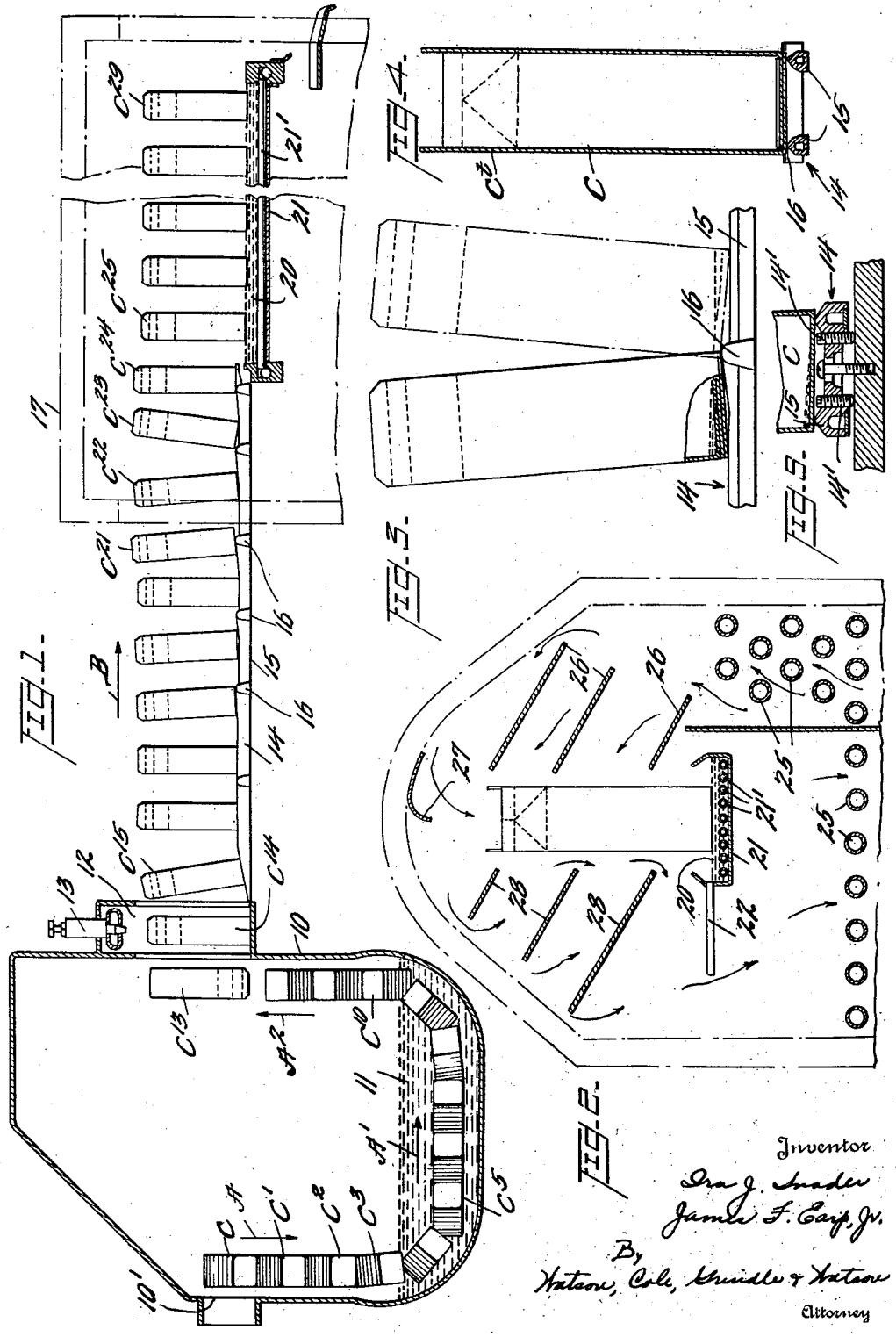
May 12, 1942. I. J. SNADER ET AL 2,282,898

METHOD OF COATING CONTAINERS

Filed April 1, 1939



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Patented May 12, 1942

2,282,898

UNITED STATES PATENT OFFICE

2,282,898

METHOD OF COATING CONTAINERS

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Application April 1, 1939, Serial No. 265,522

9 Claims. (Cl. 117—95)

The present invention relates to methods of coating containers, more particularly to methods of coating containers which have been fabricated of paper and are designed for use in the packaging of perishable products, especially milk and other food products which must of necessity be placed in sterile containers and maintained in sterile condition until consumed.

