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Gibellina

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[45] **Dec. 16, 1975**

[54] **POOL CLEANING APPARATUS**

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[73] Assignee: **Airwick Industries, Inc.,** Carlstadt, N.J.

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[52] **U.S. Cl.**..... **134/167 R;** 4/172.15; 4/172.17

[51] **Int. Cl.**[2]..... **B08B 9/08**

[58] **Field of Search**..... 4/172.15, 172.16, 172.17; 134/167 R, 168 R; 15/1.7; 210/169

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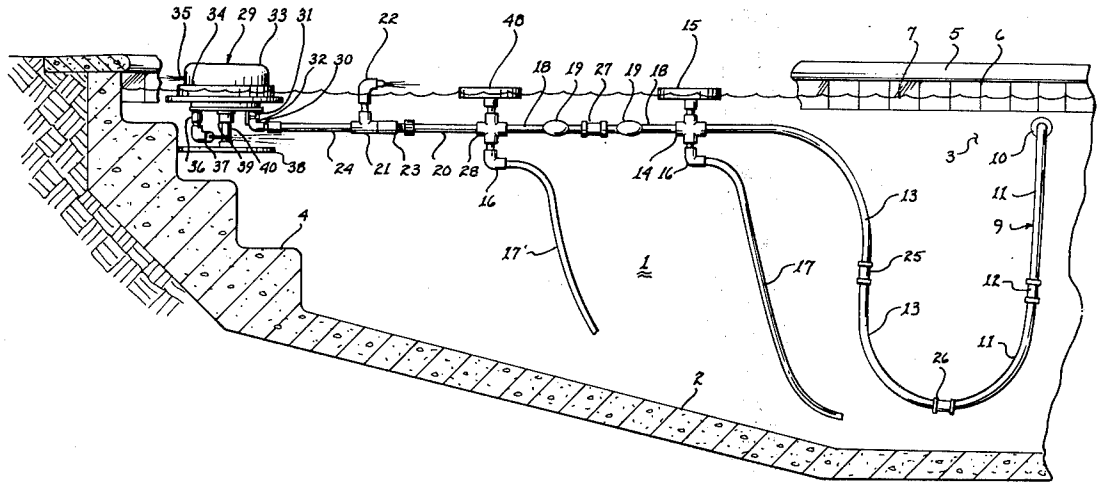
Primary Examiner—Robert L. Bleutge

Attorney, Agent, or Firm—Curtis, Morris & Safford

[57] **ABSTRACT**

A rotatable pool cleaning head is continuously biased toward the edges of a swimming pool by a first water jet system and propelled along the edge by a second water jet system. Self compensatory means are provided to angularly reorient the biasing of the water jet systems to accommodate changes in the curvature of the pool perimeter as the cleaning head travels therealong.

