March 26, 1940. J. E. KELLY ET AL 2,194,600

ICE MANUFACTURE

Filed Nov. 8, 1938 2 Sheets-Sheet 1

Fig. 1.

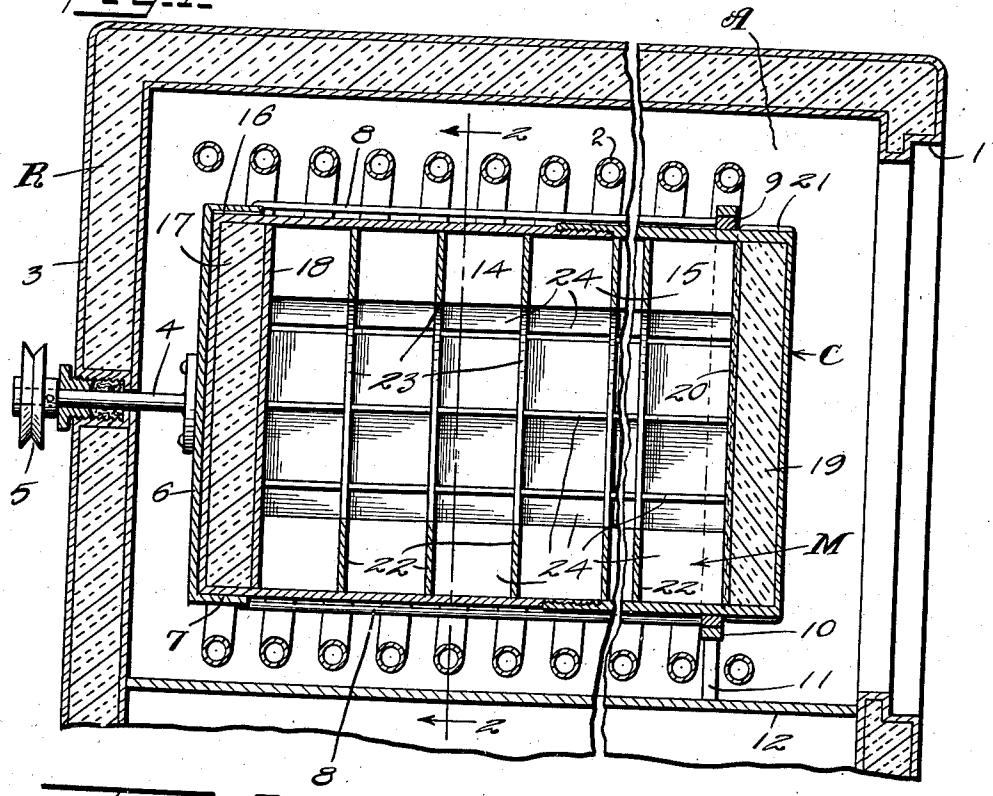


Fig. 2.

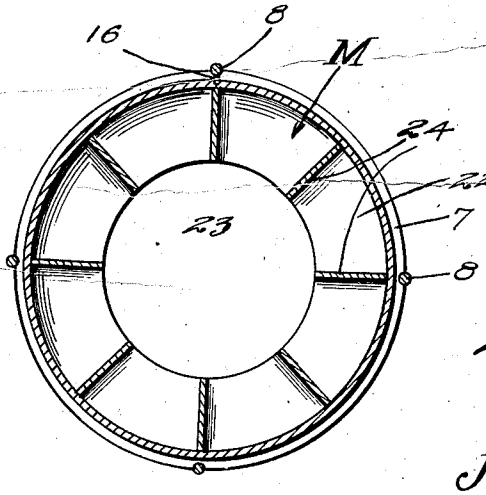
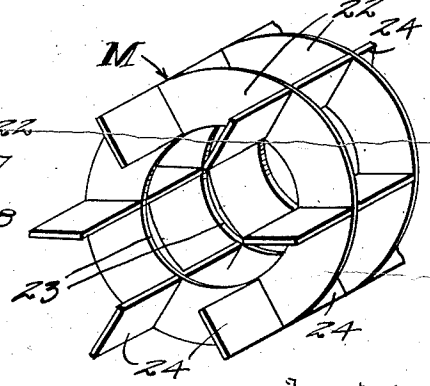


Fig. 3.



