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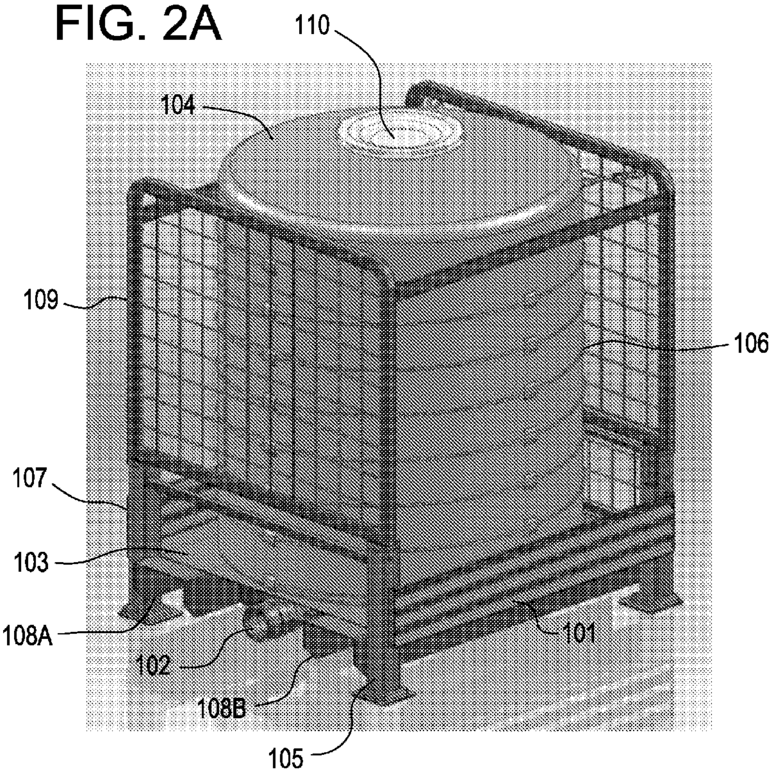
(54) Title: PROCESSES FOR FILLING, TRANSPORTING AND DELIVERING OF A VISCOUS FLUID AND USE OF A COATING COMPOSITION

FIG. 2A



(57) Abstract: A process and system to transport viscous fluids including fluids with a Laray viscosity of at least 50, the process and system involving the use of a light weight, collapsible container that may optionally be stackable when in the collapsed state.

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PROCESSES FOR FILLING, TRANSPORTING AND DELIVERING OF A VISCOUS FLUID AND USE OF A COATING COMPOSITION

[0001] This application claims the benefit of United States Provisional Patent Application No. 61/366,601 filed on July 22, 2010, which is hereby incorporated by reference for all purposes as if fully set forth herein.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to a system and process to transport highly viscous fluids.

Discussion of the Related Art

[0003] Printing inks, coatings, paints, and other viscous liquids are often shipped from the manufacturer to the user in large volume steel portable tanks, drums or other containers. Upon receipt by the user, the drums or other containers are connected to the user's equipment which applies the viscous liquid, such as a printing press or coater, or are transferred to the user's storage facilities, and the steel portable tank, drum or container is returned to the manufacturer for reuse.

[0004] A major problem with such viscous liquids, including liquids having a Laray viscosity of at least about 50, many of which are thixotropic, is that they often do not efficiently transfer from the shipping container even if some type of pressure device exerts pressure on the liquid in order assist the exit from the shipping container. The liquid may not flow out of the container at a reasonable rate of speed and/or a quantity of the viscous fluid may remain in the shipping container despite the actions taken to completely empty that container. This results in the user not being able to efficiently use all of the viscous liquid which it has received. It also adds weight to the container being returned to the manufacturer and thereby increasing costs, and hampers reuse of the containers by the manufacturer as the residual liquid must be eliminated before the container can be used for a different liquid.

[0005] In addition to the above problems, the use of metal portable tanks adds additional costs to the shipping process in three areas.

[0006] First, the shipping cost of outbound freight is weight based and limited to over the ground maximum weights. The weight per unit volume of metal in a conventional metal portable tank is much greater than that of the viscous liquid. Since the weight of each tank when filled with the viscous liquid is about 3,725 pounds (about 1,693 kg), the weight of the heavy metal of which the tank is constructed reduces the amount of ink that can be shipped in that tank.

[0007] Second, when these metal portable tank containers are being returned to the manufacturer, the number of containers is limited by space that can fit in a typical box trailer, and adds to the cost.

[0008] Third, the cost to maintain these metal portable tank containers is high due to painting, site gauges and moving parts.

[0009] To address some of these problems various types of collapsible containers have been designed. For example, US Patent No. 4,149,755 describes fluidizable material handling apparatus. Specifically, the apparatus is specifically designed for transferring powder like material that may be fluidized at the outlet by the introduction of pressurized air. The fluidized powder is then removed from the container.

[0010] Another example is provided in US Patent No. 5,660,478 which describes another system for carrying powder or similarly fluidizable material. Similar to the apparatus disclosed in US Patent No. 4,149,755, the apparatus includes a bag of flexible material that a rigid base.

[0011] Yet another example is US Patent No. 6,135,287 which describes a collapsible container for transport and storage of fluid and other particulate bulk goods. The container described generally includes a collapsible rigid shell. The container may also be equipped with an inner liner or bag. The device is disclosed for use with powder material as well as fluids. However, the device is not disclosed to work with highly viscous fluids.

[0012] While these prior art references provide some advantages to transporting bulk quantities of product they are not designed to work with highly viscous fluids. For example, the prior art references do not disclose that the containers described therein can be used with fluids having a Laray viscosity of at least 50. Fluid having high viscosity would create excessive residual volume in these types of containers and thus would not be an effective way to transport them. The residual volume may be caused by different reasons, for example no application of heat, or inability to apply pressure to the fluid. In fact, many of these prior art container, as those described above, are not designed to maintain pressure or even be pressurized to induce the fluid outflow. Thus, the prior art containers cannot effectively be employed for the transportation of viscous fluids including fluids with a Laray viscosity of at least 50. Accordingly, there still is a need for a system and method of transporting highly viscous fluids, such as printing inks and other liquids.

SUMMARY OF THE INVENTION

[0013] Accordingly, the present invention is directed to a system and process to transport highly viscous fluids that substantially obviate one or more of the problems due to limitations and disadvantages of the related art.

[0014] An advantage of the present invention is to provide a system for the transfer of highly viscous fluids using a collapsible container.

[0015] Another advantage of the present invention is to provide a process for transferring highly viscous fluids, which results in cost savings during the transport of empty containers.

[0016] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0017] To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described a process of delivering a viscous fluid from a collapsible container with a rigid base frame and a flexible fluid holding portion comprising the steps of removing fluid having a Laray viscosity of at least 50 at room temperature from the flexible fluid holding portion of a collapsible container; and collapsing the flexible fluid holding portion as the fluid is removed.

[0018] In another aspect of the present invention, a process of inputting a viscous fluid into a collapsible container, the collapsible container including a rigid frame and a flexible fluid holding portion, comprising the steps of moving the rigid frame to an open position; inputting the fluid having a Laray viscosity of at least 50 at room temperature into the container through a bottom portion of the flexible fluid holding portion; allowing the flexible fluid holding portion to expand as the fluid is inserted.

[0019] In a further aspect of the present invention, a system of transporting a viscous fluid using a collapsible container comprising emptying a fluid having a Laray viscosity of at least 50 at room temperature from a collapsible container; collapsing the collapsible container; and stacking the collapsed container over other similarly collapsed containers.

[0020] In yet another aspect of the present invention, a process of using a coating composition delivered using a process described above.

[0021] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

[0023] In the drawings:

[0024] FIG. 1 is a diagram of an exemplary embodiment.

[0025] FIGS. 2A-2L illustrate an exemplary embodiment of a collapsible container for the transfer of a high viscosity fluids and its operation.

[0026] FIG. 3 provides an alternative embodiment of a collapsible container for the transport of highly viscous fluids.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

[0027] Reference will now be made in detail to an embodiment of the present invention, example of which is illustrated in the accompanying drawings.

[0028] A way to ameliorate the difficulties just described and reducing cost involves introducing the viscous liquid into a container constructed of flexible light weight material which is adapted to collapse when empty and allows for the viscous fluid to outflow at an acceptable rate. In an exemplary embodiment, the discharge flow rate of the viscous fluid may be 2 to 5 GPM. Also, the filling rate of the container should not be viewed as limiting.

In an exemplary embodiment the filling rate may be as high as 50 GPM or 400lbs/min. The container may also contain or be adapted to receive heating and/or pressure. The heat acts to reduce the viscosity of the liquid and thereby facilitate its exit from the container. Pressure would also help induce evacuation of the viscous fluid from the container. Furthermore, the ability to collapse the container when empty would permit more efficient storage of the container when not in use and/or return of the container from the user to the manufacturer.

