United States Patent

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[54] **METHODS AND APPARATUS FOR CLEANING DRUMS**
16 Claims, 12 Drawing Figs.

[52] U.S. Cl. ..... **134/23,** 134/24, 134/25 A, 134/32, 134/43, 134/148, 134/152
[51] Int. Cl. **B08b 9/12**
[50] Field of Search ..... 134/22, 23, 24, 32, 33, 147, 148, 150, 151, 152, 199, 43, 25 A; 15/62, 57, 58, 71

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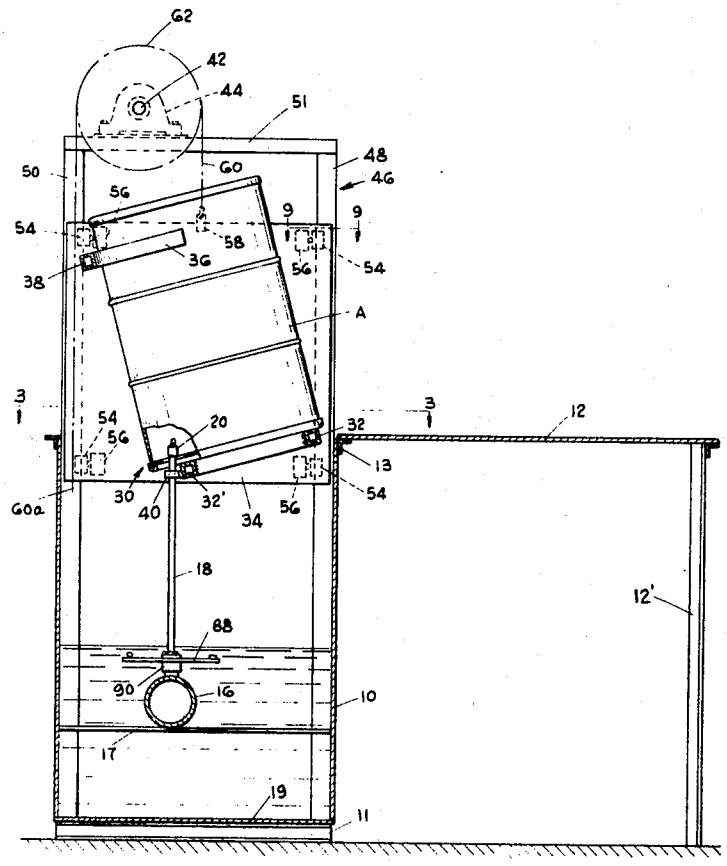
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ABSTRACT: A method of and apparatus for cleaning drums of the type having a bung opening in the cover which employs a tank having a plurality of nozzle pipes positioned in the tank. The nozzle pipes are stationary or in a fixed position, one for each drum to be cleaned. The drums are supported so that their bung openings are facing and in alignment with the nozzle pipes. The drums are moved over the stationary nozzle pipes and retracted. During the reciprocable movement of the drums a cleaning solution is sprayed against the interior surfaces of the drums.



