March 31, 1959 H. G. VESTERDAL ET AL 2,879,785

APPARATUS FOR SHIPPING GREASES

Filed May 31, 1955 2 Sheets-Sheet 1

FIG.-1

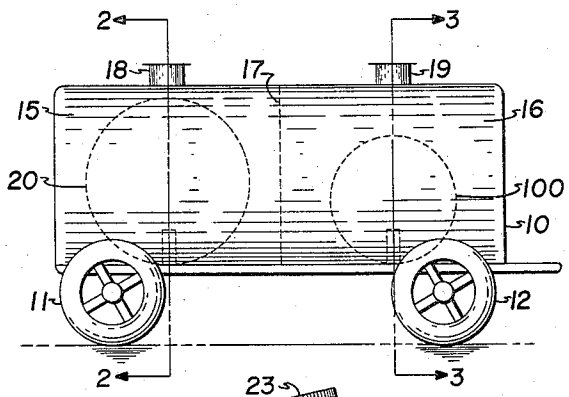
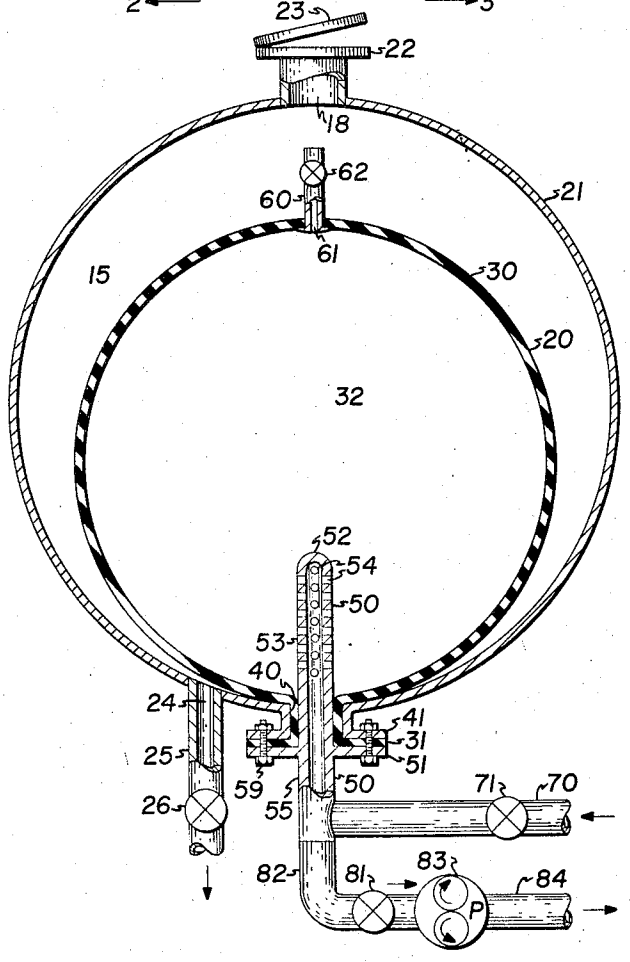


FIG.-2



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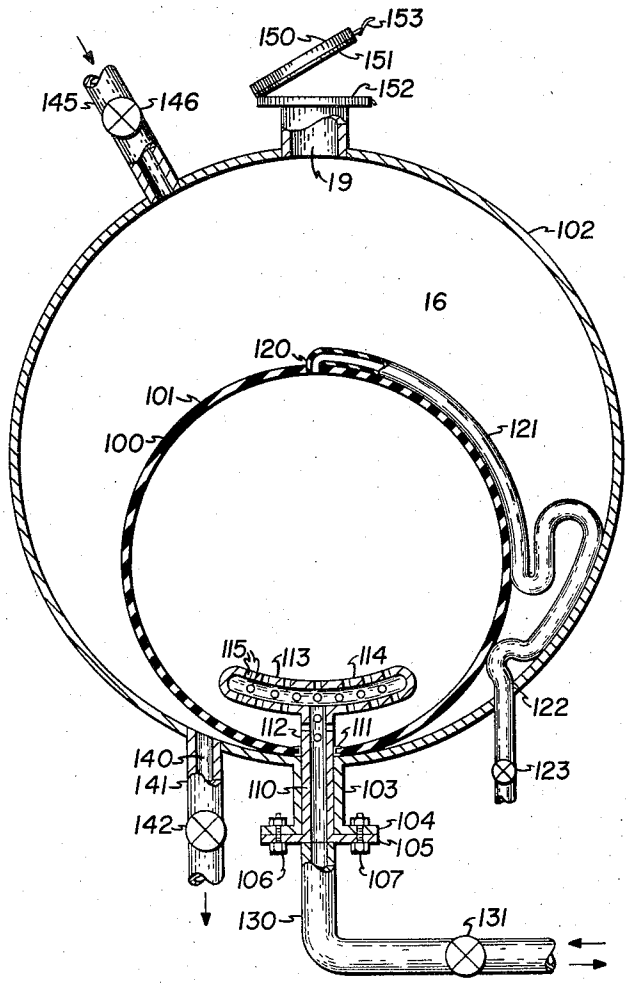


