

June 1, 1943.

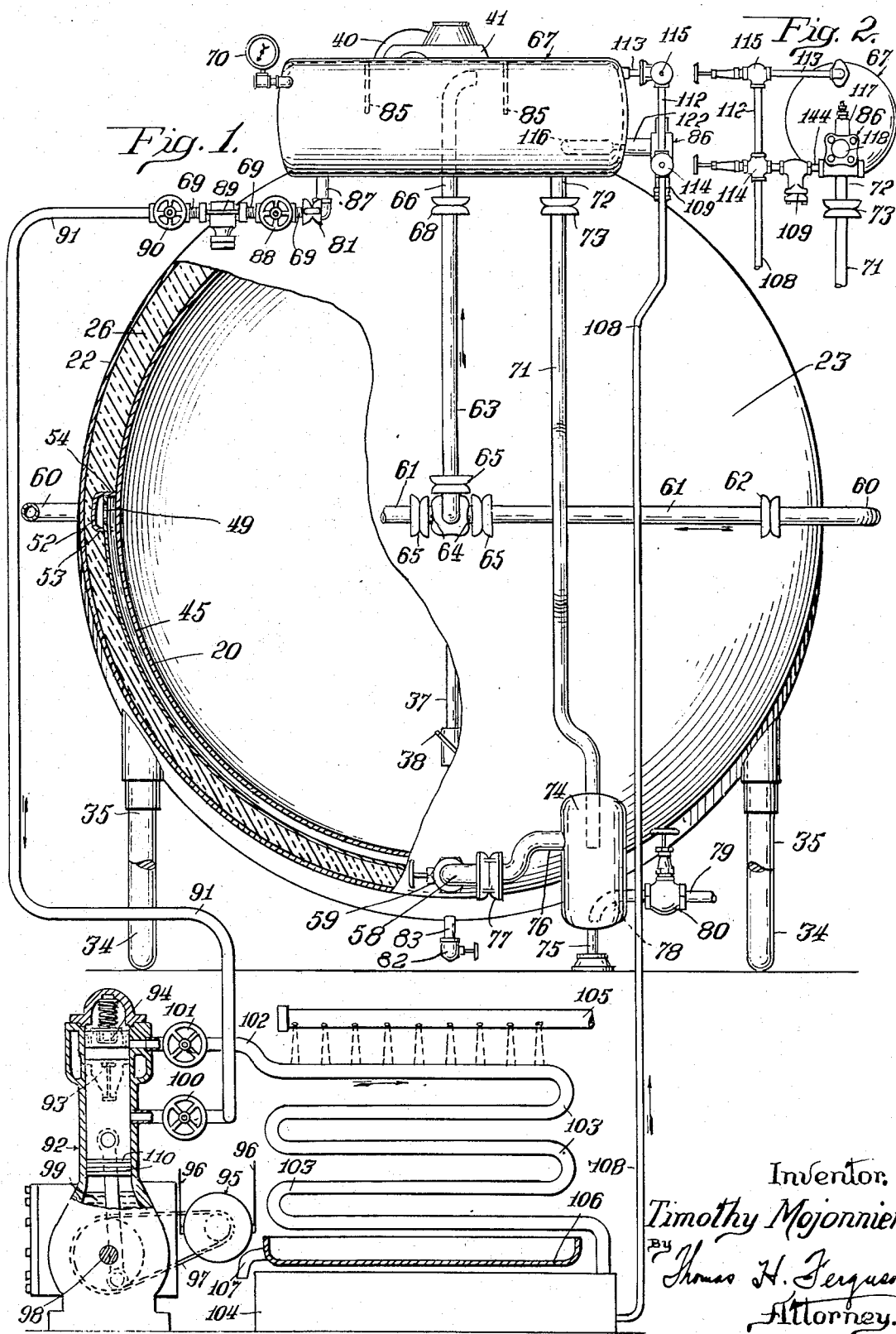
T. MOJONNIER

2,320,531

VAT

Filed Jan. 9, 1942

4 Sheets-Sheet 1



Inventor.
Timothy Mojonnier
By Thomas H. Ferguson
Attorney.

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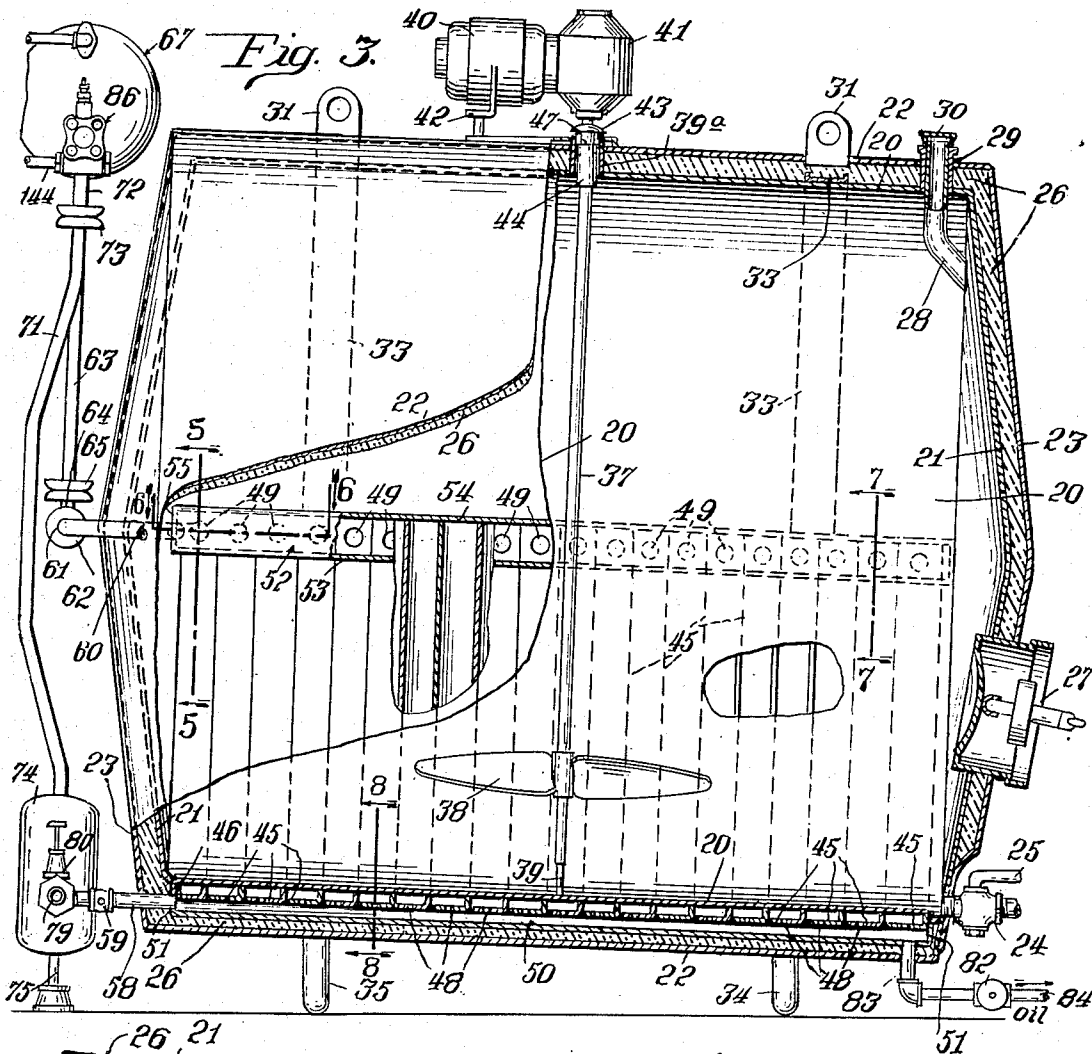
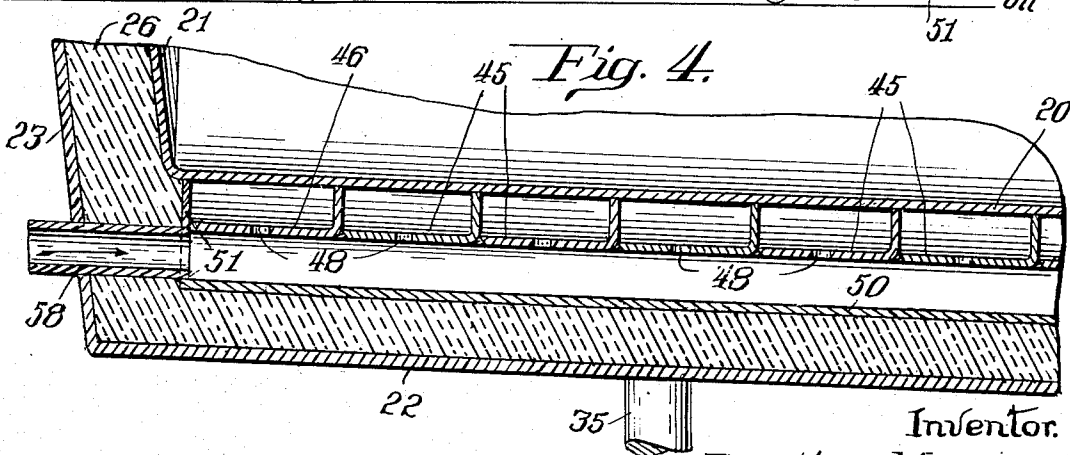
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4 Sheets-Sheet 2



