Sept. 11, 1928. 1,683,949

J. G. BERGDOLL

BRINE CIRCULATOR

Filed May 20, 1927 2 Sheets-Sheet 1

Fig. 1.

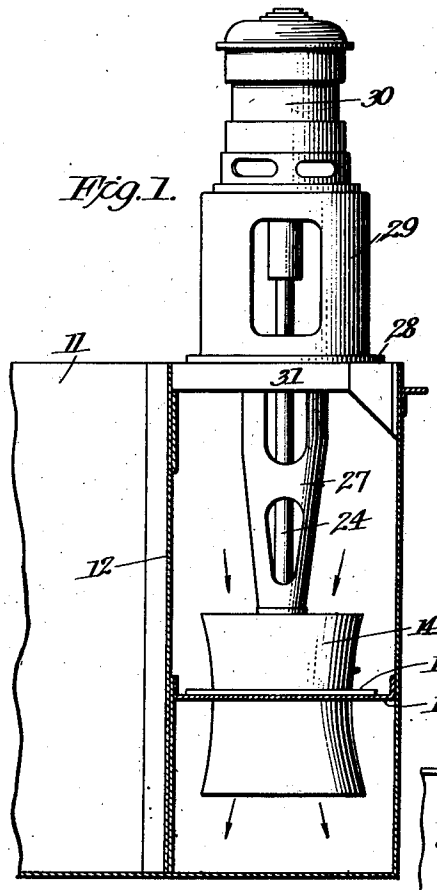


Fig. 5.

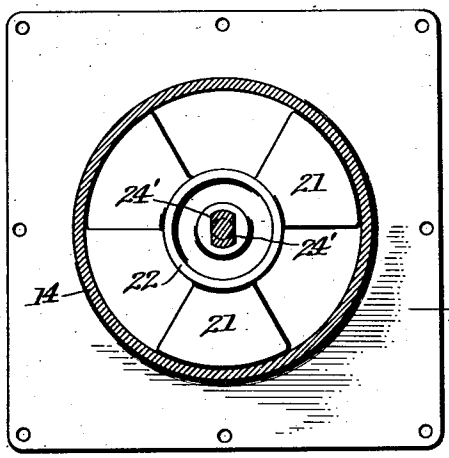
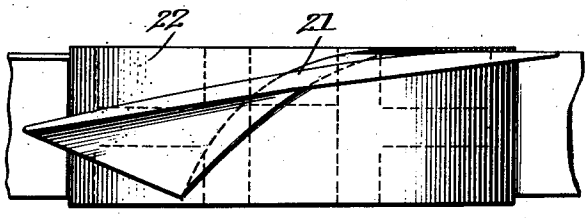


Fig. 6.



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Fig. 2.

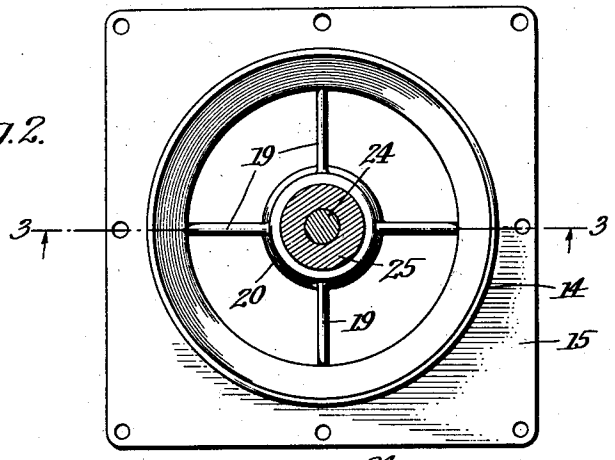


Fig. 3.

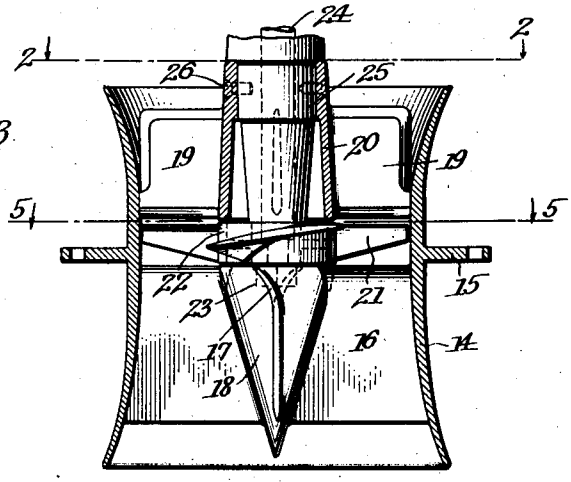
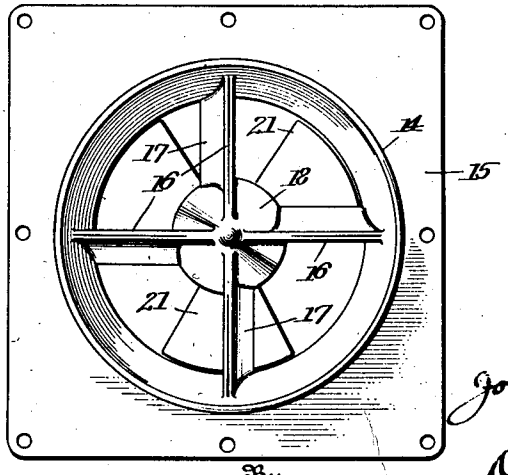


Fig. 4.