FIG.-3

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APPARATUS FOR SHIPPING GREASES

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2 Claims. (Cl. 137—264)

This invention relates to apparatus useful for transporting materials of a grease consistency and more particularly relates to apparatus adapted to be installed in conventional tank wagons, tank trucks, tank cars and the like, whereby both liquid products and greases may be simultaneously or alternatively transported therein.

Liquid products such as gasolines, heating oils, diesel oils, fuel oils, lubricating oils and the like have been conventionally transported employing tank cars, tank trucks, tank wagons and the like. The utilization of such forms of transportation for transporting greases or other materials of a grease consistency such as asphalts, rust preventive compositions and the like has not been successful heretofore due to the high cost of special tank wagons, tank cars, etc., specifically adapted for shipment of greases and the like. Since the packaging and shipment of grease is relatively expensive, it would be highly desirable to provide a simple and inexpensive means for transporting greases in bulk in tank wagons, tank cars and the like. Heretofore it is not believed that there was such a means available.

A novel apparatus has now been found for transporting materials of a grease consistency, which apparatus is particularly useful for transporting materials having an A.S.T.M. penetration (as determined by the tentative standard method, A.S.T.M. No. D217–44T) of about 250 to 390 mm./10 at 77° F. The apparatus can also be used very advantageously for greases of a semi-fluid consistency. Thus, in general the apparatus of this invention is useful for transporting greases or other materials of a grease consistency having an A.S.T.M. penetration above about 275 mm./10 at 77° F.

The particular apparatus of this invention comprises a flexible bag which is impervious to fluids and a tube which passes hermetically through the bag and extends into the interior of the bag. The portion of the tube which extends into the interior of the bag is provided with a plurality of spaced openings in the wall thereof defining a plurality of passageways which are sufficient in size and number to permit the passage of grease or the like readily therethrough. The other end of the tube, that is, the end exterior to the bag, is adapted to pass grease or the like into and from the bag through the tube via the passageways. This tube is an essential element of the present apparatus and is necessary to prevent the plugging of the bag outlet by the bag itself (which may collapse in a way so that the bag wall would cover the bag outlet) during the discharging operation. Preferably, the bag is extensible as well as flexible.

The bag is adapted to be arranged within the casing of a tank wagon, tank truck, tank car and the like or a compartment thereof. In the operation of the apparatus of this invention, the bag may be filled through the tube with grease which is then transported to its destination where the grease is discharged from the bag through the tube, and then the casing of the tank wagon may be filled in the space between the casing wall and the exterior of the bag with a liquid product such as gasoline,

lubricating oil and the like for shipment on the return trip. If desired, both a liquid product and grease may be transported in the same compartment simultaneously, with the wall of the bag providing a hermetic seal between the liquid product and the grease.

The invention will be better understood by reference to the attached drawings, of which:

Fig. 1 is a side view of a conventional 2-compartment tank wagon provided with apparatus in accordance with the present invention;

Fig. 2 is an enlarged cross-sectional view of the tank wagon of Fig. 1 looking along line 2—2 of Fig. 1, showing in detail one embodiment of the apparatus of the present invention; and

Fig. 3 is an enlarged cross-sectional view of the tank wagon of Fig. 1 looking along the line 3—3 of Fig. 1, showing in detail another embodiment of the apparatus of the present invention.

Referring now to the drawings, reference numeral **10** designates a conventional 2-compartment tank wagon provided with wheels **11** and **12** (with corresponding wheels on the other side, not shown) adapted to make tank wagon **10** transportable. Tank wagon **10** is provided with two compartments, compartments **15** and **16**, which are separated from each other by partition **17**. Compartments **15** and **16** are adapted to transport a separate liquid product in each compartment. A liquid product is conventionally charged into compartment **15** through port **18**, and a liquid product is conventionally charged into compartment **16** through port **19**. Shown within compartment **15** is apparatus **20**, which is the embodiment of the apparatus of this invention set forth in detail in Fig. 2. Shown in compartment **16** is apparatus **100**, which is the embodiment of the apparatus of this invention set forth in detail in Fig. 3.

