

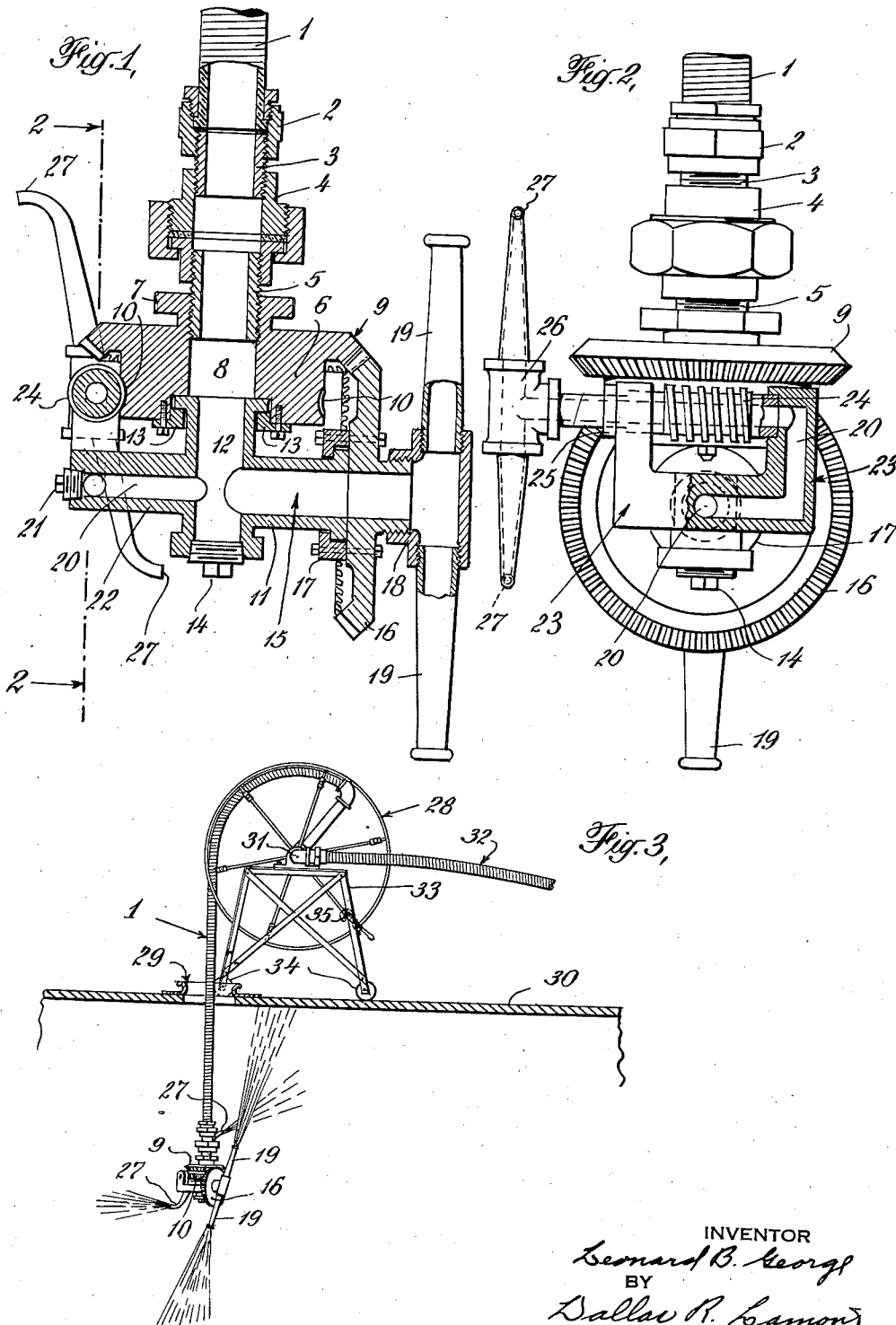
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APPARATUS FOR CLEANING THE INTERIOR OF TANKS

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APPARATUS FOR CLEANING THE INTERIOR
OF TANKS

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This invention is directed to the improvement of means for cleaning the interior of tanks, especially tanks on shipboard designed for the transportation of oil, and is more specifically directed to the development of jetting means for cleaning solutions employed in such operations, and the use of such jetting means.

In the construction of tank ships, such as those commonly used for the transportation of petroleum and its products, the exterior skin or shell of the ship is also utilized as the external wall of the tanks. The ship is interiorly divided by bulkheads, etc., into a number of tanks and suitable working spaces for other ship uses, such as boiler and engine rooms, and the like.

