# United States Patent [19]

**Monroe**

[11] **3,716,883**

[45] **Feb. 20, 1973**


[54] **FLUID DRIVEN CLEANING IMPLEMENT FOR SWIMMING POOLS**


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[52] **U.S. Cl.** .....**15/1.7,** 15/387

[51] **Int. Cl.** .....**E04h 3/20,** A47l 5/00

[58] **Field of Search** .....15/23, 24, 50 C, 103, 1.7, 15/375, 387; 173/168, 169; 114/222



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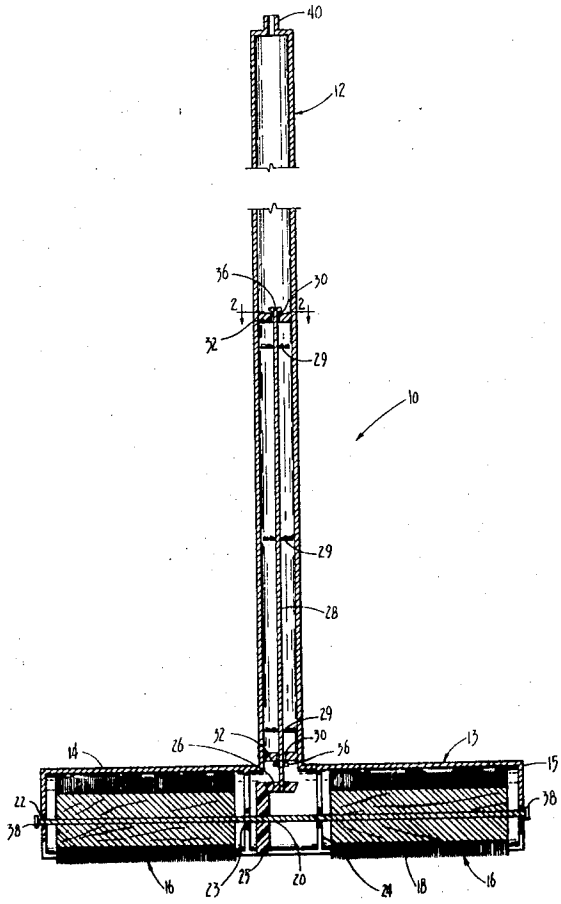
[57] **ABSTRACT**

A fluid driven implement for removing dirt and stains from the walls of a swimming pool is described, said implement having an inverted T-like configuration, comprising in part a horizontally disposed elongate brush housing having rear and side walls defining a semi-cylindric cavity, the opening defined by the walls of the housing lying in an essentially vertical plane, a hollow, elongate handle extending vertically from the rear wall of the housing, an opening in the rear wall affording an inlet to the handle interior, cylindric brushes longitudinally aligned within the semi-cylindric housing, and a water actuated turbine comprising a shaft and impeller assembly rotatably supported within the hollow handle, rotary motion of the turbine transmitted to the brushes through a right angle gear. An outlet at the end of the hollow handle is connected to the low pressure side of a water pump, whereby water adjacent the inlet to the handle is drawn therethrough to drive the turbine.