Inventor.
Timothy Mojonnier
 By *Thomas H. Ferguson*
 Attorney.

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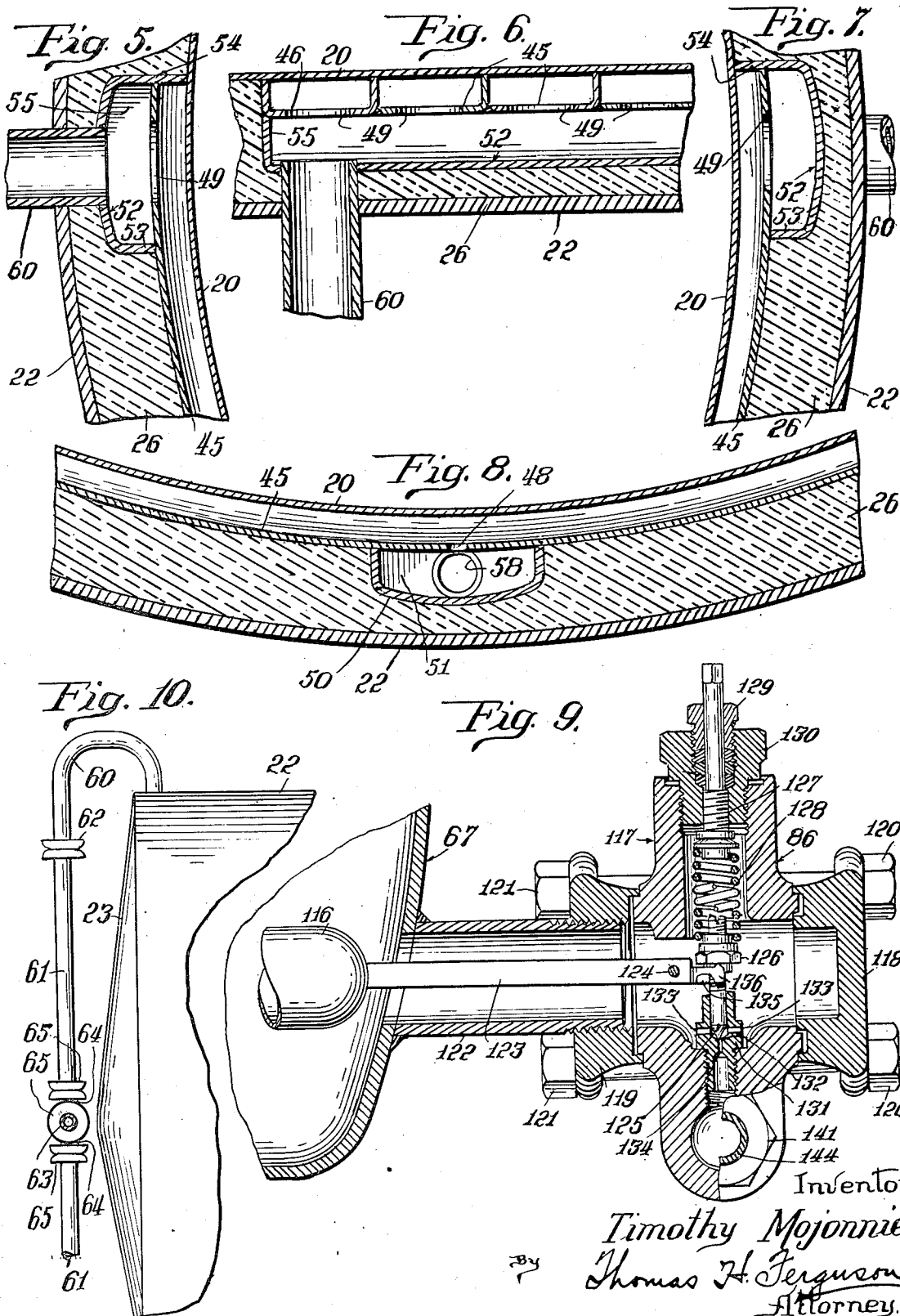
T. MOJONNIER

