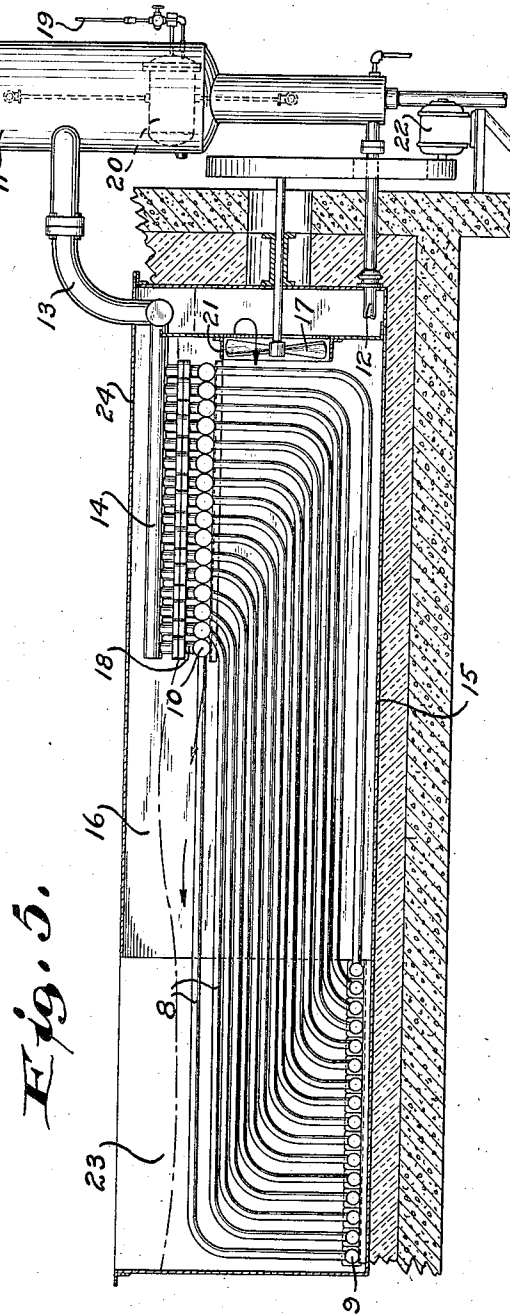
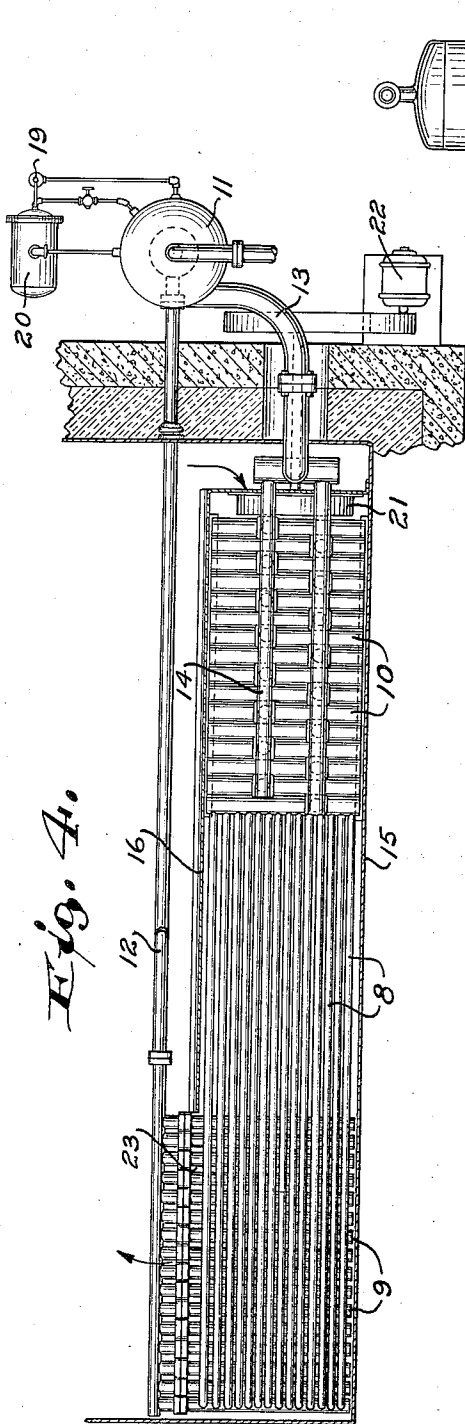
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2 Sheets-Sheet 2