**6 Claims, 5 Drawing Figures**



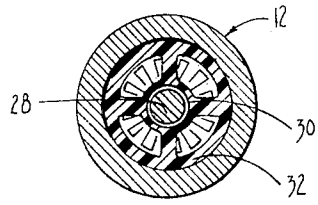



FIG. 2

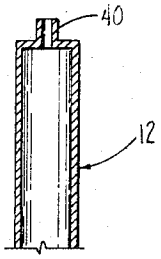



FIG. 1

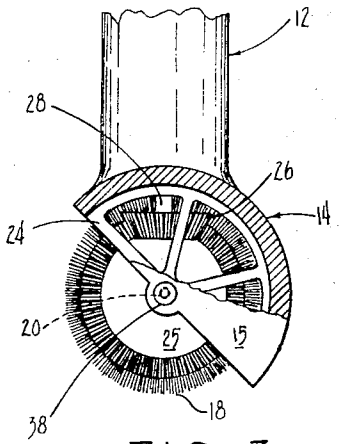



FIG. 3

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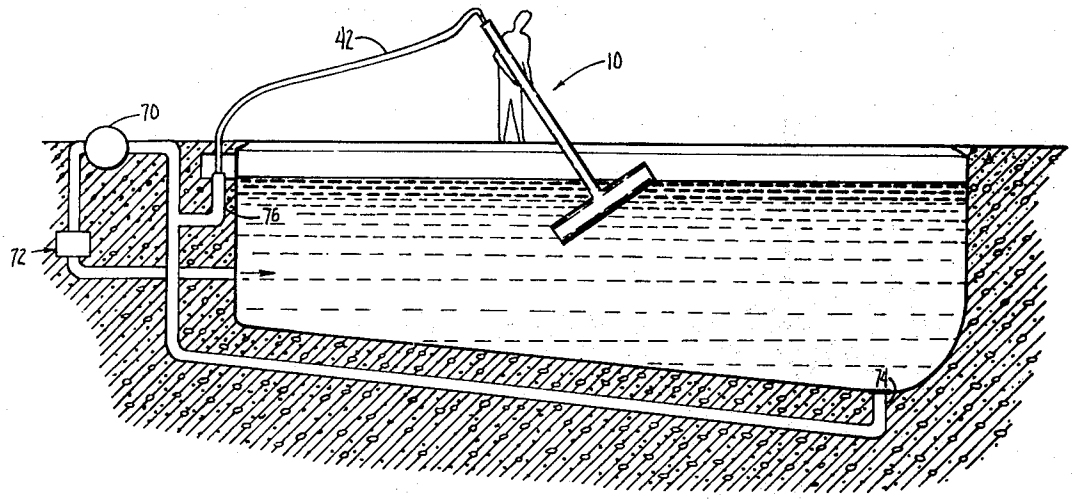


FIG. 4

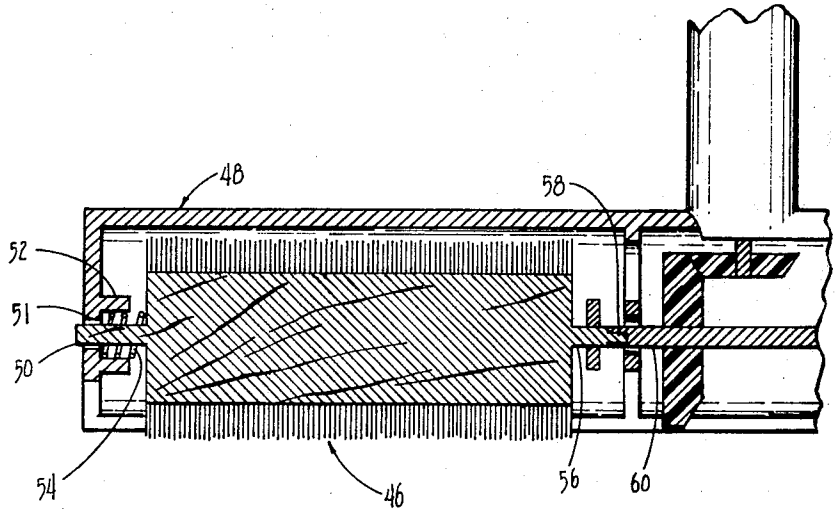


FIG. 5

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# FLUID DRIVEN CLEANING IMPLEMENT FOR SWIMMING POOLS

This invention pertains to cleaning implements and more particularly to fluid driven cleaning implements for swimming pools.

In U.S. Pat. No. 3,471,884 a fluid driven swimming pool cleaning implement is described especially designed for cleaning the side walls of a swimming pool and particularly that portion of the side walls above the water line. Water, drawn up through an inverted L-shaped conduit is passed over an impeller, the rotary motion imparted to the impeller transmitted to a circular brush. The vertically downwardly disposed leg of the L-shaped tube permits continued brush operation though the brush is above water.

The efficacy of this cleaning implement is diminished by the fact that it cannot be used to clean the walls of the pool near their intersection with the pool floor. The same vertical tube which permits operation of the brush above water, prohibits the brush from being brought into close proximity to the wall bottom. Similarly, pool steps cannot be cleaned with this device. The brush cannot be brought into contact with the face of the steps because of the interference of the vertical tube.

It is an object of this invention, therefore, to provide a fluid driven cleaning implement which can be used to clean the walls of a swimming pool, including that portion of the walls near their intersection with the pool bottom, as well as that portion above the water line.

It is a further object of this invention to provide a fluid driven cleaning implement which is especially suitable for cleaning in and around sharp cornered areas in a swimming pool such as associated with pool steps.

In accord with these above objects, a fluid driven cleaning implement for swimming pools is contemplated wherein the fluid inlet for the impeller assembly is so located that the need for a vertical tube is eliminated. Thus the brush can be brought into close proximity with the walls of the pool near intersecting surfaces thereof.