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Fig. 4.

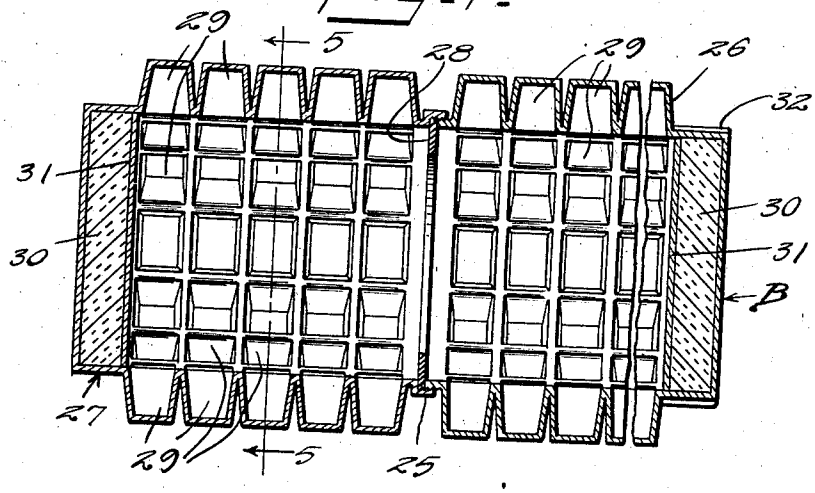


Fig. 5.

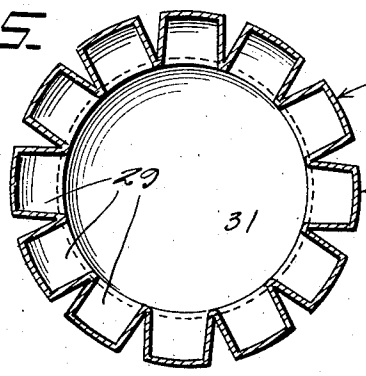


Fig. 7.

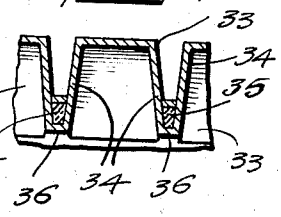
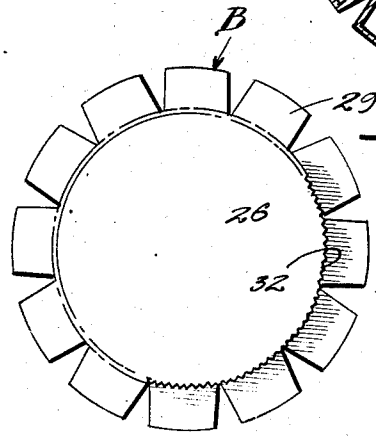


Fig. 6.



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UNITED STATES PATENT OFFICE

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ICE MANUFACTURE

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Application November 8, 1938, Serial No. 239,570

9 Claims. (Cl. 62—108.5)

This invention relates to ice manufacture, and it is primarily an object of the invention to provide means whereby ice may be frozen in a domestic mechanical refrigerator in a manner whereby the ice is free of impurities and also free of air pockets so that a pure and clear product is assured.

Another object of the invention is to provide a container to be supported for rotation within the freezing chamber of the refrigerator and adapted to be rotated during the period of freezing, such rotation serving to agitate the water initially applied within the container to free such water of impurities that may be therein and also to eliminate the forming of air pockets during the period the water is freezing.

An additional object of the invention is to provide a container to be rotated within the freezing chamber of a refrigerator and adapted to initially contain a predetermined amount of water to be frozen and wherein the container has associated therewith means whereby the water as frozen will be formed into what is known as cubed or sized ice.

Furthermore, it is an object of the invention to provide a container for holding water to be frozen and which container is adapted to be rotated within the freezing chamber of a refrigerator during the freezing operation to separate from the water any impurities therein so that the ice when frozen will be free of impurities, such agitation of the water during the freezing operation also assuring the ice to be free of air pockets and wherein the peripheral portion of the container is provided with means for forming the ice as it freezes into cubed or sized ice.

The invention consists in the details of construction and in the combination and arrangement of the several parts of our improved ice making apparatus whereby certain important advantages are attained and the device rendered simpler, less expensive and otherwise more convenient and advantageous for use, as will be hereinafter more fully set forth.