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REFRIGERATING COIL

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8 Claims. (Cl. 62—126)

The present invention relates generally to improvements in the art of heat transfer, and relates more specifically to improvements in the construction of refrigerating coils of the so-called boiler type especially adapted for the purpose of cooling liquid such as brine.

Generally defined, an object of the present invention is to provide an improved refrigerating coil which is simple and compact in construction, and which is also highly efficient in operation.

It has long been common practice in the art of refrigeration to utilize so-called boiler type coils for the purpose of cooling liquid such as brine. In these brine cooling systems, the brine is circulated through a coil comprising a series of elongated pipes having their opposite ends attached to headers and within which the refrigerant is confined, the opposite ends of the pipes and the corresponding headers being located at different elevations and the medial portions of the pipes extending substantially horizontally. The prior coils of this type are undesirably bulky and therefore necessitate the use of relatively large propellers and driving motors in order to insure effective circulation of the brine; and all of the prior coil structures are moreover difficult to manufacture, assemble and repair. The previous brine cooling coils are moreover relatively inefficient because of the faulty disposition of the end headers and resultant necessary restriction in size thereof, and the prior coils are also relatively costly and subject to excessive leakage.

The present invention therefore contemplates provision of an improved coil assemblage of the boiler type, which obviates all of the defects of the previous coils, and which has far greater cooling capacity per unit of space occupied.

Another specific object of my present invention is to provide a new and useful refrigerating coil structure, which can be readily manufactured, assembled and dismantled, and thus maintained free from leaks.

A further specific object of the invention is the provision of improved disposition of the headers for boiler type refrigerating coils, whereby maximum heat transfer surface is made available with connecting pipes of minimum length.

Still another specific object of my invention involves the provision of a cooling coil for liquid or gas, which will permit the use of a relatively small circulating propeller and driving motor in order to insure circulation at velocities which will result in most efficient functioning of the apparatus.

An additional specific object of the invention is

to provide an improved coil assemblage wherein the suction headers at the propeller end of the coil may be disposed in contact with each other so as to provide an enclosed conduit for augmenting the entrance velocity of the brine.

Another specific object of my invention is to provide an improved coil assemblage which can be manufactured and maintained at minimum cost, and which is far superior in many respects to the prior similar types of coils.

These and other objects and advantages of the invention will be apparent from the following detailed description.

A clear conception of the several features constituting the present improvement, and of the mode of constructing and of utilizing refrigerating coils built in accordance with my invention, may be had by referring to the drawings accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the various views.

Fig. 1 is a perspective view of one of the improved refrigerating coils, showing the same completely assembled but removed from the brine tank;

Fig. 2 is an enlarged horizontal transverse section through the risers of the individual suction headers of the coil, the section being taken along the line 2—2 of Fig. 1;

Fig. 3 is a similarly enlarged side elevation of the suction end of the improved coil;

Fig. 4 is a top view of one of the new coils showing the same applied in a brine cooling system; and

Fig. 5 is a side elevation of the coil and brine cooling system, showing the brine tank in section.

While the invention has been shown and described herein as being specifically applied to a boiler-type of coil especially adapted to cool liquid such as brine, it is not the intent to thereby unnecessarily restrict the scope, since at least some of the improved features are more generally applicable to coils of other types for cooling gases such as air.

Referring to the drawing, the refrigerating system to which the invention has been applied is of the flooded type and comprises in general a coil consisting of a series of substantially horizontal pipes 8 having their lower ends connected to supply headers 9 and their upper ends similarly connected to suction headers 10; a refrigerant supply tank and accumulator 11 having its lower end connected to the coil supply headers 9 by a liquid refrigerant supply pipe 12 and its upper

portion connected to the coil suction headers 10 by a gas return pipe 13 through collecting headers 14; a tank 15 having a partition 16 forming a conduit within which the coil is located; and a propeller 17 for constantly circulating the brine or other liquid through the conduit and in intimate contact with the coil pipes 8.