[0029] The nature of the viscous fluid is not particularly limited and the system can be used in connection with any liquid or paste including any liquid or paste which has a Laray viscosity of at least about 50 at ambient room temperature. The viscosity of the liquid may be determined using a Laray viscometer. For example, the viscosity of a liquid may be measured using a Laray viscometer, a Laray Timer TMI 92-15 (0.00 second resolution), a temperature probe capable of measuring in 0.5° C increments, a Laray computer program, a water bath maintained at 25 ± 1.0 C, approximately 2 to 3.5 grams of sample fluid or liquid and a spatula. Initially, the instruments should be checked for cleanliness and overall proper condition. The Laray viscometer should be leveled. The temperature should also be checked and the instrument should be controlled at 25 ± 1 C, a draft controlled cabinet can be used. The Laray Rod may be wetted using the spatula to spatulate the sample on the bench without overworking the sample. The liquid sample is preferably deposited uniformly around the Laray rod. Consistency in this initial step for testing different samples is likely to result in more consistent data. The Laray rod may then be dropped into the fluid sample using force sufficient to equal a drop time of approximately one second.

[0030] A standard Laray test may be accomplished using the drop sequences listed in table I.

TABLE I

1st Drop	1.00-1.15 seconds
2nd Drop	1.85-2.15 seconds
3rd Drop	2.85-3.15 seconds
4th Drop	3.85-4.10 seconds
5th Drop	4.80-5.00 seconds

[0031] It should be understood that a weight capable of dropping the rod within the specified time range may be selected and adjusted as appropriate for each drop sequence listed in Table I. It is generally preferable to avoid or minimize multiple drops for each time range. The weight, in Kilograms, and the time, in seconds, should be recorded along with the collar temperature in degrees Centigrade. The recorded test data may then be uploaded to the Laray program that can calculate the viscosity, yield value, and shortness ration.

[0032] The results may be recorded from these calculations. For the purposes of these measurements, the viscosity at 2500 sec- 1 Shear Rate is defined as the ability of the sample fluid to resist deformation or flow and is measured in poise (1 poise = 0.1 Pascal second). The yield value at 2.5 sec-2 Shear Rate is the hypothetical force required to initiate flow and is measured in dynes/cm^2. Finally, the Shortness Ration is the ratio of yield value to viscosity.

[0033] An alternative to the standard Laray test may be Vertis Laray method. The Vertis Laray method would involve preparing a sample and placing the sample on the Laray rod as described above. A 700g weight is then placed on the rod before it is dropped. The rod is then pulled back so that the sample may be redistributed around the collar and the rod. The rod is then dropped two consecutive times with the 700g weight while recording the time. The drop-times are preferably within ± 0.1 second of each other. The average of the drop times is set as the initial time. The rod may then be dropped three more times once with a 500g weight, once with a 300g weight, and once with a 100g weight. The time should be recorded for each drop. The collar temperature should also be recorded in degree Centigrade. The recorded data is then uploaded into the Laray program which can then calculate the viscosity, yield value, and shortness ratio as defined above.

[0034] The system and process to transport the highly viscous fluids should not be viewed as limited to a specific highly viscous fluid. One exemplary liquid that may be delivered by the described system and method may be a printing ink, the composition of which is also not restricted and may be any known ink composition. For example, the printing ink may be a thixotropic printing ink. Alternatively, the liquid may be a coating liquid, paint or the like substance. Further, other highly viscous liquids, including liquids with a Laray viscosity of at least 50 at room temperature (i.e. 25 C), may be transported with the system of method described herein.

[0035] In one embodiment, the viscous liquid may be introduced into a shipping container which may include an outlet. The container may be a collapsible container, i.e. a container that may be collapsed either partially or fully once the fluid is evacuated. In other words the container may be partially collapsed when any portion of the fluid is removed. The container may also be fully collapsed once substantially all of the fluid has been removed. Also, it should be understood that for the purposes of this description, the term "collapsing" should be construed to mean that the container is at least capable of folding into itself to achieve a compact structure as later explained and illustrated in, for example, Figs. 2H-2J. According to an exemplary embodiment, a collapsible container may include a liner that may be folded to fit into a base frame. The collapsible container may also include an articulated outer shell that may be folded over and optionally fit into the base frame. The container may also be stackable once in a fully collapsed state. This would allow for ease of storage and high volume transport.

[0036] The container may be adapted to allow its contents to be heated such as by a heating device so as to increase the temperature of the viscous liquid. If heating is desired, the heater may be disposed to heat the liquid in the vicinity of the outlet. The heater may also be designed to heat the entire volume of the shipping container, if desired. To improve the heating efficiency, the container may also be constructed of heat conductive materials. Such materials may typically include plastics and/or metals. A heat conducting material would ease the transfer of heat, for example, emanating from an external heater. Also, the container may be configured to include or adapted to receive a heating element. In an exemplary embodiment the heating element may also be in direct contact with the fluid.

[0037] The system may also employ other means for inducing the viscous fluid to flow through the outlet. For example, the system may include the application of pressure to the fluid. Pressure may be provided in the form of air pressure. Another application of pressure may be mechanical pressure. In this latter embodiment, the pressure may be applied manually to the container. Alternatively, mechanical pressure may be applied by way of an automated mechanical apparatus. Also, pressure may be applied both mechanically and non-mechanically. For example, one system may include the application of both manual pressure and air pressure.

[0038] Pressure may be provided to the fluid from any location of the container. In an exemplary embodiment pressure may be provided at an opposite end of the container from the outlet of the fluid. For example, if the fluid outlet is located at the bottom of the container, pressure may be introduced at the top of the container. In another embodiment, pressure may be introduced at a midsection of the container. In yet another embodiment, pressure may be introduced at the vicinity of the fluid outlet. Moreover, pressure could be introduced at multiple locations of the container either simultaneously or at different times.

[0039] Additional means for inducing the viscous fluid to flow through the outlet include the use of gravity, means for shaking or vibrating the container. The container may also be equipment with safety features such as pressure relief valves. In an exemplary embodiment, the container may be equipped with a 5 psig max pressure relief valve.

[0040] The configuration of the shipping container is not restricted as long as it is adapted to allow the viscous fluid to properly evacuate through the outlet. The shipping container may contain an outer shell and a liner for receiving the viscous fluid. There are no restrictions on the shape or materials of construction for either the outer shell or the liner. Exemplary materials for the outer shell or structure may be metal, corrugated board, carbon steel, plastic, aluminum, steel or any other material which is sufficiently strong so as to protect the liner and its contents during transport. Exemplary materials for the liner can be polyethylene or polypropylene or polyurethane coated fabric, but other materials of construction can be used. In one embodiment, the outer shell is preferably rigid during transport but is collapsible as is the liner after the viscous fluid has been removed from the liner. The outer shell may also have many different designs, such as a solid shell, a grid, or perforated. The outer shell may also include larger openings that may allow access to and/or view of the inner liner.

[0041] In one embodiment, the container may also include a base frame. The base frame may be rigid. The base frame may be designed to support the liner and outer shell. The base frame may also be designed to provide an outlet for the viscous fluid. The base frame may also be designed to incorporate a heater. Alternatively, the base frame may be designed so that a heater can be placed under the container. Also, the base frame may be designed so that it can store the collapsible outer shell and liner when the fluid has been evacuated. The base frame may further be designed to be stackable over other base frames when the containers have been collapsed.

[0042] The container may further include a base platform. The platform may include a pattern design so as to further induce the flow of the viscous fluid. The platform may be at a bottom portion of the liner and/or provided at the base of the container. In one exemplary embodiment, the platform is located in the base frame. The inclusion of a platform may also be accomplished while maintaining the ability to stack the containers when in a collapsed state.

[0043] The following descriptions of the shipping container embodiments are for illustration purposes only and are non-limiting. Many other shipping container constructions can be employed. In one embodiment, the container may include an outer structure which is sufficiently strong and rigid to protect an inner liner which receives the viscous fluid during transport, and permits proper evacuation of the highly viscous fluid and/or fluids with a Laray viscosity of at least 50.

[0044] Independent of the particular container design the system would generally allow for the transport of high viscous fluids and preferably the ability to collapse the empty containers so they can be stacked for storage and/or easier transport. More specifically, the container may be filled with a viscous fluid. The filling of the liquid may be accomplished for example using a pump. The viscous fluid may be introduced through an inlet of the container. The inlet may be directly in the liner portion. Once filled, the container may be transported from one location to a second location. The container may also be used simply as storage of the viscous fluid. When desired the fluid may be evacuated from the container.

The flow rate of the fluid outlet may be controlled to be at a desired level. To induce the outlet of the fluid, one may employ a pump. The pump may be connected to a bottom portion of the container either to the outlet on the base frame or directly to the outlet in the liner or flexible holding portion. One may also heat the fluid to induce outflow. The heating may be performed before and/or during evacuation of the fluid. Another option would be to apply pressure to the fluid to induce outflow. Also, to further induce outflow, one may guide the fluid to the outlet of the container. One way to guide the fluid to the outlet of the container may be to provide a bottom platform that includes a flow guide to the container. The container may be collapsed as the fluid exits the container. Alternatively, the container may be collapsed once substantially all of the fluid has exited the container. Collapsing the container may be done manually. Alternatively, the collapsing may be done using a mechanical apparatus. The collapsing may also be done by a combination of manual and mechanical means. Once multiple containers have been collapsed, they may be stacked for storage and/or easier transport. The fluid transported by the above described system may be then used in a variety of applications. As explained above, the fluid is not limited and may include for example an ink, paint, pigments or a coating composition.

