Nov. 10, 1942. J. A. HEINZELMAN 2,301,780

REFRIGERATION SYSTEM

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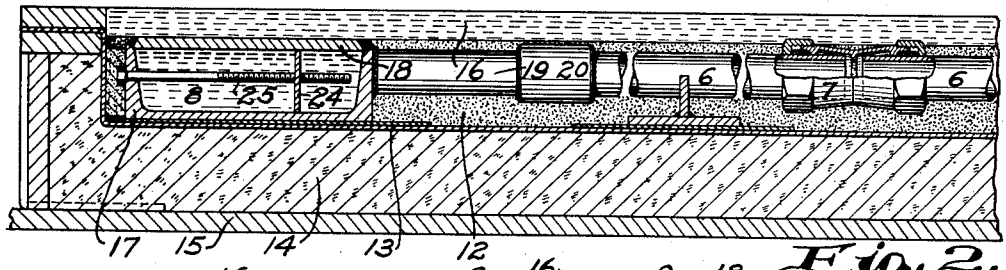

Fig. 2.

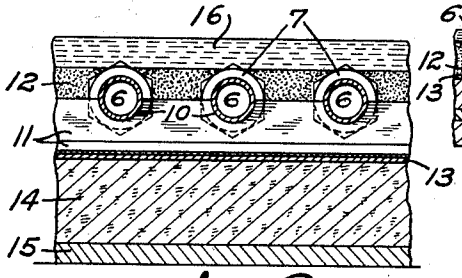

Fig. 3.

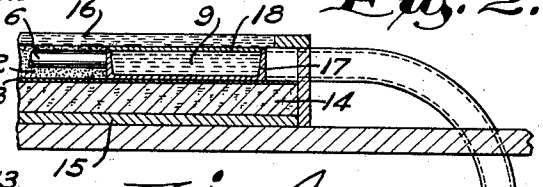

Fig. 4.

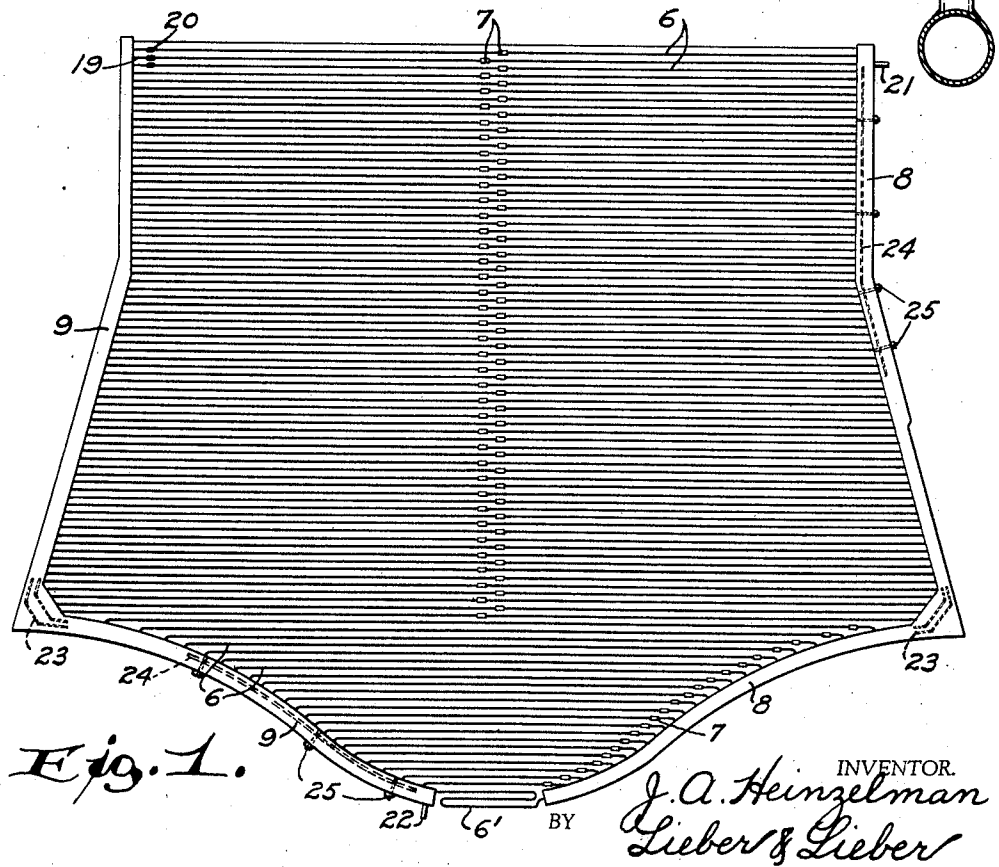

Fig. 1.