The storage of liquids in containers fabricated of paper is rendered difficult by reason of the absorbent nature of the fiber of which the paper is made, paper readily absorbing liquids when brought into contact therewith and becoming very weak when wet. It is therefore necessary to apply to the surfaces of a paper container to be used in the packaging of a liquid some coating substance which in and of itself is impervious to liquid, or repels liquids, in order that the paper fibers of the container may not become wet. It will be appreciated likewise that paper containers made use of in the packaging and distribution of liquids should be of the self-supporting type and comparatively rigid, since the pressure of the liquid within the container is considerable even when the container is at rest, and the danger of failure is of course increased when the container is handled or transported. Numerous materials may be employed as coating substances for the walls of paper containers but that material which has been most widely used comprises a paraffin or a paraffin containing substance which not only resists penetration of liquid when deposited as a layer over the surface of a paper sheet but also imparts increased stiffness to such sheet, thus increasing the ability of a container or the like, which comprises a plurality of such paper sheets or panels, all coated, to maintain its shape during handling or transportation, despite the internal pressure of the liquid and externally applied blows or shocks incident to handling.

While the present invention contemplates a novel method of coating paper containers of all forms and shapes with liquid coating compositions which are liquid at elevated temperatures and solid at room temperatures, it relates particularly to a method of coating containers which are of tubular form and substantially completed save for the final closure of one end, which end is only closed after the container has been charged with the substance to be dispensed. Broadly speaking, the process comprises immersing the container in a bath of the molten coating material, withdrawing the container from the bath and draining off excess coating material while the container is maintained in a heated atmosphere, erecting the container and introducing into its interior any additional small measured quantity of coating material which may be necessary to insure full coverage of its bottom with such material, and subsequently chilling the coating material to effect its hardening. Coating of the containers in a nearly completed stage of fabrication is advantageous in that the container need be subjected to but few further operations which tend to disturb the coating already applied.

Practically all containers fabricated of paper include certain portions of greater thickness than other portions. Ordinarily the bottom of a container of the tubular type comprises several plies or thicknesses of paper secured together by an adhesive whereas the side walls and top are of lighter construction. That portion of the container which is of greatest thickness tends to absorb more coating material than those portions of less thickness and likewise is slower to cool after its temperature has been raised by immersion in a molten bath of coating material. In accordance with the present invention the aforementioned characteristics of the paper container are given full consideration and, after the container has been immersed, drained in a heated atmosphere, and erected, the heavier bottom of the container is covered with an additional amount of coating material. Not only is this precaution taken to ensure that an ample supply of the coating material covers the bottom of the freshly coated container, where of course leakage is most likely to subsequently occur, but the cooling of the container is so effected that practically all portions thereof are cooled simultaneously. This involves the withdrawal of a larger number of heat units from the relatively heavy (and heavily coated) bottom of the container in a given period than from the relatively thin top or tubular body of the container. This is accomplished by subjecting that portion of the container which tends to retain heat longest to the action of a cooling medium of higher heat conductivity than that portion of the container, or those portions, which are of lighter section.

For instance in the case of a tubular container with a multi-ply bottom, the heavier bottom portion of the freshly coated container is immersed in a liquid bath cooled to low temperature whereas the thinner portions of the container wall are adequately cooled, and the coating material thereon hardened, by the simple application thereto of a current of cooled air or other gas. It is highly advantageous to cool all portions of

a freshly coated container in this manner when the coating operation described is carried out upon a complete automatic machine for the fabrication, coating, charging and sealing of paper containers, since time spent in effecting the cooling operation is minimized and the maximum speed of operation of the machine as a whole realized.

The improved method will be hereinafter more fully described and in the accompanying drawing, various instrumentalities for carrying out the several steps of the method are illustrated diagrammatically.

In the drawing:

Figure 1 is a view showing diagrammatically a portion of a mechanism by the aid of which the immersion, draining and cooling of paper containers in accordance with the improved method, may be accomplished;

Figure 2 diagrammatically illustrates a means for directing cooled air or other gas over certain of the wall surfaces of a freshly coated container;

Figure 3 is a fragmentary view showing portion of a means employed to effect rocking movement of a container to cause the small body of coating material resting upon the upper surface of its bottom to flow back and forth to effect proper distribution thereof;

Figure 4 is a vertical axial section through a paper container of a type particularly well adapted to be coated by the improved coating process, and

Figure 5 shows the bottom portion of a container which has been laterally tilted.

The container C, shown in section in Figure 4, is square in horizontal section, having four side walls of similar area and shape each comprising a single ply or thickness of paper. The bottom comprises three plies of paper of the same thickness and the foldable top C^t of the container is shown to be open. The paper employed is preferably relatively light in weight but strong in texture and the resulting container is rigid and self-supporting so long as its walls remain dry. In order to prevent wetting and weakening of the container walls, the improved method which comprises the subject matter of the present application has been provided.

