Feb. 2, 1960 R. C. TIEDE 2,923,136

MUG COOLER AND REFRIGERATION SYSTEM THEREFOR

Filed Oct. 22, 1954 2 Sheets-Sheet 1

Fig. 1.

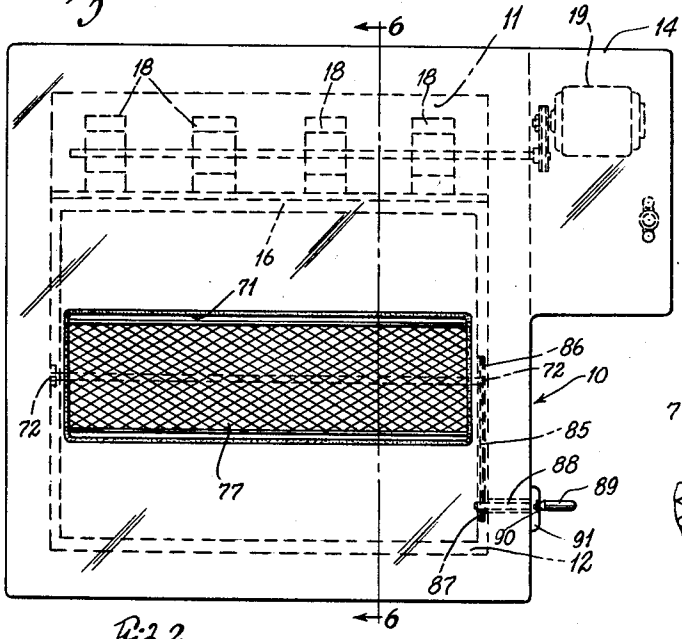


Fig. 2.

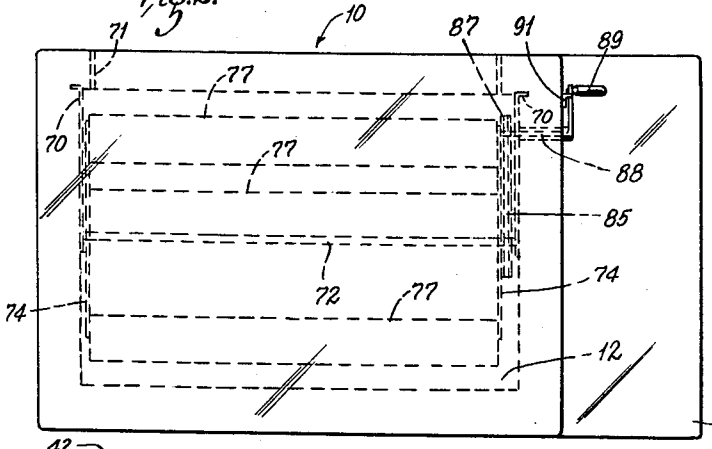


Fig. 7.

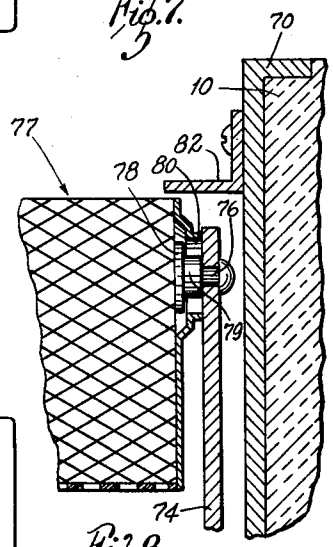


Fig. 8.

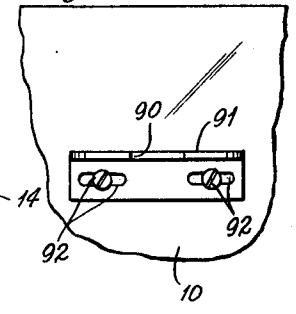
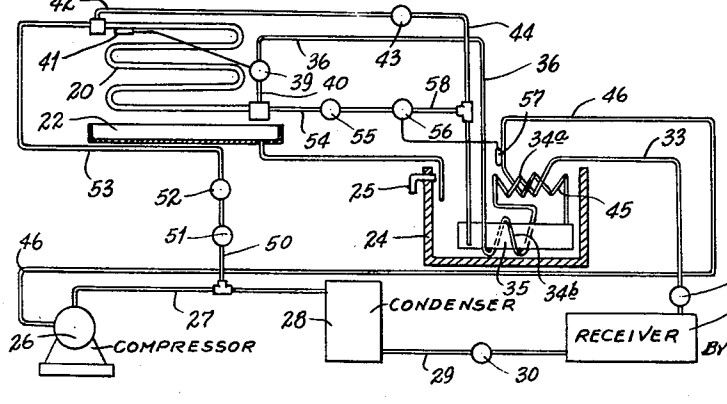


