Feb. 17, 1959 A. E. PEARCE 2,873,891

CONTROLLED RATE FLUENT MATERIAL FEEDER

Filed Oct. 25, 1957 3 Sheets-Sheet 1

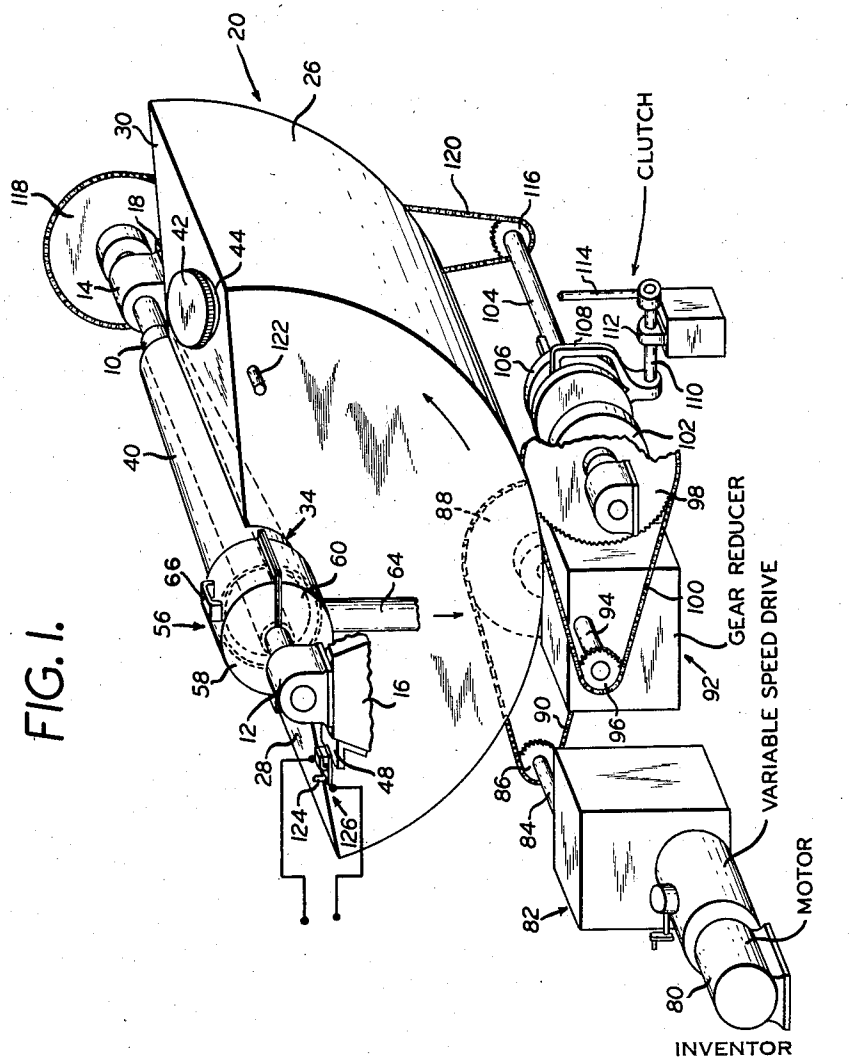


FIG. 1.

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Filed Oct. 25, 1957 3 Sheets-Sheet 2