First the container is covered with the coating material selected. Application of the coating material to the walls of the container may be effected in various ways but this is preferably accomplished by immersion since by immersing the container in a bath of the selected coating material in molten form, all areas of the same, both exterior and interior surfaces, are brought into full contact with the coating material. In Figure 1 of the drawing there is indicated at **10** a chamber for coating material and at **11** a bath of coating material, for instance a paraffin containing material, in the bottom of this chamber. It will be understood that suitable heating devices are utilized to maintain the bath of molten material in molten condition and to maintain the atmosphere in the chamber **10** above the surface of the bath at a relatively high temperature so as to prevent solidification of the molten material upon any container so long as the container remains in the chamber.

A plurality of containers are indicated at C, C', C^2, etc., and these containers are intermittently or continuously advanced along a predetermined path in the direction indicated by the arrows A, A' and A^2, each container being introduced into the chamber **10** through an aperture in its side wall such as indicated at **10'**, passing downwardly bottom end foremost, but with its major axis at an inclination to the vertical, entering the bath bottom end foremost, but still inclined, passing through the bath as shown, issuing from the bath bottom end uppermost so as to permit the coating material within the container to drain and finally reaching some position such as indicated at C^{13}, being at this point ready for removal from the chamber, all surfaces having been coated but the excess coating liquid having been drained therefrom during its upward movement from the surface of the bath to position C^{13}. The mechanism employed for moving the containers through the bath and effecting draining thereof may vary as desired but we preferably make use of a mechanism such as that disclosed in our copending application, Serial 172,025.

Thereafter the container is inverted, i. e., placed bottom end down by a mechanism such as that likewise disclosed in our copending application, the container coming to rest within a heated chamber **12** closely adjacent the chamber **10**. At this point one or more drops of molten coating material may be introduced into the open upper end of the container in order to ensure that the upper surface of the container bottom is fully and adequately coated. As has previously been pointed out, the relatively thick bottom of the container tends to absorb more coating material than the side walls and it is obvious that there is a greater tendency for the container to leak around its lower end than elsewhere, due to the heavier pressure of the liquid there. Hence a measured amount of coating material in molten form is directed into each successive container reaching the position C^{14} by a heated nozzle or spray device **13** of any suitable form, positioned immediately above the container. The means for operating the nozzle **13** may vary widely and comprises no part of the present invention. The coating material supplied, however, is preferably withdrawn from the bath **11** within the chamber **10** and forced upwardly to the jet device **13** by a suitable pump.

After the introduction of a measured amount of additional coating material into a container occupying position C^{14} the container is pushed from the chamber **12** by a pusher (not illustrated) onto a steam heated trackway **14** and at this point is loosely engaged by a conveying device (not illustrated) to be advanced along the trackway from left to right (Figure 1). The trackway is illustrated in section in Figure 4. Its details need not be described inasmuch as they are fully illustrated and described in our copending application Serial 172,025. It is only necessary here to say that steam is circulated through the hollow interiors of the two side rails **15** of the trackway so that these side rails are maintained in heated condition and prevent cooling of the bottoms of containers which are dragged along the trackway.

The side rails **15** of the trackway are connected at spaced points by cross members **16** and the rounded upper surfaces of the cross members project above the upper edges of the side rails **15**, as indicated in Figure 3, so that containers passing along the trackway in the direction of the arrow B (Figure 1) will rock as their bottoms pass over the several cross members. This rocking movement of each container causes the molten coating material which lies upon its bottom to flow rearwardly and forwardly across such

bottom, as indicated in Figure 3, to ensure that no portion of the container bottom fails to be subjected to contact with an adequate supply of coating material. Ultimately each successive container reaches a position C^{21}, just without a housing diagrammatically indicated at 17. In the next operation of the conveyor it is brought within the housing and in Figure 1 of the drawing the containers indicated at C^{22}, C^{23} and on up to C^{29} are all within the housing 17.

Within this housing the cooling of the container is effected and when the container is ultimately discharged from the housing it is quite cool, the coating material has entirely set, and the container is ready for charging. The heated trackway projects within the housing 16 for a certain distance, the containers in positions C^{22}, C^{23} and C^{24} still resting upon the heated trackway. The container C^{25}, however, has passed over the end of the heated trackway and dropped into a bath 20 of liquid, for instance water, which has been cooled to a very low temperature, in the case of water almost to the point of freezing. In the usual case the empty paper container will be sufficiently buoyant to actually float on the bath 20 and will remain floating thereon until its removal from the bath by the action of the conveyor. The container occupying position C^{29} has been moved the entire length of the bath 20 and the next operation of the conveyor will effect its removal therefrom. The bath 20 is a relatively shallow body of fluid which is contained within a horizontally extending pan 21 supplied by means of a duct 22 with liquid at low temperature to replace that which passes off with the containers. Ducts for refrigerant are indicated at 21'.