Fig. 9.



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Fig. 3.

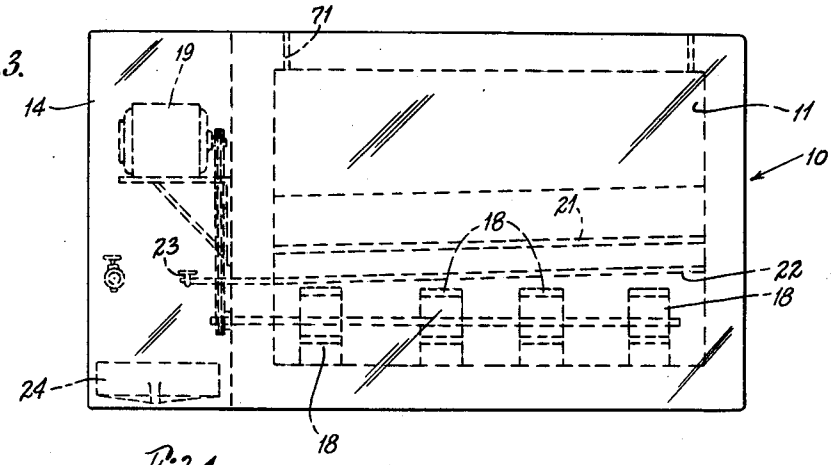


Fig. 4.

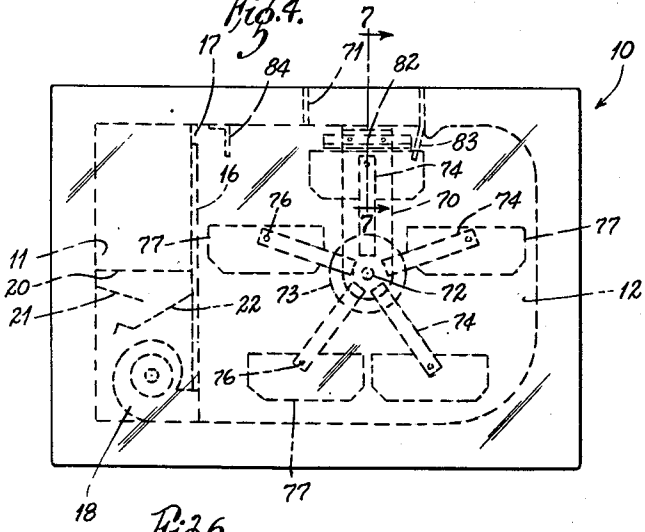


Fig. 5.

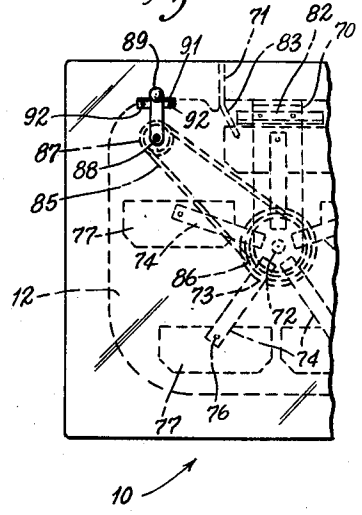
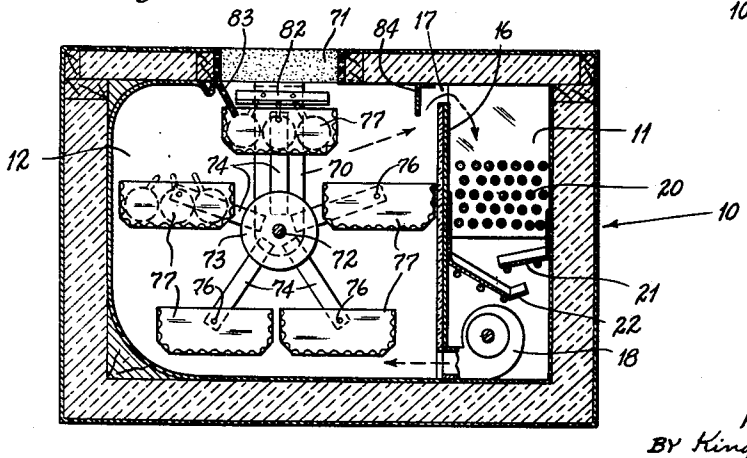


