United States Patent

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[72] Inventors **George H. Doornbos**
Grand Rapids;
John W. Knutson, Spring Lake, Mich.

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[73] Assignee **Werner Machinery Company**
Grand Rapids, Mich.

[54] **SPRAY MEANS FOR BULK TANK WASHERS**
8 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **239/142;** 239/246; 239/248; 239/567
[51] **Int. Cl.** **B05b 9/00**
[50] **Field of Search** 239/142, 246, 8, 140; 259/7, 8, 23, 24, 134, 135; 134/167, 168, 180, 181; 239/142, 144

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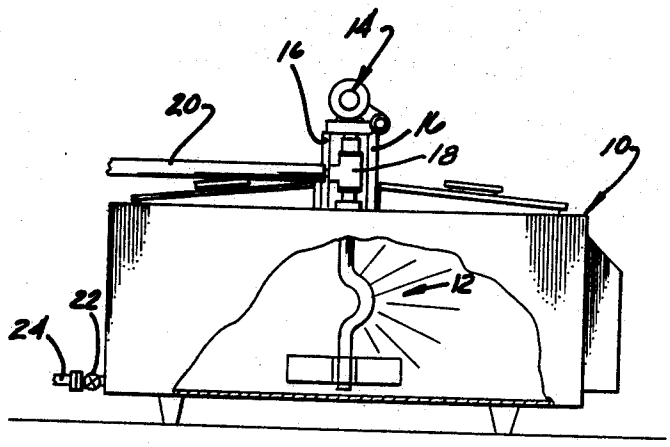
Primary Examiner—Lloyd L. King
Attorney—Price, Heneveld, Huizenga & Cooper

ABSTRACT: An elongate shaft of generally tubular form which is mountable vertically within a bulk tank from its upper or top end, to be rotatably driven about its longitudinal axis. The shaft has agitator blades attached to its lower extremity, and a central portion of the shaft is laterally offset from the said axis in a smoothly curved U-shaped configuration. The shaft has a series of vertically spaced spray apertures formed therein along said U-shaped offset for spraying liquid pumped through the hollow shaft outwardly therefrom into the interior of the bulk tank over a semicircular arc of approximately 180°.



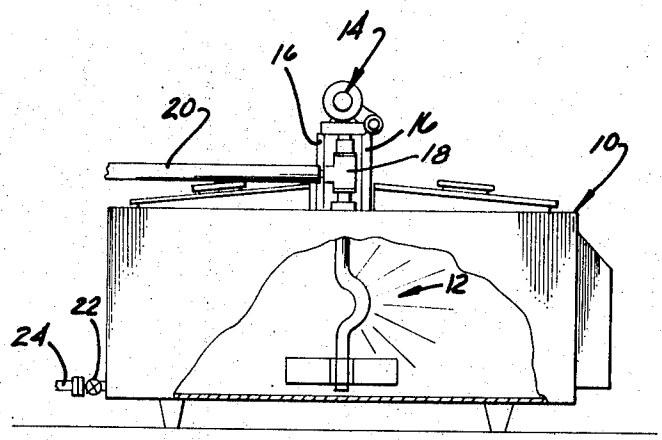


FIG. 1.

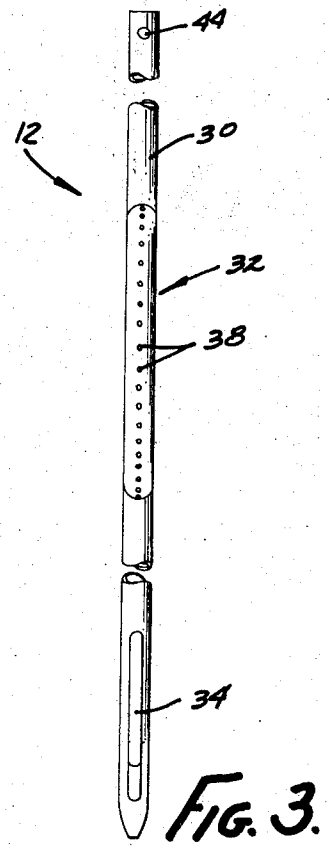


FIG. 3.