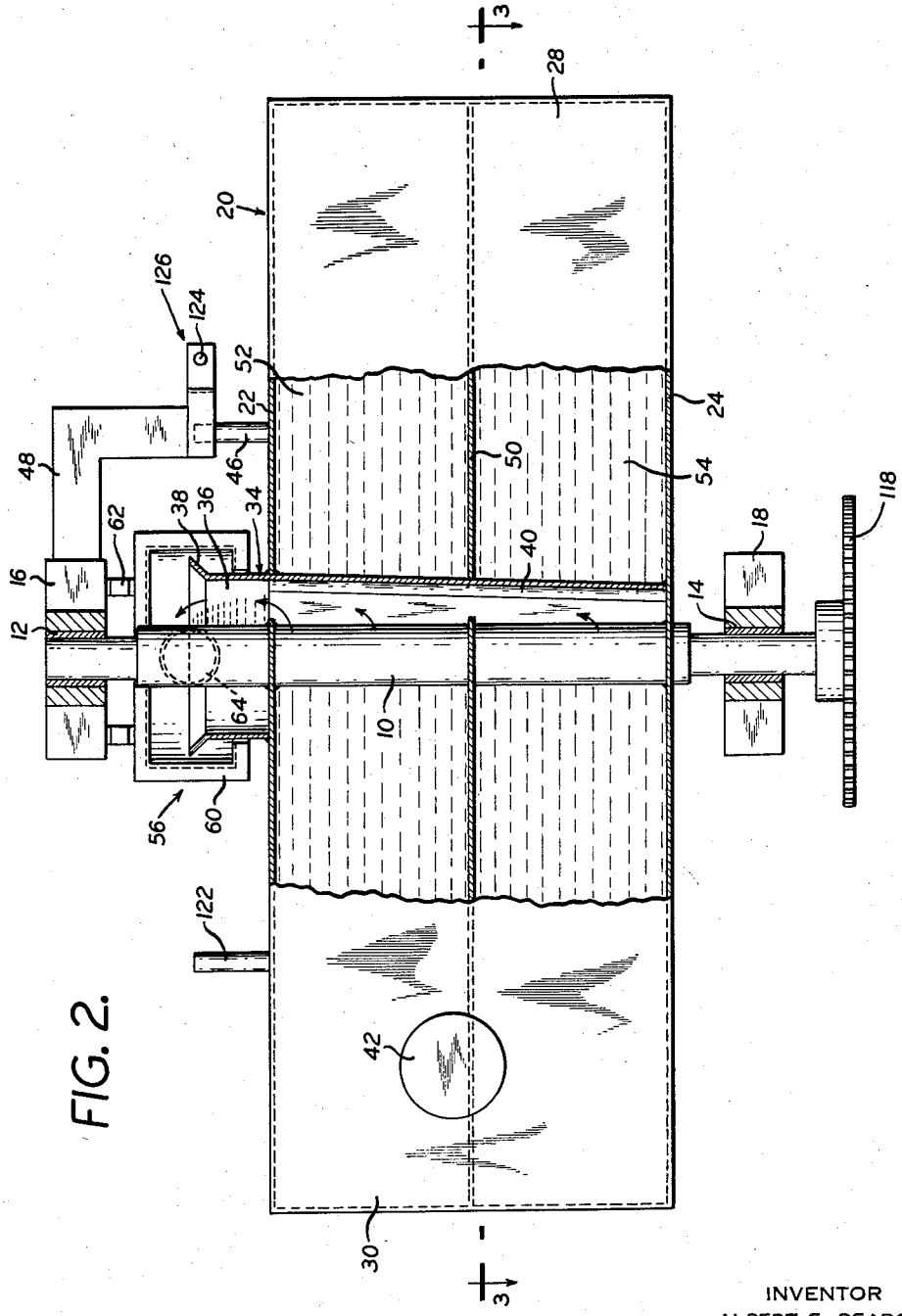


FIG. 2.

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CONTROLLED RATE FLUENT MATERIAL FEEDER

Filed Oct. 25, 1957 3 Sheets-Sheet 3

FIG. 3.

