United States Patent

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[54] OIL-TANK-CLEANING APPARATUS
5 Claims, 3 Drawing Figs.

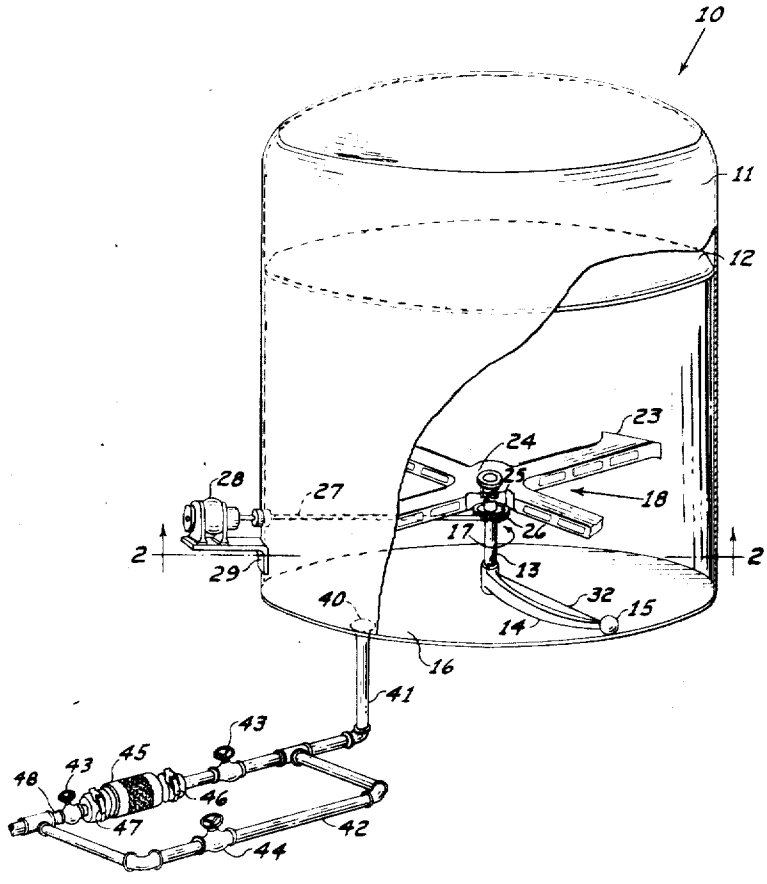
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[51] Int. Cl. B01d 21/06
[50] Field of Search ..... 210/298, 528, DIG. 9

[56] References Cited
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1,912,595	6/1933	Schlenz	210/528 X
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ABSTRACT: A cleaning apparatus for an oil tank. A rod is rotatably mounted to the floor of the tank and to a frame attached to the tank sidewalls. An arm having a sphere at one end contacting the sidewall of the tank is attached to the rod and receives sediment for filtering. An outlet pipe is connected to the tank via this hole and receives the sediment. A motor drives the rod with suitable gearing.