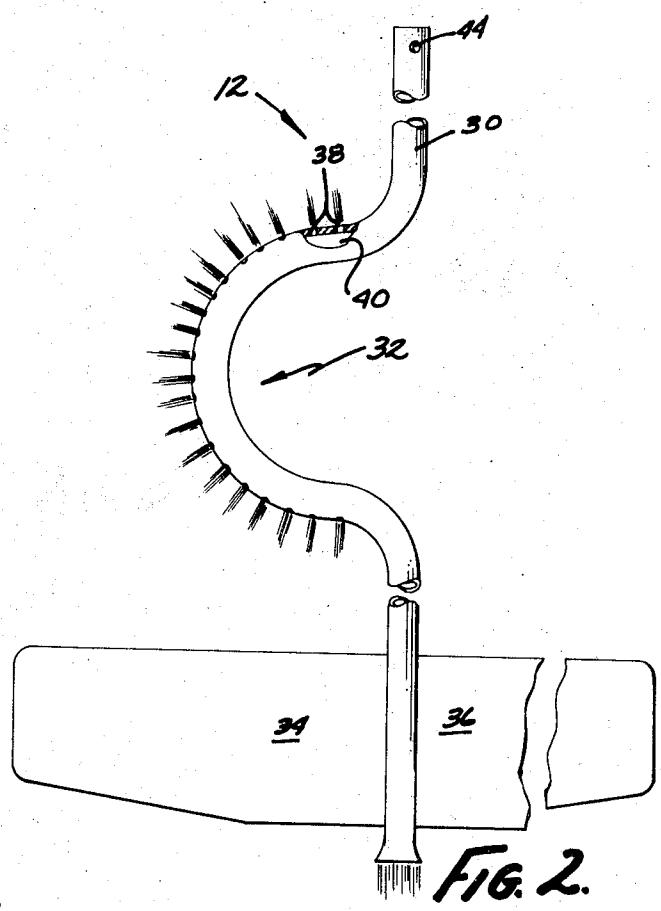


FIG. 2.

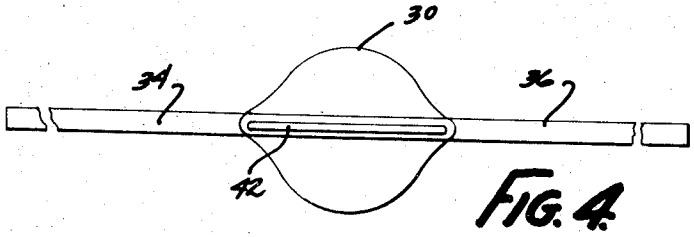


FIG. 4.

INVENTORS
GEORGE H. DOORNBOS
JOHN W. KNUTSON
BY Price, Heneveld
Huizenga & Cooper
ATTORNEYS

SPRAY MEANS FOR BULK TANK WASHERS

BACKGROUND OF THE INVENTION

This invention relates to bulk storage tanks for liquid and the like, and to means for cleaning the interior of such a tank when the contents thereof have been removed. More particularly, the invention relates to a combined agitator device and spray means for mounting within a bulk tank by attachment to the conventional agitator drive, so as to be rotatable within the tank.

In the past, bulk storage tanks such as are widely used to store milk and the like have been cleaned through a laborious manual operation in which the tank is hosed out and scrubbed down internally. Because of health considerations, the cleaning of such tanks must of necessity be extremely thorough and comprehensive, and the manual cleaning was therefore a time consuming and wearying task; furthermore, really satisfactory cleaning of the expansive and curved interiors of the tanks was difficult to obtain by manual techniques.