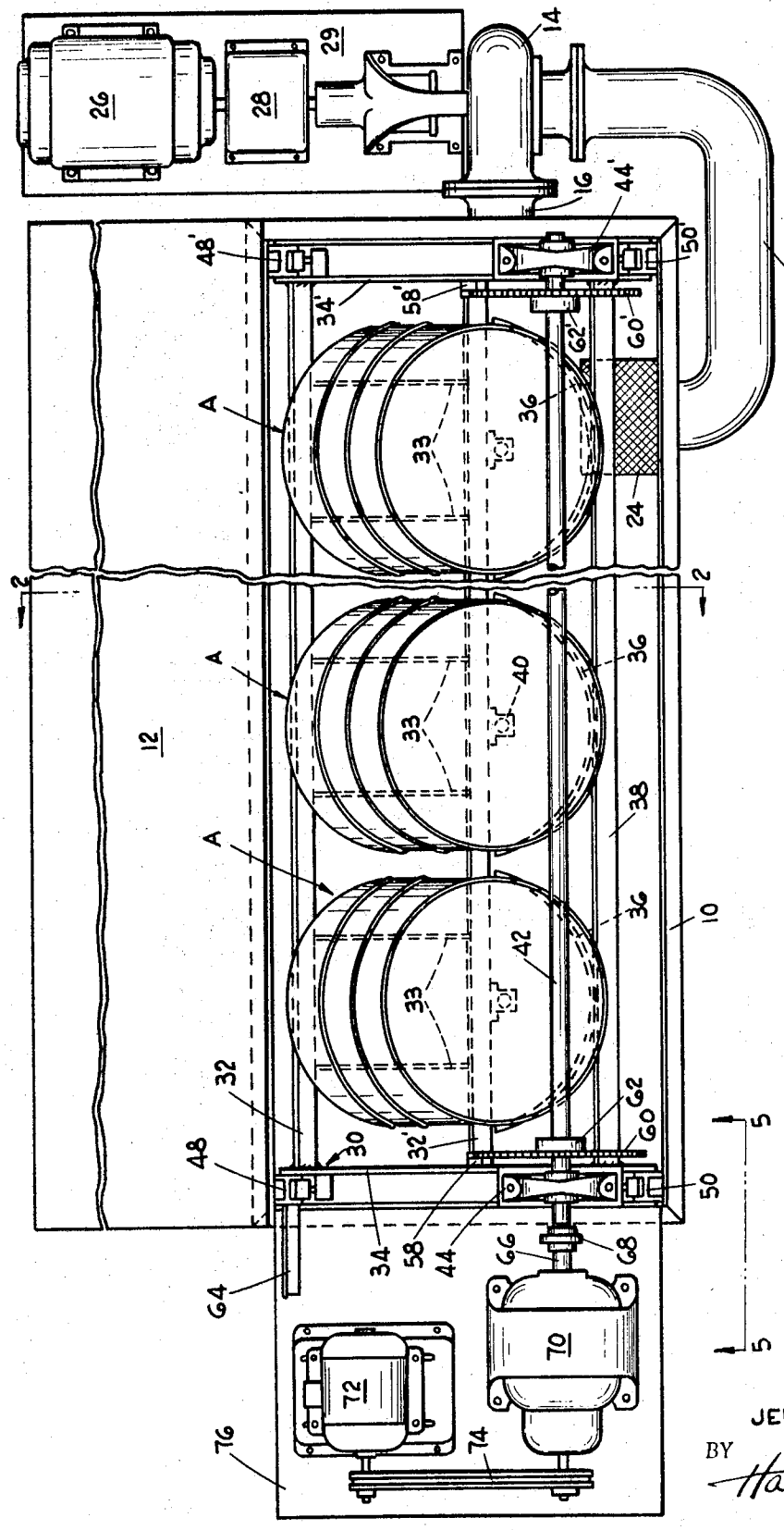


FIG. 1

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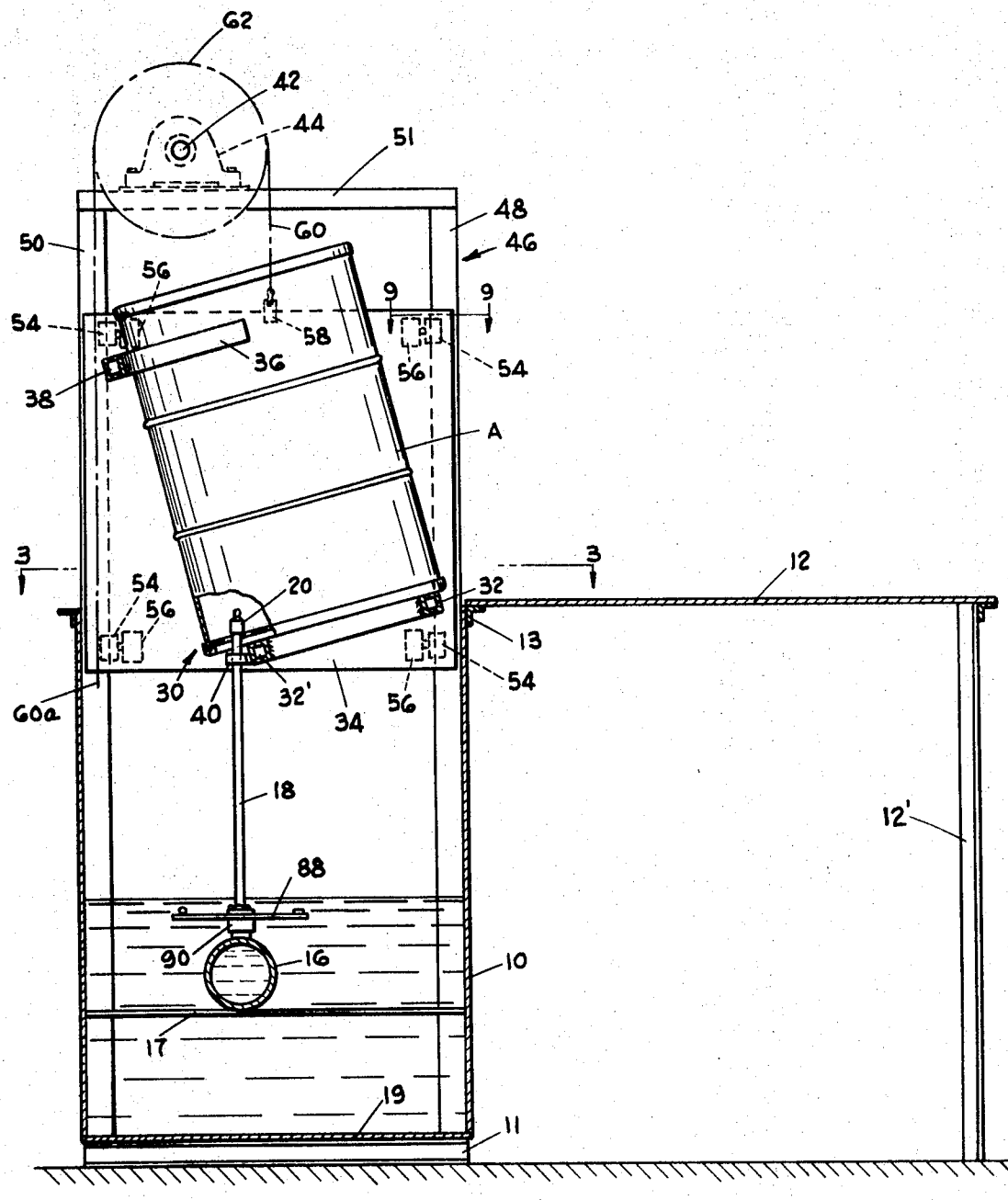


