Oct. 9, 1956

J. F. JOYSLEN

2,766,065

APPARATUS FOR CLEANING TANKS AND THE LIKE

Filed July 29, 1954

FIG. 1

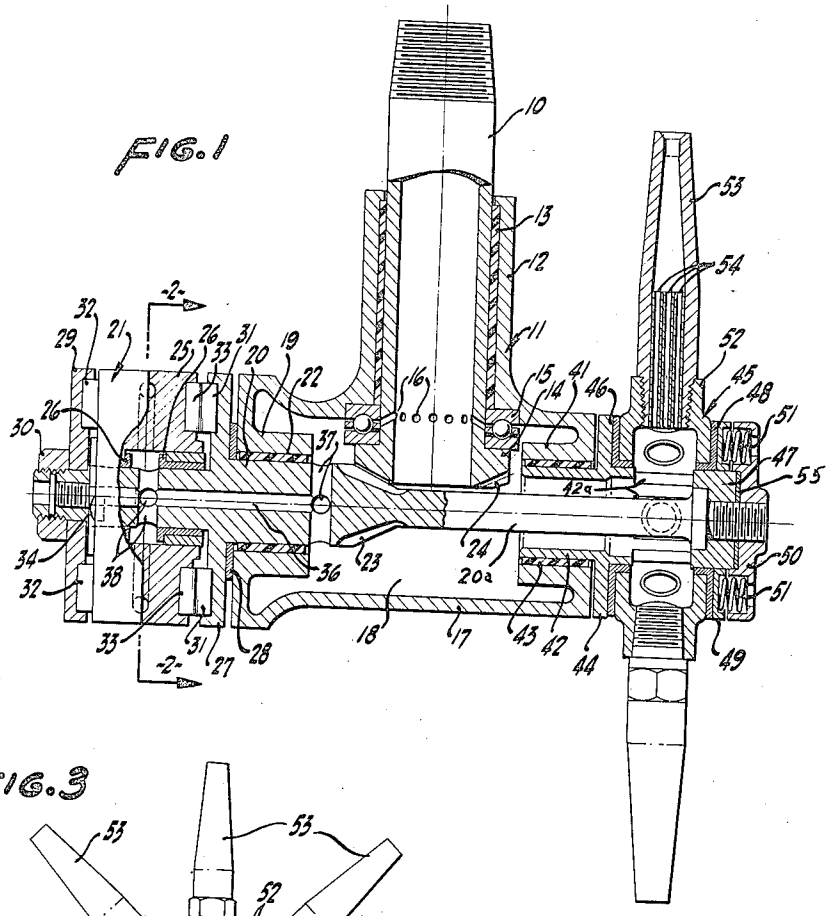


FIG. 3

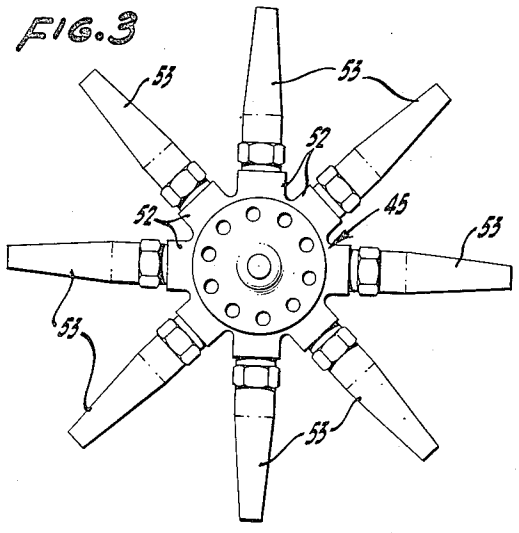
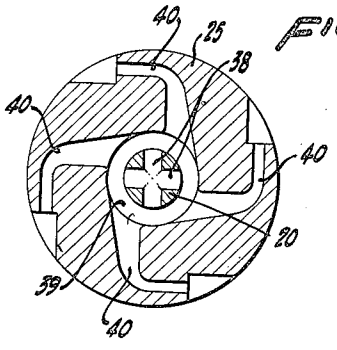


FIG. 2



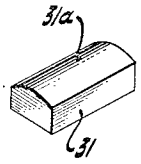


FIG. 4

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United States Patent Office

2,766,065

Patented Oct. 9, 1956

2,766,065

APPARATUS FOR CLEANING TANKS AND THE LIKE

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Application July 29, 1954, Serial No. 446,449

13 Claims. (Cl. 299—18)

This application relates to an apparatus for use in cleaning tanks and the like. More particularly, the application is directed to a nozzle spray head adapted to be inserted in a tank to spray the interior thereof with cleaning or treating solutions.