Because of the foregoing reasons, others have provided methods of cleaning bulk tanks in which the tank is filled with a cleaning solution and the bladed agitator structure with which all such tanks are equipped for stirring the milk to prevent its stratification was then used to agitate the cleaning solution, in an attempt to splash it about the interior of the tank and thereby clean it in a somewhat automated manner. However, special-purpose agitators were generally considered to be necessary in order to satisfactorily splash the cleaning solution in the required manner, and a gearing change in the rotary drive mechanism for the agitators also was considered necessary since the normal speed of rotation for merely stirring the milk is rather slow. Also, considerable manual effort was still required in flushing the tank out manually with a hose, filling it manually with the cleaning solution, draining the cleaning solution, flushing the cleaning solution from the tank, etc. Because of these limitations, others have provided various types of spray equipment for the interior of the bulk tank, so that a more thorough job could be done with less effort on the part of the operator. Some of this spray equipment was devised for permanent mounting within the tank, generally at the top thereof, whereas other types of such equipment were merely inserted into the tank when it became time to clean it.

In copending application Ser. No. 563,810, assigned to the assignee of the present invention, a novel and highly practical apparatus for washing bulk tanks is disclosed and claimed, in which the conventional agitator shaft is replaced with a hollow shaft, which, while carrying agitator blades for the conventional purpose, also was equipped with a spray means. With this apparatus, the hollow agitator shaft could be used as a conduit for the cleaning solutions, which would then be sprayed directly from the spray means carried by the agitator shaft, which is intended to be rotated during this spraying process but which does not require any gearing change for speeding up the normal rotation of the agitator. By the use of this apparatus, a permanent installation was afforded in which a single device could be used both for stirring milk contained in the bulk tank and also for cleaning the interior of the tank when such milk has been removed therefrom.

SUMMARY OF THE INVENTION

The present invention provides in effect an improvement of the structure shown and claimed in the aforementioned copending application Ser. No. 563,810. The device of the invention comprises a preferred form of a combined spray means and agitator device of a greatly simplified structural nature which lends itself extremely well to rapid and uncomplicated manufacturing techniques and which nonetheless produces very superior performance. The present device in its essence comprises an elongate shaft means which is mountable within a bulk tank in a vertical orientation for rotation about its longitudinal axis and which includes agitator blade means secured to the shaft, preferably near its lower extremity, adjacent the bottom of the bulk tank. A portion of the shaft, preferably located medially thereof, is laterally offset from the longitudinal axis thereof, and the shaft is tubular in nature, at least from the top thereof through the aforesaid offset portion. A plurality of spray apertures are formed in the offset portion for discharging liquid pumped thereto through the tubular shaft outwardly of the shaft and against the interior of the bulk tank to wash it.

DRAWINGS

FIG. 1 is a fragmentary front elevational of a typical bulk tank, showing the device of the invention installed therein;

FIG. 2 is an enlarged fragmentary front elevation of the device of the invention;

FIG. 3 is a side elevational view of the structure of FIG. 2; and

FIG. 4 is a fragmentary end elevation of the structure of FIGS. 2 and 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1, a typical bulk tank **10** is depicted in the manner set forth in the above-mentioned copending application Ser. No. 563,810, with the device **12** of the present invention shown in place within the bulk tank in the preferred manner. As is fully set forth in the above-referenced copending application, the bulk tank **10** has an agitator drive means **14**, typically consisting of a gear motor arrangement, which is mounted atop the bulk tank by elevated brackets or standoffs **16**. A drive coupling **18** is provided for coupling the drive means **14** to the combined agitator and spray means **12** and for introducing a supply of cleaning solution thereto from an inlet conduit **20**. Drive coupling **18** is fully described in aforementioned copending application Ser. No. 563,810. The bulk tank has a bottom outlet equipped with a valve **22**, by which cleaning solution may be emptied from the tank through an outlet conduit **24**.

Details of the device **12** of the invention are seen in FIGS. 2, 3, and 4. The device basically comprises an elongated tubular shaft **30**, whose medial portions **32** are offset in a U-shaped configuration, and which has a pair of paddlelike agitator blades **34** and **36** secured to its lower extremity to extend radially of the shaft in diametrically opposed fashion.