Fig. 6.



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MUG COOLER AND REFRIGERATION SYSTEM THEREFOR

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Application October 22, 1954, Serial No. 464,057

11 Claims. (Cl. 62—225)

The present invention relates to a mug cooler, and especially to one that may be used for cooling and keeping cool mugs of the type used for root beer.

The present mug cooler includes a box having its own refrigeration and cold air circulating means.

This refrigeration apparatus has means that delivers refrigeration to a main coil in the box during a normal cycle, and to the collected condensate from the box during an automatic defrosting cycle, which condensate is, in turn, used as a means to precool the refrigerant during a subsequent normal cycle. The arrangement avoids wasting the refrigeration contained in the liquid of the main evaporator coil, during defrosting, since that liquid is expelled during defrosting into a receptacle that is in heat exchange relationship with the condensate. The latent heat of the refrigerant is thus delivered to the condensate so as to be subsequently available for precooling the refrigerant from the receiver, in the next normal cycle.

The cooler has a mug supporting device which acts not only as a support and storage means for the mugs, but also as a means to move the mugs through the refrigerated air stream in a proper relationship to the direction of flow of the air stream, to obtain maximum efficiency in refrigerating the mugs.

Among the objects of the invention are the provision of a compact, self-contained beer mug refrigerating device having its own refrigeration means and mug supporting elements; the arrangement of the mug supporting device which will present a supply of cold mugs adjacent a withdrawal and reloading opening; the provision of a mug supporting device of a rotating character which, while it presents one set of mugs for withdrawal, disposes other sets of mugs in varying degrees of cooling within the box; and the provision of a mug supporting means that provides for holding a maximum number of mugs in the coldest part of the refrigerating air stream for the longest period of time. Another object is the provision of space for storage of washed mugs on top of the box or cabinet, at convenient reach.

Other objects include the provision of a mug cooling apparatus with arrangement for ready removal of the mug supporting elements for being cleaned and for rendering the interior of the box accessible to cleaning.

Other objects include the provision of a refrigeration apparatus that minimizes wastage of refrigeration during defrosting, and that, in so doing, cools evaporator condensate, and then uses that condensate to precool the refrigerant during the next operating or normal cycle.

Other objects and advantages will appear from the description to follow.

In the drawings:

Figure 1 is a plan view of the mug cooler;

Figure 2 is a front elevation thereof;

Figure 3 is a rear elevation of the mug cooler;

Figure 4 is an end elevation of the mug cooler taken from the left end of Figure 1;

Figure 5 is a partial end view taken from the right end of Figure 1;

Figure 6 is a vertical section taken on the line 6—6 of Figure 1;

Figure 7 is a fragmentary sectional view through one end of a mug basket support taken on the line 7—7 of Figure 4;

Figure 8 is a fragmentary view showing a bracket having a holding notch for the handle that moves the cooler support means; and

Figure 9 is a diagrammatic view of the refrigeration apparatus.

The mug cooler includes an insulated box 10 which may be considered as divided into a chamber 11 containing the refrigerating means, and a chamber 12 containing the mug support means. In addition, there is a projection on the right end of the machine in Figure 1 which comprises a motor chamber 14 that may contain various motors, solenoid valves, an expansion valve for the precooler coil, the precooler coil, the condensate collecting tank, electric controls, and like parts to be described. The motor chamber 14 is separated from and insulated from the interior chambers 11 and 12.