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UNITED STATES PATENT OFFICE.

JOHN G. BERGDOLL, OF YORK, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO YORK ICE MACHINERY CORPORATION, OF YORK, PENNSYLVANIA, A CORPORATION OF DELAWARE.

BRINE CIRCULATOR.

Application filed May 20, 1927. Serial No. 193,025.

This invention relates to circulators and particularly to the circulators used in the freezing tanks of refrigeration systems.

Heretofore the practice in can ice plants and similar installations, has been usually to place the cans in rows between trombone coils making up the evaporator. For this reason the path of flow of the brine from the can to the evaporator and back to the same or another can is short and only a very sluggish circulation is necessary. Recent tendency has been toward the use of small evaporators operating at a very high heat transfer rate and located at a point remote from most of the cans. In such systems the brine must be circulated at a rapid rate in contact with the evaporator so that an adequate circulation of the brine through all parts of the tank will be secured, and so that the brine will flow rapidly enough to deliver heat at the necessary rate to the evaporator.

The type of circulator heretofore used is very inefficient when operating against the relatively high pressure heads which are necessarily developed as an incident to the rapid circulation of the brine in contact with the evaporator. While it would perhaps be possible to make use of circulating pumps for this purpose, such pumps are not well adapted to the service, and the purpose of the present invention is to provide a circulator particularly adapted to use in brine tanks and capable of operating with reasonably good efficiency against pressure heads encountered in plants of the type above mentioned.

A successful embodiment of the invention is illustrated in the accompanying drawings, in which

Fig. 1 is an elevation of the circulator with its housing, together with the driving motor and sustaining framework, the whole structure being shown in position in a brine tank of the high velocity duct type.

Fig. 2 is a plan view, partly in section, showing the circulator proper, the plane of section being indicated by the line 2—2 of Fig. 3.

Fig. 3 is a vertical section on the line 3—3 of Fig. 2.

Fig. 4 is a view looking upward at the lower end of the circulator housing showing the propeller in place.

Fig. 5 is a section on the line 5—5 of Fig. 3.

Fig. 6 is a fragmentary elevation of the propeller forming a part of the circulator.

Referring first to Fig. 1, 11 represents the wall of the brine tank, at one end of which there is a vertical partition 12 isolating a space from the remainder of the tank, such space being subdivided by horizontal partition 13. Brine from the tank flows to the space above the partition 13 from which it is discharged by a circulator, hereinafter described, into the space below the partition 13. From this latter space it passes into and through a duct in which is located the evaporator (not shown). After flowing through the duct in contact with the evaporator the brine is returned to the tank. The arrangement by which brine is delivered from the tank to the space above the partition 13 and the connections to the evaporator duct, are subject to considerable variation, and as these details form no part of the present invention, no attempt to illustrate them has been made.

A flow directing and diffusing tube 14 is mounted in an opening in the partition 13 by means of a flange 15 which seats upon the partition and is bolted thereto. The tube 14 is contracted at its middle and flares toward either end with a gradual curvature, as shown, the amount of flare being a matter of design.

As the water approaches the tube 14 at very low velocity a wide flare at the inlet end is desirable, but the amount which it is practicable to give is limited by manufacturing considerations. At the outlet end the flare should be such that the brine leaves the tube at practically the lineal speed of flow through the duct.

Formed integral with the tube 14 are a plurality of diffusing vanes 16, of which four are shown. These vanes are curved, as best shown at 17, in Fig. 3, the curvature 17 being designed to convert the rotary motion of the brine occasioned by the rotation of the propeller into an axial flow, thus converting velocity head into pressure head. Four diffusing vanes are shown, but more or fewer might be used and all are connected at the center by a hub 18 which tapers to a point and which is given an approximate stream line form. The vanes 16 when viewed in cross section have stream line form for the purpose of reducing eddying.

Preferably, but not necessarily, alined with the diffuser vanes 16, and spaced vertically therefrom, are guide vanes 19 which are connected together by means of a tubular hub 20. The vanes fit snugly within the upper end of the tube 14. While the guide vanes are shown as the same in number as the diffuser vanes, this is not essential. A propeller having a plurality of blades 21 (three blades being shown) and having a central hub 22, is mounted in the interval between the diffuser vanes 16 and the guide vanes 19, and is so dimensioned as approximately to fill that space, there being only the minimum working clearance between the tips of the blades and the interior of the tube 14. The hubs 18, 20 and 22 collectively form a stream line body extending axially through the center of the tube 14 and terminating in a point at the discharge end of the tube.