In prior structures of this type it was customary to employ spray heads incorporating a fluid motor driven either by the fluid being sprayed or by a separate source of fluid under pressure. The motor was directly geared to rotate the nozzle head assembly about one axis and to rotate the nozzles about a second axis at right angles thereto. In directly geared structures of this type, it is inherent that the stream issuing from the nozzles will repeat a certain pattern of movement, and after a predetermined number of revolutions of the fluid motor, the parts will return to the same point. The spray heads will then repeat the same cycle of operation. In the use of spray heads of this type, it has been found that under certain conditions of operation the devices tend to stripe the interior of the tank being cleaned, or treated, and it is to avoid this set pattern of operation and the striping effect inherent therewith that the present structure has been devised.

It is, therefore, the principal object of this invention to provide a spray head which is rotatable about one axis, while the nozzles rotate about an axis at right angles thereto, wherein the rotation of the nozzles is not directly correlated with the rotation of the head whereby an infinite variation of the spray pattern is obtained, and the creation of a set pattern of spray and striping the interior of the tank being treated is avoided.

Another object of this invention is to provide a spray head of the type set forth in the preceding object wherein the rotation of the assembly as a whole is effected through the use of a rotary impact motor, whereby the rotation of the spray head is effected in intermittent periodic increments of movement.

A further object of the invention is to provide a spray head according to the preceding object wherein the rotation of the spray head as a whole is accomplished by a direct gearing between the impact motor and the assembly, and wherein a friction drive is employed between the motor and the spray nozzles, thereby permitting a controlled slippage therebetween to provide an infinite variation of the spray pattern.

A still further object of the invention is to provide a spray head according to the preceding object wherein the tension on the friction drive may be adjusted to vary the slippage thereof and thus infinitely vary the spray pattern obtained.

Still another object of the invention is to provide a spray head of the type according to the preceding objects which is adapted to be used with various chemical cleaning solvents or with acids and other corrosive liquids used to treat the interior of a tank, whereby both the cleaning and treatment of the tank may be accomplished with the same set-up, thus decreasing the time necessary for the reconditioning of a tank.

One form which the invention may assume is described

in the following specification, and illustrated by way of example in the accompanying drawings, wherein:

Fig. 1 is a sectional view through a spray head assembly embodying the principles of my invention.

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is an end view of the nozzle head assembly.

Fig. 4 is a perspective view of one of the striking blocks.

Referring now to the drawing, **10** indicates a supporting conduit adapted to be connected by suitable pipes or hoses (not shown) to a source of cleaning fluid under pressure. A T-shaped tubular housing, generally indicated at **11**, has a tubular portion **12** which rotatably embraces the conduit **10**. A sleeve of inert sealing material **13** of polytetrafluoroethylene, commonly referred to as "Teflon," or other materials having extremely high resistance to wear and corrosion such as sintered carbides, or chrome plate, is interposed between the tubular portion **12** of the housing **11** and the conduit **10** to act both as a bearing material and a seal. The inner end of the conduit **10** is provided with an external flange **14**, and a ball type thrust bearing **15** is interposed between the housing **11** and the flange. A plurality of passages **16** is provided in the conduit **10** adjacent the bearing **15** to permit fluid from the conduit **10** to flush the bearing.