The internal structural framework members of the ship, composed of beams and columns fabricated of structural steel, usually of somewhat complicated design, pass through the storage spaces in the tanks, and are submerged when the tanks are filled. There are frequently numerous members of this structural framing within a tank, and at several levels.

Proper cleaning of oil from the inner walls, top, and bottom of the tanks, and from the surfaces and interstices of the structural framework is frequently necessary. When the last cargo has been a "dirty" oil such as fuel oil, and the next is to be a "white" product, cleaning is necessary for reasons of product color. When repairs are needed, the tanks must be cleaned to avoid the explosion hazards due to gas.

The earliest methods of cleaning consisted of entering the tank with a hose, equipped with a nozzle, washing down all that could be dislodged, pumping out the wash water and oil while washing, and finally scraping the unreached deposits and scale loose manually, as with wire brushes, etc. When a hose stream strikes directly, under the high pressures which have always been available, it cleans well, and very little scraping is necessary. The difficulties of complete hand hosing are obvious.

Cleaning solutions have been used, but have made little headway, as sea water, probably due to its salt content, seems to be quite efficient, and can be had for the pumping cost. The efficiency of action of the cleaner can be increased by heating, but working conditions do not permit the use of much heat when hosing by hand.

The fire fighting art long ago developed a self-driven rotating sprayhead mounted on the end of a pipe so that it could be inserted through a hole in a roof, into a cellar, or through a ship's hatch. This device was early adopted for tank

washing, and as it did not require the presence of men in the inclosure with it, permitted the use of any desirable degree of heat.

Prior art devices modelled upon this as now built consist of a rotating sprayhead having two or more nozzles, mounted upon the end of a pipe, with a water turbine, compressed air motor, or other motive device mounted on the other end of the pipe, and driving the sprayhead by means of shafts, sleeves, and the like mounted within the pipe, and internal gearing, etc. to effect an operative driving linkage.

These devices are quite unwieldy, weighing several hundred pounds, and from ten to twenty feet long. Maneuvering one, inserting it into an "ullage hole" or the like, at most only a foot or so in diameter, dodging the obstructions below, getting it into a vertical position, and lowering it to its seat, requires the services of four or five men, and is time-consuming. When performed at sea, it may be dangerous, and much cleaning is done at sea, due to stringent restrictions on the pollution of harbor waters.

Once the prior art device is inserted, its jets arise only from one zone. The numerous obstructions prevent direct jets from reaching a great portion of the walls, and consequently these, and the back portion of the obstructions get only rebound jets and ineffective cleaning. To move the jets, so as to get at previously "unseen" portions, requires that the device be removed and one with a longer pipe inserted. Even doing this, much of the cleaning is ineffective and much hand scraping still must be done.

The prior art with respect to cleaning ships' tanks might be summed up as follows:

Sea water, a good cleaner, has always been freely available, at pressures much higher than necessary. Adoption of certain devices from an analogous art has permitted the use of jets of any desired temperature. No great flexibility of positioning has been available in any of the jet devices.

It has therefore been an object of this invention to provide a jet producing means capable of the utmost flexibility in positioning, and of a type which can be handled with a maximum of safety and a minimum of labor. A further object has been the development of a device free from internal operative parts in contact with sea water, of a device capable of being maintained by inexperienced labor, and of one free from intricate design requiring the attention of a skilled mechanic for major repairs. Other

objects have been to make greater effective use of the energy present in high pressure water supply, and to attain such other objects and advantages as may hereinafter appear.

5 In its essential form my device consists of a self-propulsive rotating sprayhead suspended from a laterally flexible torsion resisting hose.

In order to more fully explain the device, reference is made to the drawing attached to and forming a part of this specification, in which:

Figure 1 is a vertical section through the spray head.