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SHEET 1 OF 2

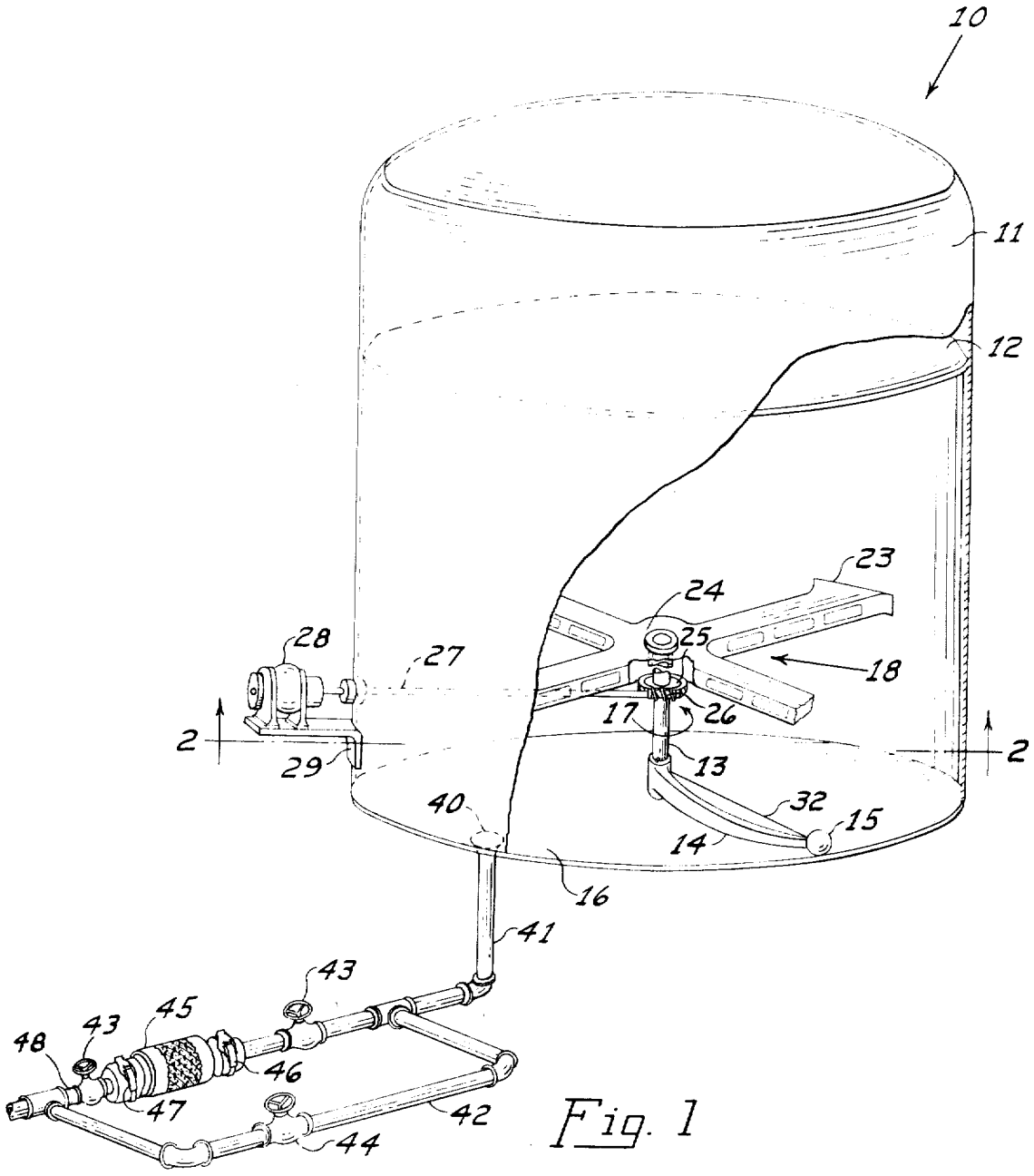


Fig. 1

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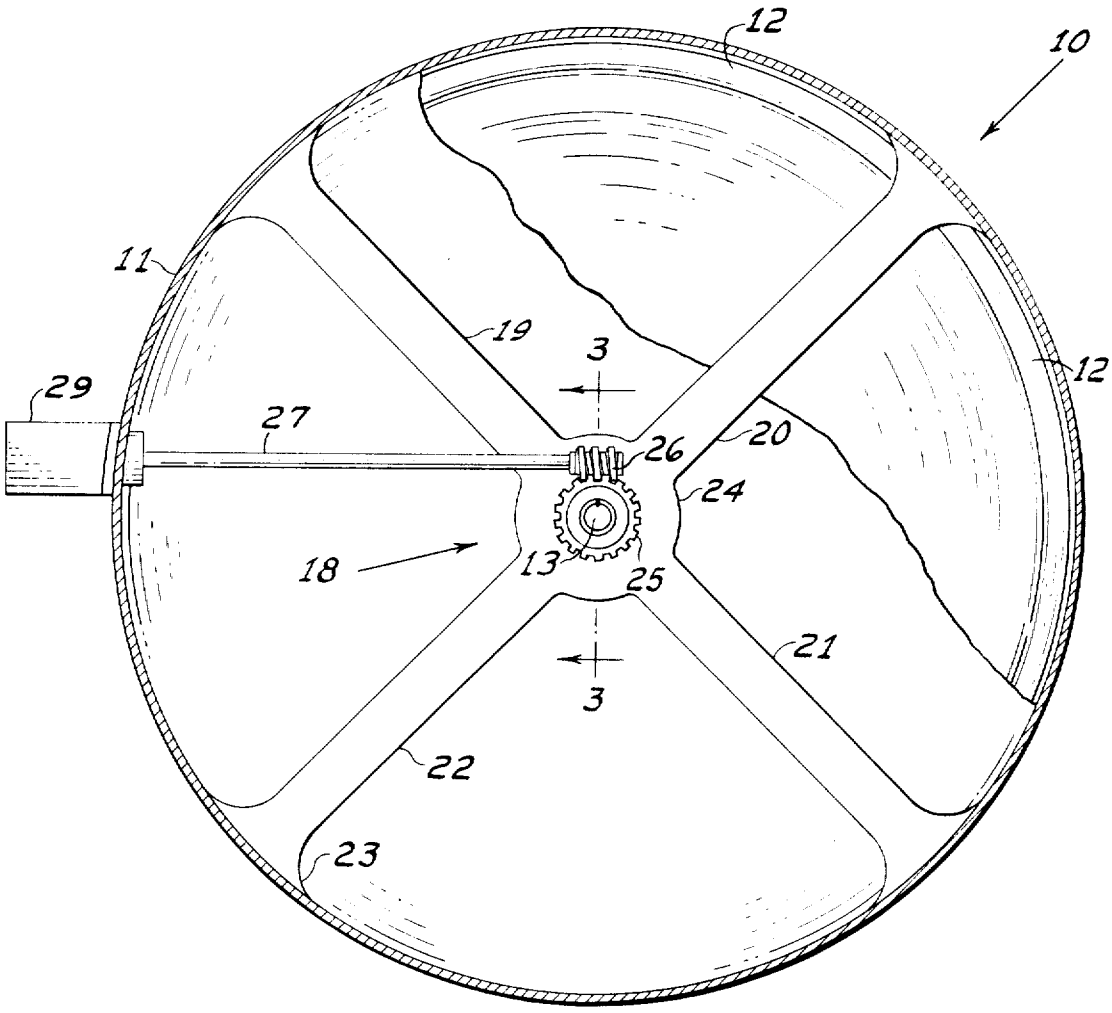


Fig. 2

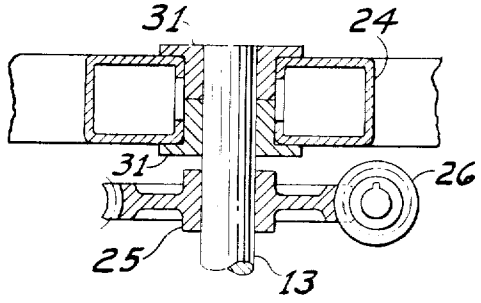


Fig. 3

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OIL-TANK-CLEANING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is in the field of cleaning devices, and more specifically, cleaning devices for oil tanks.

2. Description of the Prior Art

Large tanks are utilized to store large quantities of oil. Many of the tanks have roofs movable as the volume of oil within the tank changes. Thus, the airgap between the roof and the oil may be controlled by adjusting the roof with respect to the oil.

The following U.S. patents disclose tank cleaning devices: U.S. Pat. Nos. 1,625,721 issued to Hann; 2,552,452 issued to Phillips; and 3,140,996 issued to Scott. Generally, the prior art devices have rakes periodically sweeping the bottom of the oil tank. For example, the Scott device has a rotatable rake which also oscillates at a rate of 800 to 1,000 cycles per minute. The Phillips and Hann devices are manually operated whenever it is desired to clean the tank. The costs and delays in shutting down an oil tank for cleaning purposes are very undesirable. Thus, there is a need for a tank cleaning apparatus which will continuously and automatically clean the tank without interfering with regular tank operations. The device should prevent sediment buildup, thus alleviating the necessity for scraping the hardened sediment with a rake. Many of the prior art devices attach to the roof of the oil tank and thus are not usable with oil tanks having movable roofs. The present cleaning device is attached to the side walls of the oil tank thereby allowing the roof to be moved in accordance with the volume of the oil contained within the tank. The rakes or arms of the prior art cleaning devices sometimes bend or warp as a result of force exerted on the arm by the oil sludge. The cleaning device of the present invention has a strong structure to prevent bending of the cleaning arm. The sediment is forced out through a pipe and a strainer is provided to catch large objects accidentally dropped into the tank.