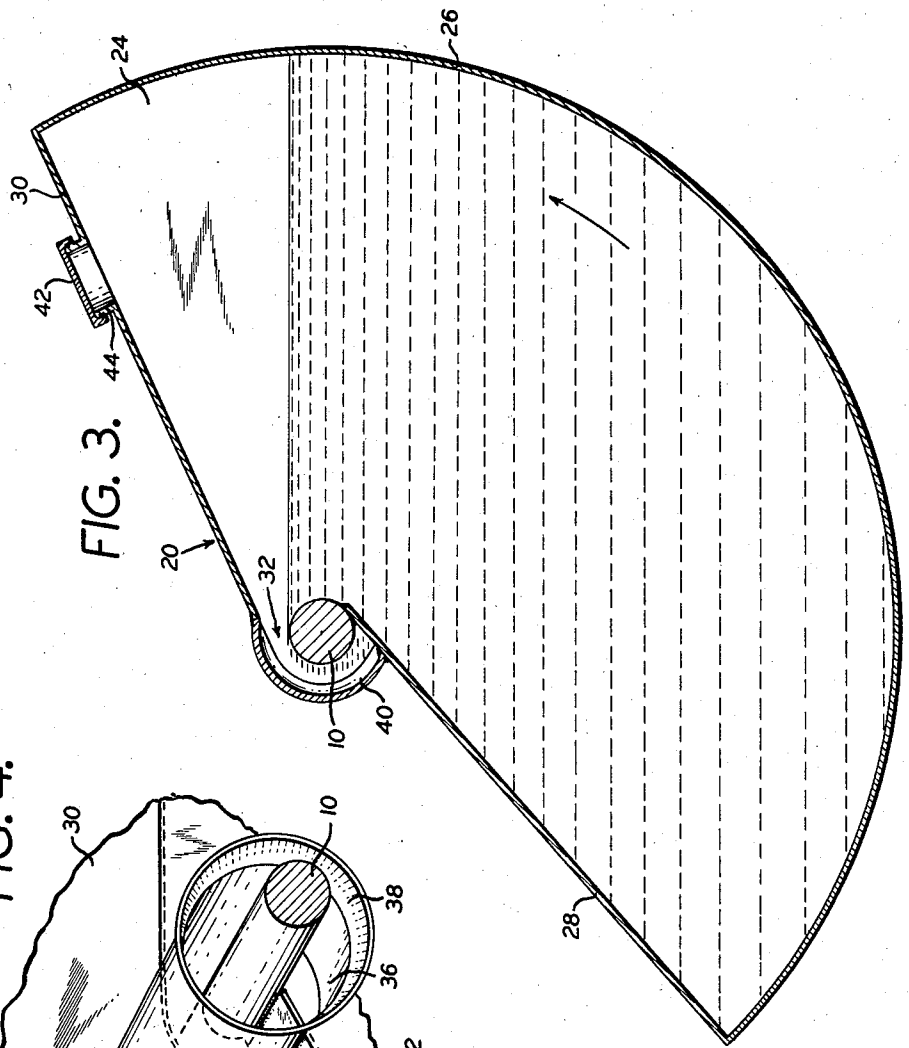
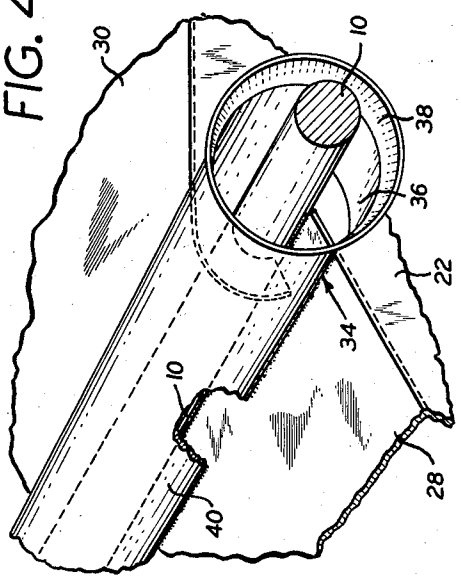


FIG. 4.



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2,873,891

CONTROLLED RATE FLUENT MATERIAL FEEDER

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Application October 25, 1957, Serial No. 692,411

10 Claims. (Cl. 222—144)

This invention relates to devices for delivering liquid at a controlled volumetric rate.

Such a device may be used with advantage for adding chemicals to a liquid supply, or for treating solid material or suspensions and will serve, when the main stream of material to be treated is advanced at a determinable rate, as a proportional feeder for maintaining uniformity of treatment.

Although the invention is not limited to the paper industry, it has been worked out with particular reference to the prevention of the formation of slimes in paper making machinery, and has been used with advantage for adding a minute proportion of a mold-inhibiting agent or fungicide to pulp suspensions which constitute furnishes for paper making machines.

It is an object of the invention to provide a device adapted to be rotated at controlled speed, which, when so rotated, will discharge liquid under a constant head and in constant proportion to the rotary speed to a constant point of delivery.

To this end, it is a feature that a horizontal shaft is provided upon which a sector-like tank or drum of circular cross section is supported, the tank comprising parallel end walls located respectively at closed and discharge sides of the tank, an arcuate peripheral wall coaxial with the shaft, and generally radial boundary walls disposed in planes substantially tangent to the shaft. One of the boundary walls desirably extends into engagement with the shaft and forms a sealed joint therewith, while the other boundary wall is spaced from the shaft to leave a space for liquid to pour over the shaft. A discharge conduit sleeve segment, coaxial with the shaft, extends through the end wall at the discharge side of the tank and has a discharge end portion therebeyond. The sleeve segment is connected in continuous sealing relation with both boundary walls and with the closed end wall. The sleeve is desirably frusto-conical in form so that its bottom slopes away from the shaft toward the discharge side of the tank in all operative positions of the tank.