The hub 18 is hollow and houses the nut 23 by means of which the propeller is fixed in its shaft 24. The propeller is held against turning on its shaft by its engagement with the flats 24′ formed at the end of the shaft.

Sustained within the hub 20 is a sleeve 25 which carries the lower bearing for shaft 24. Sleeve 25 is locked in place in the hub 20 by means of screws 26. The sleeve 25 is formed at the lower end of a tapered tubular frame member 27 which is connected at its upper end with the base plate 28. The base plate 28 forms the lower portion of the base frame 29 on which the electric motor 30 which drives the propeller is mounted. The motor includes a thrust bearing (not shown) but of known form. It is important to note that the tapered tubular member 27 merges into the stream line body above mentioned as made up by hub portions of the vanes and propeller. The base plate 28 rests on cross bars 31 carried by the brine tank. The circulator is thus a rigid unit primarily supported on the cross members 31 but also tightly connected to partition 13 from which the tube 14 in particular derives some support. The shaft 24 is, of course, connected to be driven by the electric motor 30.

The general configuration of the propeller blades is illustrated quite clearly in Fig. 6 and conforms quite closely to known practice. The blades of the propeller and the guide vanes 19 are given at least an approximately stream line form and the curvatures of the blades of the propeller and the vanes of the diffuser are worked out in accordance with the desired rotary speed of the propeller and the pressure head against which the brine is to be delivered.

The tapered form of the tube 14 is favorable to the necessary changes of velocity as the brine approaches the propeller and the guide vanes confine the brine to direct axial flow. The propeller blades impart to the brine a combined rotary and axial motion which is corrected by the diffuser vanes. These vanes convert the rotary velocity into axial pressure head. Brine circulators of this type have been designed to give efficiency as high as sixty per cent when operating against the heads encountered in the high velocity duct systems now commonly in use. This efficiency is approximately twice that attainable with conventional brine circulators.

It is obvious that certain details of the mechanical construction are susceptible of variation, and consequently I do not limit my invention in these respects.

What is claimed is,—

1. In a circulator, the combination of a housing comprising in one piece a flow directing and diffusing tube having curved diffusing vanes adjacent one end thereof, said vanes merging adjacent the longitudinal axis of the tube into a stream line hub; a plurality of guide vanes removably mounted in the other end of said tube and having a central shaft sustaining hub, there being an interval between the diffusing vanes and the guide vanes; a propeller mounted in said interval and having a central hub which with the other two hubs completes a stream line body; and a rotatable shaft on which said propeller is mounted.

2. The combination of a motor; a base therefor; a frame extending from said base; guide vanes fixed on the end of said frame; a guide tube embracing at one end said guide vanes and serving to center the frame relatively to the tube; diffusing vanes in the other end of said tube and spaced from the guide vanes; a propeller in the interval between the guide and diffusing vanes; and a shaft connecting said motor and propeller.

3. The combination of a motor; a base therefor; a frame extending from said base; guide vanes fixed on the end of said frame; a guide tube embracing at one end said guide vanes and serving to center the frame relatively to the tube; diffusing vanes in the other end of said tube and spaced from the guide vanes; a propeller in the interval between the guide and diffusing vanes; a central stream line hub structure made up in sections respectively integral with the guide vanes, propeller and diffusing vanes; a bearing in said guide vane hub section; and a shaft turning in said bearing and connecting said motor and propeller.

4. The combination of a motor; a base therefor; a tapered tubular frame extending from said base; radial guide vanes fixed on the end of said frame; a guide tube contracted at its middle and flaring towards its opposite ends, embracing at one end said guide vanes and serving to center the frame relatively to the tube; curved radial diffusing vanes in the other end of said tube and spaced from said guide vanes; a propeller in the interval between the guide and diffusing vanes; a cen-

tral stream line hub structure forming a continuation of said tapered tubular frame and made up in sections respectively integral with the guide vanes, propeller and diffusing vanes; a bearing in said guide vane hub section; and a shaft turning in said bearing and connecting said motor and propeller.

5. In a circulator, the combination of fluid guiding means, including a diffusing tube, supporting means for said tube, guiding vanes and diffusing vanes in opposite ends of said tube, said fluid guiding means being separable into two portions, one of which includes one set of vanes and the other of which includes the supporting means and the other set of vanes; a shaft supported for rotation in said removable set of vanes; and a propeller mounted on said shaft and removable with the vanes and shaft as a unit.

6. In a circulator, the combination of fluid guiding means including a diffusing tube, supporting means for said tube, guiding vanes and diffusing vanes in opposite ends of said tube, said fluid guiding means being separable into two portions, one of which includes the tube, the supporting means and one set of vanes, and the other of which comprises the other set of vanes; a shaft supported for rotation in said removable set of vanes; and a propeller mounted on said shaft and removable with the vanes and shaft as a unit.

In testimony whereof I have signed my name to this specification.

JOHN G. BERGDOLL.