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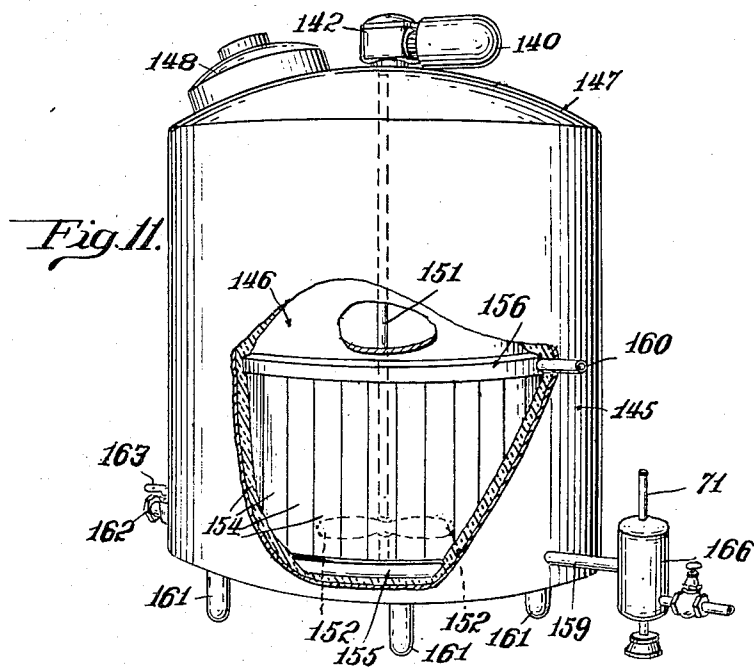
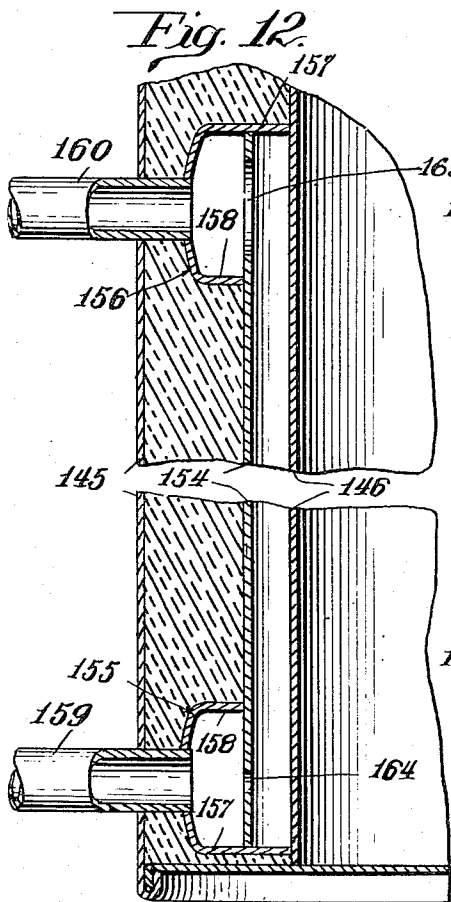
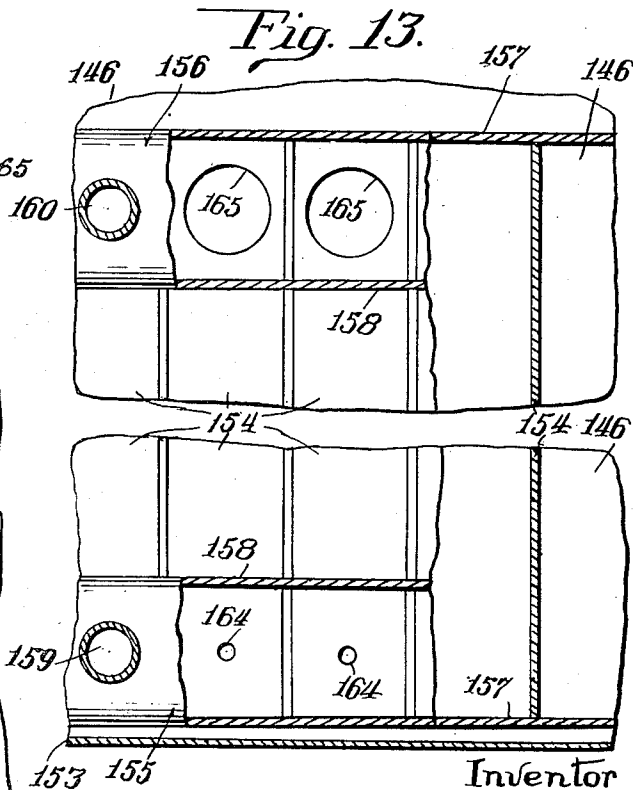
T. MOJONNIER

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4 Sheets-Sheet 4



Inventor
Timothy Mojonnier
By Thomas H. Ferguson
Attorney.

UNITED STATES PATENT OFFICE

2,320,531

VAT

Timothy Mojonnier, Oak Park, Ill., assignor to
Mojonnier Bros. Co., a corporation of Illinois

Application January 9, 1942, Serial No. 426,162

14 Claims. (Cl. 62—141)

The present invention relates to vats for treating a liquid such as milk. It is capable of various uses in the storing and handling of commodities but will be treated here as pertaining to the cooling of milk, and so will be described primarily in that connection.

One object of the invention is to provide a compact vat wherein all of the cooling elements are compactly arranged and hidden from view in the completed structure. To this end, I employ paths for the refrigerant which are located within the wall of the completed vat so that the finished vat may appear clear of all but the minimum number of connections.

Another object is to employ headers in connection with the refrigerating tubes which shall be effective in distributing the refrigerant to the wall covered by the refrigerating portion. To this end, I employ very small openings as the communicating means between the inlet header and the tubes. In like manner I employ relatively large openings as the means for communicating between the tubes and the outlet header or headers. Thus, where ammonia is the refrigerant, it is well distributed to the cooling tubes by encountering the small holes while it is in liquid form, and then upon becoming a gas, or a mixture of the liquid and gas, by reason of the withdrawal of heat through the walls adjacent to the refrigerating tubes from the contained commodity, it passes freely through the large openings provided at the outlet end.

Another object has to do with the removal of foreign matter from the refrigerant. In most refrigerating systems employing compressors, the lubricating oil works its way past the piston and contaminates the refrigerant. One object is to remove this oil. Other foreign matter may be removed at the same time. The oil is heavier than the refrigerant and so when the refrigerant mixed with the oil comes to rest, the oil may be collected in a trap and drawn off. And a blow-off cock is further provided at the forward end of the inlet header to remove any of the objectionable matter that may have collected therein.

Another object is to provide an efficient and highly sanitary vat which will comply with all the legal requirements of public health boards and the like.

These and other objects and features of the invention will be best understood upon reference to the following detailed description taken in connection with the accompanying drawings. These drawings illustrate two forms of the invention. In one form, the vat has its axis substantially

horizontal and in the other the axis of the vat is vertical.