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REFRIGERATION SYSTEM

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18 Claims. (Cl. 62—12)

The present invention relates in general to improvements in the art of refrigeration, and relates more particularly to improvements in the construction and operation of refrigerating systems especially applicable to ice skating rinks or other installations wherein it is desirable to uniformly freeze relatively large areas of rather thin ice.

An object of the invention is to provide an improved refrigeration system for ice skating rinks or the like, which is comparatively simple in construction and highly efficient in use.

It has heretofore been common practice in the construction and operation of artificial ice skating rinks, to produce and maintain the ice with the aid of a multiplicity of horizontal parallel pipes to the corresponding ends of which refrigerant such as brine was admitted from a common supply header past numerous fittings and flow control valves, and from the opposite corresponding ends of which the spent refrigerant was delivered into a discharge header. The horizontal freezing pipes were ordinarily of considerable length and rigid from end to end, and in order to compensate for expansion and contraction thereof, it was customary to locate the headers in deep and rather wide pits considerably below the horizontal plane of the distribution pipes, and to connect the headers with the ends of these pipes by means of individual elbows and risers in which the control valves were located. This arrangement produced a very complicated and cumbersome system which was not only costly to install and to operate, but which also required considerable attention in order to maintain the same in satisfactory operating condition at all times. In order to install these prior complicated systems, the pits within which the headers were confined, had to be made of considerable size so as to permit assembly of the risers and valves, to allow proper expansion of the horizontal pipes, and to enable the operators to subsequently manipulate the valves disposed within the pits; and this pit construction therefore added considerably to the building cost, and resulted in waste of otherwise available and useful skating area.

It is therefore a more specific object of my present invention to provide a new and useful ice skating rink assemblage which obviates all of the objectionable features of the ordinary prior systems of this general type.

Another specific object of this invention is to provide a refrigeration system for ice rinks or the like, which is devoid of excess control valves and complicated fittings, and which makes maximum skating area available in confined or limited spaces.

A further specific object of the invention is to provide improved header assemblages for refrigerated skating rink systems, whereby the necessity of providing the usual header confining pits and expansion risers and elbows, is eliminated.

Still another specific object of my invention is to provide improved means of compensating for expansion and contraction of the pipes and headers in a refrigeration system of the skating rink type, and for eliminating eddies and other refrigerant flow disturbances.

An additional specific object of this invention is to provide improved instrumentalities for insuring uniform distribution of refrigerant throughout the headers and pipes of a refrigeration system having large area, and for preventing possible short circuiting of refrigerant without doing useful work.

A further specific object of the present invention is to provide a refrigeration assemblage for ice skating rinks or the like, which can be manufactured and installed at relatively low cost, due to the use of standard structural elements in forming the headers, stock pipe lengths in the connections between headers, standard expansion couplings in the pipes, and the elimination of control valves between the headers and distribution pipes.

These and other specific 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 operating ice rink refrigeration systems embodying the invention, may be had by referring to the drawing 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 diagrammatic plan view of a typical ice skating rink installation built in accordance with the present invention;

Fig. 2 is an enlarged transverse vertical section through one of the headers and an adjacent portion of the rink shown in Fig. 1, the section being taken in a plane parallel to the refrigerant distributing pipes;

Fig. 3 is a vertical section through a fragment of the same rink, the section being taken at right angles to that of Fig. 2 and across several of the distribution pipes; and

Fig. 4 is a fragmentary sectional view showing

the connection leading from one of the headers to the brine cooling apparatus.

While the invention has been shown herein as being embodied in an ice skating rink installation of particular shape, it is not my desire or intent to thereby unnecessarily restrict the scope or utility of the improvement.

Referring specifically to Fig. 1, the improved refrigeration system shown therein, comprises in general, a multiplicty of approximately parallel and horizontal brine distribution pipes 6 each having two or more alined sections which may be connected by an expansion coupling 7; a refrigerant supply header 8 directly connected to corresponding ends of all of the pipes 6 and disposed in about the same horizontal plane as that of the pipes; and a spent refrigerant receiving and discharge header 9 directly connected to the opposite corresponding ends of all of the pipes 6 and likewise disposed in approximately the same horizontal plane.