The novel features of our invention will hereinafter be definitely claimed.

In order that our invention may be the better understood, we will now proceed to describe the same with reference to the accompanying drawings, wherein:

Figure 1 is a vertical sectional view of a diagrammatic character taken through the freezing chamber of a mechanical refrigerator showing a container constructed in accordance with an embodiment of our invention mounted therein;

Figure 2 is a transverse sectional view taken substantially on the line 2—2 of Figure 1 looking in the direction of the arrow;

Figure 3 is a fragmentary view in perspective of the ice forming mold shown in Figures 1 and 2 but unapplied;

Figure 4 is a longitudinal sectional view taken through a container constructed in accordance with another embodiment of our invention;

Figure 5 is a sectional view taken substantially on the line 5—5 of Figure 4;

Figure 6 is a view in end elevation of the container as comprised in Figures 4 and 5;

Figure 7 is a detailed sectional view illustrating a further embodiment of the invention.

As illustrated in Figures 1, 2 and 3 of the drawings, A denotes the freezing chamber within a refrigerator R preferably of a domestic or household type, access within the chamber A being through the opening 1 to be closed by a conventional door. Suitably arranged within the chamber A are the refrigerant coils 2.

The wall 3 of the refrigerator shell or box opposed to the opening 1 and at substantially the axial center of the coils 2 has disposed therethrough a shaft 4. As herein disclosed, this shaft 4 is provided with suitable means, as at 5, exteriorly of the shell or box of the refrigerator to be connected with a suitable source of power whereby the shaft 4 may be rotated as and when desired. In practice this shaft 4 preferably rotates at between twenty and thirty revolutions per minute.

The inner end portion of the shaft 4 has fixed for rotation therewith a plate 6 having its marginal portion defined by a surrounding flange 7 disposed in a direction toward the opening 1. This flange 7 has suitably secured thereto, as by welding or otherwise as may be preferred, the rear end portions of the rods 8 herein disclosed as four in number and equidistantly spaced around the flange 7. These rods 8 are of a length to terminate in desired proximity to the opening 1 and said outer or forward ends of the rods 8 are secured to an annular member 9 which snugly and rotatably fits within an annular supporting member 10 herein disclosed as mounted, as at 11, upon the bottom wall 12 of the chamber A. If desired, suitable anti-friction means may be employed in connection with the members 9 and 10 but as this is an obvious expedient a detailed description and illustration thereof is thought unnecessary. The supporting member 10 is particularly desirable under those conditions

where the mounting of the shaft 4 in itself is insufficient to support the plate 6 and its load.

The plate 6 and its associated parts are adapted to hold for rotation therewith a container C in which the ice is frozen. As illustrated in Figure 1, the container C, formed of a metal which is a quick conductor of heat, is divided into what may be termed a body section 14 and a cap section 15. The cap section 15 may be applied and held to the body section 14 in any manner preferred but, as illustrated in Figure 1, the cap section 15 threads upon the body section 14. The container C is of such length as may be required as is also the internal diameter of the container. The body section 14 is also of a capacity to hold the maximum amount of water to be placed within the container C for freezing. The cap section 15 has its interior of such cubic dimensions with respect to the capacity of the body section 14 to determine the maximum thickness of the ice frozen within the container C, as will hereinafter be more particularly referred to.

The container C can be readily applied or removed and it is to be noted that the shaft 4 is so positioned with respect to the opening 1 whereby the desired placement or removal of the container C may be easily accomplished.

When water to be frozen is placed within the body section 14 the container, of course, is outside of the chamber A and is positioned on end with its open end uppermost. After this body section has been properly filled the cap section is applied and the container C is then inserted through the member 9 and caused to engage within the flange 7 so that as the shaft 4 rotates the applied container C will be caused to rotate accordingly. As indicated at 16 in Figure 1, the inserted end portion of the container C and the inner face of the flange 7 may be provided with a tongue and groove connection to assure a positive coupling of the container C to the flange 7. It is to be stated, however, that this is not at all times necessary as the rods 8 also provide an effective means to cause the applied container C to rotate with the shaft 4.