In its broadest aspects, the brush of this invention comprises at least one cylindric brush, a housing for rotatably carrying the brush along its longitudinal axis, and a fluid driven turbine assembly including at least one impeller mounted on a shaft carried within a conduit extending at right angles from the housing. An opening in the housing wall affords a passageway from the interior thereof into the conduit whereby fluid is drawn past the turbine assembly to rotate same when the housing is immersed in water. Rotary motion of the turbine is transmitted through a right angle gear assembly to the brushes.

By using cylindric brushes efficient cleaning is obtained. As all brush elements have the same rotational velocity a uniform cleaning action is achieved. To the contrary, if circular brushes were employed, reduced cleaning efficiency would result as only the outermost brush elements are moving at maximum speed, i.e., the rim speed. Brush elements near the rotational axis of the brush hardly rotate at all. Cleaning action with these elements is supplied almost solely by the movement of the brush across the pool surfaces. By using a fluid actuated turbine to drive the brush, an inexpensive and convenient source of power is afforded. With



the conduit connected to a suitable vacuum source, such as the low pressure side of a pool pump, water adjacent the opening in the housing is drawn into the conduit, and passes therethrough at high velocity. The moving stream of water impinges on the turbine impeller causing rotation thereof which in turn rotates the shaft. This rotary motion is transmitted through the gear assembly to the brushes.

It is further contemplated that the brush have an inverted T-like configuration, with the brush housing comprising the lower portion of the T. The conduit, which also serves as a handle to move the brush over the surface to be cleaned, comprises the upper portion and is connected to the housing about midway between its ends and at right angles thereto. The housing itself may be of any suitable configuration so long as a sufficient opening is provided to expose the brushes for contact with a surface to be cleaned. In one embodiment, the housing comprises a semicylindrical rear wall and semicircular side walls to define a semicylindrical cavity having a rectangular opening lying in an essentially vertical plane. The brushes are carried within the housing for rotation about their longitudinal axis and are coaxially aligned with the cylindric axis of the semicylinder. As used herein, the term cylindric axis defines the axis of the cylinder from which the semicylinder may be generated. By so aligning the brushes, maximum projection beyond the housing is achieved. The likelihood of the housing interfering with the movement of the brushes across the pool walls is thereby reduced.

In a preferred embodiment, the rectangular opening defined by the walls of the semicylindrical brush housing will lie in a plane inclined from the vertical at 45°, the handle extending vertically from the rear wall, its longitudinal axis intersecting the cylindric axis of the semicylinder. The brushes are exposed whereby contact with both the pool bottom and side walls is afforded. The brush can be positioned at intersecting pool surfaces, and simultaneous cleaning of surfaces effected. Thus, sharp cornered areas such as associated with swimming pool steps may be more efficiently and effectively cleaned.

The inverted T configuration offers the further advantage of permitting operation of the brush while partially removed from the water. So long as the inlet to the turbine assembly within the brush handle remains submerged in water, the brush will continue to operate. Thus, not only may those portions of the swimming pool walls below the water surface be cleaned, but those above the water surface as well. To clean above the water line, the brush housing is tilted from the horizontal so that one of the brushes is above water. The brushes continue turning, so long as the inlet to the turbine is submerged.

As the walls of the pool are cleaned, dirt and grime dislodged therefrom becomes suspended in the pool water adjacent the brushes. The brush housing serves to confine the suspended dirt. Because of the relatively restricted cross section of the brush handle, water passes therethrough at relatively high velocities. The action of water drawn into the handle and accelerated to high velocity gives rise to a vortex flow. Dirt and other suspended material within the housing is thus drawn into the vortex and carried with the water from

the pool. Water, therefore, serves not only to drive the brushes, but to remove dislodged dirt as well.

If desired, the orientation of brush rotation can be set such that the brush bristles move across the wall surfaces upwardly in the direction of the brush handle. Rotation of the brushes thus tends to aid in moving the cleaning implement forward. Instead of having to push the brush over the sides of the pool, the implement can be allowed to pull itself. Far less exertion, therefore, is required to stroke the brush.

Another embodiment of this invention includes the use of gearing of the right angle gear assembly. A drive to driven gear ratio of 3:1 has been found to be particularly suitable. With such gearing, greater torque and hence more power is provided the rotating brushes. Therefore, greater pressures can be exerted on the brushes as they are moved across the pool surfaces without significantly reducing brush speed.

These and other objects, features, advantages of the cleaning implement of this invention will become more readily apparent from consideration of the following description of the accompanying drawings illustrating a preferred embodiment thereof.

