Nov. 14, 1961 G. W. DEL VECCHIO 3,008,159

FLUID OPERATED SWEEPER

Filed July 7, 1958

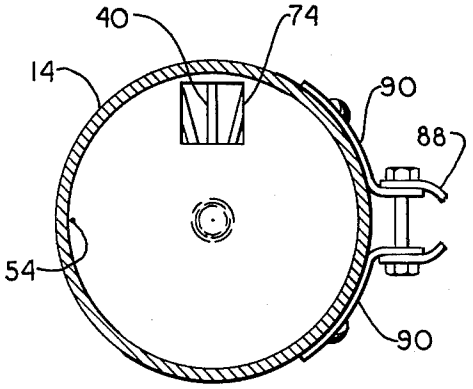



FIG. 4

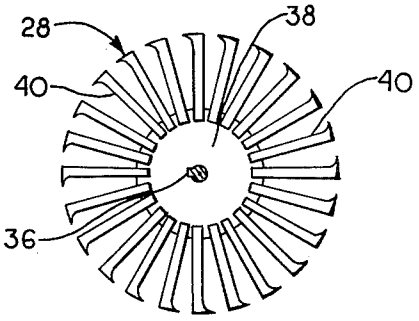



FIG. 5

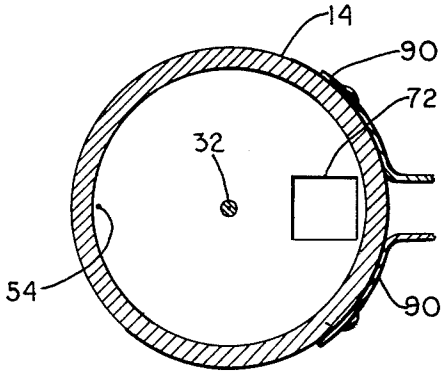



FIG. 3

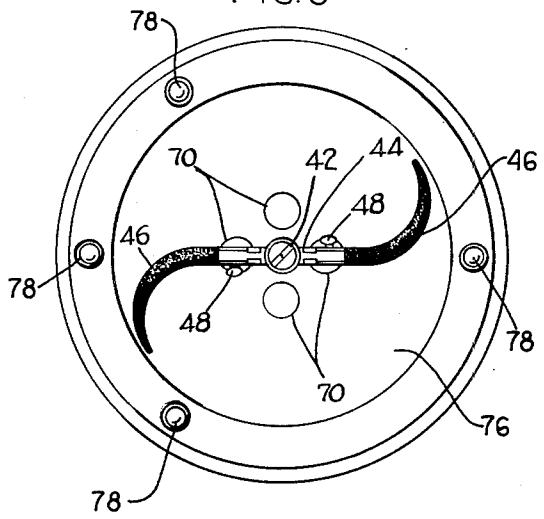



FIG. 2

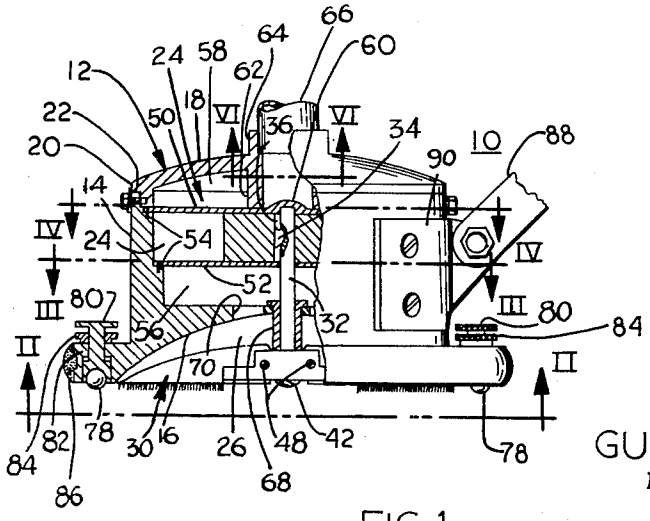



FIG. 1

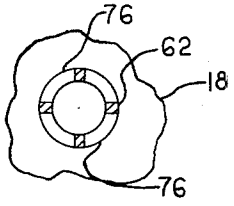



FIG. 6

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# FLUID OPERATED SWEEPER

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The present invention relates to a fluid operated sweeper and more particularly to a suction sweeper for cleaning the bottom of swimming pools while water is contained in the pool.