A partition 16 extends from the floor of the interior of the box almost to the top thereof, so as to separate the two chambers 11 and 12. It is an insulated baffle. The space 17 over the top of this partition constitutes an air flow passageway as will appear. In the bottom of the chamber 11 there is a plurality of blowers 18 the outlets of which are mounted through the partition 16 so that they may draw air from within the chamber 11 and drive it out across the bottom of the chamber 12 until it finally is again drawn inwardly to the chamber 11 by way of the passage 17. These blowers are all driven from a common shaft that is connected to the motor 19 in the motor chamber 14.

The chamber 11 contains a refrigeration coil 20, which is an evaporator for a compressor-condenser-evaporator type refrigeration unit the details of which are shown schematically in Figure 9, later to be described. Below the coil 20 there are suitable overlapping condensate trays 21 and 22. The tray 21 extends downwardly and forwardly from the back wall of the box 10, while the tray 22 extends downwardly and backwardly from the back of the partition 16, with its rear edge upturned so as to provide a gutter-like arrangement. The upper tray drains onto the lower, and both trays slope downwardly toward the left end in Figure 3 so that the condensate from the coil 20 is conducted to the left wall of the box. There suitable piping connects through a drain tap 23 and discharges into a receptacle 24. The receptacle has an overflow pipe 25 (Figure 9). Preferably the receptacle 24 is used with refrigerant coils in a manner to be described.

As shown in Figure 9, a compressor 26 (which is ordinarily remotely installed) feeds a hot gas line 27, which leads to a condenser 28. From the condenser 28 a line 29 leads through a check valve 30 to a receiver 31. The discharge from the receiver 31 leads through a valve 32 and out through a pipe 33. The line 33 leads into a first coil 34*a* immersed in the condensate receptacle 24 within the motor compartment 14. The normal condensation on the main evaporator coil 20 keeps this tank 24 full, while the overflow 25 permits the tank 24 to contain a certain maximum amount of condensate.

The outlet of the first condensate coil 34*a* connects into a second coil 34*b* that surrounds a tank 35 also immersed in the condensate tank 24. The outlet of the coil 34*b* is by way of a pipe 36 that leads through an expansion device 39 which is connected by a line 40 into the primary evaporator coil 20. The expansion

device 39 is preferably a constant superheat thermostatic expansion valve of familiar type, having a bulb 41 at the outlet of the coil 20.

The outlet of the evaporator coil 20 is primarily by way of a pipe 42 leading through a valve 43 to a pipe 44 that connects into the bottom of the previously-mentioned tank 35. The outlet of the tank 35 connects into a heat exchange coil 45. This coil 45 connects by way of a pipe 46 back into the suction side of the compressor 26.

In addition to the foregoing circuit, there is a defrosting circuit which includes a pipe 50 connected into the hot gas pipe 27 leading from the compressor 26. The pipe 50 leads through a manual valve 51 and an automatic solenoid valve 52, and thence by way of a pipe 53 into the outlet end of the main evaporator coil 20. The pipe 53 may be soldered to the drain pan 22, so that it may thaw the contents thereof. There is also a pipe 54 leading from the inlet end of the evaporator coil 20 that passes through a solenoid valve 55 to a second expansion device 56. This is preferably another constant superheat thermostatic expansion valve having a thermal bulb 57 located at the outlet of the coil 45. The outlet side of the expansion valve 56 is connected by a pipe 58 into the pipe 44 previously described.

This refrigeration system is designed not only to provide cooling within the chamber 12 of the box, but also to provide defrosting. In addition, it provides for precooling of the refrigerant ahead of the expansion valve by passing it through the condensate in the container 35. This will be described hereafter.

The cooling chamber 12 contains a rotary support means holding a plurality of baskets in which mugs are to be located. There are two end hangers 70 extending downwardly from the inside of the top of the box adjacent the ends of the top opening 71. The two hangers 70 support an axle 72 that is part of the rotary basket support. The support comprises two hubs 73, one at each end of the axle. Five radial arms 74 extend from each hub.