Figure 2 is a side view of the spray head, partially in section, and

15 Figure 3 shows the entire equipment fully set up and in operating position.

In Figure 1, 1 is a hose, which may be of any heavy duty type, but is preferably of the metallic type commonly used for steam, high pressure water and the like. 2 is a hose coupling of any standard type, serving to attach hose 1 to nipple 3 which carries a union fitting 4 of any standard type. Union 4, through nipple 5 is attached to the spray head. The spray head consists of a fixed body casting 6, having a wrench square 7, and an internal water passage 8. A portion of body 6 is formed into a bevel gear 9 and around the cylindrical lower portion of 6 a worm rack gear 10 is cut. A cross shaped casting 11, having an internal water passage 12 is affixed to the bottom of casting 6 in such a manner that it may rotate with respect to 6 about their common center line. It is secured by some means such as split collar 13. Many common methods of effecting such a fastening are known, and are no part of the present invention, so 13, as well as similar parts later encountered and having like functions are shown in very diagrammatic form to avoid confusion of drawing. Water passage 12 is closed at its lower end by plug 14, which may be removed for cleaning. One arm of casting 11, containing water passage 15, carries rotatably mounted upon its free end a bevel gear 16, having an axial water passage which is a continuation of passage 15. This gear 16 is secured by split collar 17, and to it there is fastened T 18, carrying nozzles 19—19. Passages 12 and 15 are of the full internal diameter of the hose and nozzles 19 are straight, without reaction bends at their tips, and proportioned internally to secure as high efficiency in transformation of pressure into kinetic energy of stream as possible. Another and smaller water passage 20, closed at its further end by plug 21, leads through arm 22 of casting 11. From this point on, Figure 2 should be read in conjunction with Figure 1. Arm 22 terminates in a yoke 23. Mounted in the yoke is a worm 24, retained by a thrust device 25, the shaft of which continues through 25. Water passage 20 is continued as shown through one arm of yoke 23 and axially through the shaft of worm 24, terminating in a T 26 screwed upon the free end of 24. Two nozzles 27—27 are fixed in T 26, and these nozzles have reaction tips, so designed as to convert a maximum portion of the pressure energy of the issuing water into rotative motion. The rotative motion of nozzles 27, acting through worm 24 which meshes with gear rack 10, causes casting 11 to rotate with respect to casting 6 about their common centerline, and the interaction of bevel gears 9 and 16 causes nozzles 19 to rotate about the centerline of water passage 15. Thus the point of origin of jets from nozzles 19, which jets do the actual work of cleaning, rotates continuously in a plane perpendicular

to the centerline of line 1, while the jets rotate about that point of origin in a plane parallel to the centerline of hose 1. In this manner the jets are eventually directed toward all points on the interior surface of the tank. Any suitable relation of the speeds of rotation can be gotten by varying the ratios of the gear train as desired, and the gears may have "hunting" teeth inserted, as desired, to avoid repetition of path.

Figure 3 shows the entire washing device set up and in operation. The spray head suspended from the hose 1, is dropped through any suitable small opening, such as the usual "ullage hole" 29, installed in the tank roof 30. The length of hose not used in any particular position is stored upon a reel 28, and communicates through a swivel connection 31 to a hose 32 which is attached to a valved source of water or other solution under pressure which is not shown. The reel 28 is mounted upon a suitable carriage 33, provided with wheels 34 and equipped with a latch 35 whereby the reel may be locked in any desired position.

Numerous advantages of this device over prior art devices are inherent in the design.

First, that of flexibility in positioning. The hose by which it is suspended enables me to lower it to any desired depth, and to wash the underside as well as the top of each of the several levels of complicated structural steel beams and braces obstructing the interior of the tank. I may, if I desire, tie the spray head up in some remote corner heretofore inaccessible to prior art devices. I may change its position by letting out or drawing in hose, where with prior art devices mounted on the end of a pipe, one must withdraw them, and insert another of different length, or completely disassemble the one used and reassemble it with a longer pipe. One man may handle my device, wheeling it about the deck as desired, uncovering the opening through which it is to be inserted, and lowering it as desired. Prior art devices have required no less than four or five men.

Many modern tank ships are built with "shelter decks". That is the working deck of the vessel, which forms the tank roof, is no longer used as the weather deck, the sides being extended upward, and a second, lighter deck installed above. Tankers, especially when loaded, lie somewhat low in the water, and this protects the working deck from the sea. The headroom between decks in such a vessel is usually not great. To maneuver the prior art device requires the combined efforts of four or five men. This operation must be performed every time the position of the spray head of the prior art device is changed. It is impossible to handle a pipe over ten or twelve feet long in a prior art type of spray device. Due to these difficulties, and the lack of headroom, usually all washing is done from one position and the rest finished by scrapers, etc. When a hose stream can impinge directly, it will usually clean well enough to avoid scraping, etc., and with my device capable of being worked in low headroom and able to be extended to any depth, much of this can be avoided.