According to the present invention, a liquid operated sweeper is provided which includes a housing whose walls define a chamber having an outlet connected with the low pressure side of a water pump and having a water inlet. A hydraulic motor in the form of a rotor or impeller is disposed within the chamber adapted to be operated by a fluid moving across the blades thereof. A cleansing device, such as a rotatable bristle sweeper is coupled with the impeller and is disposed adjacent the inlet whereby rotation of the impeller will effect a rotation of the cleansing device.

In the preferred embodiment of the present invention, there is provided an axially located fluid outlet passage in the walls defining the sweeper housing, and this outlet passage is adapted to accept or be coupled with the low pressure side of a water pump. In addition, fluid-direction means or partitions are located between this outlet passage and a similar substantially axially located fluid passage between the upper and a lower or inlet chamber of the sweeper, and these partitions act to direct water from the lower chamber, through an opening in one of the partitions, against the outer portion of the blades of the impeller, and thence through an opening in another of the partitions, and out of the outlet passage. The openings in the partitions are circumferentially offset, whereby the water is caused to move with the impeller blades circumferentially within the upper chamber until the moving water is in register with the opening in the other partition. Thus water passing from the lower inlet chamber, through the impeller chamber, provides the motive power for driving the impeller. Since the cleansing device is coupled to the impeller, the cleansing element is rotated over and against the surface to be cleaned, swept, or polished, as the case may be. The concentration of the flow of water from the lower inlet sweeper chamber through the openings described, affords a strong driving action against the impeller.

A handle is fitted to the housing for moving the sweeper above the surface to be cleaned, and where this surface is a swimming pool bottom, the handle may be made as long as necessary and operated remotely from the side of the pool. In this connection it is noted that the rotation of the sweeper elements tends to aid in moving the present sweeper over the pool bottom. Casters or rollers are mounted above the lower portion of the housing to permit the sweeper to be easily moved over the pool bottom, and means are provided for adjusting the height of these casters to thereby adjust the height or angle of the sweeper with respect to the surface over which it is operating. This adjustment of the height of the sweeper adjusts the entry area for water passing into the inlet of the sweeper.

The present sweeper is constructed for easy assembly and disassembly whereby it is manufactured at low cost and easily overhauled and maintained. Further, the sweeper is relatively light in weight to permit it to be easily propelled over the surface to be cleaned, and, in operation over the bottom of a pool filled with water, it may be guided by manipulating the handle. In cleaning the bottom of a swimming pool, the brush elements



effectively scrub scum and undesirable collections of debris and the like into the interior of the sweeper without raising a cloud of such matter into the main body of water in the pool. Thus, the sweeper exhausts water during the cleaning operation and substantially completely avoids contaminating the water with dirt and scum churned during the cleaning operation.

Other objects and features of the present invention will be readily apparent to those skilled in the art from the following specification and appended drawings wherein a preferred form of the invention is illustrated, and in which:

FIGURE 1 is an elevational view, partially in cross section, of the fluid operated sweeper of the present invention;

FIGURE 2 is a view taken along line II—II of FIGURE 1;

FIGURE 3 is a view taken along line III—III of FIGURE 1;

FIGURE 4 is a view taken along line IV—IV of FIGURE 1;

FIGURE 5 is a detail plan view of the impeller of the present sweeper; and

FIGURE 6 is a view taken along line VI—VI of FIGURE 1.