FIG. 2

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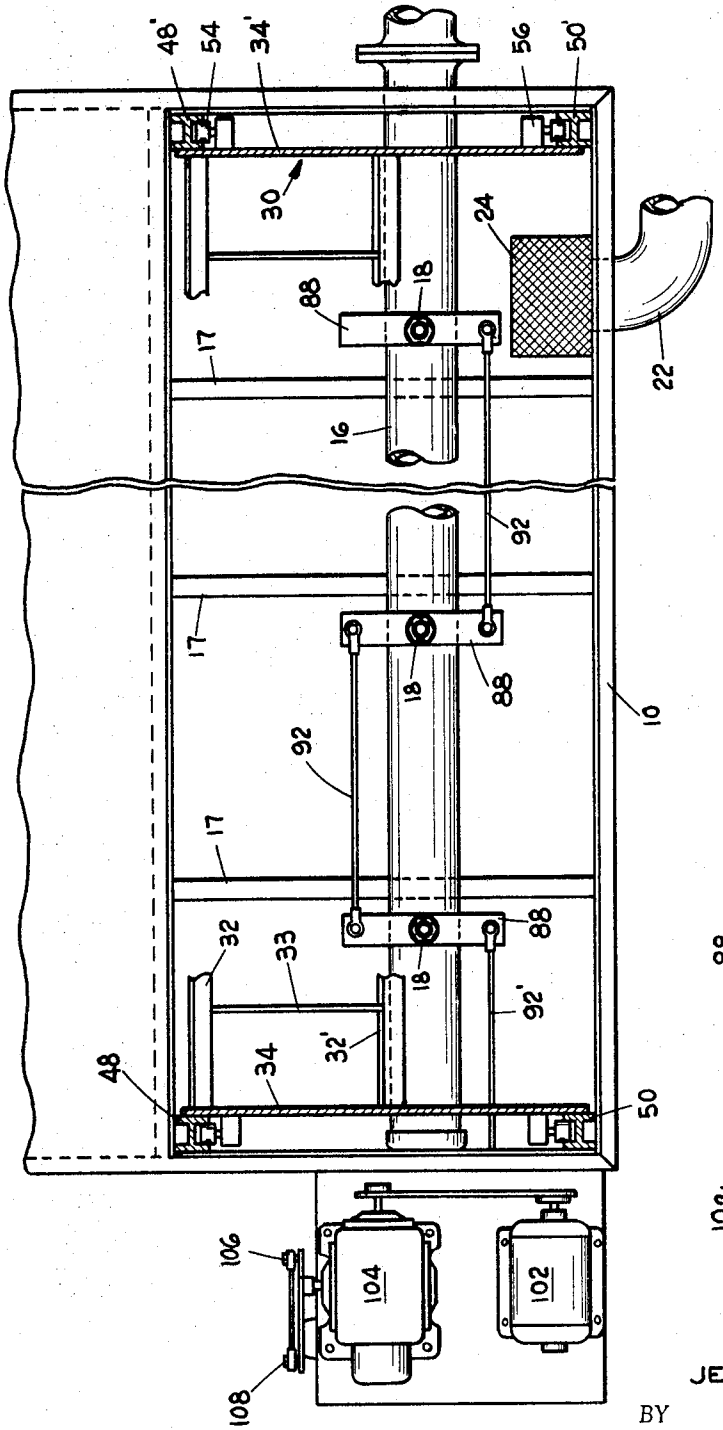


FIG. 3

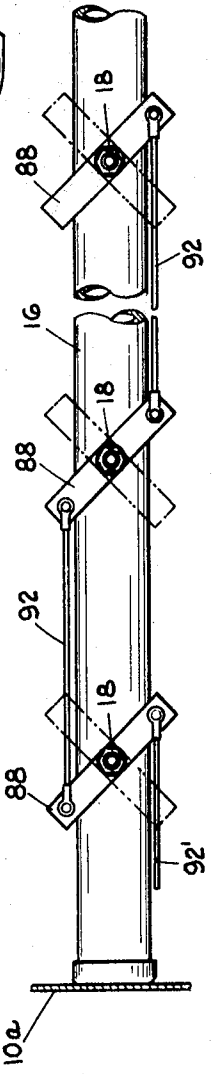


FIG. 4

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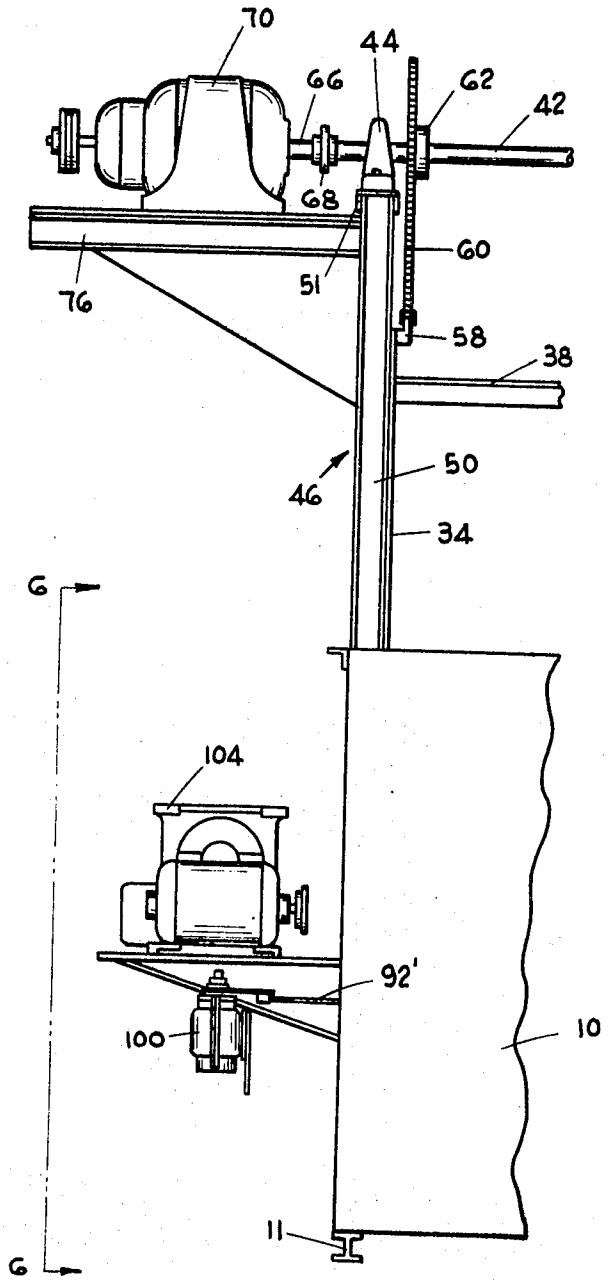