The invention constitutes an important advance over such conventional instrumentalities as positive proportional pumps, decanting feeders and bung type valves. There are no valves subject to sticking, and no joints or packing glands subject to leakage. There are no relatively moving parts in contact with chemicals. Maintenance cost is held to a minimum. The rate of feed is governed entirely by the rate of rotation of the tank and is a linear function thereof.

Other objects and advantages will hereinafter appear.

In the drawing forming part of this specification,

Figure 1 is a fragmentary perspective view of an illustrative feeder embodying features of the invention, the parts being shown in the starting position;

Figure 2 is a plan view, partly broken away, showing the tank and immediately associated parts of the feeder of Figure 1;

Figure 3 is a vertical sectional view taken on the line 3—3 of Figure 2 looking in the direction of the arrows; and

Figure 4 is a fragmentary perspective view, partly broken away, showing the shaft and immediately associated portions of the feeder including particularly the discharge end of the discharging sleeve.

The feeder comprises a shaft **10** which is rotatably mounted in bearings **12** and **14**, carried respectively by pedestals **16** and **18**. A sector-like tank **20** is supported on the shaft **10**, being desirably secured in fixed relation to the shaft, as by welding. The tank **20** is parti-circular in cross section. It comprises parallel end walls **22** and **24** located, respectively, at the discharge side of the tank and at the opposite side thereof. An arcuate peripheral wall **26**, coaxial with the shaft **10**, is made unitary with the end walls **22** and **24**, desirably by welding.

The tank further includes boundary walls **28** and **30** which extend in generally radial directions. The walls **28** and **30** are secured in sealing relation at their outer ends to the peripheral wall **26**, and are secured along their side edges to the end walls **22** and **24**, as by welding. The boundary wall **28** is tangent to the shaft **10** at its inner end and is connected in a leak proof manner to the shaft, as by welding. The boundary wall **28** is an unbroken wall which permanently closes and seals the tank at one side of the shaft **10**. The wall **30** terminates short of the shaft **10** at its inner end, leaving a space **32** through which liquid may escape over the shaft.

A discharge sleeve segment **34** comprises a complete sleeve portion **36** beyond the wall **22** at the discharge side of the tank, which sleeve portion terminates in an outturned lip **38** at its discharge end. The sleeve segment **34** also includes a sector portion **40** which extends between the end walls **22** and **24**. The sleeve segment **34** is disposed in coaxial relation with the shaft **10**. The sector portion **40** extends arcuately from the inner edge of the boundary wall **30** around into contact with the outer face of the boundary wall **28**, being continuously united with both walls as by welding. One end of the sector portion **40** abuts the end wall **24** and is continuously united with said wall as by welding.

The starting position of the tank is illustrated in Figure 1. In that position the boundary wall **30** is substantially horizontally disposed, and the boundary wall **28** extends downward at a slight inclination. With the tank in that position, a cap **42** is unscrewed from a filling neck **44** of boundary wall **30**, and the tank is filled with liquid until the liquid stands flush with the upper side of the shaft **10**. The cap **42** is then replaced on the neck **44**. The filling position is determined by engagement of a projection **46** on the wall **22** of the tank, with an intercepting bracket **48** which is affixed to the pedestal **16**. The downward slope of the wall **28** when the tank is in the position of Figure 1 is important because it precludes the formation of an air pocket inside the tank.

As the tank is turned in a counter-clockwise direction (as viewed in Figure 1), the liquid continuously stands flush with the upper side of the shaft **10** and continuously presents a horizontal surface of unchanging area. Equal angular movements of the tank, therefore, cause equal volumes of liquid to be discharged over the shaft **10** and into the discharge space which is defined between the shaft **10** and the sector portion **40** of the sleeve segment **34**. The liquid which passes over the shaft immediately runs to the bottom of the space between the shaft and the sector portion **40** of the sleeve segment. The sleeve segment is desirably of frusto-conical form, being made of increasing diameter from the wall **24** at the closed side of the tank to and through the wall **22** at the discharge side of the tank. A flow gradient is thereefore provided for inducing run-off of the liquid delivered over the shaft.

The tank is desirably subdivided into compartments,

each of uniform width but not necessarily equal in width to one another by one or more divider walls **50** which extend parallel to the end walls **22** and **24**, one such centrally located divider wall being shown and serving to separate the tank into equal compartments **52** and **54**. When it is desired to treat a liquid material or other material with two chemicals in predetermined proportions, the two compartments **52** and **54** can be separately filled with the respective chemicals. Although it is essential that both compartments be filled to the same degree, the ratio of treating chemicals to one another can be adjusted not only by the relative width of the compartments, but also by relative adjustment of the concentrations of the chemicals.