Referring to the drawings and more particularly to FIGURE 1, there is illustrated an embodiment of the fluid operated sweeper of the present invention, which is generally designated **10**, and which is particularly adapted for use in cleaning the bottoms of swimming pools filled with water. It is contemplated that any source of subatmospheric pressure may be used with the present sweeper.

During the use of swimming pools, there is an unavoidable collection of debris on the pool bottom, and certain growths and scum accumulate which must be removed for reasons of both sanitation and appearance. Sweeper **10** is designed to be manipulated over the pool bottom to scrub off and collect such debris and scum and exhaust it through the previously mentioned suction outlet without permitting any appreciable amount of such matter to be churned and thrown away from the sweeper to cloud and contaminate the main body of water in the pool.

Sweeper **10** comprises an enclosure or housing **12** having side walls **14**, a lower wall **16**, and an upper wall **18** forms a cover for housing **12**. The wall or cover **18** is provided with a peripheral flange **20** which is received by and closely mated with a peripheral shoulder or lip **22** provided by the upper edge of side walls **14**, and a plurality of machine screws or bolts are threaded into lip **22** and upper wall **18** to securely maintain the upper wall **18** in position upon side walls **14**.

Upper wall **18**, side walls **14** and the upper surface of lower wall **16** serve to define an annular upper chamber **24**, and the lower wall **16** serves to define an annular downwardly opening lower circularly shaped water inlet chamber **26**, the lower portion of which forms a circular inlet to the sweeper. A fan, rotor, or impeller **28**, best viewed in FIGURE 5, is rotatably mounted in chamber **24** and an operating device or sweeper element **30** is rotatably mounted in chamber **26**. Means **32** are coupled between impeller **28** and operating device **30** to provide for common rotation thereof, means **32** in the present embodiment being a vertically i.e. axially disposed shaft which is secured at its upper end to impeller **28** by a key **34** which is carried within a keyway **36** provided in the center section **38** of impeller **28**.

As illustrated, impeller **28** includes the center section **38** which is provided with a plurality of vertical slots for accepting the inner ends of a corresponding plurality of

impeller blades 40, the inner ends of blades 40 being rigidly secured in the slots of section 38 and the outer ends of blades 40 being dished or tapered for maximum efficiency of operation under the action of the fluid moving thereover. The outer tips of blades 40 are spaced closely adjacent to side walls 14 to minimize any fluid leakage therebetween, and blades 40 are preferably made of a resilient material, such as rubber, whereby the outer tips of blades 40 sweep or scrub against side walls 14 during rotation of impeller 28.

Sweeper element 30 is rigidly secured to the lower end of shaft 32 by a screw 42 disposed through a suitable opening in a sweeper center section 44 and into a suitable axially threaded opening provided in the lower end of shaft 32.

Center section 44 is preferably formed to provide a pair of radially extending arms to which a pair of sweeper sections 46 are secured by a pair of screws 48. The pair of screws 48 may be loosened or removed to permit the replacement of worn sweeper sections 46 with new sweeper sections 46, or with abrading or polishing sections, as desired. With this construction it will be seen that rotation of impeller 28 effects a rotation of shaft 32 which in turn rotates sweeper element 30 to thereby scrub or clean the surface upon which sweeper 10 is disposed. The upper surface of sweeper sections 46 increase in vertical cross section from the outward tip inwardly, and the under side of the lower wall 16 is shaped to diverge upwardly inwardly away from sweeper sections 46. The described configuration of the under surface of lower wall 16, namely, the segment of a hollow sphere, serves to channel or guide upwardly moving fluid toward the axis of sweeper 10.