The U-shaped offset medial portions **32** of shaft **30** are smoothly curved away from the longitudinal axis of the shaft over the entire excursion of the offset portion, such that this portion is generally devoid of sharply angular corners which might otherwise produce areas which are difficult or impossible to clean and which would likely produce bacteria cultures. The curved outer periphery of the offset portion **32** is provided with a series of vertically spaced spray apertures **38** which may be formed therein by drilling through the wall of the tubular shaft and which preferably are spaced relatively further apart on the generally horizontal leg portions of the offset and closer together over the generally vertical portion thereof, as illustrated in FIG. 2. The hollow interior of shaft **30** provides a passage **40** (FIG. 2) for the cleaning solutions communicated to the interior of the shaft by the drive coupling **18** (FIG. 1) from the inlet conduit **20**. As will become apparent, such solutions thus are supplied directly to the spray apertures **38** through the passage **40**, which therefore may be termed a conduit. Upon receiving such cleaning solutions the spray apertures **38** discharge the same in a series of spray jets forming a semicircular pattern, as illustrated in FIG. 2.

It should be noted here that the leg portions of the U-shaped offset **32** closely adjacent the straight or axially extending portions of shaft **30** are formed so as to extend generally normally away from the axis of the shaft. Some of the spray apertures **38** should be located in this region and reasonably close to the shaft, so that the jets of cleaning solution discharged therefrom will be directed substantially vertically, i.e., substantially parallel to the axis of shaft **30**. These substantially vertical spray jets then form the end extremities or edges of

the spray pattern produced by all of the spray apertures and this pattern will then be seen to be substantially semicircular and of very nearly 180° in extent.

As will be seen from FIGS. 2, 3, and 4, the lowermost extremity of shaft 30 is crimped beneath the agitator blades 34 and 36 to provide an elongated, slitlike spray aperture 42 (FIG. 4). The latter may be, and preferably is, rather narrow, being of approximately .010" in diameter, so that a fine, hard, or high-pressure spray is discharged therefrom directly against the bottom of the bulk tank. As will be appreciated, crimping the end of the shaft 30 will laterally elongate the same, so that spray aperture 42 will be longer than the nominal diameter of shaft 30 above the agitator blades. This serves to extend the spray discharged through this elongated aperture into a fanlike shape (as seen in FIG. 2) which thoroughly cleans the bottom of the tank in the area directly beneath the shaft and the agitator blades. The crimping of the shaft into the narrow aperture 42 creates a back pressure against the force under which the cleaning solution is pumped into the shaft, thereby causing the spray to be discharged from apertures 38 under considerable pressure.

As will be noted in FIGS. 2 and 3, the shaft 30 preferably has a pin 44 at its upper extremity, i.e., opposite the end carrying the agitator blades 34 and 36. This pin protrudes laterally from the shaft a relatively short distance, and comprises the preferred means for mounting the shaft structure of the invention within the bulk tank in the suspended manner illustrated in FIG. 1. As described in more detail in the aforementioned copending application Ser. No. 563,810, such a mounting means is designed to cooperate with a sleevelike coupling member located at the lower extremity of the drive coupling 18. Sleeves of this general type have long been used for the purpose of suspending shafts of a variety of natures, and such a sleeve includes an inverted J-shaped slot in its wall in which the pin 44 is slidable when the shaft is inserted into the sleeve. While this manner of mounting the shaft of the present invention is most preferred from a point of view of convenience and adaptability to conventional types of structures which are typically available, there no doubt are other types of mounting arrangements which could satisfactorily be used.

As is further disclosed in the said copending application, the drive coupling 18 should preferably be arranged so that a limited amount of leakage is allowed over the exterior periphery of the shaft. That is, while practically all of the cleaning solution from the inlet conduit 20 is transferred into the passage 40 within the tubular shaft 30, there nonetheless is a continuous film of cleaning solution passing downwardly over the entire outer periphery of the shaft to clean it at the same time that the bulk tank is being cleaned. Further, the spray apertures which are oriented downwardly on the U-shaped offset portion 32 of the shaft are in generally central alignment over agitator blade 34 and will thoroughly clean it. Alternatively the U-shaped offset portion may be oriented perpendicular to the agitator blades so that the aforesaid downwardly-oriented spray apertures direct spray directly at the bottom downwardly-oriented the bulk tank to clean only the latter, since tests have shown that the agitator blades themselves are very adequately cleaned by relatively dense random sprays deflected from the interior of the tank, together with the aforementioned leakage along shaft 30.