The portion **17** of the housing **11** extends at right angles to the portion **12** and defines a chamber **18** in communication with the open inner end of the conduit **10**. The left end of the housing portion **17**, as viewed in Fig. 1, is provided with a circular bearing boss **19**. A stator member **20** of a rotary impact motor, generally indicated at **21**, is rotatably mounted in the bearing boss **19** with a sleeve **22** of "Teflon," or other wear and corrosion resistant material, interposed therebetween. The stator **20** extends through the chamber **18** and out of the opposite end of the housing portion **17**. A bevel gear **23** is formed integral with the stator **20** and meshes with a bevel gear **24** formed on the inner end of the conduit **10**, whereby rotation of the stator **20** will cause the housing **11** to rotate about the axis of the conduit **10**.

The rotary impact motor **21** is external of the housing portion **17** and axially aligned therewith. The motor comprises the stator member **20**, previously mentioned, and a rotor **25** rotatably mounted thereon by suitable sleeve bearings **26** made of sintered carbide, or other corrosion and wear resistant material. The stator **20** is provided with an outwardly extending radial flange **27** of the same external diameter as the rotor **25**. The flange **27** is located between the rotor **25** and the end of the housing portion **17**. A flat circular bearing member **28** of sintered carbide, or other wear and corrosion resistant material, is interposed between the flange **27** and the housing potrion **17**. A second flange **29** is keyed to the outer end of the stator **20** and held thereon by a suitable nut **30** threaded onto the outer end of the stator.

The flange **27** has two diametrically opposed striking blocks **31**, of sintered carbide or other wear and corrosion resistant material, recessed therein. As shown in Fig. 4, the blocks **31** are rectangular in shape and have a rounded upper surface **31***a* which projects outwardly from the flange **27** toward the rotor **25**. The flange **29** is similarly provided with two identical striking blocks **32**, of the same material as blocks **31**, which project inwardly toward the rotor **25**. The blocks **31** and **32** are in opposed relation to each other. A pair of diametrically opposed striking blocks **33** is mounted on the side of the rotor **25** facing the flange **27**. The blocks **33** are adapted to strike the blocks **31** as the rotor rotates. A pair of diametrically opposed striking blocks, only one of which is shown at **34**, is mounted on the side of the rotor **25** facing the flange **29**. The blocks **34** are adapted to strike the blocks **32** on the flange **29**. The blocks **34** are preferably angu-

larly spaced 90° from the blocks 33. However, a greater number of blocks with a different angular spacing may be used. The distance between the opposing faces of the blocks 31 and the blocks 32 is slightly less than the distance between the planes of the outer surface of the blocks 33 and 34.

From the foregoing description, it can be seen that when the rotor 25 rotates, first the blocks 33 thereon strike the blocks 31 on the flange 27 and give a rotary impact to the stator member 20 to rotate the stator relative to the housing 11. The rotor is forced outwardly to clear the blocks 31 and 33 and bring the blocks 34 into the plane of the blocks 32. After another 90° of rotation, the blocks 34 will strike the blocks 33 and produce another angular impact on the stator 20. Thus, every 90° of rotation of the rotor 25 produces an angular impact on the stator 20. The stator, therefore, rotates relative to the housing 11 by a series of intermittent increments of rotation.

The means for causing rotation of the rotor 25 comprises a longitudinal bore 36 extending from the outer end of the stator 20 to a point inside the chamber 18. A plurality of radial ports 37 connects the bore 36 with the chamber 18. A plurality of radial ports 38 connects the bore 36 with an annular groove 39 formed in the central portion of the rotor 25. A plurality of L-shaped passages 40 is formed in the rotor 24. Each of the grooves 40 is connected at its inner end to the annular groove 39. The outer end of each of the passages 40 opens into the periphery of the rotor 25 and is adapted to discharge fluid tangentially thereof.

Referring now to the right end of the housing portion 17, as viewed in Fig. 1, a circular bearing boss 41 is formed therein. The boss 41 is coaxial with the boss 19 previously described. A tubular member 42 is mounted in the boss 41 with a sleeve 43 of "Teflon," or other wear and corrosion resistant material, interposed therebetween. The tubular member 42 has a radial flange 44 extending outwardly from its mid-portion adjacent the outer surface of the housing section 17. A nozzle head 45 is mounted for rotation on the outer portion of the tubular member 42. A pair of bearings 46 and 48, L-shaped in cross section and made of sintered carbide or other wear and corrosion resistant material, is interposed with the circular flange of each between the nozzle head 45 and the tubular member 42, and with the radial flange of each adjacent the outer surface of the nozzle head 45.