A pair of plates or partitions 50 and 52 are horizontally or transversely disposed between side walls 14 of housing 12, and rest upon peripheral lips or shoulders provided in side walls 14. Partition 52 is arranged adjacent to the lower surface of impeller 28, and partition 50 is arranged adjacent the upper surface of impeller 28 whereby partitions 50 and 52 are vertically spaced from one another to form therebetween an enclosure for impeller 28. Partitions 50 and 52 are located in position and restrained against rotatable movement by a pair of pins 54 which are disposed through the edges of the partitions and into a suitable opening provided in the peripheral shoulders of side walls 14 upon which the plates rest. The disposition of partitions 50 and 52 within upper chamber 24 serve also to define collection spaces or chambers 56 and 58 between partition 52 and lower wall 16, and between partition 50 and upper wall 18, respectively. As will be seen, chamber 56 serves to receive fluid and waste material subsequent to its passage through lower chamber 26 and prior to its entry into the impeller chamber, and chamber 58 serves to receive this same waste matter subsequent to its passage through the impeller chamber and prior to its discharge from sweeper 10.

Partition 50 is provided with a central opening through which shaft 32 is rotatably disposed, and partition 52 is provided with a central socket portion for rotatably receiving the upper end of shaft 32, this socket portion being reinforced by a thickened center portion or cap 60.

Cap 60 serves to accept end or axial loads imposed by shaft 32 during operation of sweeper element 30, this end load also being borne by a cylindrical center portion 62 which is formed integrally with upper wall 18 and extends downwardly from upper wall 18 into an abutment with the upper surface of partition 50. A vertical extension 64 of center portion 62 forms a socket for accepting an exhaust line or hose 66 in fluid-tight relationship. Thus, end play or end loads are borne by cap 60, while side loads imposed by shaft 32 are borne by a bushing 68 which is press fitted within a suitable central opening provided in lower wall 16, bushing 68 being provided with a central bore through which shaft 32 is rotatably disposed.



Upon the connection of hose 66 to the low pressure side of a pump (not shown), water will be drawn upwardly from lower chamber 26 through hose 66. The passage from lower chamber 26 for such fluid is afforded by a plurality of substantially centrally located outlet openings 70 provided in lower wall 16, and passage through partition 52 is afforded by an opening 72 provided adjacent one edge of partition 52. Fluid passage from the chamber of impeller 28 through partition 50 is afforded by an opening 74 provided adjacent one edge of partition 50. It is important to note that openings 72 and 74 are located in peripherally offset relationship, that is, opening 74 is located preferably 90° away from opening 72 whereby fluid passing through opening 72 is forced to flow through a 90° path within the chamber of impeller 28 prior to its passage out of opening 74. It will be apparent that opening 74 may be located offset from opening 72 a peripheral distance somewhat more or less than that described, it being important only that the fluid path be directed so as to act in a transverse direction against the blades 40 of impeller 28. Fluid passage from chamber 58 is then afforded by one or more openings 76 provided through the vertical walls of portion 62, as best illustrated in FIGURE 6.

In the operation of sweeper 10, a suction applied to hose 66 will effect a flow of fluid from beneath sweeper element 30 through the circular inlet of inlet chamber 26, through outlet openings 70, opening 72, opening 74, and openings 76, and, the transverse path of fluid from opening 72 to opening 74 will cause rotation of impeller 28. The rotational movement of impeller 28 is transferred by shaft 32 to sweeper element 30, and this consequent rotation of sweeper element 30 effects the desired scrubbing and cleaning action. Thence, the debris and waste matter loosened by the action of sweeper element 30 passes, with the fluid being exhausted, through the fluid paths above described. Thus it will be seen that no opportunity is present for the waste matter to pass in a direction or path other than upwardly through sweeper 10 and out of hose 66.

Sweeper 10 is supported by a plurality of ball or roller elements 78 which are each rotatably carried in a socket element 80 which is threadably disposed in a vertical position through a peripheral lower flange 82 which is integral with housing 12. It will be apparent that rotation of element 80 will adjust the vertical position of its associated roller elements 78, and a jam nut 84 is threadably mounted to each socket element 80, which when tightened will lock or maintain socket element 80 in its adjusted position. Adjustment of the height of sweeper 10 over the surface to be cleaned serves to adjustably vary the area of water intake between such surface and the bottom surface of sweeper 10 to thereby permit attainment of optimum suction of debris and scum into sweeper 10.