## IN THE DRAWINGS

FIG. 1 is a fragmented, cross-sectional view of the fluid driven cleaning implement of this invention;

FIG. 2 is a cross-sectioned top view of the implement of FIG. 1 taken along lines 2—2;

FIG. 3 is a fragmented partially cutaway side view of the implement of FIG. 1;

FIG. 4 is a schematic cross section of a swimming pool including its water recirculation system, the implement of FIG. 1 shown in operating position; and

FIG. 5 is a fragmentary cross-sectioned view similar to FIG. 1, illustrating a modified cleaning implement having removably mounted brush elements therein.

With reference to the drawings wherein like numerals throughout the several views represent like elements, and particularly FIG. 1, a fluid driven cleaning implement **10** is shown having an elongate hollow handle **12** joined at one end to a semi-cylindric brush housing **13** formed from arcuately shaped rear wall **14** and semicircular side walls **15**. An opening in wall **14** coterminous with the interior of handle **12** provides a means for fluid access thereto. The rectangularly shaped opening defined by walls **14** and **15** lies in a plane inclined from the vertical at a 45° angle to facilitate the simultaneous cleaning of both the horizontal and vertical surfaces of pool wall and bottom at their point of intersection.

Mounted for rotation about their longitudinal axis within the housing **13** are a pair of cylindric brushes **16** having brush elements **18**. These brushes are mounted on coaxial journal **20** which is received by bearings **22** carried on walls **15**. Similar bearings **23** intermediate the ends of the brush housing and engaging journal **20** are carried by semicylindric brackets **24**. These brackets preferably have large cut out portions to allow for relatively unimpeded movement of water therethrough.

Concentrically mounted on journal **20** between said brushes is driven bevel gear **25**. This gear is engaged by a beveled drive gear **26** at right angles. The ratio of drive gear **26** to driven gear **25** may be varied as desired though it should not be less than 1;1. Satisfactory results have been obtained using a 3:1 ratio.

Gear **26** is affixed to the end of rigid shaft **28**. This shaft is coaxially aligned and rotatably carried within brush handle **12**, and has vaned impellers **29** mounted thereon. While three impellers are shown in the drawings, more may be employed. Equally suitable are screw or helical shaped impellers. A single such impeller running the length of the shaft **28** may be used in place of the vaned impellers illustrated.

The shaft **28** is received by axially spaced bearings **30** carried in spoked wheel support brackets **32**. The openings in bracket **32** permit passage of fluid through the handle. Enlarged circular portions **36** at each end of shaft **28** prevent vertical displacement of the shaft within handle **12**. Such assures continued engagement of gear **26** with gear **25**. Similar enlarged portions **38** on shaft **22** prevent horizontal displacement of said shaft within brush housing **13**.

Connector **40** at the end of the handle **12** is adapted to receive a flexible hose **42** which is itself connected to a suction source such as the low pressure side of the water pump associated with a swimming pool recirculation system. Such a system (see FIG. **4**) usually includes a pump **70**, a filter **72**, a drain **74** at the bottom of the pool, and a skimmer **76**. Water, drawn from the pool at the drain and skimmer inlets is pumped to filter **72**, wherein it is purified and thereafter returned to the pool. While it is simple and economical to run the brush off of the pool recirculation system, any other vacuum source may be utilized.

The brush handle and housing can be constructed of any material having substantial rigidity. It is preferred to use rustproof and lightweight materials such as aluminum, or specially hardened plastics. If desired, the housing and handle may be of unitary construction. The brush handle should be of a length sufficient to reach the bottommost portion of the walls at the deepest point in the pool. For most pools, a length of **12** to **16** feet will be adequate. The gears and bearings may likewise be constructed of any suitable material. It is preferred, however, to construct the gears and bearings from corrosion resistant plastics such as TEFLON. The brush elements may be of a standard type. Nylon bristles are preferred though because of their long-lasting qualities.

The fluid driven implement of this invention is designed for cleaning a swimming pool while water is contained therein. The brush housing is submerged in water. Flexible hose **42** is attached at one end to connector **40**, and at its other end to a vacuum source such as the inlet to skimmer **76**. Low pressure in hose **42** causes water adjacent the opening in rear wall **14** into and through the hollow brush handle **12**. The resultant high velocity water stream passing and impinging on impellers **29** causes them to rotate, in turn rotating shaft **28** and gear **26**. Rotation of gear **26** in turn drives gear **25**, thus turning journal **22** on which brushes **16** are mounted.

Dirt and grease dislodged by the brushes and suspended in water is carried along with the high velocity water stream through brush handle **12**, to filter **72** via flexible hose **42**. The pumped water is recirculated to the pool. The vortex flow generated by the water stream produces a suction effect whereby water

containing suspended dirt adjacent the brush housing is drawn into the housing and thus through the brush handle to the pool filter.