The stator 20 is provided with a reduced diameter portion 20*a* which extends through the member 42 and is threadedly connected to the outer end 47 thereof. The external diameter of the tubular member 42 is slightly larger than the diameter of the portion of the stator 20 which is journaled in the boss 19 to create a hydraulic thrust on the stator 20 to the right as viewed in Fig. 1. The thrust is taken by the bearing 28 interposed between the flange 27 and the left end of the tubular housing portion 17. The friction in the sliding bearing 28 acts as a brake on the stator 20 and stabilizes the movement thereof by preventing oscillation of said stator.

An annular friction plate 49 is rotatably received on the tubular member 42 adjacent the end 47 and slidably contacts the portion of the bearing 48 adjacent the outer surface of the outer wall of the nozzle head 45. A cap 50 is threadedly fastened to the outer end of the stator 20, and a plurality of springs 51 is interposed between the cap 50 and the friction plate 49. The springs 51 force the plate 49 toward the flange 44 on the member 42 and confine the nozzle head 45 therebetween. The distance between the cap 50 and the flange 44 may be varied to adjust the tension on the springs 51 by changing the thickness of the shim 55 interposed between the cap 50 and the end 47 of the tubular member 42.

A plurality of apertures 42*a* spaced circumferentially around the member 42 adjacent the end 47 thereof permits fluid to flow from the member 42 into the nozzle

head 45. The nozzle head 45 is provided with eight nozzle outlets 52, and a nozzle 53 is threaded into each of the outlets. The nozzles 53 are of conventional design and are of the type which incorporate stream straightening tubes 54.

In spray heads designed to be used with acids, all of the parts, with the exception of the sintered carbide bearings and striking blocks and the "Teflon" seals, are made of stainless steel. If only non-corrosive liquids are to be used, of course, the assembly could be made from the less expensive materials.

In the operation of the device, the spray head assembly is suspended or suitably mounted in a tank in the manner which is customary in the art. Cleaning or treating fluid under pressure is pumped in through conduit 10 into the chamber 18. The major portion of the fluid passes through the tubular member 42 into the nozzle head 45 and out through the nozzles 53 to impinge on the surface of the tank being cleaned. The remainder of the fluid enters the ports 37, passes through the bore 36 and out through the ports 38 into the annular groove 39 in the rotor 25. The fluid passes from the annular groove 39 through the four passages 40 in the rotor and jets tangentially from the outer ends thereof and causes the rotor to rotate. As previously explained, the rotor causes the stator 20 to rotate by periodic intermittent increments of rotation. Because of the direct drive of the intermeshing bevel gears 23 and 24, the rotation of the stator 20 causes the housing 11 to rotate about the axis of the conduit 10.

The cap 50, the friction plate 49 and the springs 51 together form a friction drive between the stator 20 and the nozzle head 45. Due to the nature of the rotational movement of the stator 20 explained above, there will be a certain amount of slippage between the friction plate 49 and the nozzle head 45, and the amount of rotation of the nozzle head 45 will not be in proportion to the rotation of the assembly as a whole about the conduit 10. Hence, the spray pattern will not repeat itself for every rotation of the housing as it would if there were a direct drive between the stator and the nozzle head. It can readily be seen that by changing the tension on the springs 51, in the manner previously described, the degree of slippage between the stator and the nozzle head 45 can be changed, and hence the spray pattern within the tank can be varied from a very fine pattern to a coarse pattern.

While I have shown a nozzle head incorporating eight nozzles, it should be understood that other nozzle heads could be used, it merely requiring that the nozzles be symmetrically located so that their thrust will cancel out.

From the foregoing description it may be seen that I have provided a spray head for cleaning tanks or the like wherein a variable spray pattern is obtained and wherein the spray pattern will not repeat itself in cycles as the device is operated. It may further be seen that I have provided an assembly which is extremely resistant to deterioration by any of the corrosive or alkaline cleaning or treating solutions or liquids normally used in the cleaning or treatment of tanks or the like.