It has been found, in actual practice, that it is necessary to gradually decrease the volumetric capacity of the circular inlet or plenum chamber 26 from the bottom thereof to adjacent the axis thereof and to locate the outlet for the chamber adjacent the axis of the upper wall of the chamber. By so shaping the plenum chamber and so locating the outlet thereof the velocity of the motor is of sufficient high value to actuate the motor through the relatively small water pump standardly used at home swimming pool installations, and turbulences, which entrap leaves and other dirt, are not present in the plenum chamber, and the water and debris lifting areas are uniform through the like areas lying in the same planes transverse to the axis of the chamber and including the entire peripheral inlet area. A bumper 86, made of a suitable resilient material such as rubber or plastic, is mounted to the edge or periphery of flange 82 to protect sweeper 10 from the hard usage and abuses which are encountered in bumping sweeper 10 against,

for example, the side walls of the swimming pool being cleaned.

Sweeper 10 is guided over the surface to be cleaned by manipulation of a handle 88 which is secured to brackets 90 which are rigidly fixed or fastened to side walls 14. Only a portion of handle 88 is illustrated, but it will be obvious that handle 88 may be of any suitable length or shape.

The water circuit may include the sweeper, the pump for drawing water through the sweeper, a filter tank or other suitable means for cleansing the water being circulated, and the clean water may then be returned to the pool whence it originally came. Thus no water is wasted by the use of the present invention.

While certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims:

I claim:

1. A cleaner for swimming pools or the like comprising in combination, a housing having an outlet for liquid connectible with the low pressure side of a liquid pump, said housing having a circularly shaped inlet chamber, the axis of said chamber being vertical, said chamber being open at the bottom providing a circularly shaped inlet at the bottom thereof and an outlet at the top thereof adjacent the axis of the chamber, said chamber defined by an upper wall, the under side of said wall having the shape of a segment of a hollow sphere for gradually decreasing the volumetric capacity of the chamber from the bottom thereof to the top thereof; a hydraulic motor within the housing including a rotor movable in response to the flow of liquid through the housing, said motor being disposed between the outlet of the inlet chamber and the first mentioned outlet; a rotatable cleaning element adjacent said inlet to the chamber, said cleaning element having a portion projecting below the inlet to said chamber; and means on the housing for spacing the inlet of the chamber from the surface to be cleaned a distance substantially equal to the height of the projecting portion of the cleaning element.

2. A cleaner as defined in claim 1, in which the last



mentioned means is operable to adjust the distance between the inlet of the chamber and the surface being cleaned.

3. A suction sweeper comprising a housing, said housing having walls defining an impeller chamber and a downwardly open sweeper chamber which is downwardly progressively larger; a vertically disposed shaft carried by the housing; an impeller rotatable within said impeller chamber and carried by said shaft, said impeller including blades; sweeping means rotatable within said sweeper chamber and secured to said shaft; an upper partition transversely disposed between and supported adjacent the upper surface of said impeller by the side walls of said housing, said upper partition having an opening offset from the vertical axis of said impeller, and a lower partition transversely disposed between and supported adjacent the lower surface of said impeller by said side walls, said lower partition having an opening offset from the vertical axis of said impeller, said openings in said upper partition and said lower partition being circumferentially offset with respect to each other to thereby guide fluid transversely against the blades of said impeller, said lower partition being spaced above the walls defining said sweeper chamber to thereby form an intermediate chamber, said sweeper chamber walls including a substantially centrally located fluid passage between said sweeper chamber and said intermediate chamber.

4. A suction sweeper according to claim 3 and characterized in that said sweeper means includes at least one arm which is arcuately shaped whereby when said sweeper means is rotated the inner arc-like face of said arm forms the leading side of the arm for inwardly directing fluid to the substantially centrally located fluid passage in said sweeper chamber walls.

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