FIG. 5

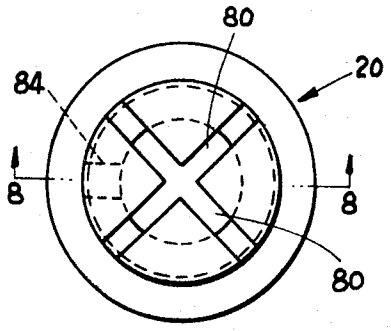


FIG. 7

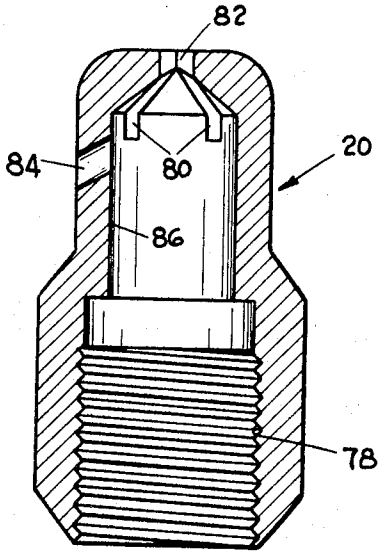


FIG. 8

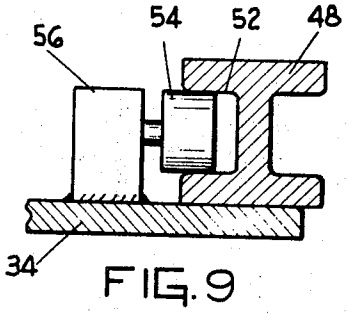


FIG. 9

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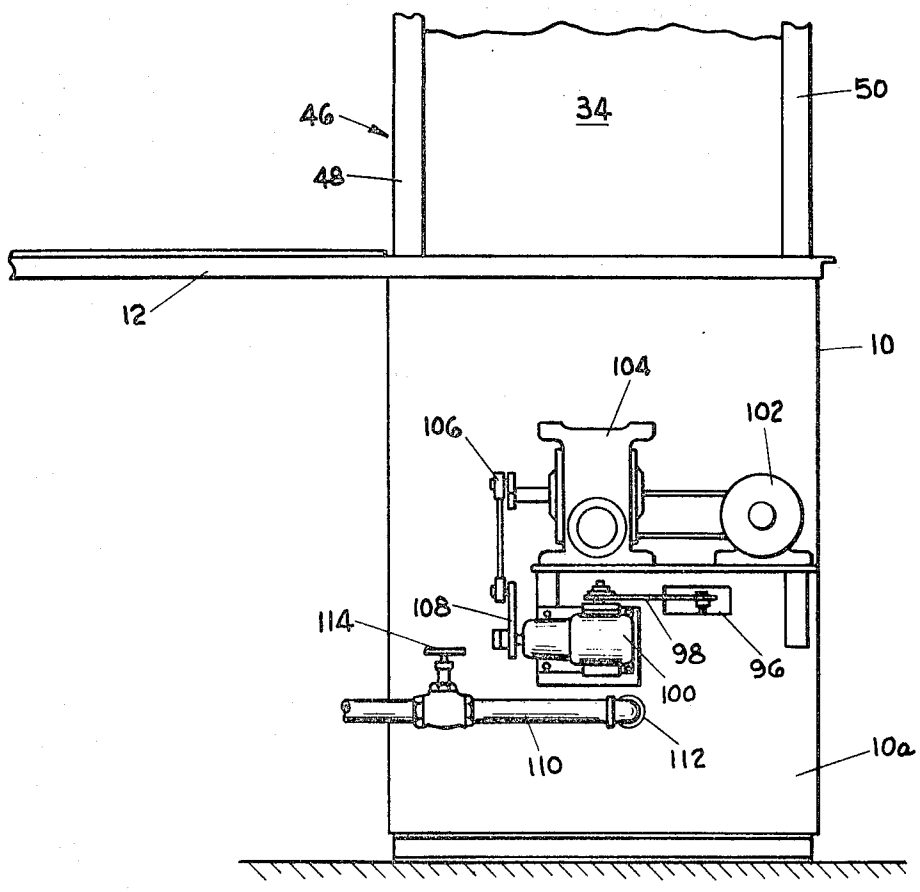


FIG. 6

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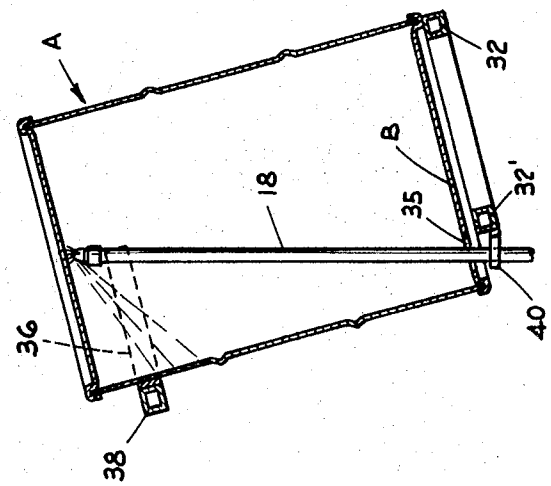