The pipes 8 of the improved coil are disposed in both vertical and horizontal rows being spaced slightly out of contact with each other, and the opposite end portions of these pipes 8 extend downwardly and upwardly away from the more closely nested medial horizontal portions thereof and are permanently welded to the headers 9, 10 respectively. The lower refrigerant supply headers 9 extend cross-wise beneath the downwardly directed ends of the pipes 8 and may be spaced slightly from each other as shown; and the corresponding ends of these headers 9 are detachably connected to the supply pipe 12 at a freely accessible portion of the side of the coil, by means of bolts and flanges as clearly shown in Figs. 1 and 4. The upper suction headers 10 extend transversely across the upwardly directed gas delivery ends of the pipes 8 and are preferably disposed in substantial contact with each other so as to form a closure at the top of the propeller end of the coil. The corresponding upper ends of the pipes 8 may be welded or otherwise permanently secured to the suction headers 10, and these headers have alternately offset or staggered gas discharge riser pipes 18 which are detachably connected to the lower portions of the collecting headers 14 by means of flanges and bolts as clearly shown in Figs. 1, 2 and 3. The parallel collecting headers 14 are detachably connected to the upper portion of the accumulator 11 by means of the two-part return pipe 13, and the headers 9, 10, 14 as well as the pipes 12, 13, 18 should be of sufficient capacity to permit unrestricted supply and return of the refrigerant.

The accumulator 11 is of well known construction, being provided with a fresh refrigerant supply line 19 and a float actuated control valve 20 for regulating the admission of refrigerant in accordance with variations in level of the liquid within the accumulator 11. The pipes 12, 13 are in open communication with the accumulator, and suitable shut-off valves may be provided wherever desired. The propeller 17 is also of well known construction, being located in a brine inlet housing 21 and operable by an electric motor 22. The partition 16 which is located within the brine tank 15, extends along the side of the coil from the housing 21 to the series of lower headers 9, as shown in Figs. 4 and 5, thereby leaving a brine outlet opening 23 at the ends of the pipes 8 above the headers 9. A top closure 24 may also be provided above the coil, but this closure should preferably avoid constricting the area of the conduit within which the coil is located, and the direction of flow of the brine circulated by the propeller 17 is indicated by arrows in Figs. 4 and 5.

During normal operation of the refrigerating system shown in the drawings, liquid refrigerant is being delivered to the headers 9 and pipes 8 from the accumulator 11 through the supply pipe 12, and gaseous refrigerant is being returned to the accumulator 11 through the headers 10, risers 18, collecting headers 14 and return pipe 13, in a well known manner. The propeller 17 is being operated by the motor 22 to circulate brine from the tank 15 through the housing 21 and along the pipes 8. The brine travels at relatively high

velocity as it passes through the restricted conduit bounded on top by the suction headers 10, and upon leaving the restricted zone, the velocity is somewhat reduced and the brine builds up to a higher level as shown by the dot-and-dash line in Fig. 5. As the flow reaches the delivery opening 23 beyond the end of the partition 16, the brine passes laterally of the coil into the main body of the tank 15 from whence it is ultimately recirculated by the propeller 17. The brine is thus repeatedly cooled by direct contact with the pipes 8 and headers 9, 10, in a most efficient manner.

The construction of the main coil including the formation of the pipes 8 and the disposition of the headers 9, 10, permits relatively unobstructed flow of the brine through the coil at sufficiently high velocity to insure most effective heat transfer. The suction headers 10 form an effective deck for insuring maximum velocity of flow nearest the propeller 17, and the decrease in velocity beyond this deck provides ample time for subsequent cooling. The improved formation and disposition of the pipes 8 and headers 9, 10 also accommodates expansion and contraction without introducing leakage, and the detachable connections between the headers 9, 10 and the pipes 12, 13 respectively permit most convenient and rapid assembly and dismantling of the coil structure. These detachable connections are obviously located where they are readily accessible, and the headers and piping may be made of sufficient size to insure effective operation by virtue of the transverse disposition of the former. The staggered location of the riser pipes 18 also permits the headers 10 to be placed closely adjacent each other, and the entire coil assemblage is obviously simple, compact and durable.