Referring now to Fig. 2, apparatus **20** of this invention will be now described in detail. For the purpose of clarity, parts of tank wagon **10** not essential to an understanding of this invention have not been shown in Fig. 2. Reference character **21** designates a rigid casing defining compartment **15** of tank wagon **10**. Normally, casing **21** is constructed of steel and has a thickness in the range of about ¼ to ½ inch and an average internal diameter in the range of about 4 to 8 feet. Casing **21** is provided with port **18**, as described heretofore, which is located generally at the top of casing **21**. Port **18** is provided with flange **22** and cover **23**. If desired, a gasket and lock arrangement (not shown) may be provided for port **18** such that cover **23** and flange **22** cooperate to provide an air-tight seal. Cover **23** is raised during the filling operation of compartment **15** through port **18**.

Casing **21** is also provided with a second port **24** in the lower portion thereof which is employed in emptying a liquid product from compartment **15**. Port **24** communicates with outlet conduit **25** which is provided with a valve **26** which is opened to discharge liquid products from compartment **15** and closed during the filling and storage operation of compartment **15**. Conduit **25** may be provided with a suitable connection for attachment to a hose or to a pump (not shown) for discharging a liquid product from compartment **15**. The aforedescribed casing and inlet and outlet ports are conventional in tank wagons.

In accordance with this invention, a flexible bag **30** is arranged within compartment **15**. Bag **30** is impervious to fluids and is preferably constructed of an extensible material such as nitrile rubber, neoprene or other flexible or elastic material which is resistant to attack by hydrocarbons. The capacity of bag **30** is preferably approximately that of compartment **15** and for conventional tank wagons should be about 800 to 3,000 gallons. Also, bag **30** preferably has a form corresponding generally to the

shape of compartment 15. In this form of the invention, casing 21 is provided with port 40, which is located in the bottom wall of casing 21. Port 40 is provided with a flange 41. Bag 30 is also provided at the bottom portion thereof with a rigid flange 31 which is arranged below and adapted to cooperate with flange 41 of port 40 to thereby provide a fluid-tight seal between the interior of casing 21 and the interior of bag 30. Extending vertically upward through port 40 is tube 50 which is also provided with a rigid flange 51 which cooperates with flanges 31 and 41 of bag 30 and port 40, respectively. Bolts 59 are employed to hold together flanges 31, 41 and 51. Gaskets (not shown) may be employed to assure a fluid-tight seal between flanges 31, 41 and 51. The upper end 52 of tube 50 as initially formed is preferably closed. Upper portion 53 of tube 50, that is, the portion of tube 50 extending into the interior 32 of bag 30, is provided with a plurality of spaced openings which define a plurality of passageways 54 adapted to permit the passage of materials of a grease consistency readily therethrough. Preferably, these passageways 54 are circular in transverse cross-section, each having a transverse cross-sectional diameter of at least about ⅛ inch. More preferably, these passageways 54 will have a cross-sectional diameter in the range of about ¼ to ½ inch. It is not essential that these openings be arranged uniformly in upper portion 53. However, it is preferred to have these passageways 54 arranged substantially symmetrically with respect to the longitudinal axis of tube 50 in upper portion 53. Generally about 20 to 200 passageways 54 will be provided in upper portion 53. It will be apparent that the length and inner diameter of upper portion 53 of tube 50 as well as the number and size of passageways 54 will preferably be related to the capacity of bag 30 and casing 21. The inner diameter of tube 50, as well as the number and size of passageways 54, should be selected such that about 5 to 100 or more gallons per minute of grease may be pumped to and from the interior of bag 30. Generally, the inner diameter of tube 50 will be in the range of about 1½ to 3 inches. The length of upper portion 53 of tube 50 should be sufficient to prevent bag 30, in the event of its collapse on tube 50, from substantially affecting the rate of discharge of grease therefrom through tube 50. In general, the length of upper portion 53 of tube 50 should be at least 1 inch, but preferably is greater. Preferred heights for upper portion 53 of tube 50 are in the range of about 0.1 to 0.5 times the average diameter of casing 21 with a minimum height being preferably about at least 6 inches. As will be shown later in the specification, there is an optimum height for upper portion 53 for a particular bag.