Fig. 1 is an end elevation of the novel vat of the first form, parts being shown in section and parts broken away for clearness, together with refrigerating apparatus and connections shown in diagram, all in accordance with the present invention. Fig. 2 is an end elevation of the surge drum and its controls, at one end of the apparatus. Fig. 3 is a longitudinal vertical section of the vat, parts being broken away to illustrate the construction, and the surge drum being shown in full. Fig. 4 is a central longitudinal section similar to that shown in Fig. 3 but upon a larger scale. Fig. 5 is a detail sectional view illustrating the vat structure where the vertical refrigerant channels and one of the outlet headers meet, the plane of section being indicated by the line 5—5 of Fig. 3. Fig. 6 is a similar view illustrating the parts in horizontal section, the plane of section being indicated by the line 6—6 of Fig. 3. Fig. 7 is a detail of the vat at the opposite end of the refrigerant channels, the plane of section being indicated by the line 7—7 of Fig. 3. Fig. 8 is a similar detail view illustrating the inlet header in association with the vertical, or upright, refrigerant channels, the plane of section being indicated by the line 8—8 of Fig. 3. Fig. 9 is a vertical section through the float valve employed in the surge drum. Fig. 10 is a plan view of the end of the vat showing particularly the position of the inlet pipes. Fig. 11 is a perspective view of a vat of the second form, having a vertical axis instead of a horizontal one, parts being broken away to indicate the interior. Fig. 12 is a vertical section through the inlet pipe and the outlet pipe illustrating the structure of this form of the invention more in detail. And Fig. 13 is an elevational view illustrating a portion of the structure in detail with its several parts broken away to show the construction. Throughout these views like characters refer to like parts.

Referring to the drawings in detail, and at first to the first form of the invention, which comprises a vat having a horizontal axis, it may be noted that the vat comprises an inner and outer shell. The inner shell is composed of a cylinder 20 having ends 21. These parts are welded together as a whole to make up the shell. The outer shell includes a cylinder 22 which is concentric with the cylinder 20 and provided with ends 23. The ends 23 and the cylinder 22 are secured together by welding. Ordinarily, the shells are spaced apart and the axes of the cylinders are coincident and slightly inclined downward to-

ward the front. Where the outlet valve 24 is located, the two sheets of material are brought together. This is at the forward end of the vat and positioned so as to completely drain the vat of its contents. The valve 24 is provided with an operating handle 25.

Heat insulation 26 is located within the space between the two shells, as we shall see later. This space also accommodates the refrigerant conducting means as we shall presently point out. The vat is also provided with a manhole 27, by which it may be entered for cleaning. In addition, there is also a milk inlet fitting 28, which is turned at its outlet toward the adjacent shell wall 21 so as to cause the milk to enter the vat with a minimum of agitation. This milk pipe is introduced through a thimble opening 29 in the adjacent portion of the vat wall and is provided with a closing gap 30, as is common with such devices. At suitable points, the vat is also provided with rings 31 by which it may be handled. These rings are located at the centers of arcuate bands 33 which more or less embrace the inner shell and are firmly secured to the same. The vat is also provided with a pair of legs 34 which extend downward near its forward end. It is also supplied with a pair of legs 35 which are slightly longer than the legs 34. This is for the purpose of giving the vat a proper inclination to the horizontal. Perhaps the inclination is most clearly shown in Fig. 3.

A suitable agitator is provided for the vat. This includes an agitating shaft 37 to which suitable blades 38 are attached. The shaft has a bearing 39 upon the inner shell 20, at its lower end, and passes through a thimble 39^a at its upper end. Within the latter, it is connected by a coupling sleeve 44 to the short shaft length 47 of the reduction gear 41. This gear is driven by an electric motor 40. The motor 40 and the gear 41 are suitably secured to the top of the vat by legs 42. Obviously when the motor is driven the shaft is rotated and the contents of the vat are agitated. A suitable oil hat 43 is located upon the shaft 37 and protects the interior of the vat from oil or other impurities that may tend to pass along the shaft. This construction is the same as that shown in the application of Timothy Mojonier et al., Serial No. 322,770, filed March 7, 1940, issued as Patent No. 2,277,526, dated March 24, 1942.

Coming now to a consideration of the refrigerating part of the apparatus, it will be noted that there are a number of upright parallel tubes connected at their ends by headers. These are all located within the space between the shells 20 and 22 of the vat. These tubes are made up of angle members which, in the present instance, extend around the tank in semicircular fashion. These angle members, designated 45 and 46, are fitted to the inner cylinder wall 20 of the vat. The member 46 is a channel iron having comparatively short legs or flanges which are secured, preferably by welding, to the cylinder 20. The next angle member is an angle iron 45 having one long leg or flange and one short one. The long flange is secured to the adjacent member 46, preferably by welding, and the short flange is likewise secured to the shell 20. All the other members are angle irons 45, like the one just described, and each is similarly connected to the adjacent member 45 and the shell 20. Thus, the refrigerating tubes are built up and the long flanges form a substantial face.

The face formed by these arcuate angle members 45, 46 is provided with a row of apertures 48 of relatively small diameter, at the inlet point, and a similar series of relatively large diameter openings 49, at the upper ends of these members, at their outlet points. Thus are the arcuate tubular passages formed which carry the refrigerant from the inlet point to the outlet points.

In a specific case, where the cross section of the tube has an area of substantially 3 inches by 1½ inches, the small openings 48 are each a ⅜ inch hole and the large openings 49 are 1¼ inches in diameter. This is merely given by way of illustration.

At the inlet points is a header 50. It covers the openings 48 and extends lengthwise of the vat. This inlet header 50 is located at a central lower point and is inclined downward and forward, the same as the bottom of the vat. The opposite ends of the header 50 are provided with flanges 51 which are fitted against the face formed by the channel members. This header is preferably secured in place by welding.

Likewise outlet headers 52 are provided at the two extremities of the tubular members 45, 46. Each extends horizontally and embraces all of the large openings 49 on its side of the vat. Each header 52 consists of a channel iron having leg or flange 53 and a long leg or flange 54. The long flange 54 closes the upper ends of each of the channels formed by the channel members 45, 46. Each header 52 has its flanges 53 and 54 secured in place, preferably by welding. The ends of the headers 52 are provided with flanges 55, which also abut against the channel member 46 at the one end and against the channel member 45 which completes the tube structure at the other end. It is preferably secured in place by welding.

Thus, a refrigerant admitted to the inlet header 50, is distributed to each of the refrigerating tubes through the small openings 48. Where ammonia is used, the same will be in liquid form when it passes through the openings 48. As it passes upward through the refrigerating tubes, formed by the angle members 45, 46, it will take up heat from the contents of the tank, and when it reaches the outlet headers 52, it will consist of gas, or gas and liquid mixed. This gas, or the mixture, will pass readily through the large openings 49 into the outlet headers 52.

It will be obvious that the liquid ammonia, upon entering the header 50 will be under pressure. This will insure its passing to and through all the small openings 48. Hence there will be a good and complete distribution to all the tubes.

The refrigerant is conducted to the inlet header 50, through an inlet pipe 58, which is passed through openings in the two shells, and an opening in the end flange 51 of the header 50. It is properly secured in place by welding or otherwise, as may be desired. This inlet pipe is controlled by valve 59 contained therein, which is closed when it is necessary to repair the tank or cut off the supply. It is open during operation.