Many smaller tanks, such as the ship's fuel tank in the fore part of the ship, are reached only by tortuous passages, down ladders and the like. My device can be uncoupled from the hose and taken to locations well high inaccessible to prior art devices without disassembly and reassembly at point of use.

Prior art devices are usually driven by shafts,

or sleeves extending from the motor device down through the water pipe and connecting to the spray head by internal gearing, etc. When laid away, these devices must be completely disassembled, wiped dry, oiled, and reassembled. They are somewhat complicated mechanically, and this operation requires the services of a skilled mechanic and consumes a great deal of time. Even with such care, it is frequently found that the next time they are desired to be used, they will not operate, due to rust from incomplete cleaning or to faulty reassembly, and they must be again taken down and worked over.

In my device, all of the operative parts are external, except such simple wearing surfaces as are freely accessible from the interior water passages, and none of the operative contacts require the use of close clearances. When laying my device away, I need only to dry it, or even may allow it to dry itself, if very hot water has been used, and after removing plug 14 or 21, dip the device in a container of oil, drain off excess oil, and then the whole device may be laid away without further attention. These services may be performed by very inexperienced labor. My device is of such a nature that even major repairs can be made by comparatively unskilled labor, and due to the simplicity of the few parts, no great stock of spare equipment need be carried.

The design of the nozzles is such that the jet nozzles convert the greatest portion possible of the pump pressure into velocity energy of stream, while the reaction nozzles convert as much of it as possible into rotative motion, no attempt being made to do both with one stream, as in some prior art devices, which results in performing neither function effectively.

I claim:

1. In a device for washing the interior of ships tanks and the like, the combination of a laterally flexible member acting both as support and supply pipe and capable of being extended to a variable depth within the tank, and a spray head on the end of said support, said spray head comprising a fixed body being formed into an external bevel gear, a second portion of said body being formed into a second gear, and with a liquid passage in the interior of said fixed body, and a rotating body rotatively affixed to said fixed body, said rotating body having a cross form, with internal water passages, one arm of said cross terminating in a yoke, carrying a worm gear, the water passage in this arm extending through one side of the yoke and axially through the worm gear shaft, which shaft extended, terminates in a T having mounted therein nozzles of reaction type to convert liquid pressure into rotative motion of shaft and worm which is rotatively mounted in said yoke, whereby said worm, working upon the second gear of the fixed body may cause the rotating

body to turn with respect to the fixed body about their common center-line, the other arm of the cross having rotatively mounted upon its outer end a bevel gear which meshes with the bevel gear of the fixed body, the water passage of this cross arm extending axially through said bevel gear and terminating in a T having mounted therein nozzles formed to convert liquid pressure into velocity energy of jets.

2. A device for washing the interior of ships tanks comprising a laterally flexible tubular supply member arranged to act as the sole support of a spray head, and a spray head comprising a body having an internal liquid passage, said body being non-rotatably affixed to said support, a first gear and a second gear formed externally upon said body, a second body rotatively affixed to said first body, a central liquid passage in said second body communicating with the liquid passage in said first body, reaction jets rotatively mounted upon said second body, a worm gear rotatively mounted upon said second body and cooperating with said reaction jets and with the second gear upon the first body in such manner that rotation of the reaction jets transmitted through the worm and gear causes the second body to rotate with respect to the first body, internal liquid passages in said second body leading from the central liquid passage thereof to the reaction jets, a third gear wheel rotatively mounted on said second body, nozzles designed to transform liquid pressure into high velocity mounted to rotate with said third gear, said third gear cooperating with the first gear upon the first body, and a liquid passage extending through the second body from the central passage thereof, through said third gear, and terminating in the last named nozzles.

3. A device for washing the interior of ship tanks and the like comprising a laterally flexible tubular supply means acting additionally as the sole support of the spray head, a main feed pipe rotatably affixed thereto, a secondary feed pipe rotatably mounted on the lower end of feed pipe, a nozzle feed pipe mounted on said secondary pipe at an angle thereto, an impact jet forming nozzle member rotatably mounted on said nozzle feed pipe, a reaction type liquid motor capable of substantially converting pressure of liquid into rotative motion which motor is supported by said secondary feed pipe and rotatable therewith, means for diverting a minor portion of the liquid from within said secondary feed pipe to said liquid motor, means on the motor coacting with means on the main feed pipe for effecting relative rotation between the main feed pipe and the secondary feed pipe, a gear on the main feed pipe and means supported by the secondary pipe engaging the gear for rotating the jet forming nozzles with respect to the nozzle feed pipe.

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