While I have shown and described the preferred form of my invention, it is obvious that various changes may be made in its construction by those skilled in the art, without departing from the spirit of the invention as defined in the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a tank washing spray head assembly, a rotary impact motor, positive drive means connected to said motor for rotating said assembly about a first axis, a nozzle head rotatably mounted to rotate about a second axis perpendicular to said first axis, and drive means connected to said motor for rotating said nozzle head about said second axis, said last mentioned drive means comprising a slip mechanism whereby there is no direct ratio

between the rotation of said assembly and the rotation of said nozzle head and therefore an infinite spray pattern is obtained.

2. In a tank washing spray head assembly, a rotary impact motor, positive drive means connected to said motor for rotating said assembly about a first axis, a nozzle head rotatably mounted to rotate about a second axis perpendicular to said first axis, and means including a slip friction drive assembly connected to said impact motor for rotating said nozzle head about said second axis.

3. In a tank washing spray head assembly, a rotary impact motor, positive drive means connected to said motor for rotating said assembly about a first axis, a nozzle head rotatably mounted to rotate about a second axis perpendicular to said first axis, means including a slip friction drive assembly connected to said impact motor for rotating said nozzle head about said second axis, and means to vary the tension on said friction drive assembly to vary the degree of slippage therein.

4. A tank washing spray head assembly comprising a supporting conduit, a housing rotatably supported on said conduit, a drive mechanism mounted in said housing, said drive mechanism adapted to be rotated relative to said housing by periodic intermittent increments of rotation, gear means connecting said drive mechanism and said conduit for rotating said drive mechanism and housing relative to said conduit by periodic increments of rotation, a nozzle head mounted on said housing for rotation about an axis perpendicular to the axis of rotation of said housing, a plurality of nozzles mounted in said nozzle head, and a friction drive assembly connecting said drive mechanism and said nozzle head.

5. A tank washing spray head assembly comprising a supporting conduit, a housing rotatably supported on said conduit, a drive mechanism mounted in said housing, said drive mechanism adapted to be rotated relative to said housing by periodic intermittent increments of rotation, gear means connecting said drive mechanism and said conduit for rotating said drive mechanism and housing relative to said conduit by periodic increments of rotation, a nozzle head mounted on said housing for rotation about an axis perpendicular to the axis of rotation of said housing, a plurality of nozzles mounted in said nozzle head, a friction drive assembly connecting said drive mechanism and said nozzle head, and means to vary the tension on said friction drive assembly to vary the degree of slippage therein and thereby vary the ratio between the rotation of said nozzle head and the rotation of said housing.

6. A tank washing spray head assembly comprising a supporting conduit, a housing rotatably supported on said conduit, a rotary impact motor in said housing, positive drive means connecting said impact motor and said conduit for rotating said impact motor and said housing relative to said conduit by periodic intermittent increments of rotation, a nozzle head rotatably mounted on said housing for rotation about an axis perpendicular to the axis of rotation of said housing, a plurality of nozzles mounted in said nozzle head, and a friction drive assembly connecting said impact motor and said nozzle head.

7. A tank washing spray head assembly comprising a supporting conduit, a housing rotatably supported on said conduit, a rotary impact motor in said housing, positive drive means connecting said impact motor and said conduit for rotating said impact motor and said housing relative to said conduit by periodic intermittent increments of rotation, a nozzle head rotatably mounted on said housing for rotation about an axis perpendicular to the axis of rotation of said housing, a plurality of nozzles mounted in said nozzle head, a friction drive assembly connecting said impact motor and said nozzle head, and means to vary the tension on said friction drive assembly to vary the degree of slippage therein and

thereby vary the ratio between the rotation of said nozzle heads and the rotation of said housing.

8. A tank washing spray head assembly comprising a supporting conduit, a housing rotatably supported on said conduit, a rotary impact motor in said housing, a first bevel gear journaled for rotation in said housing and connected to said motor, a second bevel gear meshing with said first bevel gear and fixed to said conduit whereby said motor and said housing are rotated by periodic intermittent increments of rotation about said conduit, a nozzle head rotatably mounted on said housing for rotation about an axis perpendicular to the axis of rotation of said housing, a plurality of nozzles mounted in said nozzle head, and a friction drive assembly connecting said impact motor and said nozzle head.