Similarly, the outlet headers 52 are provided with outlet pipes 60 located at the ends of the headers 52. These pipes pass through openings in the outer shell 22 and openings in the headers 52, and, like the pipe 58, are properly welded in place. Each pipe 60 is bent so as to extend around the end of the vat in the manner indicated in Fig. 10. There it meets with an auxil-

lary pipe 61, which extends horizontally, and to which it is coupled by coupling 62. At the center, the two pipes 61 are connected to an upright pipe 63. The connection is made through a series of nipples 64 and couplings 65. The upright pipe 63 communicates with a short pipe 66 which extends upward into the surge drum 67, to a point near its top. The pipes 63 and 66 are connected by suitable coupling 68. Thus the surge drum is located well toward the top of the vat. It is provided with a pressure gauge 70 by which the pressure of the contained gas is indicated. An outlet pipe 71 is also provided for the drum 67. It is connected to a nipple 72 by coupling 73 and extends down into the top of a trap 74. Where the nipples 66 and 72 pass through the drum 67, they are suitably secured in place, preferably by welding. The pipe 71 is sprung or bent, as shown in Fig. 3, so as to pass the transverse pipe 61.

This trap 74 is mounted on a stand 75 and is connected by a pipe 76 with that end of the inlet pipe 58 which is at the high end of the vat. A coupling 77 connects the two pipes. The pipe 71 passes well down into the bowl of the trap 74. Toward its lower end, the trap has a curved outlet pipe 78, which is open at its lower end, which lies well toward the bottom of the bowl. This outlet pipe 78 extends from the bowl of the trap outward and there connects with a pipe 79, through an intervening valve 80. This valve is normally closed, but is opened from time to time so as to draw off any foreign matter from the refrigerant. The oil is usually such foreign substance. Ordinarily lubricating oil is heavier than liquid ammonia and so settles down to the bottom of the trap bowl 74. When it is desired to empty the trap, it is only necessary to open the valve 80 and the pressure within throws out the oil through discharge pipe 79. It is then caught in a suitable vessel.

In addition to controlling the oil in this way, the forward end of the inlet header 50 is provided with a blow-off cock 82 in a connecting pipe 83 which serves as a blow-off outlet for the header. It communicates with a pipe 84 which may be led to a suitable accumulator or other device for catching the oil. This blow-off cock 82 may be operated when the valve 80 is operated. In this way, any additional accumulations of oil within the inlet header are blown out of the system. It will be apparent that the trap 74, and the header 50, will perform the functions of accumulating and discharging the foreign matter from the refrigerant, no matter how the refrigerant is produced or forced through the system.

In the present instance, I have shown one method of supplying a refrigerant to the refrigerating tubes formed by the members 45, 46. By this method a liquid refrigerant is supplied to the interior of the surge drum 67. From the drum 67 it is fed through the trap 74 to the lower header 50 of the vat. It will pass upward, as before explained, through the several refrigerating tubes to the outlet headers 52, and then on through them, in its gasified or partially gasified form, up into the surge drum 67. It enters, as noted, through the curved portion of the pipe 66 at the upper end of the drum. There the gas will be separated from the liquid, the liquid dropping down and the gas rising up, will pass off through the opening provided. Where ammonia is used, a definite charge is

supplied to the system. Baffles 85 within the upper part of the surge tank prevent surging.

The gas which results from the cooling action within the tubes formed by the members 45, 46, is collected and compressed, and cooled down again so as to return to its original liquid form. It is supplied to the surge drum 67 by means of a float valve 86.

The path of the gas and the operations by which it is reduced to liquid form may now be considered. From the upper part of the surge drum, a pipe 87 extends, by suitable nipples 89 and couplings 81, through a valve 88, back-pressure regulator 89, valve 90, and pipe 91, to the intake of the compressor 92. There it passes into the compression chamber, through inlet valve 93, upon one stroke of the piston of the compressor, and, upon the return stroke, it is compressed by reason of the valve 94, as is well known in such devices. The compressor is driven by any suitable means, such as the electric motor 95. It is supplied from a suitable source of electricity, through conductors 96, and, operating by means of belt 97, rotates the shaft 98 of the compressor. The crank and its parts are immersed in a body of oil 99, which, in the operation of the compressor, thoroughly lubricates all the parts. Some of the oil dashing up, engages the piston and passes the piston rings 110 into the chamber occupied by the gas being compressed. Oil thus finds its way into the refrigerant.

In this connection, it may be noted that suitable cut-off valves 100 and 101 are shown in connection with the intake pipe 91 and the outlet pipe 102 of the compressor. By closing these it is possible to remove the compressor for repairs or other purposes.

The compressed refrigerant now passes through a cooling coil 103, and, as the same is cooled, it becomes thoroughly liquefied in the container 104. The supply of cooling water from the supply pipe 105, passing down over the coils, enables this end to be attained. A basin 106 below the coils, catches the water and it is carried off through an outlet 107. From the receiver 104, the refrigerant passes upward through a pipe 108, and on through a strainer 109 into the interior of the float controlled valve 86.

When the valve 86, or the strainer 109, is out of order and needs repairing, then the liquid may be passed upward and into the top of the surge drum 67 through the by-pass formed by the pipes 112 and 113, controlled by valves 114 and 115. In operation, when the supply of liquid refrigerant in the surge drum 67 falls off, the float 116 of the float valve 86, by dropping down, opens up the valve 86 and allows the liquid refrigerant to flow into the surge drum. This will continue until the float, upon rising, cuts off the supply again.

The proper difference in pressure is maintained between the surge drum 67 and the pipe 91 by a back pressure valve 89. Such a valve is shown in the patent of H. G. Mojonner, No. 2,259,263; granted October 14, 1941, and need not be further described. By adjusting it the range of pressures within the pipe 91 may be varied with a consequent variation in the degree of refrigeration. Other examples of back pressure valves are found in United States Patents No. 833,062, Krichbaum, granted October 9, 1906, and No. 1,141,975, Osborne, granted June 8, 1915.

The strainer 109 is also of simple construction and contains a screen or other means for straining the refrigerant.

The float valve 86 is shown herein, and comprises a hollow body 117 which is closed at one end by head 118 and at the other end by a similar but apertured head 119. Suitable bolts 120 and 121 secure the heads to the body. The head 119 is threaded for the reception of a thread upon a boss 122, which is welded or otherwise secured to the adjacent wall of the surge drum 67. This boss 122 is apertured for the passage of the float lever 123, which is pivoted to the body by transverse pin 124. The bifurcations 135, 136 at the end of the lever 124, passes on opposite sides of a needle valve 125, which is threaded at its upper end for the reception of adjusting nuts 126. Between the upper side of these nuts 126 and a head on a vertically adjustable stem 127, is a coiled compression spring 128 which may be adjusted to place a proper pressure upon the controlling float. The stem 127 is held in final adjusted position by a gland 129, which passes into a bonnet 130, screwed into the top of the body 117. The needle valve 125 cooperates with a suitable bushing 131 which is provided with a suitable seat 132. When the valve is down, the valve 125 is closed upon its seat 132 and the passage is likewise closed. This passage extends through lateral openings 133 and a vertical opening 134. At its lower end, the transverse opening into the body 117 communicates with the passageway 134. Into this passageway 134 enters a bushing 141. The bushing 141 is provided with a central opening which is interiorly threaded for the reception of the connecting pipe 144 by which it is connected to the strainer 109 and thus comes within the supply connection. It will be obvious that when the valve is operated, it will open and close the needle valve 125 and thus control the supply to the surge drum 67.