Preferably, bag 30 is provided with a valved venting means 60 in the upper portion thereof since during the filling operation of bag 30, in many instances, air may be pumped into the interior of bag 30. Valved venting means 60 provides a means for releasing this entrapped air so that interior 32 of bag 30 may be filled completely with grease. In the embodiment of the invention shown in Fig. 2, bag 30 is provided with vent conduit 61 which is provided with valve 62. In the filling operation, the top portion of bag 30 will be forced upwards such that valved venting means 60 approaches port 18. At this point, the operator of the tank wagon may reach through port 18 and open valve 62 to thereby release any entrapped air in the interior 32 of bag 30 during the filling operation. After entrapped air is released, valve 62 is closed. Venting means 60 should be of sufficient capacity to permit the release of air from the interior of bag 30 without necessitating the stopping of the filling operation.

The grease is introduced into bottom portion 55 of tube 50 through inlet conduit 70 by opening valve 71 therein. The grease is forced into interior 32 of bag 30 through inlet conduit 70, tube 50 and passageways 54 by means of any conventional grease pump or equivalent means (not shown), such as a gear pump. After bag 30 is filled to the desired extent, valve 71 is closed. If expanded bag 30 does not completely fill compartment 15 of casing 21, a liquid product such as heating oil, gasoline, lubricating oil or the like may be introduced into compartment 15 between the exterior of bag 30 and the interior of casing 21 through port 18. In this way, both a grease and a liquid product may be transported in the same load.

When it is desired to remove the grease from the interior of bag 30, valve 81 in outlet conduit 82 is opened and pump 83 is operated to discharge the grease through outlet conduit 84. Since the interior of tube 50 and interior 32 of bag 30 are in fluid communication and are fluid-tight with respect to compartment 15, it is possible to employ pump 83 to remove the grease from interior 32 of bag 30 due to the atmospheric pressure exerted on the exterior of bag 30 when cover 23 of port 18 is open. If desired, pump 83 may be employed in the filling operation of bag 30.

Another embodiment of the apparatus of the present invention is shown in Fig. 3. Bag 101 is arranged within compartment 16 defined by rigid casing 102 which is preferably constructed of a metal such as steel. As in the case of bag 30, bag 101 is impervious to fluids and is constructed of a flexible material and is preferably constructed of an extensible or elastic material such as nitrile rubber, neoprene or the like, which is resistant to attack by hydrocarbons. The capacity of bag 101 is preferably substantially the same as that of compartment 16, and for conventional tank wagons should be about 800 to 3,000 gallons. Extending upwards into bag 101 is tube 110. Tube 110 passes hermetically through bag 101 at seal 111. Casing 102 is provided in its lower wall with port 103, which has a flange 104. Tube 110 is provided in its lower portion with flange 105, which cooperates with flange 104 to effect a fluid-tight seal. Bolts 106 and 107 are tightened to thereby connect together flanges 104 and 105. A gasket (not shown) may be arranged between flanges 104 and 105 to assure a fluid-tight seal between flanges 104 and 105.

As shown in Fig. 3, the upper end 112 of tube 110 is provided with two substantially radially extending tubular members 113 and 114, the interiors of which communicate with the interior of tube 110. Tubular members 113 and 114, as well as upper portion 112 of tube 110, are provided with a plurality of spaced openings defining a plurality of passageways 115 which are adapted to permit the passage of grease readily therethrough. Passageways 115, as well as the interior cross-sectional area of tubular members 113 and 114 and tube 110, are sufficient in size to permit ready flow of grease through tube 110 and tubular members 113 and 114 into the interior of bag 101 as well as the discharge of grease from the interior of bag 101 through tubular members 113 and 114 and tube 110. Preferably, passageways 115 have circular transverse cross-sections and are approximately symmetrically positioned with respect to the longitudinal axis of tube 110 and tubular members 113 and 114. The diameters of passageways 115 are preferably in the range of about ¼ to ½ inch and the number of passageways 115 will be about 20 to 200. In this arrangement, sealing of all of the passageways is prevented during the discharge of bag 101 should bag 101 collapse on any portion of tubular members 113 and 114 or upper portion 112 of tube 110. Tubular members 113 and 114 each extend at least about 1 inch outwards from tube 110 and preferably extend outwards at least about 6 inches from tube 110. In conventional tank wagons, the length of tubular members 113 and 114 may be in the range of about 0.05 to 0.25 of the average diameter of casing 102. The internal diameters of tubular members 113 and 114 and tube 110 are preferably in the range of about 1½ to 3 inches.