FIG. 10B

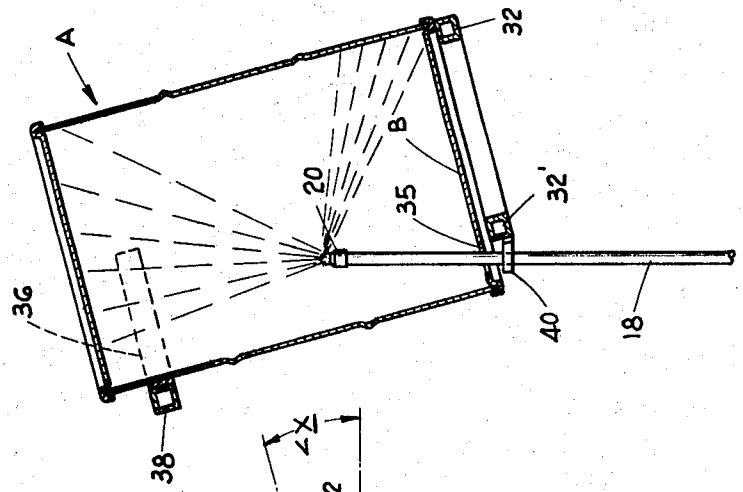


FIG. 10A

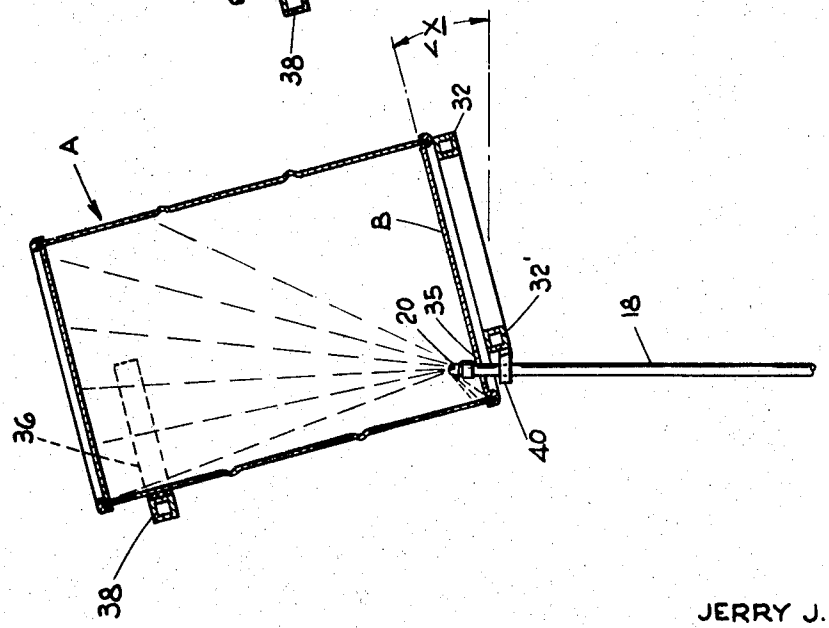


FIG. 10

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METHODS AND APPARATUS FOR CLEANING DRUMS

The invention relates to improvements in methods and apparatus for cleaning drums of the type having a bung opening in the cover.

The primary object of the invention is to provide a simple, effective and economical method of and apparatus for cleaning drums.

To effectuate these purposes a tank is provided in which a plurality of nozzle pipes are positioned. The nozzle pipes are stationary, and in longitudinally spaced relation, one nozzle pipe for each drum to be cleaned. The drums are placed upon a movable support which is reciprocated during the cleaning cycle, whereby the drums are moved down over the nozzle pipes and retracted. During the movement of the drums cleaning fluid is sprayed against the interior surfaces of the drums. The movement of the drums with respect to the stationary nozzle pipes is permitted by aligning the bung openings of the drums with the nozzle pipes.

By maintaining the nozzle pipes in a stationary position and moving the drums to be cleaned with respect to the pipes a number of advantages are afforded. Flexible joints for the nozzle pipes, with the attendant difficulties inherent in the use of flexible joints, are eliminated. The number of seals which would otherwise be located in the strong cleaning solution, where the seals would rapidly deteriorate, are minimized. The pump and associated equipment are positioned outside of the tank and away from the deteriorating effect of the strong cleaning solutions. The means for reciprocating the support for the drums also is located exteriorly of the tank where it is not affected by the strong cleaning solution.

These, and other objects and advantages of the invention will be apparent from the following detailed description, taken in conjunction with the drawings, which illustrate a preferred embodiment of the invention, in which;

FIG. 1 is a top plan view of apparatus made in accordance with the invention;

FIG. 2 is a vertical cross sectional view taken approximately in the plane of line 2—2 of Fig. 1, a drum being shown partly broken away and in a cross section;

FIG. 3 is a horizontal view taken approximately in the plane of line 3—3 of Fig. 2, the drums being omitted in this view for clarity in illustration;

FIG. 4 is a view illustrating means for oscillating the stationary nozzles which are cooperable with the respective drums;

FIG. 5 is a partial side view looking in the direction of the arrows 5—5 of Fig. 1;

FIG. 6 is a partial end view looking in the direction of arrows 6—6 of Fig. 5;

FIG. 7 is a top plan view of a nozzle suitable for use in the apparatus of the invention.