Other float valves, suitable for the purpose, are illustrated in United States Patents No. 604,018, Carmichael, granted May 17, 1898, and No. 1,886,468, Cornish, granted November 8, 1932.

I have further illustrated my invention in connection with a vat of the type illustrated in Fig. 11, wherein the axis of the concentric cylinders is vertical. Therein the outer shell 145 is associated with an inner shell 146. The vat construction is much the same as that heretofore described, but the tubes for carrying the refrigerant are straight and vertically arranged and the headers are horizontal. In this instance, the vat is provided with a top 147, which is suitably connected to the vertical walls formed by the vat cylinders 145 and 146. This top is provided with a manhole 148. A central gearing 142 driven by motor 140 rotates the agitator shaft 151, which is suitably mounted in a bearing on the bottom 153 of the vat and provided with blades 152, similar to the shaft 37 and the associated blades 38 of the other form of the invention.

Here the vertical tubes are formed by angle irons 154, similar to the angle irons 45, in the preceding form of the invention. These angle irons are nested together within the space between the inner and outer shells of the vat, and secured to the inner cylinder 146 the same as angle irons 45 were secured in the previous case. In this instance, an inlet header 155 and an outlet header 156 are provided. These headers close the ends of the vertical tubes, by having one flange 157 longer than the other 158. Here the inlet header 155 is provided with an inlet pipe 159 and the outlet header 156 is provided with an outlet pipe 160. The vat is provided with suitable legs 161. There is also an outlet valve 162, 75

operated by handle 163, to withdraw the contents from the vat. The parts all operate in the same way as before described, in the case of the prior form of the invention. It will be noted that in Fig. 13, the portion of the figure toward the left, has only the outer shell and insulation removed, to show the pipes 159 and 160 entering the headers 155 and 156. Adjacent thereto the headers are broken away so as to show the small openings 164 in association with the inlet header 155 and large openings 165 in association with the outlet headers 156. Then further to the right, the parts are shown with all removed except the inner shell 146 and a portion of the angle member 154, which is shown in section.

The lower header 155 in this instance, is not shown inclined to the horizontal, as in the first form of the invention. With this form, it will not be necessary to employ the blow-off cock, but it will suffice to employ a trap 166 like the trap 74 in the first form. This trap 166 is connected directly to the inlet pipe 159. It is the same as the trap 74 and is connected into the system in the same way.

It will be apparent that the vat may be used in the handling of various liquids, indeed, with any liquid product. Thus, it has been used for the cooling of milk products such as fresh milk, as described, skim-milk, evaporated milk, cream, ice cream mix and the like. It has also been used for cooling egg meat.

In making up the vats, various parts are composed of metal, as will be obvious. Where milk is to be handled, stainless steel may be used, as the same is non-contaminable to milk. Likewise, in making up the same for use with other substances, other metals may be used. Ground cork or other insulation may be used as the heat insulating material.

It will also be recognized that the areas of insulation may be varied to suit the requirements in any particular case. The construction lends itself easily to such variation.

In carrying out the invention, it will be apparent that other alterations and modifications may be made in the construction shown, without departing from the spirit and scope of the same. Accordingly, it is desired that the terms of the appended claims be construed so as to cover such alterations and modifications.

I claim:

1. A vat of the class described, comprising an inner cylindrical shell and an outer cylindrical shell, spaced apart, the axes of the cylinders being coincident and extending downward and forward so as to give the bottom of the vat a downward and forward inclination, a series of arcuate angle members between said shells bearing against the inner shell, said members providing a series of arcuate tubes for conducting a refrigerant, an inlet header for the tubes located in the lower half of said vat and between said shells and having its interior communicating with the interiors of said tubes through small openings, said inlet header being inclined downward from the horizontal, an outlet header for the tubes also located between said shells but at a higher level than said inlet header and having its interior communicating with the interiors of said tubes through large openings, an inlet pipe communicating with said inlet header, an outlet pipe communicating with said outlet header, insulation within said outer shell about said tubes and headers, refrigerating means operative to introduce the refrigerant to said

tubes through said inlet pipe and inlet header and to withdraw the same therefrom through said outlet header and outlet pipe, means for variously setting said refrigerating means to provide the refrigerant at different degrees of refrigeration, and a blow-off cock communicating with the lower portion of said inlet header.

2. A vat of the class described, comprising an inner cylindrical shell and an outer cylindrical shell, spaced apart, the axes of the cylinders being coincident and extending downward and forward so as to give the bottom of the vat a downward and forward inclination, a series of arcuate angle members between said shells bearing against the inner shell, said members providing a series of arcuate tubes for conducting a refrigerant, an inlet header for the tubes located in the lower half of said vat and between said shells and having its interior communicating with the interiors of said tubes through small openings, said inlet header being inclined downward from the horizontal, an outlet header for the tubes also located between said shells but at a higher level than said inlet header and having its interior communicating with the interiors of said tubes through large openings, an inlet pipe communicating with said inlet header at its high end, an outlet pipe communicating with said outlet header, insulation within said outer shell about said tubes and headers, refrigerating means operative to introduce the refrigerant to said tubes through said inlet pipe and inlet header and to withdraw the same therefrom through said outlet header and outlet pipe, means for variously setting said refrigerating means to provide the refrigerant at different degrees of refrigeration, a trap near the upper end of said inlet header for removing foreign matter from the refrigerant, and a blow-off cock communicating with the lower portion of said inlet header.

3. A vat of the class described, comprising an inner cylindrical shell and an outer cylindrical shell, spaced apart, the axes of the cylinders being coincident and extending substantially horizontally, a series of arcuate angle members located between said shells and bearing against the under side of said inner shell over a considerable area lying on both sides of a central point, said members providing a series of arcuate tubes for conducting a refrigerant, an inlet header at said central point located between said shells and having its interior communicating with the interiors of said tubes at said central point through small openings, a pair of outlet headers for the tubes located between said shells and adjacent to the separated ends of the tubes, said outlet headers having their interiors communicating with the interiors of said tubes through large openings, an inlet pipe communicating with said centrally disposed inlet header, a pair of outlet pipes communicating respectively with said outlet headers, a heat insulating material within the outer shell around said tubes and headers, refrigerating means operative to introduce the refrigerant to said tubes through said inlet pipe and inlet header and to withdraw the same therefrom through said outlet headers and outlet pipes in parallel, means for variously setting said refrigerating means to provide the refrigerant at different degrees of refrigeration, and a blow-off cock at the forward end of said inlet header.