[0045] Figure 1 shows an exemplary schematic embodiment. A portable tank 1 has an outlet 2 at a bottommost portion, and is positioned on two supports 3 so as to provide a gap 4 between the bottom of the tank and the floor. A heating unit 5 is disposed in gap 4. The outlet communicates through a conduit 6 to a pump 7, and from pump 7 through a second conduit 8 to storage compartment 9.

[0046] Figure 2A-2L illustrates an exemplary embodiment of a collapsible container for transporting highly viscous fluids and liquids with a Laray viscosity of at least 50, and its functionality. Figure 2A shows possible construction of a base frame, an inner liner and an outer shell.

[0047] A rigid base frame 101 may include an outer, generally vertical peripheral wall 107 which defines the outside of the base, a discharge opening or outlet 102 and a load supporting deck 103 with the discharge opening or outlet 102 located at a lower portion of deck 103. Base frame 101 can be made, for example, of metal, corrugated board, carbon steel, plastic, steel, aluminum or any other material which is sufficiently strong so as to support and protect the liner and its contents during transport.

[0048] Discharge opening or outlet 102 may be of any desired size that allows for flow of the viscous fluid. In one exemplary embodiment, the discharge outlet or opening may be a 3 inch NPT in size with a 3 inch NPT valve connection. In an exemplary embodiment discharge opening or outlet 102 is also designed such that it can remain flooded, i.e. air tight so that no air is introduced into the system during discharge of the fluid. Although outlet 102 is shown as located on the side, the location should not be viewed as limiting and may be adjusted as desired. In an alternative embodiment, for example, outlet 102 may be located at a corner or even at the bottom. Load supporting deck 103 may generally be planar. However, supporting deck 103 may optionally be inclined downwardly toward one side of base frame 101.

[0049] As illustrated in Figures 2G, the base frame may define a well area into which the liner and/or the outer shell can collapse when the container is substantially empty. By having a base frame with a well area that is configured to receive collapsible portions of the container, being the liner and/or the outer shell, it is then possible to stack the empty containers as shown, for example, in Figure 2L. By stacking the containers it is possible to ship more containers at once while requiring less space. This in turn leads to large cost savings in the shipping of empty containers.

[0050] The base frame 101 may also be equipped with a conduit (not shown) communicating with the outlet 102 at one side adjacent to the lower most edge of deck 101 extending from the space above the deck through the peripheral wall for discharge of the viscous liquid within the liner. The base frame 101 may also include a plurality of legs 105 which are engageable with the ground for supporting the container and its load, and may be spaced to receive the lifting tines of a fork lift so that the loaded containers may be readily moved from one place to another. In an exemplary embodiment as illustrated in Figure 2, the base frame 101 may also be equipped with rails 108a and 108b that may be used by a loading apparatus such as a fork lift so that the container may be easily moved. The rails may, for example, be two directional fork channels that can be engaged from either end.

[0051] A tubular liner 104, i.e. the flexible holding portion of the container, for receiving the viscous liquid may be secured or even welded to base frame 101. The exemplary embodiment illustrated in Figures 2A-2L may also include an opening in the form of inlet 110 for the introduction of the viscous liquid. Although shown at a top portion of the liner, inlet 110 may be located anywhere on the liner. Inlet 110 may also be connected to an outer shell of the container. In yet another exemplary embodiment, the container may be filled and emptied through the same conduit. In such an embodiment, inlet 110 may be removed and instead the container may be filled using discharge opening or outlet 102 described herein. In still a further embodiment, the container may be filled by way of both inlet 110 and discharge opening or outlet 102. The liner/base frame combination may or may not be permanently secured together. In other words, the liner and the base frame may be separate elements or may be integral with each other.

[0052] The shape of the liner should also not be viewed as limiting. For example, the liner may assume a rectangular shape rather than the circular shape shown in Figure 2. Other configurations are also possible. For example, the liner may be hexagonal, octagonal, or any other configuration. The liner may either be constructed to have a desired shape, such as a circular or rectangular cross-section. Alternatively, a constraining means, such as an internal frame or straps, inside, within or even outside the liner may be provided for constraining the liner to assume a desired shape.

[0053] In an exemplary embodiment, a desired shape of the liner may be obtained using a set of tension members within the liner which may be in the form of a flexible wire cable covered by a flexible sheath to protect the cable. The tension members may be connected at their ends to the side walls of the liner by connectors which may be a combination of a coupling and a clevis attached to the coupling. Circumferential straps 106 may be optionally installed around the bag during or after filling to provide additional circumferential support.

[0054] The liner may be adjusted to retain its shape even when the fluid has been evacuated. Once empty the liner may then be collapsed. Alternatively, the liner may be design to collapse as the fluid is discharged. As noted earlier, the material of construction of liner 104 is not restricted although it is preferably a tough, strong material. Exemplary materials for the liner can be polyethylene or polypropylene or polyurethane coated fabric, but other materials of construction can be used.

[0055] It should be noted that the base frame may be designed to accommodate the liner and thus may be modified depending on the desired shape of the liner. Independent of the shape, the base frame may still include the other features described herein.

[0056] An articulated outer shell 109 may also be provided as shown in Figure 2A. Exemplary materials for the outer shell or structure may be metal, corrugated board, carbon steel, plastic, aluminum, steel or any other material which is sufficiently strong so as to protect the liner and its contents during transport. As described earlier, the outer shell may have different designs. In the illustrated embodiment the outer shell is a grid. Alternatively, the outer shell may be a solid structure or perforated structure and may also have large openings to view and/or access the liner. As illustrated, the outer shell may also be provided on only some sides of the liner while leaving an open area on one or more sides. The outer shell may also be collapsible. The outer shell may collapse as the fluid is evacuated from the inner liner. Alternatively, the outer shell may retain its structure and may be collapsed once the liner has been emptied. For example, as shown in Figures 2H-2J, the outer shell may be folded. As shown in figure 2J-2K, the well provided in the base frame may also be configured to receive at least a portion of the collapsed outer shell. The outer shell may be manually collapsed. Alternatively, the outer shell may be designed to include a self-collapsing mechanism that may be automatic or user operated.

[0057] To further secure the liner with the rest of the container the liner may also be fastened to the outer shell. Any means for fastening may be employed. In an embodiment shown in Figure 2C, the means for fastening is illustrated as a latch or strap. Alternatively, the means for fastening may be a bracket or any like device that can secure the liner to the outer shell. Also, any number of fastening means may be employed. Thus, even though Figure 2C only shows using a single means for fastening, i.e. only one latch or strap, more than one may be employed as desired. For example, the liner may be fastened to the outer shell by a number of latches or other means for fastening located at different locations on or around the liner.

[0058] Although not shown in the figures, base frame101 may also include a gas inlet on one side for the introduction of pressurized gas for the discharge of the viscous fluid.

[0059] In an alternative embodiment (also not shown), the gas inlet may be provided at the top of the container through a fitting, or at an opposite end of the container from fluid outlet 102. The gas inlet may even be connected directly to the liner. In another embodiment the gas inlet may be connected to the outer shell. The location of the gas inlet should not be viewed as limiting. Also, multiple gas inlets may be provided to the container at different locations so as to have better control over the application of pressure to the fluid. It should also be understood that the gas is not limited to a particular material. In an exemplary embodiment, the gas may be compressed air. However, any gas that will not react or affect the viscous fluid in an undesired manner may be used.

[0060] In yet another embodiment, pressure to the highly viscous fluid may be applied mechanically. Mechanical pressure may be applied in different ways. In one embodiment the mechanical pressure may be applied manually by pressing on the liner and/or outer shell. Alternatively, mechanical pressure may be applied using any suitable mechanism that can apply pressure to either the liner and/or the outer shell. For example by using a RAM assembly plate with a pneumatic driven cylinder that could press down onto the liner bag. The mechanism may be either manually operated or automated.

[0061] In yet another exemplary embodiment, pressure to the highly viscous fluid may be applied both mechanically and by gas pressure.

[0062] A heating element (not shown in Figure 2A-2L) may be provided in base frame 101. The heating unit may be integral with the base or it may be a separate unit and designed to ride on the base or be slid underneath base frame 101. The heater could also be within the liner. The nature of the heating element is not restricted and it may be, for instance, electrical heating coils, a heat transfer surface connectable to a source of heat, or a heating pad. The amount of heat supplied may also be adjusted depending on the properties of the viscous fluid. In an exemplary embodiment the heating may be designed to result in a temperature of approximately 48 C at an area inside or outside the container and proximate to the discharge opening or outlet 102. In general, the heating element may be designed to heat the liquid somewhat above ambient temperature, for example, to about 30 to 75 °C, although any temperature which does not cause degradation of the viscous fluid can be employed.