SUMMARY OF THE INVENTION

The present invention is a cleaning apparatus for an oil tank having a movable roof. A spiderlike frame is fixedly attached to the tank sidewalls. A vertically erect rod is rotatably mounted to the frame and to the bottom wall of the oil tank. A concave arm is fixedly attached to the rod and has a sphere mounted on one end for engaging the side of the oil tank. A guy wire is attached between the two ends of the arm. The sediment swept by the arm falls into a hole in the bottom of the oil tank. An outlet pipe and strainer communicate with the tank through the hole in the bottom wall. A motor and suitable gearing rotate the rod.

It is an object of the present invention to provide an oil tank cleaning apparatus which will continuously and automatically clean the tank bottom without interfering with normal tank operations.

It is a further object of the present invention to provide an oil-tank-cleaning apparatus which will prevent sediment buildup on the bottom of the tank, thus alleviating the necessity to scrape the hardened sediment which is normally deposited on the tank bottom.

Yet another object of the present invention is to provide a cleaning device for an oil tank having a movable roof which is sufficiently strong so as to not bend or warp with use.

Related objects and advantages of the present invention will be apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary perspective view of an oil tank incorporating the present invention

FIG. 2 is a cross-sectional view of the device of FIG. 1 taken along the line 2—2 and viewed in the direction of the arrows.

FIG. 3 is an enlarged fragmentary view of the gearing shown in FIG. 2 taken along the line 3—3 and viewed in the direction of the arrows. FIG. 3 has been rotated 90°.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiment illustrated in the drawing and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alteration and further modifications in the illustrated device, and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

Various waste products and sediments typically accumulate in the bottom of oil storage tanks. This situation can be costly in many ways. For example, the daily maintenance and disposition of the matter accumulating on the bottom of the tank require considerable time and expense. Chemicals have been developed to dissolve the matter accumulating the bottom of the tank, and mixers or agitators have been provided to force the dissolved matter through the outlet pipe. Nevertheless, various sediments still accumulate on the bottoms of many oil tanks currently in use. My apparatus prevents any sediment from building up on the bottom of the tank by continuous and automatic sweeping action of an arm.

FIG. 1 is a perspective view of an oil tank **10** having a movable roof **12** positioned and enclosed by sidewall **11**. Movable roof **12** is adjustable in the vertical direction so as to control the volume of tank **10**. The cleaning apparatus is positioned at the bottom of the tank so as to not interfere with the vertical movement of roof **12**. Tank **10** is broken away in FIG. **1** to more clearly illustrate the cleaning apparatus. The controls and mechanism for adjustment of roof **12** are well known and therefore this specification will not elaborate thereon.

Bridge structure or frame **18** is fixedly attached to tank wall **11** approximately **4** feet above the bottom tank wall **16**. Frame **18** is spiderlike having members **19**, **20**, **21** and **22** integrally attached to hub **24**. FIG. **2** is a sectional view of frame **18** taken along the line 2—2 of FIG. **1** and viewed in the direction of the arrows. Each member has an end **23** abutting against sidewall **11**. Ends **23** are fixedly attached to tank wall **11** by welding or other suitable fastening means. The configuration of frame **18** may be varied to fit the exact inside diameter of each tank to be provided with the cleaning apparatus of the present invention. Frame **18** serves two main purposes. First, the frame provides a bottom limit for the vertical moving roof **12**. Many of the movable roofs employed in oil tanks float on top of the oil like a pontoon. Thus, in the event that the oil level is lower in elevation than frame **18**, then roof **12** will be supported by frame **18**. The second function of frame **18** is to provide a hub **24** for rotatably mounting the top end of rod **13**. The opposite end of rod **13** is rotatably mounted to the bottom **16** of the oil tank. Fixedly attached to rod **13** and positioned parallel and adjacent to bottom wall **16** is concave arm **14**. Arm **14** is made from heavy durable plastic and is attached to rod **13** by fastening devices, such as screws. Mounted on the opposite end of arm **14** is ball roller **15**. Fastening devices are also used to secure roller **15** to arm **14**. Roller **15** is made from polytetrafluoroethylene and is in sliding engagement with side wall **11**. A guy wire or cable **32** is made from stainless steel and is connected at one end to rod **13** and, at its opposite end, to ball **15**. Cable **32** is attached to the rod and ball **15** so as to be in tension with arm **14** resting still. Thus, as rod **13** and arm **14** rotate in the direction of arrow **17**, cable **32** will prevent arm **14** from bending backwards as a result of force exerted on the arm by the material accumulated on the bottom of the tank. The concave shape of arm **14** forces any sediment resting on the bottom of the tank out towards sidewall **11** as arm **14** rotates in the direction of arrow **17**. A hole **40** is provided in bottom wall **16** for the sediment carried by arm **14** to pass therethrough. An outlet pipe **41** receives the oil and sediment from hole **40**. A standard strainer **45** is mounted on pipe **41** by standard clamps **46** and **47**. A bypass pipe **42** is connected to