4. A vat of the class described, comprising an inner cylindrical shell and an outer cylindrical shell, spaced apart, the axes of the cylinders being coincident and extending substantially

horizontally, a series of arcuate angle members located between said shells and bearing against the under side of said inner shell over a considerable area lying on both sides of a central point, said members providing a series of arcuate tubes for conducting a refrigerant, an inlet header at said central point located between said shells and having its interior communicating with the interiors of said tubes at said central point through small openings, a pair of outlet headers for the tubes located between said shells and adjacent to the separated ends of the tubes, said outlet headers having their interiors communicating with the interiors of said tubes through large openings, an inlet pipe communicating with said centrally disposed inlet header, a pair of outlet pipes communicating respectively with said outlet headers, a heat insulating material within the outer shell around said tubes and headers, refrigerating means operative to introduce the refrigerant to said tubes through said inlet pipe and inlet header and to withdraw the same therefrom through said outlet headers and outlet pipes in parallel, means for variously setting said refrigerating means to provide the refrigerant at different degrees of refrigeration, a trap located in the piping of said refrigerating means to collect foreign matter that may be contained in the refrigerant on its way to said inlet header, and a blow-off cock at the forward end of said inlet header.

5. A vat of the class described, comprising an inner cylindrical shell and an outer cylindrical shell, spaced apart, the axes of the cylinders being coincident and extending downward and forward so as to give the bottom of the vat a downward and forward inclination, means cooperating with said inner shell to provide a series of arcuate tubes for conducting a refrigerant, an inlet header for the tubes located in the lower half of said vat and between said shells and having its interior communicating with the interiors of said tubes through openings which are in cross-sectional area each about one-tenth that of said inlet header, said inlet header being inclined downward from the horizontal, an outlet header for the tubes also located between said shells but at a higher level than said inlet header and having its interior communicating with the interiors of said tubes through openings which have a cross-sectional area about four times that of said first mentioned openings, an inlet pipe communicating with said inlet header, an outlet pipe communicating with said outlet header, insulation within said outer shell about said tubes and headers, refrigerating means operative to introduce the refrigerant to said tubes through said inlet pipe and inlet header and to withdraw the same therefrom through said outlet header and outlet pipe, means for variously setting said refrigerating means to provide the refrigerant at different degrees of refrigeration, and a blow-off cock communicating with the lower portion of said inlet header.

6. A vat of the class described, comprising an inner cylindrical shell and an outer cylindrical shell, spaced apart, the axes of the cylinders being coincident and extending downward and forward so as to give the bottom of the vat a downward and forward inclination, means cooperating with said inner shell to provide a series of arcuate tubes for conducting a refrigerant, an inlet header for the tubes located in the lower half of said vat and between said shells and having its interior communicating with the interiors

of said tubes through relatively small openings, said inlet header being inclined downward from the horizontal, an outlet header for the tubes also located between said shells but at a higher level than said inlet header and having its interior communicating with the interiors of said tubes through relatively large openings, an inlet pipe communicating with said inlet header at its high end, an outlet pipe communicating with said outlet header, insulation within said outer shell about said tubes and headers, refrigerating means operative to introduce, the refrigerant to said tubes through said inlet pipe and inlet header and to withdraw the same therefrom through said outlet header and outlet pipe, said refrigerating means including a compressor, some of the lubricating oil from which compressor in operation necessarily mingles with and contaminates the refrigerant, means for variously setting said refrigerating means to provide the refrigerant at different degrees of refrigeration, a trap for collecting oil deposits separated from said refrigerant by gravity, said trap being near the upper end of said inlet header and being provided with an outlet, a valve for controlling said outlet operative when opened to discharge accumulators of oil due to the pressure within the trap, and a blow-off cock communicating with the lower portion of said inlet header to blow off the oil not taken up by said trap but accumulated in said inlet header.

7. A vat of the class described, comprising an inner cylindrical shell and an outer cylindrical shell, spaced apart, the axes of the cylinders being coincident and extending substantially horizontally, means located between said shells and co-operating with said inner shell to provide a series of arcuate tubes for conducting a refrigerant, said tubes lying on either side of a central point, an inlet header at said central point located between said shells and having its interior communicating with the interiors of said tubes at said central point through openings which are in cross-sectional area each about one-tenth that of said header, a pair of outlet headers for the tubes located between said shells and adjacent to the separated ends of the tubes, said outlet headers having their interiors communicating with the interiors of said tubes through openings which have a cross-sectional area about four times that of the first mentioned openings, an inlet pipe communicating with said centrally disposed inlet header, a pair of outlet pipes communicating respectively with said outlet headers, a heat insulating material within the outer shell around said tubes and headers, refrigerating means operative to introduce the refrigerant to said tubes through said inlet pipe and inlet header and to withdraw the same therefrom through said outlet headers and outlet pipes in parallel, means for variously setting said refrigerating means to provide the refrigerant at different degrees of refrigeration, and a blow-off cock at the forward end of said inlet header.

8. A vat of the class described, comprising an inner cylindrical shell and an outer cylindrical shell, spaced apart, the axes of the cylinders being coincident and extending substantially horizontally, means located between said shells and co-operating with said inner shell to provide a series of arcuate tubes for conducting a refrigerant, said tubes lying on either side of a central point, an inlet header at said central point located between said shells and having its interior communicating with the interiors of said tubes

at said central point through relatively small openings, a pair of outlet headers for the tubes located between said shells and adjacent to the ends of the tubes, said outlet headers having their interiors communicating with the interiors of said tubes through relatively large openings, an inlet pipe communicating with said centrally disposed inlet header, a pair of outlet pipes communicating respectively with said outlet headers, a heat insulating material within the outer shell around said tubes and headers, refrigerating means operative to introduce the refrigerant to said tubes through said inlet pipe and inlet header and to withdraw the same therefrom through said outlet headers and outlet pipes in parallel, said refrigerating means including a compressor, some of the lubricating oil from which compressor in operation necessarily mingles with and contaminates the refrigerant, means for variously setting said refrigerating means to provide the refrigerant at different degrees of refrigeration, a trap for collecting oil deposits separated from said refrigerant by gravity, said trap being located in the piping of said refrigerating means adjacent to the inlet of said inlet header, and a blow-off cock at the outlet end of said inlet header to blow off the oil not taken up by said trap but accumulated in said header.

9. A cold wall vat for cooling a liquid under treatment with a refrigerant readily vaporizable at ordinary temperatures, comprising an inner shell and an outer shell, spaced apart, means between said shells bearing against the inner shell and spaced from the outer shell and co-operating with said inner shell to provide a series of substantially upright parallel tubes for conducting the refrigerant, an inlet header for the tubes also located between said shells and having its interior communicating with the interiors of said tubes, an inlet pipe for communicating with said inlet header, said inlet pipe and header being adapted to receive the refrigerant in liquid form, an outlet header for the tubes also located between said shells but at a higher level than said inlet header and having its interior communicating with the interiors of said tubes, the same readily passing the refrigerant after it has been heated by the liquid within the vat and thereby becomes gasified, a cooperating outlet pipe communicating with said outlet header, heat insulating material within the outer shell about said tubes and headers, a trap, means for supplying said refrigerant in liquid form to said inlet pipe and header through said trap and withdrawing the refrigerant in gasified form from said outlet pipe and header, said means including a compressor which in operation necessarily passes small amounts of lubricating oil into the refrigerant, the trap serving to catch the oil separated from the refrigerant by gravity, said trap being provided with an outlet, and a valve for controlling said outlet operative by pressure from within to discharge accumulations of oil from the trap.