Preferably the height of tubular members **113** and **114** above the bottom of casing **102** does not exceed about 12 inches. Generally the interenal diameter of tubular members **113** and **114** and tube **110** and the number and size of passageways **115** should be selected to permit the charge or discharge of about 5 to 100 or more gallons per minute to and from bag **101**.

Preferably, bag **101** is provided with a vent in the upper portion thereof. In Fig. 3, vent **120** is provided in the top of bag **101**. Vent **120** communicates with vent line **121** which extends from vent **120** downwards around bag **101** and passes through casing **102** through port **122**. Vent line **121** is constructed of a flexible material and preferably constructed of an extensible or elastic material such as nitrile rubber, neoprene or the like. Vent line **121** is provided with valve **123** which may be opened during the filling operation to release from the interior of bag **101** any entrapped air, and which may thereafter be closed. The capacity of vent **120** and vent line **121** is sufficient to permit the release of any entrapped air in bag **101** without necessitating the stopping of the filling operation.

The bottom of tube **110** connects with conduit **130** which in this specific embodiment of the invention may be employed for both the filling and discharge operation. Conduit **130** is provided with valve **131** which is opened during the filling or discharge operation and closed thereafter. During the filling operation, grease may be pumped through conduit **130**, tube **110** and passed into the interior of bag **101** through passageways **115** in upper portion **112** of tube **110** and tubular members **113** and **114**.

Casing **102** is provided with upper port **19** through which a liquid product may be introduced into compartment **16** between casing **102** and the outer surface of bag **101**. This liquid product may be removed from the interior of compartment **116** through port **140** by means of outlet conduit **141** by opening valve **142** therein. Thus in this form of the invention, it will be apparent that a grease may be transported in the interior of bag **101** alternatively or simultaneously with the carrying of a liquid product in compartment **16** between casing **102** and the exterior of bag **101**.

The grease may be discharged from the interior of bag **101** by connecting conduit **130** to a grease pump with port **19** open. However, in this particular specific embodiment of the present invention, a grease pump is not required during the discharge operation. This is accomplished by introducing a compressed gas, such as compressed air, through conduit **145** by opening valve **146** therein to thereby admit the compressed gas into compartment **16** between casing **102** and the outer wall of bag **101**. In carrying out this operation, valve **142** in outlet conduit **141** is closed and cover **150** for port **19** is closed. Thus cover **150** is lowered until gasket **151** attached thereto contacts flange **152** of port **19**. Locking mechanism **153** is employed to tighten cover **150** through gasket **151** against flange **152** to give a fluid-tight seal such that no compressed gas may escape through port **19**. Generally, a pressure within compartment **16** on the exterior of bag **101** in the range of about 5 to 25 p.s.i. gauge will be sufficient to discharge substantially all of the grease from the interior of bag **101**.

Thus it will be seen that the novel apparatus of the present invention comprises a flexible bag which is impervious to fluids and a tube which passes hermetically through the bag, the portion of the tube within the interior of the bag being provided with a plurality of spaced openings or perforations defining passageways of sufficient size and number to permit the ready passage of grease therethrough. The apparatus of this invention is adapted to be arranged within the casing of a conventional tank wagon, tank truck, tank car and the like or compartment thereof. The tube which is provided with a plurality of spaced openings prevents plugging of the outlet means during the discharge operation. Preferably the bag is constructed of an extensible or elastic material and preferably the bag is provided with a valved venting means in the upper portion thereof.

The description of the present invention in this specification will obviously suggest many modifications which are within the scope of the present invention to those skilled in the art. This is particularly true in the case of the perforataed charge-discharge tube within the interior of the bag. Thus this tube may be provided with more than two tubular members, for example, or the tubular members may be curved upwards or downwards, or the tube may expand into an enlarged bulb provided with a plurality of spaced openings, etc. Although the tube preferably extends upwards through the bottom portion of the compartment casing into the bottom of the bag, this is not essential and, if desired, the tube may be passed through a port in the sides of the casing into the side of the bag or even may be extended downwardly through a port in the upper portion of the casing into the upper portion of the bag.