When the container C is within the chamber A it is in a horizontal position and the water will fill the lower portions of the body section 14 and the cap section 15 with the water line determined by the cubic dimensions of the cap section 15. At this time it is to be stated that the greater the cubic dimensions of this cap section 15 the thinner will be the formation of the ice and vice versa.

As the container C with the water therein rotates, say between twenty and thirty revolutions per minute, the water within the container C will be agitated and such agitation will result in any impurities within the water working toward the axial center of the container and at the same time this agitation of the water will relieve the water of air pockets so that the ice when formed will be pure and clear. As the container C rotates the ice will first congeal upon the inner face of the peripheral wall of the container from end to end and as the container rotates the ice will continue to thicken until all of the water within the container has frozen. When the freezing operation has been completed the ice will be of a tubular form and the impurities which have been worked out of the water during its agitation will be upon the inner face of the bore through the tubular ice formation and can be readily carried off by having water poured through the bore of the formed ice after it has been removed from the container C.

It is believed to be obvious that the removal of the ice is accomplished after the container C has been taken out of the freezing chamber A.

In this formation of ice it is of particular importance that the ends of the container C be effectively insulated against heat transmission therethrough and particularly against the admission of cold so that congealing of the water upon the end faces of the container C is substantially eliminated.

In the present embodiment of our invention the closed end portion of the body section 14 is provided therein with a layer 17 of suitable heat insulating material, such as asbestos although we do not wish to be understood as limiting ourselves to this particular material. This insulating lamination 17 has preferably disposed over its inner face a plate 18 preferably of a metal similar to the metal from which the walls of the sections 14 and 15 are formed.

The closed end of the cap section 15 also has provided thereover a lamination 19 of suitable heat insulating material, such as asbestos or as otherwise may be preferred, and disposed over the inner face of this lamination 19 is a plate 20 also preferably of a metal similar to that from which the cap section 15 is formed.

From the operation of the device as just described a single tubular block of ice is formed within the container C and in order that the cap section 15 may be removed after the freezing operation, the outer or closed end portion of said cap section 15 is provided circumferentially thereabout with the relatively short gripping flanges 21. It is believed to be obvious that in lieu of these flanges 21 other suitable means may be employed for the same purpose.

It is also particularly desirable that the ice produced within the container C be in the nature of cubed or sized ice and for this purpose we provide a mold M. This mold M, as herein disclosed, comprises a series of annular plates 22 of a maximum diameter substantially equal to the internal diameter of the container C. These plates 22 each define a central opening 23 of relatively large diameter. The annular plates 22 are spaced apart as desired in a direction lengthwise of the container C and coacting and interlocking with these annular plates 22 are a series of longitudinally disposed strip plates 24 of a length substantially equal to the distance between the plates 18 and 20 when the sections 14 and 15 are assembled. These strip plates 24 are of any desired number and are preferably equidistantly spaced in a direction circumferentially of the annular plates 22. These plates 22 and 24 coact with each other and with the plates 18 and 20 to provide a plurality of mold pockets in which the water is frozen when the mold M is applied within the container C and during the rotation of said container. The cubic capacity of the body section 14 of the container C is preferably slightly less than the combined capacity of the pockets of the mold M so that when the body section 14 is filled with water, it is assured that the amount of such water is not excessive but is of a quantity sufficient to provide for the forming of the ice within all of the pockets of the mold.

In practice, it is preferred that the width of each of the strip plates 24 and also the width of each of the plates 22 between its outer and inner margins be equal to approximately one-

third of the diameter of the central openings defined by the members 23. This relative proportion is of advantage as it assures the free flowing of the water during the rotation of the container within the freezing chamber A as said container rotates. This results in the desired agitation of the water as it is being frozen to assure the elimination therefrom of all impurities and to eliminate the forming of air pockets within the ice.

After the container C with the frozen cubed or sized ice therein has been taken out of the refrigerating chamber A, the cap section 15 is separated from the body section 14 of the container and the mold M with the formed ice therein removed. Water can then be poured on the mold M not only to release the formed ice from the walls of the pockets of the mold but to pass through the central portion of the mold to carry out the impurities which have been separated from the water during the freezing operation.

It is to be noted that in the freezing of the water within the container C with the mold M therein there is substantially produced a tubular block of ice as has hereinbefore been stated with respect to the operation of the container C without using the mold.