FIG. 8 is a vertical cross sectional view taken approximately in the plane 8—8 of Fig. 7;

FIG. 9 is a horizontal cross-sectional view taken approximately in the plane of line 9—9 of Fig. 2, this view showing one of the guide means for the vertically movable drum support; and

FIGS. 10, 10A and 10B illustrates a cycle in the operation of cleaning a drum or a plurality of drums.

In accordance with the method of the invention a tank is provided which has positioned therein a plurality of stationary, longitudinally spaced nozzle pipes. A plurality of drums are supported so that the bung openings of the drums face and are in alignment with the nozzle pipes. The support for the drums is mounted for reciprocable movement. During a cycle, the drums are moved over the stationary nozzle pipes and retracted. During the movement of the drums the interior surfaces of the drums are sprayed with a cleaning solution. Preferably, the nozzle pipes are oscillated about their respective longitudinal axes during the movement of the drums.

Referring to the drawings, apparatus in accordance with the invention comprises a tank 10 which may be set on the ground or, as shown in Figs. 2 and 5, may be supported above ground on suitable support members 11. As shown in Figs. 1–3 and 6, an elevated working platform 12 is connected to the tank near the top thereof, as by an L-shaped member 13 welded or bolted to the side of the tank (Fig. 2), the opposite end of the platform being supported by a plurality of spaced, vertically extending support members 12'.

As shown in Fig. 1 a pump 14 is provided to circulate a cleaning solution for the drums A to be cleaned. As known in the art, a cleaning solution is selected for the particular kind of material which coats the interior of the drum and which it's desired to remove. For example, where the interior of the drum is coated with a varnish, a caustic solution is used; where the coating is an oil, a caustic solution containing soda ash may be used; and for other materials to be removed solutions containing appropriate cleaning compounds are used.

A horizontally extending main pipe 16 is in communication with the pump 14, and a plurality of longitudinally spaced, vertically extending nozzle pipes 18 are in flow communication with the main pipe. The main pipe at its extremity remote from the pump is sealed against the end 10*a* of the tank as shown in Fig. 4. A nozzle 20 is positioned on the top of each pipe 18. The nozzle pipes and their respective nozzles are stationary in the sense that they have no movement in vertical and horizontal planes. However, as will be subsequently described, the nozzle pipes and their respective nozzles are mounted for oscillation about the longitudinal axis of each pipe. While a single pipe and nozzle be used for the cleaning of a single drum, for the purposes of increased production it is preferred to provide a plurality of the longitudinally spaced nozzles as illustrated so that a plurality of drums may be cleaned during each cycle of operation of the apparatus. Six or eight drums may be cleaned at a time.

As shown in Figs. 2 and 3, the main pipe 16 rests upon a plurality of longitudinally spaced support members 17 which extend between and are secured to the sides of the tank 10 near but above the bottom 19 of the tank. After the drums are cleaned, cleaning solution is recirculated back to the suction side of the pump 14 by a return pipe 22. As shown in Figs. 1 and 3 screen means 24 is provided at the bottom of the tank to filter out the waste from the cleaning solution before it is recirculated back to the pump. The screen means may take the form of a screen basket positioned at an opening in a sidewall of the tank. The orifice of the return pipe is sealed to the opening in the side of the tank. As shown in Fig. 1, the pump 14 is operated by a motor 26 through a gear reducer 28, the motor and gear reducer being situated upon a suitable platform 29. The main pipe 16 coming off the pump 14 extends through a sealed opening in one end of the tank at a level below the level of the cleaning solution which is maintained in the tank 10 (Fig. 2).

A drum support 30 is mounted for up and down movement or reciprocable movement in a vertical plane. As shown in Figs. 1 and 2, also Figs. 10, 10A and 10B, the drum support comprises a pair of transversely spaced, longitudinally extending bars 32, 32' having their ends secured, as by welding, to a pair of end plates 34, 34'. The bars 32, 32' are spaced apart an amount slightly less than the diameter of a drum. Also, to better support each drum upon the vertically movable drum support and to rigidify the drum support assembly, longitudinally spaced, transversely extending members 33 are secured at their ends to the bars 32, 32' so that each drum may be supported by the bars 32, 32' and a pair of support members 33 as best shown in Fig. 1.

As shown in Figs. 10, 10A and 10B, the drums A are positioned upon the vertically movable drum support with their cover ends B, the ends having the usual bung openings 35 therein, on the lower side. The bung openings face and are in alignment with the nozzles 20 atop the pipes 18. The bung openings 35 are located rearwardly of the rear drum support bar 32'. At the start of the cleaning cycle, it is preferred that the nozzles 20 extend through the bung openings a slight amount.

As shown in Figs. 1, 2, 10, 10A and 10B, the drums A are supported upon the drum support assembly 30 at an angle,

that is, they are tilted. The plane of a cover B of each drum is at an angle *x* (Fig. 10) of approximately 10° to 20° with respect to the horizontal. The preferred angle is approximately 15°. The tilted position of the drums upon the drum support assembly may be accomplished by locating the longitudinally extending front bar **32**, which is closest to the operator's working platform **12**, at a higher level than the rear bar **32'**.

To maintain the drums in tilted position while they are being cleaned, a series of longitudinally spaced, arcuate retainers **36** are provided, one for each drum, against which the respective drums are leaned. The retainers are secured, as by welding, to another longitudinally extending bar **38** having the ends thereof secured, as by welding to the end plates **34**, **34'**. The bar **38** is located above and rearward of the rear support bar **32'**.