From the foregoing description it will be apparent that my present invention provides a boiler-type of refrigerating coil which besides being simple in construction, is also highly efficient in use. The improved coil structure may obviously be readily manufactured and installed at relatively low cost, and the elimination of obstructions between and around the pipes 8 permits free and rapid circulation of the brine with the aid of a relatively small propeller 17 and motor 22. For this reason a relatively small and compact coil assemblage will insure most efficient heat transfer per unit of space occupied; and the accessibility of the joints permits convenient repairing of leaks. The coil assemblage may in some instances, be welded throughout, thus omitting the detachable flanged connections; and the collecting headers 14 may obviously be associated with the ends of the transverse suction headers 10 in cases where less head room is available, and the two headers 14 may also be replaced by a single larger collecting header if so desired. The improved coil has proven highly successful in actual commercial use, and is far superior to prior coils of the same general class.

It should be understood that it is not desired to limit the present invention to the exact details of construction and to the precise mode of use herein shown and described, for various modifications within the scope of the appended claims may occur to persons skilled in the art.

I claim:—

1. A refrigerating coil, comprising, laterally spaced groups of conduits each comprising a series of pipes lying in a vertical plane and each pipe having downwardly and upwardly directed opposite end portions, a series of headers perma-

nently attached to the lower ends of corresponding pipes of said groups, a common refrigerant supply pipe detachably connected with corresponding ends of all of said headers, a second series of substantially contacting headers permanently attached to the upper ends of corresponding pipes of said groups, and laterally spaced collecting headers connecting alternate headers of said second series.

2. A refrigerating coil, comprising, several groups of substantially horizontal pipes lying in parallel vertical planes and each having downwardly and upwardly directed opposite end portions, closely adjoining parallel headers connecting the lower ends of corresponding pipes of said groups and extending across said planes, other closely adjoining parallel headers connecting the upper ends of the corresponding pipes of said groups and also extending across said planes, and refrigerant supply and exhaust pipes detachably connected to said lower and upper headers respectively.

3. A refrigerating coil, comprising, several groups of pipes disposed in superimposed substantially horizontal planes and each having downwardly and upwardly directed opposite end portions, a header connecting the lower ends of the pipes of each group, and another header connecting the upper ends of the pipes of each group, all of said headers being disposed parallel to each other and extending transversely across the coil.

4. A refrigerating coil, comprising, several groups of pipes disposed in superimposed substantially horizontal planes and each having downwardly and upwardly directed opposite end portions, a header connecting the lower ends of the pipes of each group, and another header connecting the upper ends of the pipes of each group, the upper headers lying close together to provide a deck at the adjacent coil ends.

5. A refrigerating coil, comprising, superimposed groups of pipes disposed in substantially horizontal planes and each having oppositely directed opposite ends, parallel headers connecting the ends of the pipes of each group and extending transversely across the coil, and refrigerant supply and discharge pipes detachably associated with said headers and extending longitudinally of the coil.

6. A refrigerating coil, comprising, several groups of pipes disposed in superimposed substantially horizontal planes and having their corresponding inlet end portions directed downwardly, a header permanently attached to the lower ends of the pipes of each group and extending transversely across the coil, and a common refrigerant supply pipe detachably connected to all of said headers at one side of the coil.

7. A refrigerating coil, comprising, several groups of pipes disposed in superimposed substantially horizontal planes and having their corresponding end portions directed upwardly, a header permanently attached to the upper ends of the pipes of each group and extending transversely across the coil, and gas collecting means detachably connected to the upper medial portions of said headers.

8. A refrigerating coil, comprising, several groups of pipes disposed in superimposed substantially horizontal planes and having their corresponding end portions directed upwardly, a header permanently attached to the upper ends of the pipes of each group and extending laterally of the pipes, and gas collecting means detachably connected to the upper medial portions of said headers, said headers lying in substantial contact with each other to provide a deck above the discharge ends of said pipes.

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