9. A tank washing spray head assembly comprising a supporting conduit, a housing rotatably supported on said conduit, a rotary impact motor in said housing, a first bevel gear journaled for rotation in said housing and connected to said motor, a second bevel gear meshing with said first bevel gear and fixed to said conduit whereby said motor and said housing are rotated by periodic intermittent increments of rotation about said conduit, a nozzle head rotatably mounted on said housing for rotation about an axis perpendicular to the axis of rotation of said housing, a plurality of nozzles mounted in said nozzle head, a friction drive assembly connecting said impact motor and said nozzle head, and means to vary the tension on said friction drive assembly to vary the degree of slippage therein and thereby vary the ratio between the rotation of said nozzle head and the rotation of said housing.

10. A tank washing spray head assembly comprising a supporting conduit, a housing rotatably supported on said conduit, a stator member rotatably supported in said housing, a rotor rotatably supported on said stator and adapted to be rotated by fluid pumped through said conduit and housing, means on said rotor adapted to produce periodic rotary impacts on said stator and cause said stator to rotate relative to said housing by periodic intermittent increments of rotation, positive drive means connecting said stator and said conduit for rotating said stator and housing relative to said conduit by periodic increments of rotation, a nozzle head rotatably mounted on said housing for rotation about an axis perpendicular to the axis of rotation of said housing, a plurality of nozzles mounted in said nozzle head, and a friction drive assembly connecting said stator to said nozzle head.

11. A tank washing spray head assembly comprising a supporting conduit, a housing rotatably supported on said conduit, a stator member rotatably supported in said housing, a rotor rotatably supported on said stator and adapted to be rotated by fluid pumped through said conduit and housing, means on said rotor adapted to produce periodic rotary impacts on said stator and cause said stator to rotate relative to said housing by periodic intermittent increments of rotation, positive drive means connecting said stator and said conduit for rotating said stator and housing relative to said conduit by periodic increments of rotation, a nozzle head rotatably mounted on said housing for rotation about an axis perpendicular to the axis of rotation of said housing, a plurality of nozzles mounted in said nozzle head, a friction drive assembly connecting said stator to said nozzle head, and means to vary the tension on said friction drive assembly to vary the dgree of slippage therein and thereby vary the ratio between the rotation of said nozzle head and the rotation of said housing.

12. A tank washing spray head assembly comprising a supporting conduit, a housing rotatably supported on said conduit, a stator member rotatably supported in said housing, a rotor rotatably supported on said stator and adapted to be rotated by fluid pumped through said conduit and housing, means on said rotor adapted to

produce periodic rotary impacts on said stator and cause said stator to rotate relative to said housing by periodic intermittent increments of rotation, a first bevel gear mounted on said stator, a second bevel gear meshing with said first bevel gear and fixed to said conduit whereby said housing is rotated by periodic increments of movement about said conduit, a nozzle head rotatably mounted on said housing for rotation about an axis perpendicular to the axis of rotation of said housing, a plurality of nozzles mounted in said nozzle head, and a friction drive assembly connecting said stator to said nozzle head.

13. A tank washing spray head assembly comprising a supporting conduit, a housing rotatably supported on said conduit, a stator member rotatably supported in said housing, a rotor rotatably supported on said stator and adapted to be rotated by fluid pumped through said conduit and housing, means on said rotor adapted to produce periodic rotary impacts on said stator and cause said stator to rotate relative to said housing by periodic intermittent increments of rotation, a first bevel gear mounted on said stator, a second bevel gear meshing with said first bevel gear and fixed to said conduit whereby said housing is rotated by periodic increments of movement

about said conduit, a nozzle head rotatably mounted on said housing for rotation about an axis perpendicular to the axis of rotation of said housing, a plurality of nozzles mounted in said nozzle head, a friction drive assembly connecting said stator to said nozzle head, and means to vary the tension on said friction drive assembly to vary the degree of slippage therein and thereby vary the ratio between the rotation of said nozzle head and the rotation of said housing.

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