Means is provided for receiving liquid delivered from the sleeve segment **34** and for delivering it to a desired destination. A housing **56** composed of upper and lower complementary flanged sections **58** and **60** and having an opening in its side toward the tank is separated from the pedestal **16** through brackets **62** in position to surround closely the discharge end of the sleeve segment **34**. The housing is provided with a discharge opening through the bottom of the section **60**, through which it communicates with a conduit **64** for conveying the liquid to any desired destination. Access may be had to the interior of the housing **56** by removing the housing section **58** from the housing section **60**. The housing section **58** is provided with a handle **66** for this purpose.

Mechanism is provided for driving the tank rotatively in a counter-clockwise direction from the position of Figure 1 at any desired constant speed throughout a wide range of speeds. A motor **80** is connected through an infinitely variable speed transmission unit **82** to drive shaft **84** at any desired constant speed within a wide range. The shaft **84** acts through sprockets **86** and **88** and an intervening chain **90** to transmit the drive to the input side of a reduction gear unit **92**. The output shaft **94** of the unit **92** acts through sprockets **96** and **98** and an intervening chain **100** to drive a clutch member **102**.

The clutch member **102** is mounted upon a shaft **104** with freedom for rotation relative to the shaft. A complementary clutch member **106** is keyed to the shaft **104**, being free to be shifted axially of the shaft, but capable of driving the shaft rotatively. The clutch member **106** is circumferentially grooved and is engaged in the groove by a shifting fork **108**. The fork **108** is fast on a shaft **110**, which is rockably mounted in a bearing **112**. A clutch operating handle **114** is fast on the shaft **110**. When the clutch is engaged, the shaft **104** acts through sprockets **116** and **118** and a chain **120** to drive the shaft **10**, thereby to drive the tank **20** as described.

With the clutch engaged, the motor **80** is set into operation to drive the tank counter-clockwise continuously at the chosen speed from the position of Figure 1 by the manual closing of a normally open motor switch (not shown). The manually operated motor switch is held closed by a stick relay, and the operation of the motor, therefore, is caused to continue until a projection **122** on the wall **22** of the tank **20** engages an actuating member **124** of a normally closed switch **126** to open the switch. The switch **126** is connected in series with the relay which holds the manually operable motor switch closed, and serves therefore to de-energize the holding relay. This allows the motor switch to open and thereby terminates the operation.

When the tank comes to rest, the operator disconnects the clutch, manually returns the tank to the starting position, fills the tank, re-engages the clutch, and sets the tank once more into operation by manually closing the motor switch.

The feeder is useful as a proportional feeder whenever the main stream is flowing at a known, constant volumetric rate. It is also useful when the main stream is flowing at a variable rate. By making the variable speed transmission unit responsive to a flow meter which measures the main stream flow, the rate of rotation of the novel feeder may be made proportional to the main stream flow. Since the delivery rate of the feeder is a linear function of the rate of rotation of the feeder tank, it follows that the delivery rate of the feeder will be automatically adjusted to maintain it in constant proportion to the variable rate of main stream flow.

While the invention is designed primarily for the handling of liquids, it may be designed for the handling of other fluent materials such as comminuted solids.

While the preferred embodiment of the invention has been illustrated and described in detail, it is to be understood that changes may be made therein and the invention embodied in other structures. It is not therefore, the intention to limit the patent to the specific construction illustrated, but to cover the invention broadly in whatever form its principles may be utilized.

I claim:

1. A controlled rate liquid feeder comprising, in combination, a horizontal shaft, a sector-like tank supported on the shaft, comprising parallel end walls located respectively at closed and discharge sides of the tank, a cylindrical peripheral wall, coaxial with the shaft, and two generally radial boundary walls disposed in planes substantially tangent to the shaft, one of said boundary walls extending into engagement with the shaft and forming a sealed joint therewith, and the other boundary wall terminating short of the shaft to leave a space for liquid to pour over the shaft and be discharged progressively as the shaft is turned in one direction, a discharge sleeve segment coaxial with the shaft, having a sector portion which extends in coaxial relation to the shaft between the end walls, said sleeve sector portion extending through the end wall at the discharge side of the tank and including a discharge end portion therebeyond, but being continuously connected in sealing relation with both boundary walls and with the closed end wall, and means for driving the tank at a controlled rotary speed in the direction to progressively discharge the contents of the tank over the shaft, the construction and arrangement being such that a liquid surface of constant area is maintained in a horizontal plane tangent to the shaft at the upper side thereof, so that equal quantities of liquid will be delivered over the shaft for equal increments of rotation of the shaft.