[0063] To induce outflow of the highly viscous fluid, the container may include a base platform 111. As shown in the exemplary embodiment of Figure 2F, the base platform may be located at the base of the liner. The base platform may also involve a design that induces flow of the highly viscous fluid by guiding the viscous fluid through a flow path that may lead to an outlet of the container. For example, the base platform may include slanted sidewalls, may be made of a material that provides minimal flow resistance, and may allow for a direct conduit to the container's outlet. As shown in exemplary embodiment of Figure 2F, the platform may include a flat surface with a defined central region with slanted sidewalls that can direct the fluid to flow into a central opening. In an alternative embodiment the slanted sidewalls and opening may be located at one side as opposed to the center. Also, the base platform may be slanted as a whole with respect to the ground or horizontal plane inducing flow toward one side of the base of the container. The opening may be fluidly connected to outlet 102.

[0064] The dimensions of the container should not be viewed as limiting. An exemplary embodiment may include a container having a capacity of about 350 gallons, having a cylindrical liner with a diameter of 47 inches and a height of 47 inches, or a diameter of 46 inches and a height of 49 inches. The overall side of the container may be for example 42.5 inches by 53.9 inches or 1200 mm by 1370 mm. The container may be made of a light weight material that is strong enough for the handling. In an exemplary embodiment the container may be 800 lbs or less. In an alternative embodiment the weight of the empty container may be 300 lbs or less. Finally, the size of the container in a collapsed state may also be modified as desired. In an exemplary embodiment the size of the container is such that five stacked collapsed containers reach a height of no more than 100 inches.

[0065] Figure 3 is a side view showing an alternative configuration of a container for transporting highly viscous fluids. In the illustrative embodiment shown in Figure 3, the outer shell may be affixed or connected to the side walls of the base frame in Figures 2A-2L. In this embodiment shown, the outer structure 301 may be composed of four side walls 302, only one of which is being shown for clarity, each side wall being affixed or connected to the top 303 of the side walls of base frame 304 at a point exterior to the point at which the liner is affixed to base frame 304 so that the outer structure surrounds the liner. The container side walls 302 in this case are adapted to being folded onto the top of base frame 304 and lie on top of the collapsed liner. As discussed previously, additional illustration of this operation is provided in Figures 2G-2K. Thus, each of the four walls are such that they can be folded down into base frame 304, or base frame 101 as illustrated in Figures 2G-2K. The order in which the walls are folded is immaterial. When the base frame includes a well, as previously described, the walls 302 can fold into the well or form a top on the well.

[0066] When the liner contains liquid and during transport, adjacent side walls 302 may be attached to one another adjacent a vertical corner of the outer container by a fastening means such as a bracket 305. Bracket 305 may define a recess adapted to open inwardly of the container and a bolt slidily located in the bracket so that upon assembly of the latch on the container, the bolt moves along a horizontal axis. Other means of holding walls 302 rigid during transport can be used.

[0067] If the height of the outer container walls 302 exceeds their width, each side wall 302 may be composed of two or more parts which are hingeably connected by a conventional spiral hinge 306. This permits the upper part 307 of the side wall 302 to be folded downwardly onto a lower part 308, and then the combined upper and lower parts to be folded downwardly into or onto a well in the base frame. The upper and lower parts may be provided with a latch 309 to maintain them in an upright position during transport. It should be understood that the any one or more features of the container described with respect to Figures 2A-L and previously may further be added to the exemplary embodiment shown in Figure 3.

[0068] In order to demonstrate the applicability of this system, a conventional portable metal tank container filled with a thixotropic viscous printing ink was placed in a tractor trailer in a compartment having a temperature of -15°C (10°F). The container was removed from the trailer 47 hours later. An outlet on the bottom of the container was connected to a storage tank through two conduits linked by a suction pump, as generally shown in Figure 1 except that the outlet was on the bottom of the drum rather than its side. Other than gravity, no device to exert pressure on the ink was provided. The ambient air temperature outside the container was 15°C (59°F). Fifteen minutes later, the suction pump was started but after fifteen minutes without any ink flow from the 55 gallon container to the storage container, the pump was stopped. One hour later, the ambient air temperature outside the tank had increased to 20°C (68°F) and the suction pump was restarted. Ten pounds (4.5 kg) of the ink was transferred from the container to the storage container before the flow of ink stopped. 100 minutes later, a portable heater was placed under the shipping container, spaced from its bottom, and turned on. At this time, the temperature outside the shipping container had increased to about 24°C (75°F). Thirty pounds (13.6 kg) of ink was pumped from the shipping container before flow stopped. The suction pump was turned off for about 25 minutes and then restarted. An additional 40 lbs (18.14 kg) of ink was pumped and then flow again stopped. The pump and the heater were then turned off.

[0069] About 20 hours later, the ambient air temperature was 23°C (73°F). The suction pump was turned on and a flow of ink of 8 lbs (2.5 kg) per minute was achieved for the next 15 minutes at which point the pump was turned off and the heater was turned on. After 45 minutes, the outside air temperature had risen to 24.4°C (76°F) and the temperature of the ink in the shipping container was 25°C (77°F). The suction pump was turned on and ink flowed from the shipping container to the storage container at a rate of 11 lbs (5 kg) of ink per minute. After 45 minutes, the suction pump was turned off and then turned back on about one hour later. For the first five minutes after the pump was restarted, ink flowed from the shipping container at a rate of about 23 lbs (about 10 kg) per minute and then decreased to 13 lbs (5.9 kg) per minute for an additional 20 minutes. During this flow, the ambient air temperature was 79°F (26°C) and the ink temperature in the container was 81°F (27.2°C). The pump was turned off but heating was continued for about one hour before the pump was turned on again. Ink flowed at a rate of 23 lbs (about 10 kg) per minute for the first five minutes and then reduced to a flow of 13 lbs (5.9 kg) per minute. During this pumping, the ink temperature was 81°F (27.2°C) and the ambient air temperature was 26.7°C.

[0070] It will be apparent to those skilled in the art that various modifications and variation can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

WHAT IS CLAIMED IS:

1. A process of delivering a viscous fluid from a collapsible container with a rigid base frame and a flexible fluid holding portion comprising the steps of:

   removing fluid having a Laray viscosity of at least 50 at room temperature from the flexible fluid holding portion of a collapsible container; and

   at least partially collapsing the flexible fluid holding portion as the fluid is removed.

2. The process of claim 1, further comprising heating the fluid.

3. The process of claim 2, wherein the step of heating is performed before removing the fluid from the container.

4. The process of claim 1, further comprising the step of applying pressure to the fluid from an upper portion flexible fluid holding portion.

5. The process of claim 4, wherein the step of applying pressure includes applying air pressure.

6. The process of claim 1, further comprising removing the fluid out of the flexible fluid holding portion at a predetermined rate.

7. The process of claim 7, further comprising the step of guiding the fluid through a flow guide that promotes the flow of the viscous fluid.

8. The process of claim 1, further comprising the step of fully collapsing the flexible fluid holding portion within the rigid frame after removing substantially all of the contents of the flexible fluid holding portion.

9. A process of inputting a viscous fluid into a collapsible container, the collapsible container including a frame and a flexible fluid holding portion, comprising the steps of:

inputting the fluid having a Laray viscosity of at least 50 at room temperature into the flexible fluid holding portion;

allowing the flexible fluid holding portion to expand as the fluid is inserted.

10. A system of transporting a viscous fluid using a collapsible container comprising:

filling a viscous fluid having a Laray viscosity of at least 50 at room temperature into a collapsible container;

transporting the filled collapsible container;

emptying the viscous fluid from a collapsible container;

collapsing the collapsible container;

stacking the collapsed container over other similarly collapsed containers; and

transporting the stacked collapsed containers.

11. The system of claim 10, wherein the collapsible container is collapsed after substantially all of the fluid has been emptied out of the container.

12. A system of transporting a viscous fluid using a collapsible container comprising:

transporting a collapsible container filled with a fluid having a Laray viscosity of at least 50 at room temperature;

emptying the viscous fluid from a collapsible container.

13. A system of transporting a viscous fluid using a collapsible container comprising:

filling a viscous fluid having a Laray viscosity of at least 50 at room temperature into a collapsible container;

transporting the filled collapsible container.

14. A process of delivering a viscous fluid from a collapsible container comprising the steps of:

removing the viscous fluid from a flexible fluid holding portion of a collapsible container; and

at least partially collapsing the flexible fluid holding portion as the fluid is removed.

15. A process of inputting a viscous fluid into a collapsible container comprising the steps of:

inputting the viscous fluid into a flexible fluid holding portion of the collapsible container; and

allowing the flexible fluid holding portion to expand as the fluid is inserted.