10. A cold wall vat for cooling a liquid under treatment with a refrigerant readily vaporizable at ordinary temperatures, comprising an inner shell and an outer shell, spaced apart, means between said shells bearing against the inner shell and spaced from the outer shell and co-operating with said inner shell to provide a series of substantially upright parallel tubes for conducting the refrigerant, an inlet header for the tubes also located between said shells and having its interior communicating with the interiors of said

tubes through relatively small openings, an inlet pipe communicating with said inlet header, means for supplying said refrigerant in liquid form to said inlet pipe and header, the small openings between said header and tubes being in cross-sectional area each about one-tenth that of the header whereby a substantially equal supply of liquid will be furnished to said tubes, an outlet header for the tubes also located between said shells but at a higher level than said inlet header and having its interior communicating with the interiors of said tubes through relatively large openings, each said large opening being in cross-sectional area approximately four times that of said small opening whereby they readily receive and pass the refrigerant which has been gasified by the heat abstracted from the liquid being treated, a cooperating outlet pipe communicating with said outlet header, and a heat insulating material within the outer shell about said tubes and headers.

11. A vat of the class described for cooling a liquid under treatment by a refrigerant readily vaporizable at ordinary temperatures, comprising an inner cylindrical shell and an outer cylindrical shell, spaced apart, means between said shells bearing against the inner shell and co-operating therewith to provide a series of tubes for conducting a refrigerant, an inlet header for the tubes located in the lower part of said vat and between said shells and having its interior communicating with the interiors of said tubes through relatively small openings, said inlet header being inclined downward from the horizontal, an inlet pipe communicating with said inlet header, the small openings between said header and tubes being in cross-sectional area each about one-tenth that of the header thereby insuring a substantially equal supply of liquid refrigerant to said tubes, an outlet header for the tubes also located between said shells but at a higher level than said inlet header and having its interior communicating with the interiors of said tubes through relatively large openings, each said large opening being in cross-sectional area approximately four times that of said small opening thereby readily passing the refrigerant after it has been heated by the liquid within the vat and thereby has become gasified, a cooperating outlet pipe communicating with said outlet header, insulation within said outer shell about said tubes and headers, refrigerating means operative to supply the liquid refrigerant and to withdraw the gasified refrigerant, means for variously setting said refrigerating means to provide the refrigerant at different degrees of refrigeration, and a blow-off cock communicating with the lower portion of said inlet header.

12. A vat of the class described for cooling a liquid under treatment by a refrigerant readily vaporizable at ordinary temperatures, comprising an inner cylindrical shell and an outer cylindrical shell, spaced apart, means between said shells bearing against the inner shell and co-operating therewith to provide a series of tubes for conducting a refrigerant, an inlet header for the tubes located in the lower part of said vat and between said shells and having its interior communicating with the interiors of said tubes, said inlet header being inclined downward from the horizontal, an inlet pipe communicating with said inlet header, said inlet pipe and header being adapted to receive the refrigerant in liquid form, an outlet header for the tubes also located

between said shells but at a higher level than said inlet header and having its interior communicating with the interiors of said tubes, the same readily passing the refrigerant after it has been heated by the liquid within the vat and thereby has become gasified, a cooperating outlet pipe communicating with said outlet header, insulation within said outer shell about said tubes and headers, refrigerating means operative to supply the liquid refrigerant and to withdraw the gasified refrigerant, said refrigerating means including a compressor which in operation necessarily passes small amounts of lubricating oil into the refrigerant, means for variously setting said refrigerating means to provide the refrigerant at different degrees of refrigeration, a trap serving to catch the oil separated from the refrigerant by gravity, said trap being near the upper end of said inlet header and having an outlet, a valve for controlling said outlet operative by pressure from within to discharge accumulations of oil from the trap, and a blow-off cock communicating with the lower portion of said inlet header to blow off the oil not taken up by said trap but allowed to collect in said header.

13. A vat of the class described for cooling a liquid under treatment by refrigerant readily vaporizable at ordinary temperatures, comprising an inner shell and an outer shell, spaced apart, means between said shells bearing against the inner shell and co-operating therewith to provide a series of tubes for conducting a refrigerant, an inlet header for the tubes located in the lower part of said vat and between said shells and having its interior communicating with the interiors of said tubes through relatively small openings, said inlet header being inclined downward from the horizontal, an inlet pipe communicating with said inlet header, said inlet pipe and header being adapted to receive the refrigerant in liquid form, the small openings between said header and tubes being in cross-sectional area each about one-tenth that of the header whereby a substantially equal supply of liquid will be furnished to said tubes, an outlet header for the tubes also located between said shells but at a higher level than said inlet header and having its interior communicating with the interiors of said tubes through relatively large openings, each said large opening being in cross-sectional area approximately four times that of said small opening whereby the openings readily receive and pass the refrigerant that has been gasified by the heat abstracted from the liquid being treated, a cooperating outlet pipe communicating with said outlet header, insulation within said outer shell about said tubes and headers, refrigerating means operative to supply the liquid refrigerant and to withdraw the gasified refrigerant, means for variously setting said refrigerating means to provide the refrigerant at different degrees of refrigeration, and a blow-off cock communicating with the lower portion of said inlet header.

14. A vat of the class described for cooling a liquid under treatment by refrigerant readily vaporizable at ordinary temperatures, comprising an inner shell and an outer shell, spaced apart, means between said shells bearing against the inner shell and co-operating therewith to provide a series of tubes for conducting a refrigerant, an inlet header for the tubes located in the lower part of said vat and between said shells and having its interior communicating with the interiors of said tubes through relatively small openings, said inlet header being inclined down-

ward from the horizontal, an inlet pipe communicating with said inlet header, said inlet pipe and header being adapted to receive the refrigerant in liquid form, the small openings between said header and tubes being in cross-sectional area each about one-tenth that of the header whereby a substantially equal supply of liquid will be furnished to said tubes, an outlet header for the tubes also located between said shells but at a higher level than said inlet header and having its interior communicating with the interiors of said tubes through relatively large openings, each said large opening being in cross-sectional area approximately four times that of said small opening whereby the open-

ings readily receive and pass the refrigerant that has been gasified by the heat abstracted from the liquid being treated, a cooperating outlet pipe communicating with said outlet header, insulation within said outer shell about said tubes and headers, refrigerating means operative to supply the liquid refrigerant and to withdraw the gasified refrigerant, means for variously setting said refrigerating means to provide the refrigerant at different degrees of refrigeration, a trap near the upper end of said inlet header for removing foreign matter from the refrigerant, and a blow-off cock communicating with the lower portion of said inlet header.

TIMOTHY MOJONNIER.

CERTIFICATE OF CORRECTION.

Patent No. 2,320,531

June 1, 1943.

TIMOTHY MOJONNIER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 3, for "froward" read --forward--; line 19, for "gap 30" read --cap 30--; page 6, first column, line 27, claim 6, for "accumulators" read --accumulations--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 20th day of July, A. D. 1943.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.