Each arm 74 has a pivot bearing 76 at its outer end. One of these is shown in detail in Figure 7, and they are designed to provide rocking or pivoting supports for a plurality of mug holding baskets 77 that are preferably made of expanded metal. Each of the pivots 76 has a flanged inner end 78 with an intermediate section 79 that holds the flanges 78 spaced from the inner surfaces of the arm 74.

Each of the baskets has flanged holes 80 at its opposite ends that are of a size to fit over the flanges 78 of the pivots 76, and then to slip down to bear on the intermediate section 79. In Figure 7, the basket 77 is actually shown in an intermediate position wherein the holes 80 are concentric with the pivot 76. Gravity, however, displaces the basket downwardly so that the top part of the flanged holes 80 rests upon the intermediate section 79.

By this arrangement, the several baskets 77 will always remain upright as the support arrangement is revolved. The baskets are of such width that they can normally take three mugs across as is illustrated in Figure 6. They may be of any suitable length to fit into the opening 71. A typical length will accommodate three columns of six mugs. With this design, the baskets 77 will not overturn even when they are not evenly loaded. They will merely tilt if unevenly loaded.

As shown in Figure 6, one of the baskets 77 is located just opposite the opening 71. They are designed to be rotated clockwise in that view. Adjacent the upper edge, in order to keep the top basket 77 level when it is opposite the opening 71, there is a guide bracket 82 spaced slightly above the top edge of the top basket 77 in its uppermost position. This bracket 82 may be in the shape of an angle iron as illustrated in Figures 6 and 7, which overhangs the end edge of the basket 77. In case there is an uneven loading of the basket 77 that tends to cause it to tilt, one edge will strike the angle 82 so that the basket will be held level during the time that it is in its upper position.

With the arrangement illustrated, when one basket is in its delivery position, there are two baskets 77 that are in the bottom position, and two in intermediate positions. Other numbers of baskets may be used, but this is especially desirable for reasons to appear.

Along the left side (Figure 6) of the opening 71 there is a flexible baffle 83 that engages into the upper part of each basket in the top position. Beyond the clockwise side of the opening 71 and immediately before the slot 17 there is a baffle 84.

In order to rotate the mug support, there is a chain 85 extending around a suitable sprocket wheel 86 associated with one of the hubs 73. This chain also extends around another sprocket wheel 87 attached to a crank shaft 88 that has a bearing in the wall of the cabinet 10. On the outside of the wall the crankshaft 88 has a crank handle 89 by which the shaft may be turned. The handle 89 has a slight resiliency in its laterally extending portion so that it may engage in a holding notch 90 in a bracket 91. This bracket 91 is attached by a screw and slot arrangement 92 to the wall of the cabinet 10, as illustrated in Figure 8. By this arrangement, the handle 89 may make one revolution and return to the slot or groove 90 where it is retained. The precise position of the handle in the retained position may be adjusted by loosening the screws of the screw and slot arrangement 92 and laterally displacing the bracket 91 in one direction or the other.

Use and operation

This beer mug cooler will be located in an appropriate place for its use, and the necessary electrical connections will be made to operate the refrigeration unit. When operated, the refrigeration unit will cool the evaporator coil 20 and the blowers 18 may operate to blow air in the direction illustrated in Figure 6. It will first be noted that there are a number of the blowers 18 across the bottom of the cabinet 10 discharging it through openings in the lower end of the partition 16. The blowers draw air in and expel it across the bottom of the chamber 12. This means that the coldest air is delivered across the two bottom baskets 77. These baskets are in an intermediate stage of cooling. The air is then deflected upwardly against the left side in Figure 6 so as to pass through the intermediate left hand basket 77. Above this basket it is again deflected so that it moves horizontally to the right until it strikes the deflector 83. This deflector not only keeps the air from being driven out the opening 71, but also causes it to pass across the top basket 77 and to flow toward the slot 17 provided below the baffle 84 and above the partition 16. The blowers 18 draw it then down across the coil 20 for recirculation.