In accordance with the invention, a combined agitator shaft and spray means has been provided which is believed to epitomize rapid and easy manufacturing techniques performed on a minimum of materials to provide extremely desirable results. That is, tubular shafts of stainless steel (which is preferred) are commercially available almost everywhere, and the U-shaped offset portion 32 may quickly and easily be formed by bending the shaft. As stated, the spray apertures 38 may be formed by a simple drilling operation, and the bottom aperture 42 is formed by crimping. Consequently, no special tools, machinery or operations are required to produce the device, any the only welding required is for the attachment of the agitator blades and the pin 44 to the shaft. Welding such as this is readily accessible for polishing, whereas the absence of welded areas communicating with the interior of the device makes internal polishing a very easy matter. In operation, the semicircular spray pattern produced by the offset portion of the shaft sweeps about the interior of the tank at a relatively slow pace as the shaft is rotated therewithin to thoroughly clean every portion of the interior of the tank. Further, as already stated, the device cleans both itself internally and externally as it cleans the interior of the bulk tank. It remains only to be pointed out that, as illustrated in FIG. 1, the shaft should preferably have a length sufficient to locate the agitator blades near the bottom of the bulk tank, and the offset portion of the shaft defining the spray means should preferably be located very near the center of the tank in order to optimize the cleaning performed by the spray.

It is entirely conceivable that upon examining the foregoing disclosure, those skilled in the art may devise particular embodiments of the concepts forming the basis of the invention which differ somewhat from the preferred embodiment shown and described herein, or may make various changes in structural details to the present embodiment. Consequently, it is to be recognized that the preferred embodiment shown and described is for purposes of general illustration only and is in no way intended to illustrate all possible forms of the invention.

We claim:

1. A combined s spray means and agitator device for use in bulk storage tanks and the like, said combination comprising: an elongate shaft means mountable with a bulk tank with its longitudinal axis in vertical orientation for rotation about such axis; said shaft means being hollow to permit the transferring of liquid lengthwise thereof; agitator blades means attached to said elongate shaft means for stirring a substance stored within such tank upon rotation of said shaft means; said shaft means including an integral, generally U-shaped deviation along its length, said deviation being hollow and in flow communication with the remainder of said shaft means, said deviation having a plurality of spray apertures formed therein and spaced therealong for discharging liquid forced through said shaft means outwardly of said deviation; the location and positioning of said spray apertures being such that said liquid is discharged lengthwise of and at a plurality of angles with respect to the said axis of said shaft means.

2. The combined spray means and agitator device of claim 1, wherein at least a portion of said U-shaped deviation is oriented generally normal to said axis.

3. The combined spray means and agitator device of claim 1, wherein said U-shaped deviation is smoothly curved and generally devoid of sharply angular corners.

4. The combined means and agitator device of claim 3, wherein said shaft means is mountable within said bulk tank by suspending it from one end, and wherein said agitator blade means are attached to said shaft means near the opposite end, said deviation being located between said ends.

5. The combined spray means and agitator device of claim 4, wherein said shaft means has a length sufficient to locate said blade means near the bottom of said tank, and wherein said deviation is located on said shaft means so as to be positioned substantially at the center of said bulk tank.

6. The combined spray means and agitator device of claim 1, wherein the bottom extremity of said shaft means converges to form a downwardly oriented spray aperture.

7. The combined spray means and agitator device of claim 6, wherein said bottom extremity of said shaft means is crimped to form said aperture, said aperture comprising an elongated slot.

8. The combined spray means and agitator device of claim 6 wherein said bottom extremity when crimped is laterally elongated and said slot is wider than the nominal diameter of said shaft means.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,563,464 Dated February 16, 1971

Inventor(s) George H. Doornbos and John W. Knutson

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, Line 56;
Delete "downwardly-oriented" and insert --- of --

Claim 1, Line 1;
After "combined" delete --- s ---

Signed and sealed this 6th day of July 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

WILLIAM E. SCHUYLER,
Commissioner of Paten