16. The use a coating composition delivered via the process of any one or more of the preceding claims.

17. The process of claim 16, wherein the coating composition is ink.

FIG. 1

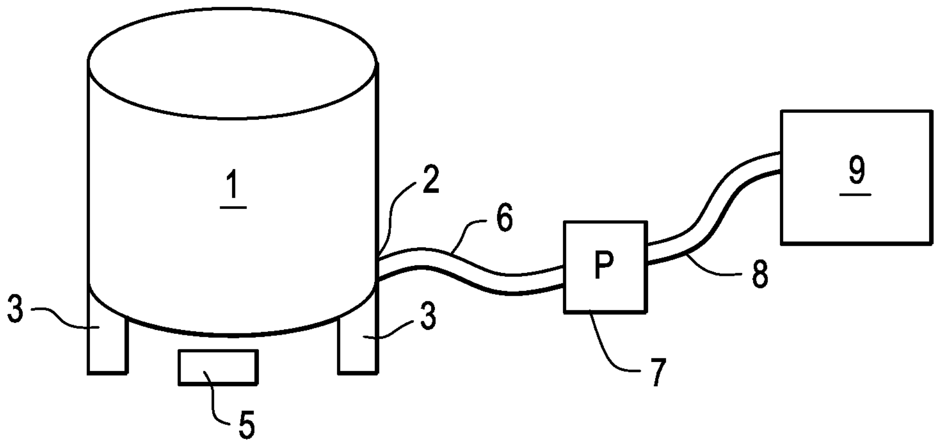


FIG. 3

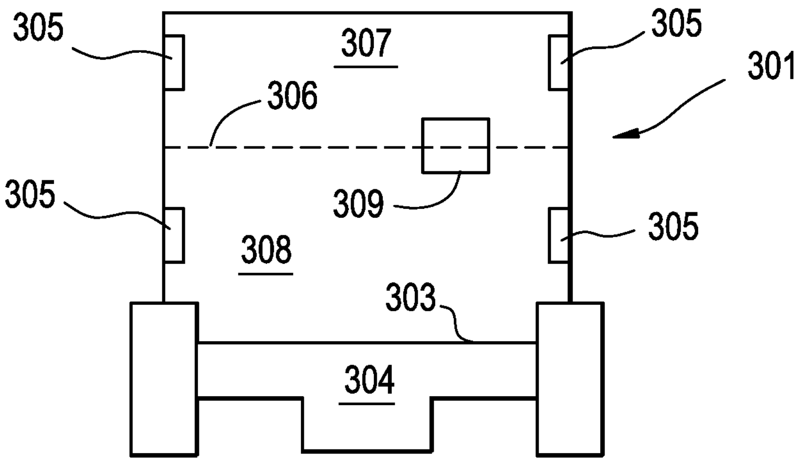


FIG. 2A

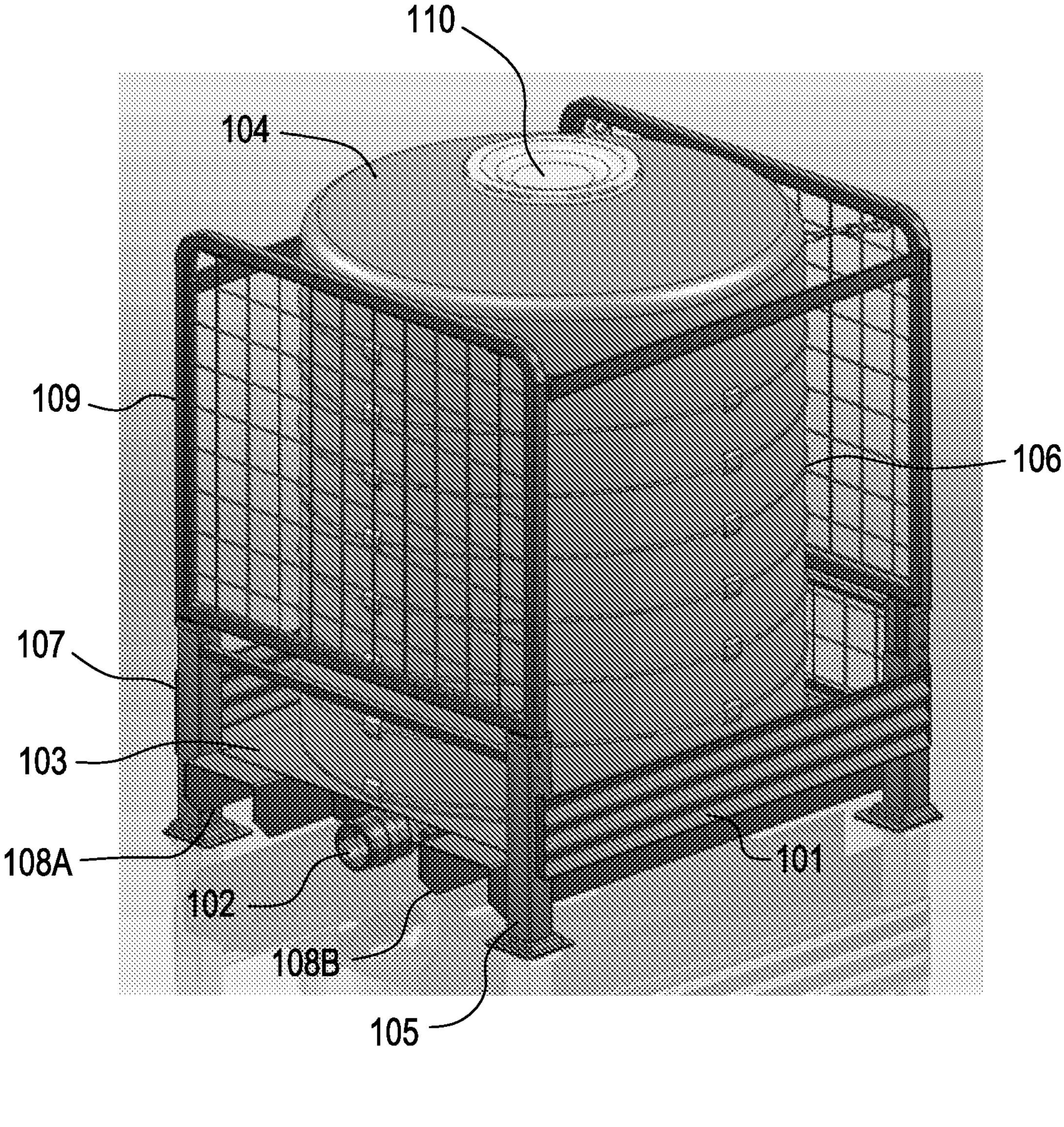


FIG. 2B

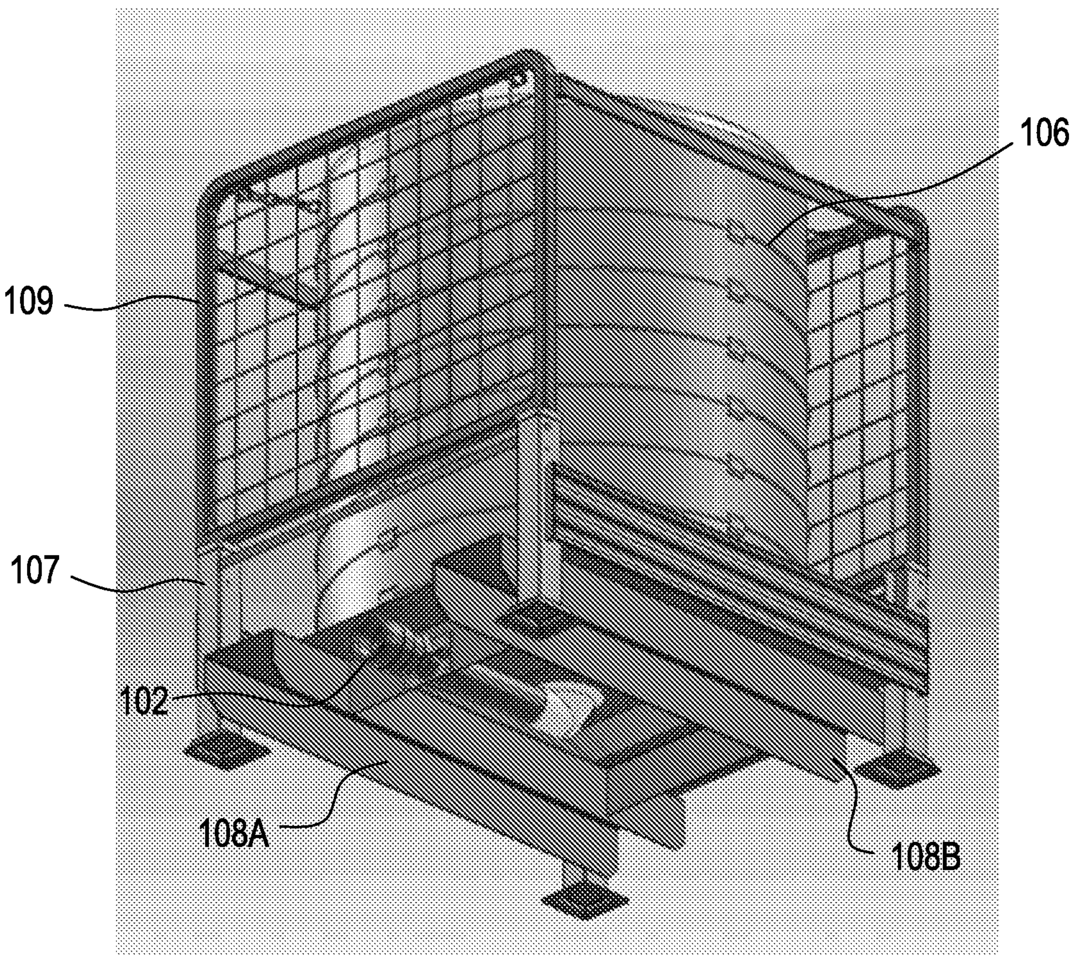


FIG. 2C

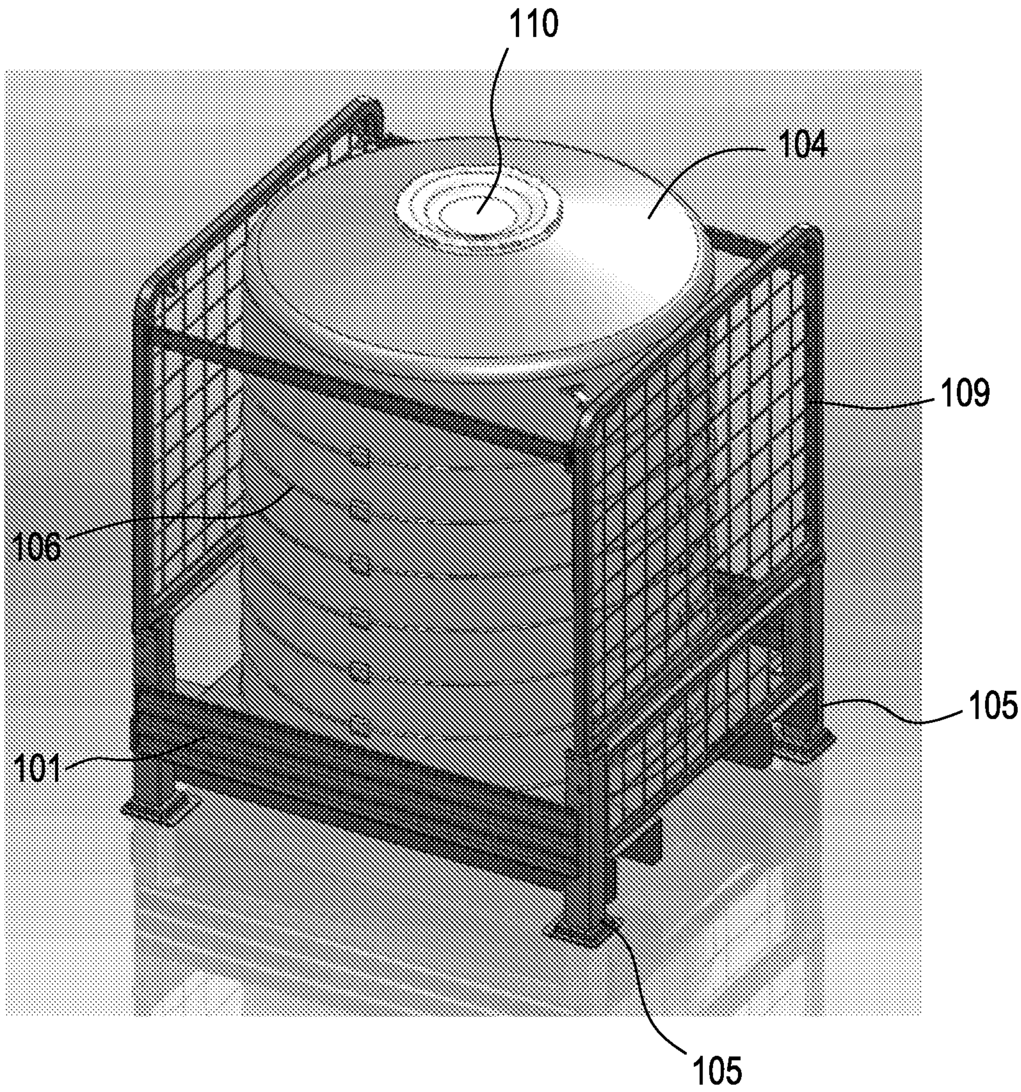


FIG. 2D