As the cold mugs are used out of the top basket 77, they are replaced with warm mugs that are to be cooled. The top surface of the cabinet is flat, with a large surface behind the opening 71, whereon washed mugs may be stored for convenient reach. After all of the cold mugs have been used out of the top basket, the handle 89 is released from the notch 90 and is rotated a complete revolution until it returns to the notch 90. This produces just enough rotation of the carrier to withdraw the original top basket 77 and to place the left hand intermediate basket of Figure 6 into the top position. This will give a new supply of cold mugs to the opening 71 and will move the warmest mugs to the right hand intermediate position in Figure 6. There they will be partially precooled by the air stream previously described. This introduces them to the cold air relatively gradually and minimizes breakage. Only after they have been in this position long enough for the cold mugs in the top basket to be used up are they then delivered to one of the two bottom positions. They stay in the bottom positions for two stages because of the

two parallel bottom positions. This is the coldest position of all.

The next stage after the two bottom positions is intermediate left position in Figure 6, to which they are elevated immediately prior to being moved to the top position. They will be kept cold in this position by the continued flow of air across them.

If it be necessary to remove any of the baskets or all of them to clean the box, the operator need only lift one end of the baskets 77 and then spread the arms 74 outwardly so as to remove the baskets from the pivot 76, the flanges 78 passing through the holes 80 to permit this to be done. The baskets can then be lifted out through the opening 71. Consequently, the entire mechanism is readily available for cleaning.

In the use of the refrigeration apparatus, the manual valves 32 and 51 are open. For a normal cycle, the solenoid valve 43 is opened and solenoid valves 52 and 55 are closed. The compressor 26 then discharges hot gas through the pipe 27 into the condenser 28. The valves 52 and 55 being closed, the bypass line 50 is cut off. The refrigerant passes from the condenser 28 through the check valve 30 into the receiver 31 and thence out into the line 33. From the line 33 the refrigerant passes through precooling coil 34*a* immersed within the tank 24, in heat exchange relationship with the coil 45 and also the condensate in this receptacle. From the precooling coil 34*a* the refrigerant passes into the coil 34*b* that surrounds the tank 35, and thereafter by way of the pipe 36 to the expansion device 39. It is located in close, heat-transfer relationship to the pipe 42 and the valve 43, to obtain all precooling possible from them.

The expansion valve 39 discharges through the pipe 40 into the main evaporator coil 20, where the principal refrigeration takes place. From the evaporator 20, the refrigerant then passes through the line 42 and the now open valve 43, and the pipe 46, into the bottom of the tank 35. From the tank 35, the refrigerant is drawn through the coil 45 and by the pipe 46 back to the compressor 26.

When it is desired to defrost, the solenoid valve 43 is closed and the solenoid valves 52 and 55 are opened. When this occurs, the check valve 30 prevents back-flow of gas from the receiver, which is at higher pressure, toward the coil 20 at lower pressure. The compressor is forced to discharge upwardly through the pipe 50 and the pipe 53, into the outlet end of the evaporator 20. The hot gas through the pipe 53 thaws ice in the drain pan 22. The hot gas rapidly builds up pressure on the cold refrigerant in the evaporator 20; and if it be assumed that the coil 20 is about 40% flooded, the gas forces this liquid out through the pipe 54, the valve 55, the expansion valve 56 and the pipes 58 and 44 into the bottom of the tank 35. Expansion and vaporization occur in the tank 35. The compressor 26 draws vapor from the top of the tank 35, through the coil 45 and the pipe 46 into the compressor. Evaporation of this refrigerant usually forms an ice bank freezing the water in the condensate tank 24. The delivery of the refrigerant to the bottom of the tank 35 and the drawing off at the top thereof prevents sucking liquid into the compressor.

The hot gas forced through the coil 20 causes that coil to act as a condenser, and it is rapidly defrosted. The melting ice flows into the tank 24. Meanwhile, the condensate is cooled and usually frozen by the refrigeration potential of the liquid from the coil 20—both the flooding liquid and the defrosting liquid resulting from the condenser action of the coil 20. This cold is stored in condensate instead of being wasted as heretofore, and is returned to the inside of the cabinet when the next normal cycle is established, in the form of precooling the refrigerant ahead of the expansion valve.

This arrangement lends itself to ready automatic control, such as by a time clock, that operates the solenoid valves at regular intervals.