The pipes 6 are preferably spaced equi-distant apart and may be of any suitable diameter, and the sections of these pipes are preferably of standard stock lengths so as to minimize cutting and waste. The individual pipes are loosely supported in semi-circular notches 10 formed in inverted T-shaped supports 11 constructed of standard flat bar stock as illustrated in Figs. 2 and 3, and if expansion couplings 7 are used, they may be of standard construction shown in Fig. 2, and may be off-set with respect to adjacent couplings as shown in Fig. 1. While the use of only one of these free expansion couplings 7 will ordinarily suffice for each pipe 6, more than one such coupling may be desirable and used in extremely long pipes, and in some cases the couplings 7 may be dispensed with entirely by introducing reverse bends in the pipes 6' as shown at the bottom of Fig. 1.

The entire bank or group of pipes 6 is preferably embedded in a bed 12 of sand, concrete, or the like which is confined within a sheet metal pan 13, and should barely cover the horizontal layer of distribution pipes 6. The pan 13 may be supported upon a layer 14 of cork composition, or other insulating or supporting material, which may be caused to rest directly upon wood or concrete flooring 15, or the like; and the pipe protecting bed 12 should be completely covered with a relatively thin layer of water or ice 16 which is ordinarily about one inch thick. The rink may of course be of any desired shape other than that specifically shown, and may in many cases be rectangular, circular or elliptical in shape.

The improved brine supply and discharge headers 8, 9 may be formed of lower channel sections 17, produced from standard channel shaped stock or of large pipes severed longitudinally, and upper plate sections 18 welded to the upstanding flanges of the pipe or channel sections 17, to provide box headers of desirable capacity; and the inner flanges of the sections 17 may be provided with rigidly attached nipples 19 to which the adjacent ends of the pipes 6 may be firmly connected either by direct welding or by means of unions 20, see Fig. 2. The pipes 6 are thus in constant and open communication with the interiors of the headers 8, 9, and the ends of the nipples 19 which are permanently connected to the sections 17 should not be permitted to extend within these sections so as to obstruct the flow of liquid through the headers. When the headers 8, 9 are short, a single length of half-pipe or channel bar and plate may be used to form the entire header, but each of these headers may be formed with a series of end connected sections diminishing in transverse cross section proceeding along the header as shown in Fig. 1, and the ends of the headers 8, 9, may be sealed by end plates or otherwise.

The brine or refrigerant supply header 8 has a refrigerant inlet connection 21 communicating with one end thereof, and this header 8 has diminishing transverse cross section proceeding away from the inlet as shown in Fig. 1. The spent refrigerant discharge header 9 has a refrigerant outlet connection 22 communicating with an end thereof, and this header 9 is of enlarging transverse cross section approaching the outlet, as also shown in Fig. 1. The supply and exhaust connections 21, 22 communicate with a cooling plant or installation for the brine, and this plant may be of any desired type having sufficient capacity to insure most effective operation of the rink refrigerating system. Either one or both of the connections 21, 22 may be formed with long bends of suitable metal, as shown in Fig. 4 in order to compensate for expansion and contraction due to variations in temperature, and these connections may also be provided with suitable flow control valves in a well known manner. In order to insure uniform flow of the refrigerant and to avoid possible short circuiting, both headers 8, 9 are preferably provided with flow distributing and directing vanes 23 at the bends in the headers; and one or both of these headers 8, 9 may be additionally provided with an elongated adjustable baffle plate 24 extending therealong and laterally adjustable therein by means of screws 25 as indicated in Figs. 1 and 2, but these baffles are preferably provided in the discharge header 9. It should be understood, that either header 8, 9 may be utilized either as an inlet or as a discharge header, dependent upon which arrangement will produce most uniform distribution of the refrigerant in the system.

While the normal operation of the improved refrigerating system should be clearly apparent from the foregoing detailed description thereof, a short resumé of this operation will be given. The brine is ordinarily being constantly cooled in a suitable cooling installation, and is being delivered through the supply connection 21 to the portion of the inlet header 8 having largest cross sectional area. From the header 8, the brine flows through the horizontal pipes 6 and expansion couplings 7 to the discharge header 9, from whence the spent refrigerant is delivered through the outlet connection 22 at the larger end of the header 9, and is returned to the cooling installation for reconditioning. As the brine or other refrigerant flows constantly through the pipes 6, it converts the liquid above the concealing bed 12 into a sheet of ice 16 and maintains the ice in proper condition for use. When it is desired to shut down the refrigeration system, it is only necessary to discontinue the delivery of brine to the inlet header 8, by closing off a single valve in the supply line. During normal circulation of the liquid refrigerant through the system, the partitions 24 in the headers 8, 9 will prevent short circuiting of the liquid through the shorter pipes 6, and these plates 24 may be readily adjusted from the exterior of the headers 8, 9, and with the aid of the screws 25, so as to insure most efficient distribution of the brine in the headers 8, 9. The refrigerant flowing through the headers and around the sharp bends therein, will also be