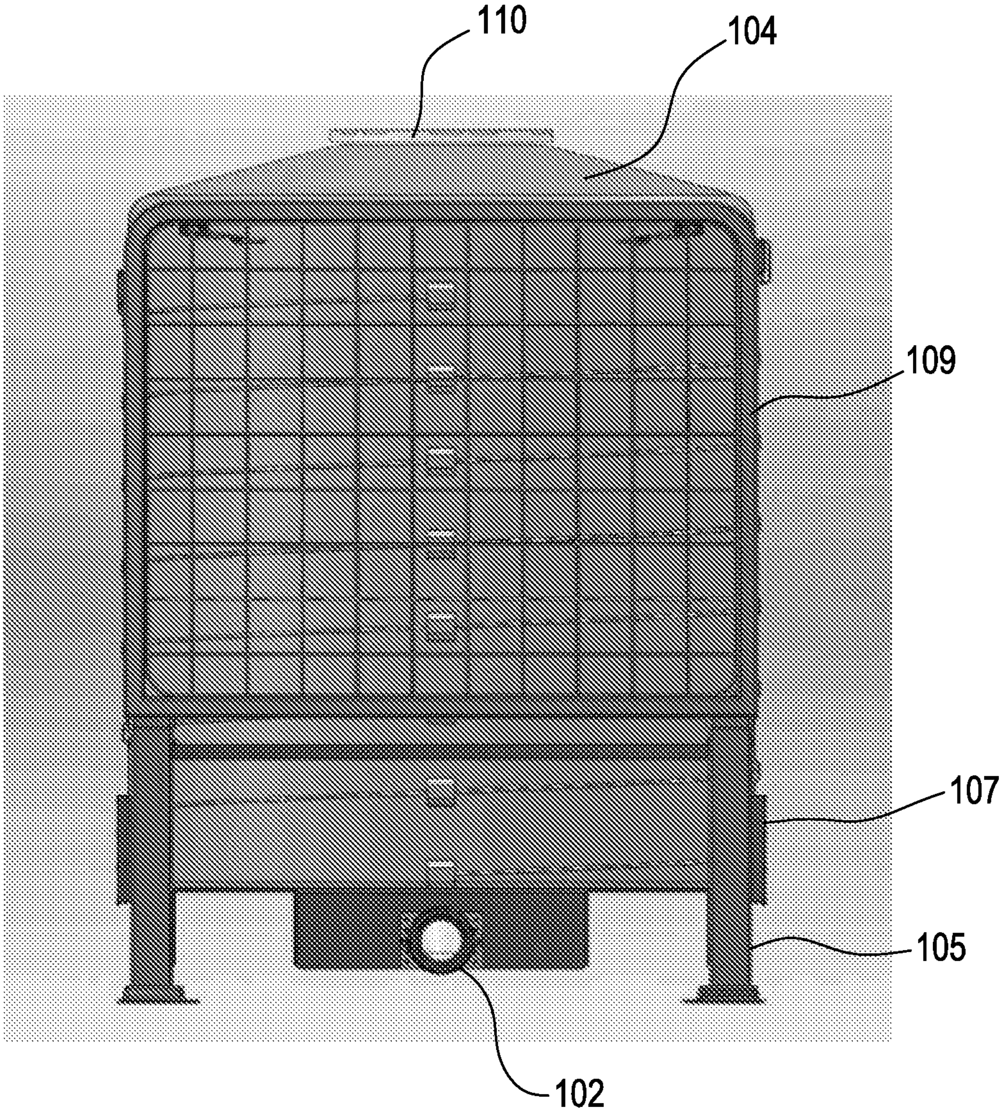


FIG. 2E

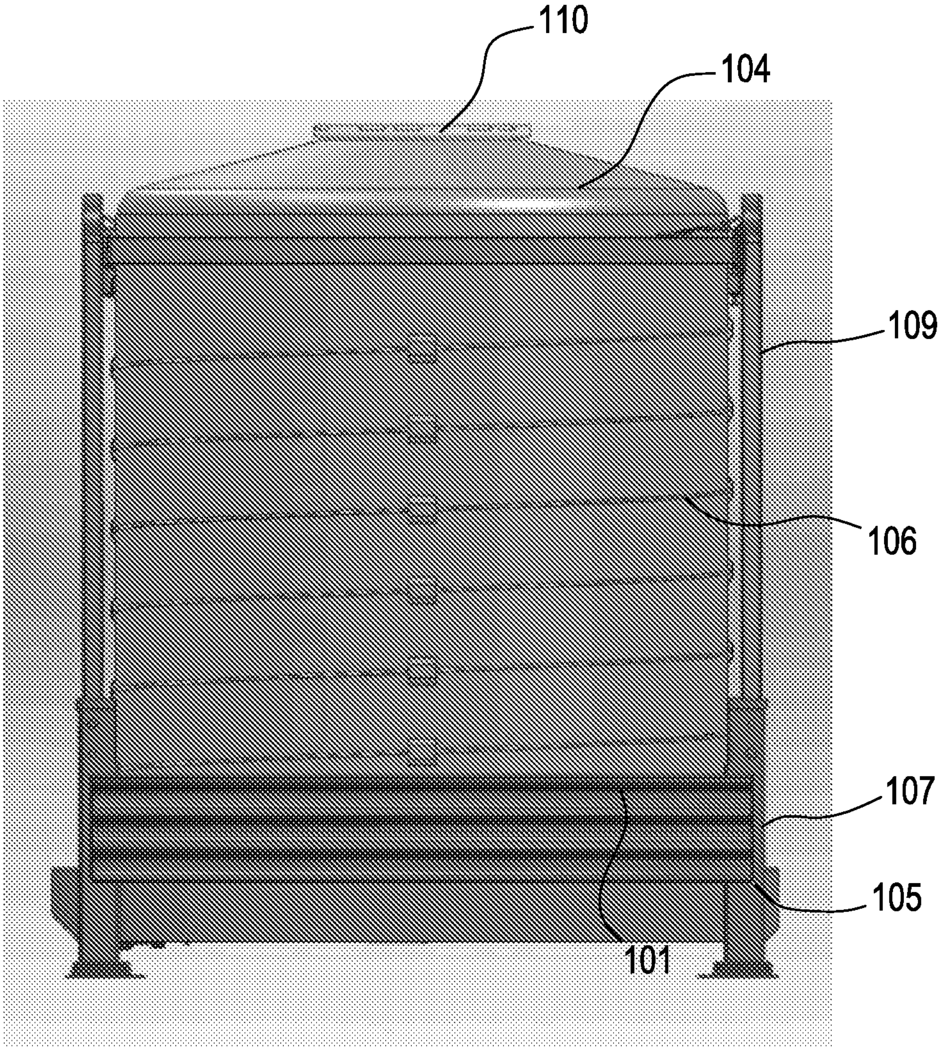


FIG. 2F

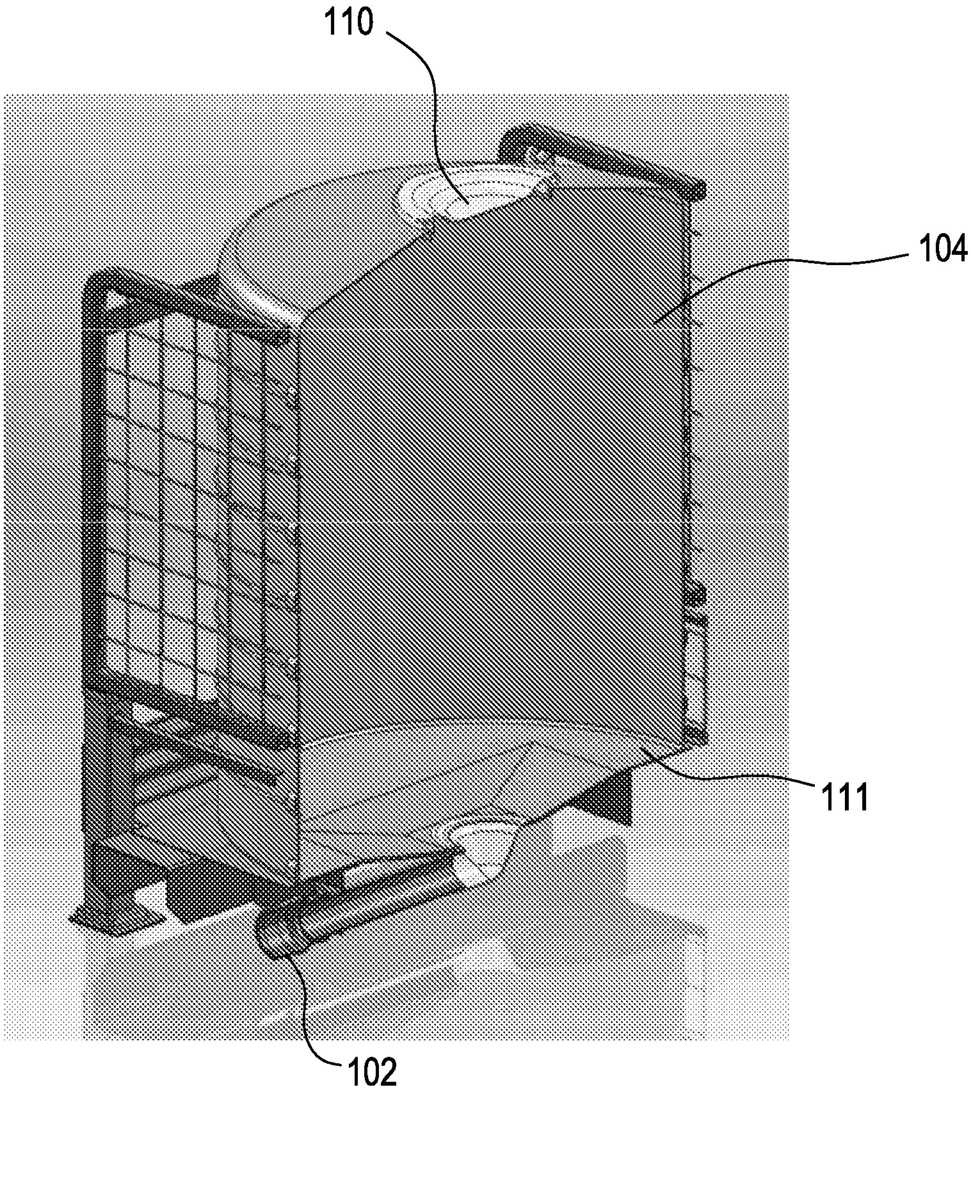


FIG. 2G

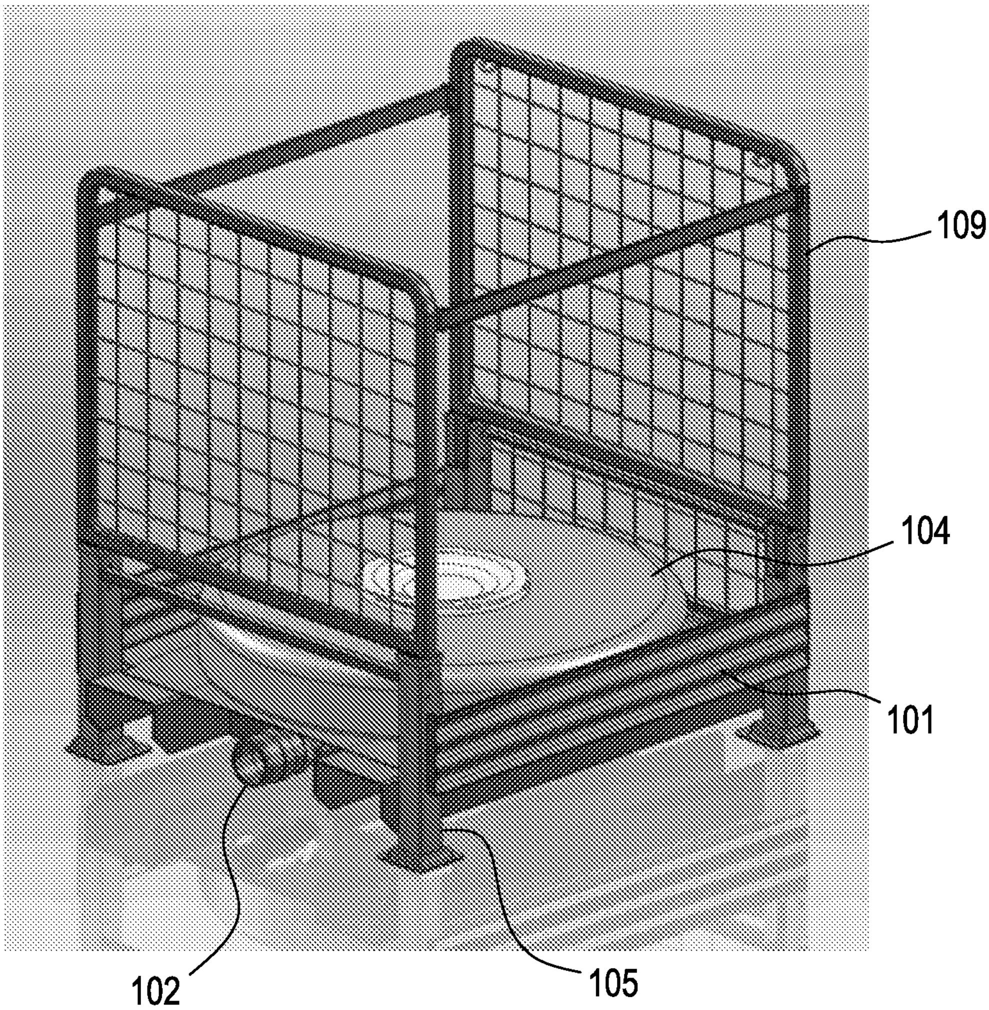


FIG. 2H

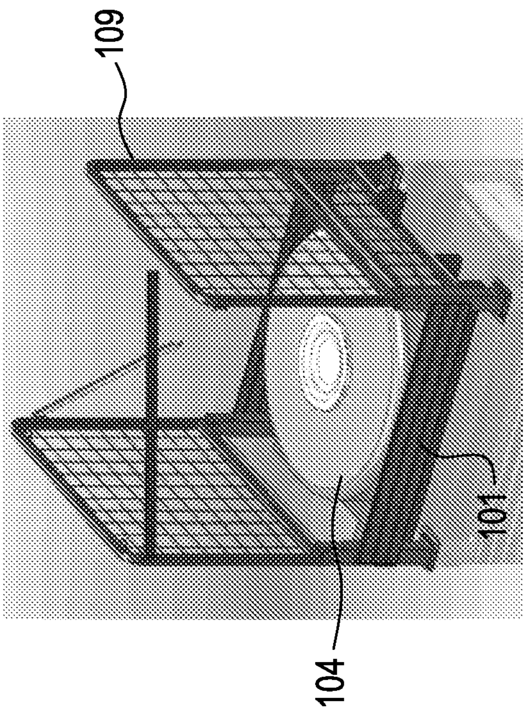


FIG. 2I

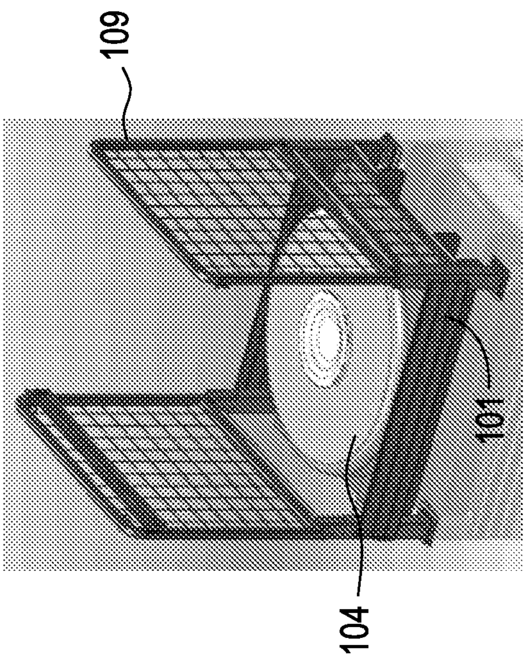


FIG. 2J

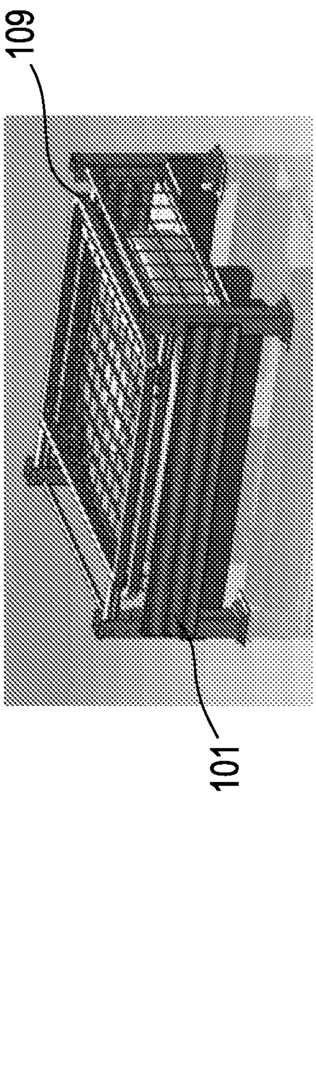


FIG. 2K

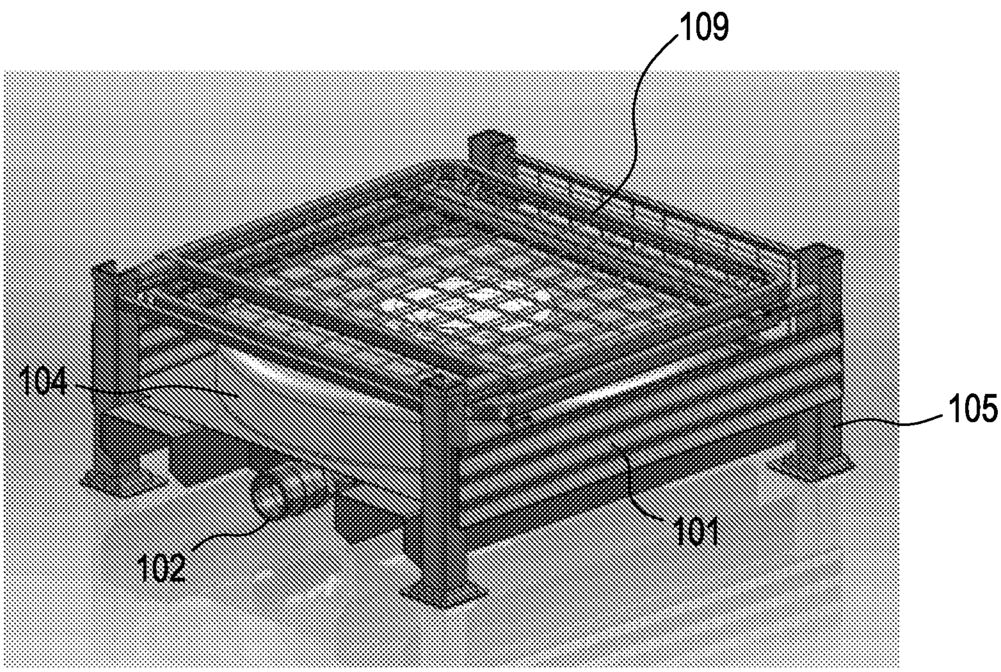
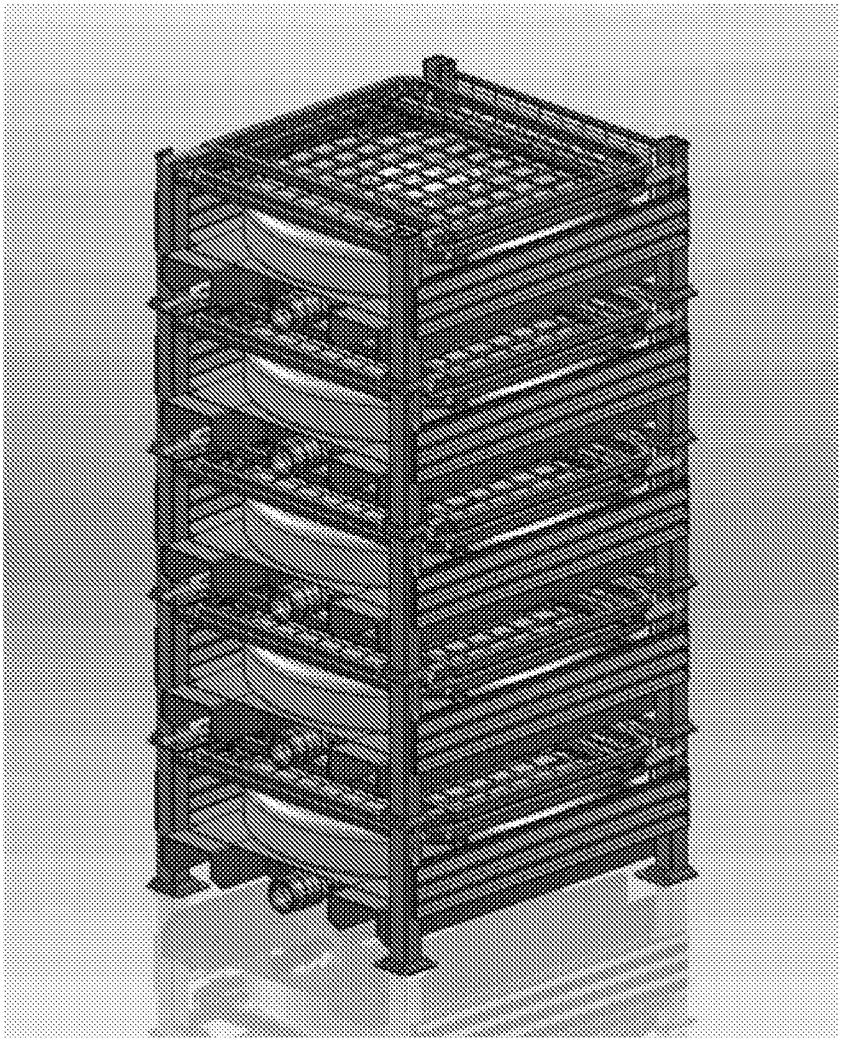


FIG. 2L



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/044838

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65D77/06
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65D B67D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	GB 2 268 231 A (TNT MATERIALS HANDLING LTD [GB]) 5 January 1994 (1994-01-05) page 1, paragraph 2 page 4, paragraph 2 - page 7, paragraph 2 figures 1-3	1,4-15
X	US 5 897 012 A (SORTWELL EDWIN T [US]) 27 April 1999 (1999-04-27) column 2, line 66 - column 7, line 61 figures 1-17	1,4-15

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 September 2011	05/10/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Piolat, Olivier

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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International application No
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EP 0590902	A1	06-04-1994	NONE			