It is also believed to be obvious that after the ice, particularly when in cubed or sized form, has been removed from the mold, said pieces of ice can be placed back into the container C to be preserved.

In the embodiment of our invention as illustrated in Figures 4, 5 and 6 of the drawings, the container B is of desired dimensions and formed of a preferred metal or material which permits the ready transmission of heat therethrough. This container B also comprises two sections detachably connecting one with the other, as at 25. As illustrated in Figure 4, the end portion of the outer or cap section 26 threads within the body section 27 and in a manner whereby is effectively held an annular member or washer 28. This member or washer 28 extend inwardly of the assembled container B for a purpose to be later explained.

The peripheral wall of both the sections 26 and 27 is formed to provide the outstanding mold pockets 29, the adjacent walls of which are spaced apart as illustrated in Figures 4 and 5 to assure effective transmission during the freezing operation and as the container B is being rotated within the refrigerating chamber A. The closed end portion of the section 27 is operatively engaged with the shaft 4 in substantially the same manner as has hereinbefore been stated with respect to the first embodiment of our invention except, of course, the connecting rods as shown in this form of invention will have to be arranged to properly coact with the outstanding mold pockets 29. This, however, is not considered to be a particular feature of the invention as the manner in which the container B is supported and rotated is of no especial importance.

The closed ends of each of the sections 26 and 27 have also disposed thereover the insulating laminations 30 of suitable material with the inner faces of each of such laminations being covered by a metallic plate 31.

In this embodiment of our invention the capacity of the body section 27 is such that when it is substantially completely filled with water, such water content will be sufficient to substantially fill all of the pockets 29 in both the body section 27 and the cap section 26.

The container B, just the same as the container C when in working position within the refrigerating chamber A, is horizontally disposed and as the container B rotates the water therein will be agitated to purify and clarify the same as has been previously explained in connection with the first embodiment of our invention. As this container B rotates the water will be dropped down from one mold pocket 29 to another therebelow and during which time such water will first congeal upon the walls of the mold pockets 29 and this freezing operation will continue until the mold pockets 29 are properly filled with ice.

It is to be noted that the opposed walls of the pockets 29 diverge inwardly. This, of course, is to facilitate the removal of the ice from within the molds after the container B has been applied, said cubed or sized ice when removed from the mold pockets will drop within either the body section 27 or the cap section 26 after, of course, the cap section 26 has been removed. It is possible, however, to effect the desired release of the formed ice within the molds 29 while the sections 26 and 27 of the container B are still in connected assembly. It is preferred, however, that such release of the ice be effected after the cap section 26 has been removed as this will permit the application of water within both of the sections 26 and 27 before releasing the cubed or sized ice so that the impurities which may be on the inner exposed faces of the ice can be removed.

Should the container B be retained within the refrigerating chamber A after the freezing of the water within the container B has been completed, and if for any reason the temperature within the refrigerating chamber should rise, the ice formed within each of the pockets 29 can readily fall within the central or body portion proper of the container B. The particular advantage of this is that when the refrigerating action again starts the water as it again freezes will not injure the container B as a result of the expansion of the water in freezing.

The outer end portion of the cap section 26 circumferentially therearound is knurled or otherwise roughened, as at 32, to facilitate the separation of the cap section 26 from the body section 27.

It is to be stated that with the use of the invention as hereinbefore described pure and clear ice cannot be expected until after all of the water as applied within the container has been frozen. It is also to be understood that pure and clear ice cannot be expected should the rotation of the container be stopped before completion of the freezing operation.

In this form of the invention it is important to provide the washer or flange 28 as it serves effectually to prevent the water during the rotation of the container B to congeal at that portion of the inner face of the container B at the connecting end portions of the sections 26 and 27. This is due to the fact that this washer or flange 28 is of rubber or similar substance on which ice will not adhere. It is, therefore, believed to be apparent that the particular purpose of this washer or flange 28 is to provide means to assure the ready separation of the cap section 26 from the body section 27 after completion of a freezing operation.