To assist in guiding the vertically movable drum support **30** with respect to the stationary nozzle pipes **18**, respective guides **40** are provided as shown in Figs. **2**, **10**, **10A** and **10B**. The guides **40** may take the form of eyelet members, the nozzle pipes extending through their openings. The eyelet members are secured to the rear support bar **32'** for movement with the drum support assembly **30**.

To impart reciprocable movement to the drum support **30** a main drive shaft **42** is provided at the top of the apparatus and extends longitudinally thereof. As shown in Figs. **1**, **2** and **5**, the main shaft is journaled in longitudinally spaced bearings **44** mounted upon a stationary frame **46** which is positioned within the tank **10**. The frame comprises rigid, vertically extending members **48**, **48'** and **50**, **50'** and cross connecting members **51** (FIG. **2**). The vertical frame members **48**, **48'**, **50**, and **50'** are respectively secured to the tank at each of the tank's four corners. Preferably, these frame members are in the form of I beams so that the configuration of such members may be utilized for guiding the drum support assembly. As more particularly shown in Fig. **9**, each of the I beam frame members furnishes a vertically extending guide groove **52** within which is received a roller **54**. Each of the rollers is mounted on a bracket **56** which is secured, as by welding, to an end plate, the respective end plates **34** and **34'** of the drum support assembly.

As shown in Figs. **1**, **2** and **5**, connecting members **58** are respectively secured to the end plates **34**, **34'** of the drum support assembly. Chains **60**, **60'** each have one end respectively connected to the connecting members **58**, **58'**. The chains extend around sprockets **62**, **62'** which are fixed for rotation with the main shaft **42**. The chains are of sufficient length so that their opposite ends **60***a* (Fig. **2**) will not reach the sprocket when the drum support assembly **30** is in its lowermost position. The drum support assembly is confined for reciprocable up and down movement and guidance by the sliding engagement of the end plates **34** and **34'** with the adjoining vertical stationary frame members **48**, **48'** and **50**, **50'** in each corner of the tank **10**.

To raise and lower the drum support **30** with the drums A positioned thereon and to operate the pump **14**, a control box **64** is provided. The controls are of the kind known in the art for energizing and stopping motors in selected timed sequence, and are not shown. As shown in Figs. **1** and **5** the main shaft **42** is connected to a second shaft **66** by a coupling **68**. The second shaft extends from a reducer **70**, which is operated by a motor **72** through an intermediate belt **74** extending around the pulleys on the shafts of the motor and reducer. The motor and reducer are mounted upon a horizontally extending platform **76** which is secured to the side and near the top of the stationary frame **46**.

Regarding the nozzles, any suitable construction may be used. It is preferred to use a nozzle having the construction as shown in Figs. **7** and **8** whereby the cleaning solution may be emitted from both the nose portion and the side of the nozzle. To enable removal and periodic cleaning the nozzles **20** are each internally threaded at **78** for engagement with a threaded portion at the top of each pipe **18**. The nose or top portion of each nozzle is provided with a plurality of slots **80**. The slots may be four in number as shown to provide a central opening **82** at their intersection. An orifice **84** is provided in the side wall of the nozzle, whereby the orifice and the slots are in communication with the nozzle's internal bore **86**.

The stationary pipes **18** and their respective nozzles **20** are oscillated about their respective longitudinal or vertical axes. The arc of oscillation is slightly less than 90°. Suitable means for oscillating the nozzle pipes are shown in FIGS. **2–6**. A nozzle pipe connecting member **88** having a central opening and hub **90** (FIG. **2**), is fastened to each pipe. The same side ends of pairs of adjacent connecting members are connected to one another by longitudinally extending rods **92** (FIGS. **3** and **4**). One of the rods, designated **92'** which is associated with the first nozzle pipe of a series of the pipes, the pipe at the left in the showing of FIG. **3**, extends through a vertical slot in the end plate **34** and through a slot **96** in the end wall **10***a* of the tank. The slot **96** is shown in FIG. **6**, and additionally permits runoff of cleaning solution therethrough when the level of the solution in the tank would rise above this opening in the tank wall.

As more particularly shown in FIGS. **5** and **6**, the rod **92'** is connected to an arm **98** extending from a 45° angle drive **100**. The arm **98** imparts a reciprocating or back and forth movement to the rod **92'**, thereby oscillating the nozzle pipes **18** interconnected by the members **88** and the rods **92**. The drive **100** is operated by a motor **102** acting through a gear reducer **104**, which in turn rotates a short arm **106** acting to oscillate an arm **108** on the shaft of the angle drive **100**.

As shown in FIGS. **6**, a pipe **110** which carries steam may be included to heat the solution in the tank. The steam pipe enters the end **10***a* of the tank through an opening provided with a seal **112** where the steam pipe enters the tank. A valve **114** may be provided in the steam line.

The described system for cleaning drums operates in the following manner. A cleaning solution suitable for removing the coating of a particular composition on the interior surfaces of the drums A is provided for the system. The cleaning solution is contained in the tank **10** at the approximate level shown in FIG. **2**. The solution also fills the main pipe **16** and the return pipe **22**. An operator standing on the platform **12** loads a plurality of drums A upon the drum support assembly **30**. As shown in FIGS. **2** and **10**, the nozzles **20** extend through the bung openings **35** in the cover B of each drum at the beginning of the cleaning cycle. The drums are held in tilted position by the arcuate members **36**.