prevented from producing undesirable eddies, and will be uniformly distributed and conveyed through the headers without undesirable disturbances, by means of the vanes **23** located at the bends. Whenever expansion or contraction takes place in the horizontal pipes **6**, the expansion coupling **7** will compensate for such variation in the length of the pipes, and although the headers **8**, **9** are disposed in the horizontal plane of the pipes, they will not be affected by such expansion and contraction of the pipes **6**, because of the compensation afforded by the couplings **7**.

From the foregoing detailed description it will be apparent that the present invention provides a refrigeration system especially applicable to ice skating rinks, which is not only extremely simple and compact in construction, but which is also highly efficient in normal use. The location of the headers **8**, **9** in horizontal alinement with the pipes **6**, permits extension of the ice **16** over the tops of these headers and thereby provides maximum skating area. The omission of all valves between the headers **8**, **9** and the pipes **6**, obviously reduces the installation to its simplest form and eliminates necessity of subsequently adjusting and maintaining a multiplicity of valves, such as were heretofore used. The provision of the expansion couplings **7** in the individual pipes **6**, also permits fixed positioning of the headers **8**, **9** in approximately the same horizontal plane as that of the pipes **6**, without danger of rupturing the joints between the elements. With the improved assemblage, the unions **20** and nipples **19** also facilitate original installation of the equipment, and these unions **20** and expansion couplings **7** also make it possible to utilize stock lengths of piping for producing the distribution pipes **6**. The use of the partitions **24** and vanes **23**, also makes it possible to obtain uniform distribution of the refrigerant throughout the entire ice area, and the present improvement has proven highly successful in numerous skating rink assemblages to which it has been practically applied.

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

I claim:

1. An ice rink refrigeration system, comprising, a plurality of approximately parallel horizontal distribution pipes each having an expansion joint intermediate its ends, a header fixedly attached to and in constant open communication with the corresponding ends of all of said pipes, each of said headers having approximately rectangular transverse cross-section and lying in the horizontal plane of said pipes, and a refrigerant distribution partition extending along at least a portion of the interior of at least one of said headers.

2. An ice rink refrigeration system, comprising, a plurality of approximately horizontal pipes, means for supporting said pipes to permit longitudinal expansion and contraction thereof, and a fixedly mounted header in direct and open communication with the corresponding ends of all of said pipes, said header having a lower trough shaped section provided with a bottom and integral upstanding opposite side flanges one of which is rigidly attached to said pipe ends, and also having a flat top closure plate secured to the upper ends of the trough section side flanges approximately in the horizontal plane of the tops of the pipes.

3. An ice rink refrigeration system, comprising, a plurality of approximately horizontal refrigerant distribution pipes, and a laterally bent header direct connected to the corresponding ends of said pipes, said header having refrigerant distributing vanes within the bends thereof.

4. An ice rink refrigeration system, comprising, a plurality of approximately horizontal pipes, a relatively wide and flat header directly associated with the corresponding ends of said pipes, a partition extending along and within a portion of said header, and means for effecting adjustment of said partition toward and away from said pipes.

5. An ice rink refrigeration system, comprising, a plurality of approximately horizontal pipes, an approximately rectangular sectioned header rigidly secured to and communicating directly with the corresponding ends of all of said pipes, a partition extending along and within a portion of said header, and means operable from the exterior of said header for adjusting said partition toward and away from said pipe ends.

6. A header for refrigeration systems, comprising an inverted channel having upright side flanges one of which is provided with a series of openings communicating with the interior of the channel, a series of horizontal pipes rigidly attached to the channel at said openings, and a plate secured to the upper ends of said channel flanges to provide a closure for the header, said plate lying approximately in the horizontal plane of the tops of the pipes.

7. A header for refrigeration systems, comprising an inverted channel bar having upright side flanges one of which is provided with a series of openings communicating with the interior of the channel, a series of horizontal pipe nipples secured within said openings with their inner ends flush with the interior of said channel bar, and a horizontal flat plate secured to the upper ends of said channel flanges to provide a closure for the header, said plate lying approximately in the horizontal plane of the tops of the pipes.