For a particular compartment and for a particular bag, there will be an optimum design for the tube. This is demonstrated, for example, by the following experiments which were carried out. A 12" x ½" standard iron nipple was sealed off smooth in one end and ¼" holes were drilled through it extending 6" from the closed end. There were 114 holes drilled in the nipple and these holes were substantially uniformly arranged in that portion of the nipple in the region of the closed end. The nipple was mounted inside a 12" (length) x 6" (diameter) rubber bag (approximate dimensions of non-extended shape) with 5" of the perforated part of the nipple extended inside the bag. The thickness of the wall of the rubber bag (non-extended form) was about 1/16". The external portion of the tube was then connected to a grease pump and grease was then pumped into the bag. The grease employed had an A.S.T.M. penetration at 77° F. of about 290 mm./10 and consisted of a mineral lubricating oil having an S.U.S. viscosity at 210° F. of about 55 thickened to a grease consistency with about 17 wt. percent of a lime soap of hydrogenated fish oil acids consisting mainly of stearic acid.

The grease was discharged from the interior of the rubber bag by attaching the discharge tube through a rubber stopper to a suction flask. The rubber bag was charged three different times with different amounts of the grease and was pumped from the rubber bag using different tube lengths inside the bag. The efficiency of the emptying operation of the bag is shown in the table below:

Length of Discharge Tube Inside Bag, Inches	Grease Charged, gms.	Grease Discharged		Grease Left in Bag	
		gms.	percent	gms.	percent
5	967	672	69.6	295	30.4
3½	742	647	87.2	95	12.8
2½	609	474	77.8	135	22.2

It will be seen from the data shown in the above table that for this particular apparatus of this invention, the optimum height of the outlet pipe inside the bag was about 3½". It will be apparent that for different bags, that is, for different bag sizes, different bag thicknesses, different bag materials, there will be an optimum design for the portion of the charge- and discharge-tube arranged within the bag. The efficiency of grease discharge from the bag shown in the above table was determined using a partially filled bag. Obviously, the efficiency of discharge would have been substantially higher from a filled bag.

A specific example of the apparatus of the present

invention is as follows: A tank wagon having two compartments is provided with the apparatus of this invention (similar to that of Fig. 1) arranged in one of the compartments. The capacity of this compartment is about 2,000 gallons and has the following dimensions: 5'9" diameter x 13' long. The compartment casing is constructed of steel plate and the casing wall is about ⅜" in thickness. There are three ports provided in the casing wall, the ports being employed for the following purposes: port No. 1 for filling and emptying the rubber bag, port No. 2 for filling and emptying the space between the rubber bag and the casing and port No. 3 for releasing air or other gases from the rubber bag and from the space between the rubber bag and the casing. These ports have circular cross-sectional areas of 12.5 sq. inches, 3.14 sq. inches, and 12.5 sq. inches, respectively.

The bag is constructed of neoprene rubber and has a wall thickness (non-extended) of about ⅛ inch and has the following approximate dimensions: 12' x 6' when deflated. The bag has a maximum capacity when extended of about 2,000 gallons.

The tube is constructed of stainless steel, has a wall thickness of about ⅛ inch and an internal diameter of about 2 inches. The tube as initially formed has a closed end and this portion of the tube extends upwards into the bag for about 12 inches. There are 200 holes, arranged uniformly and symmetrically with respect to the vertical and longitudinal axes of the tube, drilled through the tube wall extending from the tip of the closed end down to the seal between the bag and the tube. These holes are about 5/16 inch in transverse cross-sectional diameter.

A valved vent having a transverse cross-sectional diameter of about ½ inch is provided in the top of the bag. The vent conduit is constructed of stainless steel and extends upwards about 6 inches from the top of the bag.

What is claimed is:

1. An apparatus adapted to receive thereinto, store and discharge therefrom, materials having an A.S.T.M. penetration at 77° F. of about 250–390 mm./10 which

comprises a transportable rigid casing provided with at least two ports in the wall thereof, a flexible bag impervious to fluids arranged within said casing, said bag having a valved air vent in the upper portion thereof, a tube provided with a plurality of spaced openings in the wall thereof in the region of one of its ends, an inlet valve attached to said tube and an outlet valve attached to said tube, said plurality of spaced openings in the wall of said tube defining a plurality of passageways adapted to permit the passage of materials of a grease consistency readily therethrough, said tube extending through one of said ports in the wall of said casing, the portion of said tube provided with said plurality of spaced openings passing hermetically through said bag and extending more than six inches into the interior of said bag, said inlet and said outlet valves being connected to that portion of said tube extending outwardly from said rigid casing and said flexible bag.

2. The apparatus according to claim 1 wherein said transportable casing, having a capacity of about 800 to 3,000 gallons, is provided with three ports, said tube passing hermetically through one of said ports, the second of said ports being arranged in the upper portion of said casing, and the third of said ports being arranged in the lower portion of said casing, said second and third ports being adapted to charge and discharge, respectively, a liquid into the space between said casing and said bag.

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