For semiautomatic operation the operator presses a button on the control box **64**, whereupon the drums A upon the drum support assembly are moved down over the nozzle pipes **18** as shown in FIGS. **10A** and **10B**. FIG. **10B** shows the lowermost position of each drum. The drums are retracted over the stationary nozzles through the stages as shown in FIGS. **10B**, **10A** and **10** respectively.

During the reciprocable movement of the drums, which are raised and lowered by the motor **72**, the reducer **70** and the sprocket, chain and shaft arrangement **62**, **60** and **42**, the pump **14** is actuated by the motor and gear reducer **26**, **28** to cause cleaning solution under pressure, to be forced through the main pipe **16**, the nozzle pipes **18** and through their respective nozzles **20**. During the reciprocable movement of the drums, and while the cleaning solution is emitted under pressure from the nozzles **20**, the nozzle pipes **18** are oscillated by the described arrangement of pipe connecting members **88**, rods **92**, **92'**, and the actuating means comprising the arm **98**, the angle drive **100**, operated by the motor **102** acting through the gear reducer **104** and the associated parts.

After the cleaning cycle is completed the suction side of the pump **14** is actuated to withdraw a predetermined amount of cleaning solution through the return pipe **22** to thereby maintain the system in balance, and to cause waste material in the cleaning solution to be screened at **24**. Thus, for the next cycle the pump **14** circulates cleaning solution into the main pipe **16** and the nozzle pipes **18** from which waste material resulting from the cleaning of the drums has been removed.

The system may be operated automatically in the respect that the operator need only load and remove the drums from the drums support assembly in timed sequence with the timed sequence of operation for a cleaning cycle; that is to say, it is not necessary for the operator to manually actuate the various operations as above described by manually initiating the controls at the control box **64**.

It is believed that the advantages and improved results furnished by the apparatus of the invention will be apparent from the foregoing detailed description of an illustrated preferred embodiment of the invention.

I claim:

1. A method of cleaning drums of the type including a cover having a bung opening, the method comprising providing a tank having positioned therein a plurality of stationary, vertically extending, longitudinally spaced nozzle pipes, supporting a plurality of drums having their bung openings facing and in alignment with the nozzle pipes, the drums being supported at their cover ends by a single support means, moving the support means and thereby moving the drums down over the stationary nozzle pipes, retracting the drums, and spraying the interior surfaces of the drums during the movement of the drums, the movement of the drums being confined for movement in a vertical plane, the drums being in tilted position during their movement.

2. A method as set forth in claim **1** comprising oscillating the nozzle pipes about their respective longitudinal axes during the movement of the drums.

3. Apparatus for cleaning drums of the type including a cover having a bung opening, the apparatus comprising a tank, a plurality of stationary, vertically extending nozzle pipes positioned in the tank in longitudinally spaced relation, a drum support for a plurality of drums mounted for reciprocable movement into and out of the tank in a plane parallel to the longitudinal axes of the nozzle pipes, the drum support comprising a pair of longitudinally spaced end plates, first and second longitudinally extending, transversely spaced support members secured to the end plates, the transverse spacing of the support members being less than the diameter of a drum, and means for imparting reciprocable movement in a vertical plane to the drum support to permit spraying the interior surfaces of the drums during the movement of the drums.

4. Apparatus as set forth in claim **3**, wherein the first support member is at a lower level than the second support member, and a third longitudinally extending support member secured to the end plates, the third member being positioned rearward of the first support member and at a higher level than the second support member.

5. Apparatus as set forth in claim **3** including means for oscillating the nozzle pipes about their respective longitudinal axes.

6. Apparatus as set forth in claim **3** including guide means for each nozzle pipe secured to one of said support members.

7. Apparatus as set forth in claim **6** including guide means for each nozzle pipe secured to the first support member.

8. Apparatus as set forth in claim **3** including a stationary frame extending into and above the tank, the end plates being positioned adjacent the frame.

9. Apparatus as set forth in claim **8**, wherein the frame comprises a vertically extending I-beam located at each corner of the tank, and cooperable means connected to the end plates and provided by the I-beams for guiding the drum support.

10. Apparatus for cleaning drums of the type including a cover having a bung opening, the apparatus comprising a tank, a plurality of stationary, vertically extending nozzle pipes positioned in the tank in longitudinally spaced relation, a main pipe in flow communication with the nozzle pipes, a pump exterior of the tank in communication with the main pipe, a return pipe in communication with the bottom of the tank and the pump, a drum support for a plurality of drums mounted for reciprocable movement into and out of the tank in a plane parallel to the longitudinal axes of the nozzle pipes, the drum support comprising a pair of longitudinally spaced end plates, first and second longitudinally extending, transversely spaced support members secured to the end plates, the transverse spacing of the support members being less than the diameter of a drum, and means for imparting reciprocable movement in a vertical plane to the drum support to permit spraying the interior surfaces of the drums during the movement of the drums.

11. Apparatus as set forth in claim **10**, wherein the first support member is at a lower level than the second support member, and a third longitudinally extending support member secured to the end plates, the third member being positioned rearward of the first support member and at a higher level than the second support member.

12. Apparatus as set forth in claim **10** including means for oscillating the nozzle pipes about their respective longitudinal axes.

13. Apparatus as set forth in claim **10** including guide means for each nozzle pipe secured to one of said support members.

14. Apparatus as set forth in claim **13** including guide means for each nozzle pipe secured to the first support member.

15. Apparatus as set forth in claim **10** including a stationary frame extending into and above the tank, the end plates being positioned adjacent the frame.

16. Apparatus as set forth in claim **15**, wherein the frame comprises a vertically extending I-beam located at each corner of the tank, and cooperable means connected to the end plates and provided by the I-beams for guiding the drum support.

* * * * *