8. An ice rink refrigeration system, comprising, a plurality of approximately horizontal refrigerant distribution pipes, a laterally bent header direct connected to the corresponding ends of said pipes and having an approximately rectangular transverse cross-section, and a refrigerant distributing vane disposed upright within the bend of the header across the open adjacent ends of the pipes.

9. An ice rink refrigeration system, comprising, a plurality of approximately horizontal pipes, a header direct connected to the corresponding ends of said pipes and having sections of different cross-sectional area, and a partition extending along and within the section of said header having greatest cross-sectional area, said partition being disposed across the adjacent open ends of the pipes.

10. An ice rink refrigeration system, comprising, a plurality of approximately horizontal pipes, a header direct connected to the corresponding ends of said pipes and having sections of different cross-sectional area, a partition extending along and within the section of said header having greatest cross-sectional area, said partition being disposed across the adjacent open ends of the pipes, and means for effecting adjustment of

said partition toward and away from said open pipe ends.

11. An ice rink refrigeration system, comprising, a group of horizontal refrigerant distributing pipes each pipe comprising alined straight sections provided with an intervening coaxial expansion coupling for compensating for axial longitudinal expansion and contraction thereof, and relatively wide and flat supply and discharge headers fixedly positioned on opposite sides of the group and rigidly attached to the opposite ends of said pipes and being disposed in approximately the horizontal plane of said pipes.

12. An ice rink refrigeration system, comprising, a group of horizontal refrigerant distributing pipes each pipe comprising alined straight sections provided with an intervening coaxial expansion coupling for compensating for axial longitudinal expansion and contraction thereof, and relatively wide and flat supply and discharge headers rigidly attached to the opposite ends of said pipes and being fixedly positioned on opposite sides of the group in approximately the horizontal plane of said pipes, said pipes being in constantly open and undestricted communication with the interiors of said headers.

13. An ice rink refrigeration system, comprising, a group of approximately parallel horizontal refrigerant distributing pipes each pipe comprising alined straight sections having a coaxial expansion coupling interposed between the adjacent ends thereof, and relatively wide and flat supply headers fixedly attached directly to the opposite ends of said pipes and being fixedly positioned on opposite sides of the group in approximately the same horizontal plane as the pipes.

14. An ice rink refrigeration system, comprising, a group of approximately parallel horizontal refrigerant distributing pipes each pipe comprising alined straight sections having a coaxial expansion coupling interposed between the adjacent ends thereof, and relatively wide and flat supply headers fixedly attached directly to the opposite ends of said sections and being fixedly positioned on opposite sides of the group in approximately the same horizontal plane as the pipes, said pipes being constantly in direct and unrestricted communication with the interiors of said headers.

15. An ice rink refrigeration system, comprising, a group of approximately parallel horizontal distribution pipes each pipe comprising alined straight sections connected by an intervening coaxial expansion joint having one end rigidly connected to a fixed discharge header, and a relatively wide and flat fixed refrigerant supply header of approximately rectangular transverse cross section fixedly attached to and in constant open communication with the opposite ends of all of said pipes, said headers being disposed on opposite sides of the group and in the horizontal plane of the pipes.

16. An ice rink refrigeration system, comprising, a plurality of approximately parallel horizontal distribution pipes each having one end connected to a discharge header, and a relatively wide and flat refrigerant supply header of approximately rectangular transverse cross section fixedly attached to and in constant open communication with the opposite ends of said pipes, one of said headers having successive sections of different transverse cross-sectional area and being provided with a refrigerant distributing partition therein.

17. An ice rink refrigeration system, comprising, a plurality of approximately parallel horizontal distribution pipes each having an expansion joint intermediate its ends, and a header having a lower channel section fixedly secured to corresponding ends of all of said pipes and an upper closure plate for the top of the channel section, said header having successive sections of different transverse cross-sectional area constantly in open communication with said pipes and lying in the horizontal plane thereof.

18. An ice rink refrigeration system, comprising, a plurality of approximately horizontal straight pipes, means, for supporting said pipes to permit longitudinal expansion and contraction thereof, and a fixedly mounted header in direct and open communication with and rigidly attached to the corresponding ends of all of said pipes, said header lying in approximately the same horizontal plane as said pipes and having successive sections of diminishing transverse cross-sectional area.

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