Also under certain conditions we find it of advantage to provide means to resist the refrigerating action at the inner open faces of the

pockets such as comprised in the second embodiment of our invention. As illustrated in Figure 7, the pockets 33 are substantially the same as the pockets 29 hereinbefore referred to and it is to be noted that between adjacent side walls 34 of these pockets immediately adjacent to the inner open faces of such pockets we provide suitable heat insulation 35 of asbestos or otherwise as may be preferred. This insulation is of particular importance as it substantially eliminates the formation of ice upon the inner face of the peripheral wall 36 of the container between adjacent pockets 33 so that no undue hinderance or obstruction will be offered to the desired release of the ice molded within the pockets 33.

From the foregoing description it is thought to be obvious that an ice making apparatus constructed in accordance with our invention is particularly well adapted for use by reason of the convenience and facility with which it may be assembled and operated, and it will also be obvious that our invention is susceptible of some change and modification without departing from the principles and spirit thereof and for this reason we do not wish to be understood as limiting ourselves to the precise arrangement and formation of the several parts herein shown in carrying out our invention in practice except as hereinafter claimed.

We claim:

1. In combination with the freezing chamber of a refrigerator having a door opening in a wall thereof, a container, means for rotatably supporting the container within the freezing chamber in a position to be reached and removed through the door opening, and means for insulating the ends of the container to eliminate congealing from within to the ends of the container.

2. In combination with the freezing chamber of a refrigerator, a container, means for removably supporting the container within the chamber and for rotating the container, said container comprising separable sections in connection one to the other, one of said sections constituting a measure to determine the maximum amount of liquid to be placed within the container.

3. In combination with the freezing chamber of a refrigerator having a door opening in a wall thereof, a container for the liquid to be frozen, means for removably supporting the container within the freezing chamber in a position to be reached and removed through the door opening, said container being so constructed and arranged to provide molding pockets therearound and therealong at the peripheral portion of the container, said mold pockets being materially spaced from the axial center about which the container rotates.

4. In combination with the freezing chamber of a refrigerator, a container for the liquid to be frozen, means for removably and rotatably supporting the container within the freezing chamber, said container being divided transversely into two separate sections, means for maintaining said sections in assembly, said container in its peripheral portion being provided with mold pockets, one of said sections of the container serving as a measure for the liquid to be placed within the container, the capacity of said section not exceeding the combined capacity of the pockets.

5. In combination with the freezing chamber of a refrigerator having a door opening in a wall thereof, a container for a liquid to be frozen, means for removably and rotatably mounting the container within the freezing chamber for rotation about substantially a horizontal axis, said means also supporting the container in a position to be reached and removed through the door opening, and mold pockets extending along and around the container at the peripheral portion thereof and materially spaced from the axial center of the container, said mold pockets being entirely within the container.

6. In combination with the freezing chamber of a refrigerator having a door opening in a wall thereof, a container for a liquid to be frozen, means for removably and rotatably supporting said container within the chamber for rotation about substantially a horizontal axis, said means also supporting the container in a position to be reached and removed through the door opening, the peripheral wall of the container being formed to provide outstanding mold pockets opening inwardly of the container.

7. In combination with the freezing chamber of a refrigerator, a container for a liquid to be frozen, means for removably and rotatably supporting said container within the chamber for rotation about substantially a horizontal axis, the peripheral wall of the container being formed to provide outstanding mold pockets opening inwardly of the container, the walls of adjacent mold pockets being separate, and means for heat insulating the portions of the walls of the pockets immediately adjacent to their open faces.

8. The combination with a container for a liquid to be frozen within the freezing chamber of a refrigerator while the container is in rotation about a substantially horizontal axis, said container having one end open and a cap for closing said open end; of a mold removably and snugly fitting within the container, said mold comprising a plurality of annular plates and longitudinally disposed strip plates coacting with the annular plates for holding the annular plates in desired spaced relation, the outer edges of the annular plates and the strip plates having close contact with the peripheral wall of the container and the inner marginal portions of said plates being materially spaced from the axial center of the container, the annular plates and strip plates coacting to provide mold pockets.

9. A container for a liquid to be frozen within the freezing chamber of a refrigerator while the container is rotating about substantially a horizontal axis, said container comprising a peripheral wall and end walls, the peripheral wall at points therealong and therearound having portions pressed outwardly to form mold pockets, adjacent pockets being spaced apart, and heat insulating means surrounding each of said pockets immediately adjacent to the peripheral wall of the container.

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