2. A structure as set forth in claim 1, in which the tank is divided into compartments each of uniform width by at least one divider wall.

3. A structure as set forth in claim 1, in which the driving means includes means for adjusting the rate of drive of the tank to any desired value within wide limits.

4. A structure as set forth in claim 1 in which the sleeve segment is generally frusto-conical in form so that its lower side slopes downward towards the delivery side of the tank in all operative positions of rotation of the tank.

5. A structure as set forth in claim 1 in which the discharge sleeve is provided with a flaring lip at the discharge end thereof.

6. A structure as set forth in claim 1 which further includes means for determining operative limits of movement of the tank, and means for automatically disabling the tank driving means when a position is reached in which the contents of the tank are substantially exhausted.

7. A structure as set forth in claim 1 which further includes a manually operable clutch in the tank driving means whereby the tank can be freed for manual return to a filling and starting position.

8. A structure as set forth in claim 1 in which the tank boundary wall which meets the shaft is a completely closed retaining wall, and the boundary wall which is spaced from engagement with the shaft is provided with a tank filling opening, and in which means are provided for limiting movement of the tank in the return or non-operating direction to a filling position in which the closed

boundary wall slopes downward from the shaft and the filling wall extends in a substantially horizontally plane.

9. A controlled rate liquid feeder comprising, in combination, a horizontal shaft, a sector-like tank supported on the shaft, comprising parallel end walls located respectively at closed and discharge sides of the tank, a cylindrical peripheral wall, coaxial with the shaft, and two generally radial boundary walls disposed in planes substantially tangent to the shaft, one of said boundary walls extending into engagement with the shaft and forming a sealed joint therewith, and the other boundary wall terminating short of the shaft to leave a space for liquid to pour over the shaft and be discharged progressively as the shaft is turned in one direction, a discharge sleeve segment coaxial with the shaft, having a sector portion thereof extending in coaxial relation to the shaft between the end walls, said sleeve sector portion extending through the end wall at the discharge side of the tank and including a discharge end portion therebeyond, but being continuously disposed in sealing relation with both boundary walls and with the closed end wall, means for receiving and carrying away the liquid discharged by the sleeve segment, comprising a housing which surrounds the discharge end portion of sleeve segment and which has an outlet opening at its lowest point, and means for driving the tank at controlled rotary speed in the direction to progressively discharge the contents of the tank over the shaft, the construction and arrangement being such that a liquid surface of constant area is maintained in a horizontal plane tangent to the shaft at the upper side thereof, so that equal quantities of liquid will be delivered over the shaft for equal increments of rotation of the shaft.

10. A controlled rate feeder for fluent materials such as liquids and comminuted solids comprising, in combination, a horizontal shaft, a sector-like tank supported

on the shaft, comprising parallel end walls located respectively at closed and discharge sides of the tank, a cylindrical peripheral wall, coaxial with the shaft, and two generally radial boundary walls disposed in planes substantially tangent to the shaft, one of said boundary walls extending into engagement with the shaft and forming a sealed joint therewith, and the other boundary wall terminating short of the shaft to leave a space for fluent material to pour over the shaft and be discharged progressively as the shaft is turned in one direction, a discharge sleeve segment coaxial with the shaft, having a sector portion which extends in coaxial relation to the shaft between the end walls, said sleeve segment extending through the end wall at the discharge side of the tank and including a discharge end portion therebeyond, but being continuously connected in sealing relation with both boundary walls and with the closed end wall, the construction and arrangement being such that a fluent material surface of constant area is maintained in a horizontal plane tangent to the shaft at the upper side thereof, so that equal quantities of fluent material will be delivered over the shaft in equal time intervals when the drum is turned at constant speed.

References Cited in the file of this patent

UNITED STATES PATENTS

463,919	Proctor	Nov. 24, 1891
1,181,698	Taylor	May 2, 1916
1,733,464	McWilliams	Oct. 29, 1929
2,581,674	King	Jan. 8, 1952

FOREIGN PATENTS

197,990	Germany	May 1, 1908