pipe 41 having a valve 44 preventing flow within pipe 42. A second valve 43 is provided on pipe 41 and a third valve 43 is provided on pipe 48. With valve 44 in the off position preventing flow through pipe 42 and valves 43 in the on position, the oil is allowed to flow through strainer 45. Strainer 45 has ½-inch mesh wire allowing the oil and sediment to pass therethrough but catching any large objects, such as screwdrivers, which are accidentally dropped into the tank. In order to install a new strainer, valves 43 are turned to the off position and valve 44 is turned to the on position. Thus, flow may continue through pipes 42 and 48 while the strainer is being changed, thereby alleviating the necessity to interrupt normal tank operations.

Motor 28 is mounted on bracket 29, fixedly attached to sidewall 11. Rod 27 extends into tank 10 and is rotatably driven by motor 28. A worm gear 26 is provided on the end of rod 27 and is in meshing engagement with gear 25 mounted to rod 13. Gear 25 may be pinned to rod 13 so as to prevent relative motion between rod 13 and gear 25. Thus, as rod 27 is rotated, gear 25 and rod 13 will also rotate, thereby sweeping arm 14 across the bottom of the tank.

FIG. 3 is a sectional view taken along the line 3—3 and viewed in the direction of the arrows of the gearing arrangement shown in FIG. 2. A plastic bushing 31 is provided in hub 24 to rotatably receive rod 13. Gear 25 is mounted to rod 13 and is in driving engagement with worm gear 26.

Best results have been obtained by rotating arm 14 one revolution per hour. A counter is positioned on the outside of the tank to record the number of revolutions of arm 14. The operator monitors the counter thereby insuring that the tank is maintained at all times. It will be obvious from the above description that the present invention provides an oil tank cleaning apparatus which will continuously and automatically clean the tank bottom without interferring with normal tank operations. It will be further obvious from the above description that the present oil tank cleaning apparatus prevents sediment buildup, thereby alleviating the necessity for scraping hardened sediment from the tank bottom. By continuously rotating arm 14, a sediment is prevented from hardening on the bottom of the tank. The motor gear arrangement utilized to drive and rotate arm 14 is automatic and does not require manual operation. In addition, it will be obvious from the above description that the present cleaning apparatus is usable with an oil tank having a movable roof and is sufficiently strong so as to not bend or warp with use. The short center rod 13 eliminates the bowing which is found in the prior art devices. In addition, the short center rod allows inspection and maintenance of bridge structure 18. Another embodiment of the present invention has a second cantilevered arm integrally mounted to arm 14 at rod 13 with wire 32 being connected in tension to the second cantilevered arm and ball 15.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

We claim:

1. The combination of:
an oil tank having a floor, a sidewall and a movable roof, said floor having a hole therethrough adjacent said wall;
a frame fixedly attached to said sidewall and extending over said floor beneath said movable floor;
an upstanding rod having a bottom end rotatably mounted to said floor and a top end rotatably mounted to said frame;
a plastic arm fixedly connected to said rod being in sliding contact with said floor and having a concave side;
an element fixedly mounted to said arm being in slidable contact with said sidewall;
drive means operatively connected to said rod and continuously driving said arm at all times;
an outlet pipe connected to said tank via said hole; and,
a strainer removably connected to said outlet pipe.

2. The combination of claim 1 and further comprising:
a guy wire connected to said rod and said element across said concave side being in tension; and,
a bearing mounted to said frame rotatably receiving said rod.

3. The combination of claim 2 wherein:
said driving means has a motor with a rotating output shaft positioned between said frame and said floor, said means also has a worn gear on said shaft and a second gear fixedly mounted to said rod in meshing engagement with said worm gear.

4. The combination of claim 3 wherein:
said element is a sphere; and,
said frame is spider-shaped being positioned parallel, over and adjacent said shaft, said frame supports said movable roof when all of the oil is beneath said frame.

5. The combination of claim 4 additionally comprising:
a bypass pipe connected around said strainer to said outlet pipe.

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