It is evident that the mug cooler provides an efficient apparatus for refrigerating mugs, with minimum cost of purchase, use and operation.

What is claimed is:

1. In a cooler of the kind described: a box having an opening in an upper side for access to the interior thereof; a rotatable article-holding means in the box having devices peripherally disposed around it for holding articles; means to rotate the article-holding means about a horizontal axis to present successively different parts of the article-holding means opposite the opening while conducting other articles from the opening successively around a rotary path and back to the opening; air refrigeration means in one side of the box; and blower means to circulate air in the box over the refrigeration means, means to direct the air from the refrigeration means onto the lower part of the article-holding means that are spaced from the opening, and means to direct the air from such article-holding means to other parts of the article-holding means and finally back over the refrigeration means.

2. In a cooler of the kind described: a box having an opening in one side for access to the interior thereof; a rotary article-holding means in the box rotatable about a horizontal axis and having a plurality of baskets suspended pivotally around the axis so as to remain right-side up as the article-holding means revolves; means to rotate that means to bring successive baskets to the opening and to hold them there; means to restrain tilting of the basket adjacent the opening without preventing it from moving with the holding means; refrigeration means in the box; and means to circulate air over the refrigeration means and the baskets, the said air circulating means being arranged to deliver air first to the baskets opposite the opening, so that the articles in the baskets between the opening and those receiving the cold air may cool gradually.

3. The combination of claim 1 wherein the article-holding means has a plurality of pairs of radial arms spaced around its axis, and the article-holding devices are pivotally and pendulously suspended between the arms of each pair.

4. The combination of claim 3 wherein the arms are flexible and resilient, and may be separated to permit removal of the devices.

5. The combination of claim 2 wherein the opening is in the top of the box, and the air-circulating means delivers air across the bottom thereof, up the side, and draws it back across the top.

6. The combination of claim 1 wherein there is means to collect condensate from the refrigeration means, and wherein there is a coil in the refrigeration means within the condensate collecting means; an expansion device ahead of such coil; and reversing means to direct the hot gases into the refrigeration means to defrost it, thence through the expansion device and the coil to cool condensate in the collecting means during defrosting.

7. In a beer mug cooler, a box having three compartments, one for an evaporator coil, one for motors, and one for receiving mugs to be cooled; an elongated opening across the top of the mug-receiving compartment; a rotary mug holder in that compartment having a horizontal axle; opposite end devices on the axle projecting radially; a plurality of baskets pendulously mounted between the end devices with equal angular spacing around the axle; a crank means for rotating the mug holder; means for causing one rotation of the crank to move the mug holder the angular distance between adjacent baskets; a partition separating the mug compartment from the evaporator compartment; blower means in the evaporator compartment discharging through the bottom of the partition toward the opposite side of the mug compartment; a flexible baffle depending from the edge of the elongated top opening to deflect air away from that opening; return air passage means through the

top of the partition; condensate trays below the evaporator; and means to conduct condensate to outside the compartment.

8. In a refrigerating apparatus: a cabinet having a refrigeration space therein and an evaporator coil within the space; a compressor; high pressure piping having a valve therein, the piping including a precooling coil and an expansion device, and the piping connecting from the compressor into the evaporator; suction piping having a liquid receptacle, connecting from the evaporator coil back into the compressor; a valve in the suction piping; a medium for storing refrigeration, this medium surrounding the precooling coil and the liquid receptacle; and defrost piping connecting the high pressure piping with the evaporator coil outlet, a valve in the defrost piping, piping connecting the evaporator coil into the receptacle, whereby when the valves in the high pressure line and in the suction line are closed and the valve in the defrost piping is open, refrigerant in the evaporator may be driven by the compressor into the receptacle to cool the medium for later precooling of refrigerant passing through the precooling coil.

9. The apparatus of claim 8, with a second expansion device in the defrost piping between the evaporator and the receptacle.

10. The apparatus of claim 8, with juxtaposition of the high pressure piping ahead of the first expansion valve, and the suction piping from the coil and from the receptacle.

11. The apparatus of claim 8 wherein the medium is water, and wherein there is a tank containing the medium, and conduit means to conduct condensate from the interior of the cabinet to the tank.

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