With reference now to FIG. 5, an embodiment of this invention is illustrated wherein cylindrical brushes **46** are removably mounted within the brush housing **48**. Journal **50** projecting from cylindrical brush **46** is received by bearing **51**. Cylindrical wall **52** of a diameter larger than bearing **20** and concentric therewith is mounted inside the brush housing, defining a cup-shaped compartment. Helical spring **54** is received within this compartment, the overall diameter of the spring only slightly less than the inside diameter of the compartment to afford a snug fit. Journal portion **56** at the opposite end of the brush **46** and projecting a short distance therefrom has a terminal portion **58** of square cross section. This terminal portion is received by a mating depression of similar cross-section in journal portion **60**. The thus joined journal portions **56** and **60** rotate together without slipping.

Cylindric wall **52** projects inwardly into the brush housing a sufficient distance to contain spring **54**. However, it does not project a distance in excess of that which is coextensive with the length of terminal portion **58**.

To insert brush **46** into housing **48**, journal **50** is passed through the center of spring **54** and into bearing **20**. Pressure is then exerted on the brush in the direction of the bearing, the brush moved towards the bearing a sufficient distance to allow for alignment of terminal portions **58** with the depression provided in journal portion **60**. Once aligned, pressure on the brush is released, spring **54** biasing terminal portion **58** to the engaged position with journal **60**. To remove the brush, pressure is again applied in the direction of the bearing, the brush moved toward the bearing a sufficient distance to disengage terminal portion **58**. The brush is then pivoted outwardly, away from the journal and removed from the housing.

Having thus described my invention, other features, advantages, and modifications thereof will be readily apparent to those of ordinary skill in the art, and are included within the scope of this invention as defined by the following claims.

I claim:

1. A fluid driven implement for cleaning the walls and bottom of a swimming pool comprising: an elongate brush housing having two opposing planar side walls and an arcuate rear wall joined therebetween, said side walls describe a sector of a circle having a minimum arc angle of 45° and a maximum arc angle of 180°; at least one cylindrical brush rotatably mountable within said housing and having a longitudinal axle with two outward extending ends; means on said side walls for supporting said axle ends for rotational movement of the brush about the longitudinal axis of the brush, said axle ends being disposed substantially at the radial center of the side walls; an elongate handle affixed to said housing and perpendicular to the longitudinal axis of the brush; a conduit extending outwardly from said brush housing and in fluid communication with the interior thereof; a fluid drive means having a rigid shaft with at least one impeller means mounted thereon for generating rotational movement of said shaft, said drive means being rotatably housed within said conduit at a substantial distance from the shaft; and gear means for transmitting the rotational movement of said drive means to said brush, said gear means including an elongate driveshaft extending between the fluid drive means and the brush.

2. The fluid driven implement of claim 2 wherein said conduit is coextensive with said brush handle and lies in a plane parallel to the longitudinal axis of the brush and is inclined approximately 45° from the plane formed by the parallel, radial margins of the side walls, and the gear means comprises a meshing bevel gear assembly.

3. The fluid driven implement of claim 1 wherein said handle is disposed at essentially right angles to said housing midway between its side walls.

4. The fluid driven implement of claim 1 wherein said brush is positioned within said housing to maintain said housing out of contact with the walls and bottom of the swimming pool when said brush is in contact with the walls and bottom of the pool.

5. The fluid driven implement of claim 1 wherein said implement comprises at least two cylindrical brushes rotatably mountable within said housing and sharing a common longitudinal axle with two outward extending ends and said gear means mechanically engages said common axle between the brushes.

6. A fluid driven implement for cleaning the walls and bottom of a swimming pool comprising a horizontally disposed elongated brush housing, said housing having an arcuately shaped rear wall joined at its ends to semicircular side walls defining a semicylindrical cavity, said cavity having a rectangular opening lying in a plane inclined approximately 45° from the vertical; a hollow elongate handle extending vertically from the arcuately shaped wall and in fluid communication with said semicylindrical cavity; at least one cylindrical brush received within said brush housing; said brush having an axle through its longitudinal axis, said axle rotatably received by the side walls of said housing and disposed substantially in the plane of the rectangular opening of the cavity; an elongate rigid shaft mounted for rotation within said hollow handle, one end of said shaft extending into said brush housing; at least one impeller means mounted on the portion of said shaft within said handle; a first gear mounted on the end of said shaft extending into the brush housing; a second gear carried on said axle and mechanically engaging said first gear; and a connector at the remote end of said hollow handle for attachment to a suction means for drawing fluid into the hollow handle from the brush housing, whereby said fluid impinges on the impeller means, rotating said shaft, which in turn drives the cylindrical brush.

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