During the entire time that the containers are within the housing 17 the upper portions thereof are subjected to the action of cool gaseous currents, for instance currents of cooled air, and in Figure 2 of the drawing the means for circulating these cooled gaseous currents is diagrammatically illustrated. It will be perceived that a battery of tubes 25 are positioned within the housing 16 below the path of the containers. A fan, blower, or other air pumping mechanism, not illustrated, causes air to circulate through this battery of refrigerant containing tubes and to be thereby cooled, the upwardly flowing volumes of air being inwardly directed by vanes, such as indicated at 26, toward the vertically disposed side walls of the line of containers passing through the housing, portion of the air flowing over the uppermost vane 26 and striking a downwardly curved vane 27 by means of which a current of air will be caused to enter each container and to cool its interior. Vanes 28 direct cool air currents downwardly and inwardly against the opposite faces of the containers, and finally the entire stream or air current is drawn downwardly to a fan or pump, to be recirculated, small volumes of air being drawn into the casing 17 to replace any which escapes through its container inlet and discharge apertures.

The specific means for causing currents of air to flow, first over cooling means, and then over all inner and outer surfaces of the side walls of the containers, may be widely varied, and likewise the details of the means employed for cooling the container bottoms by the use of cooled liquids. In every instance, however, means will be employed the purpose of which will be to effect cooling of different portions of the container by the utilization of fluids of different heat conducting capacities. The most common fluids which may be used are, of course, air and water. Any other suitable gases and liquids may be employed, however, within the import of the invention.

It is sometimes considered desirable to cause the containers, as they pass along the trackway 14 toward the cooler 17, to rock laterally of the trackway as well as longitudinally thereof, to effect a better distribution of the molten coating material over bottoms thereof. This is easily effected by tilting the trackway laterally, as shown in Figure 5, at one or more points along its length. The trackway is flexible and may be distorted by means of set screws such as indicated at 16' to cause the containers to rock laterally first in one direction and then in the opposite direction. By thus laterally and longitudinally tilting each container just after it has received its added charge of coating material, such material will be efficiently distributed over the container bottom. After entering the cooling chamber 17 the containers are not rocked laterally, but longitudinally of the trackway only.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. The method of coating containers with a substance which is liquid at elevated temperatures and solid at ordinary temperatures, which comprises applying such substance in liquid form to the surfaces of a container in such manner that the coating layer is of different thicknesses over different areas of such surface, and cooling the coated container by subjecting the same to the action of a plurality of fluid cooling media of different heat conducting capacities, the areas of greater coating thickness being brought into heat exchanging relationship with the cooling medium of greater heat conducting capacity and the areas of lesser coating thickness being brought into heat exchanging relationship only with the cooling medium of lesser heat conducting capacity.

2. The method of coating paper containers having portions of unequal thickness with a coating substance which is liquid at elevated temperatures and solid at ordinary temperatures, comprising applying such substance in liquid form to the surfaces of the container, and cooling the coated container by subjecting the same to the action of a plurality of fluid cooling media of different heat conducting capacities, the container portions of lesser thickness being brought into heat exchanging relationship solely with the cooling medium of lesser heat conducting capacity.

3. The method of coating containers with a substance which is liquid at elevated temperatures and solid at ordinary temperatures, which comprises applying such substance in liquid form to the surfaces of a container in such manner that the coating layer is of different thicknesses over different areas of such surface, and cooling the more heavily coated portion of the container by subjecting the same to the action of a liquid cooling medium and subjecting, at the same time, the more lightly coated areas to the action of a gaseous cooling medium.

4. The method of coating paper containers having portions of unequal thickness with a coating substance which is liquid at elevated temperatures and solid at ordinary temperatures, comprising applying such substance in liquid form to the surfaces of the container, and cooling the

coated container by subjecting the thicker portions of the same to the action of a liquid cooling medium and a gaseous cooling medium, and the lighter portions solely to the action of a gaseous cooling medium.

5. The method of coating a paper container having a closed end or bottom, and an open end, which comprises immersing the container in a bath of molten material which solidifies upon cooling, withdrawing and draining the same, disposing the container with its open end uppermost and, while the coating remains fluid, introducing a supplementary measured body of liquid coating material into the interior thereof.

6. The method of coating a paper container having a flat closed end or bottom and an open end, which comprises dipping the container in a bath of molten material which solidifies upon cooling, draining the same, disposing the container with its open end uppermost, introducing a supplementary body of liquid coating material into the interior of the container while the previously applied coating remains liquid, and rocking the container to distribute the coating material over the bottom thereof.

7. The method set forth in claim 6 in which heat is applied to the container bottom while the container is rocked and the container is dropped bottom end foremost into a cooling liquid immediately after being rocked in the manner described.

8. The method set forth in claim 6 in which the container is rocked about two horizontal axes which are angularly disposed to each other.

9. The method set forth in claim 6 in which the container is rocked while heat is imparted to the container bottom to prevent premature solidification of the coating material.

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