18 Claims, 7 Drawing Figures



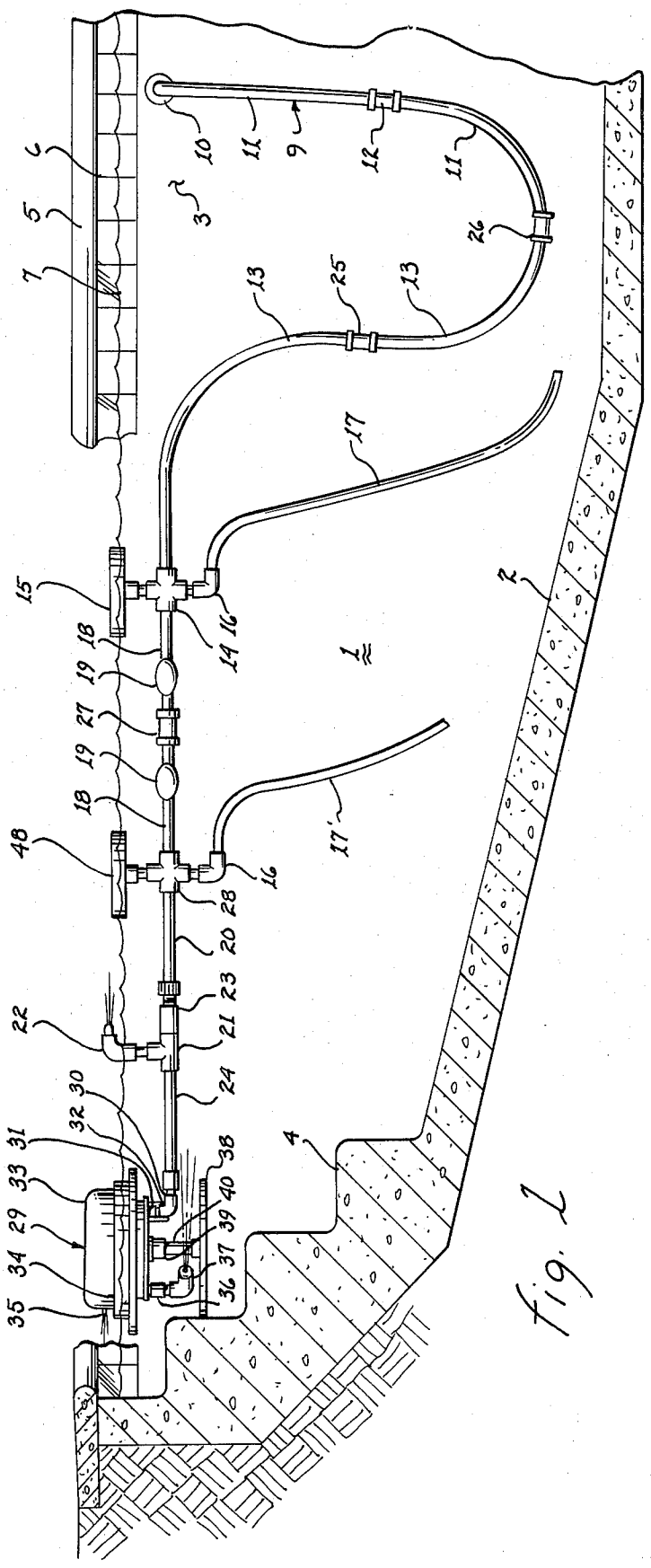

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Fig. 1

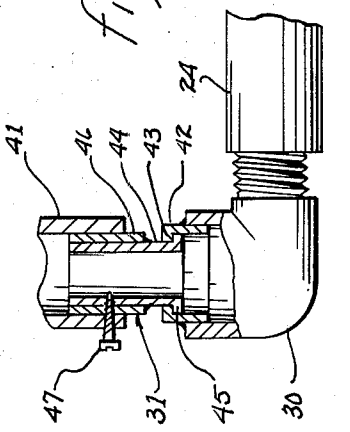

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Fig. 2

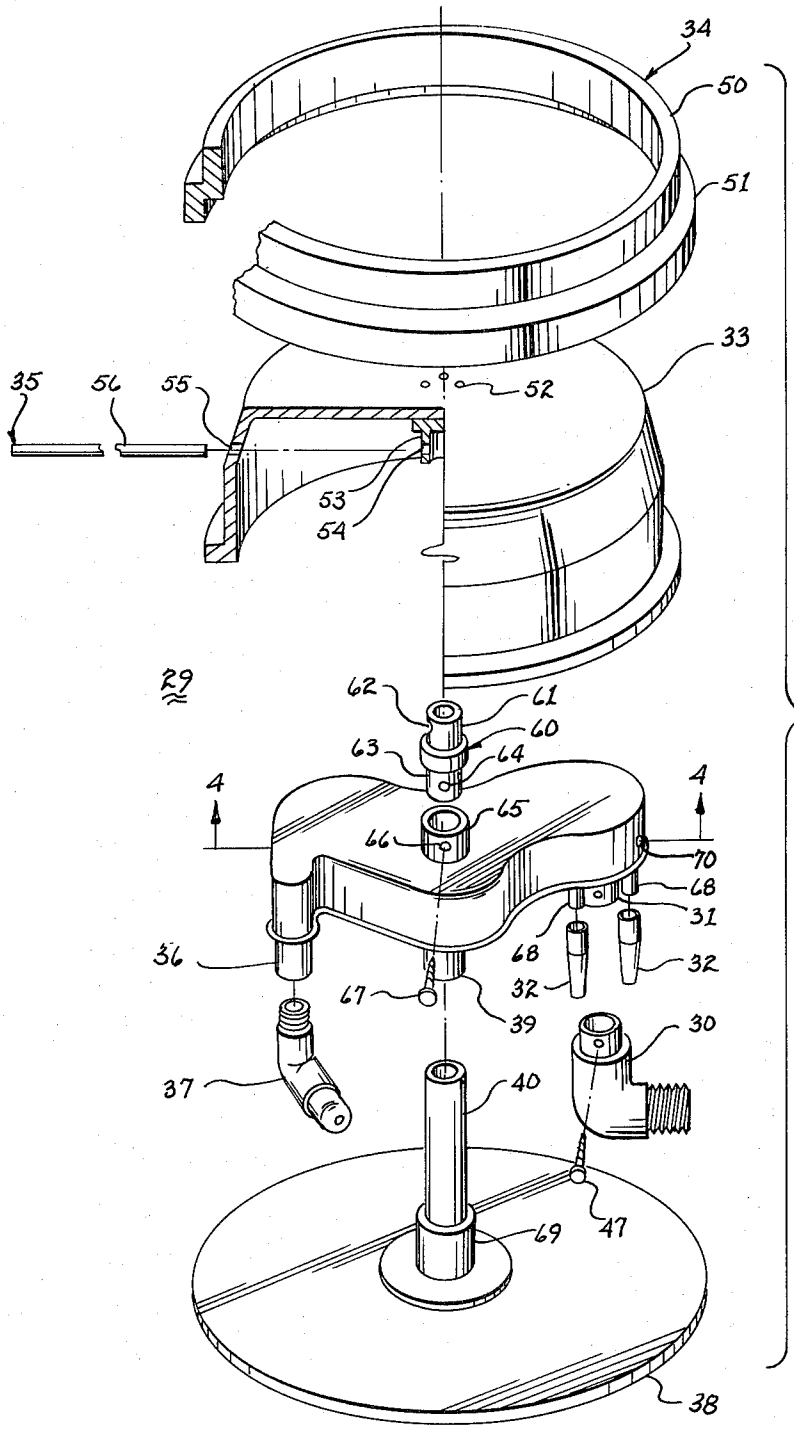

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Fig. 3

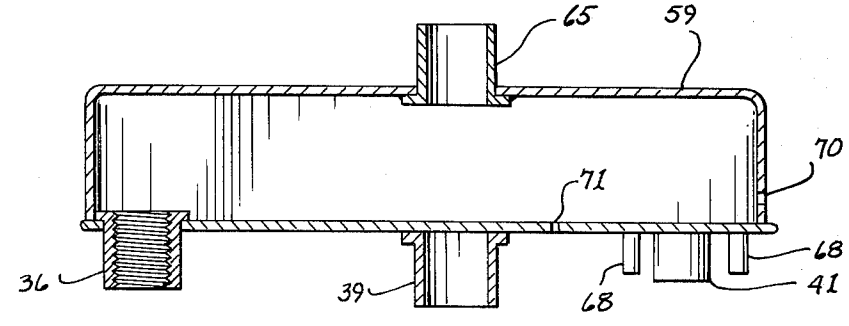

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Fig. 4

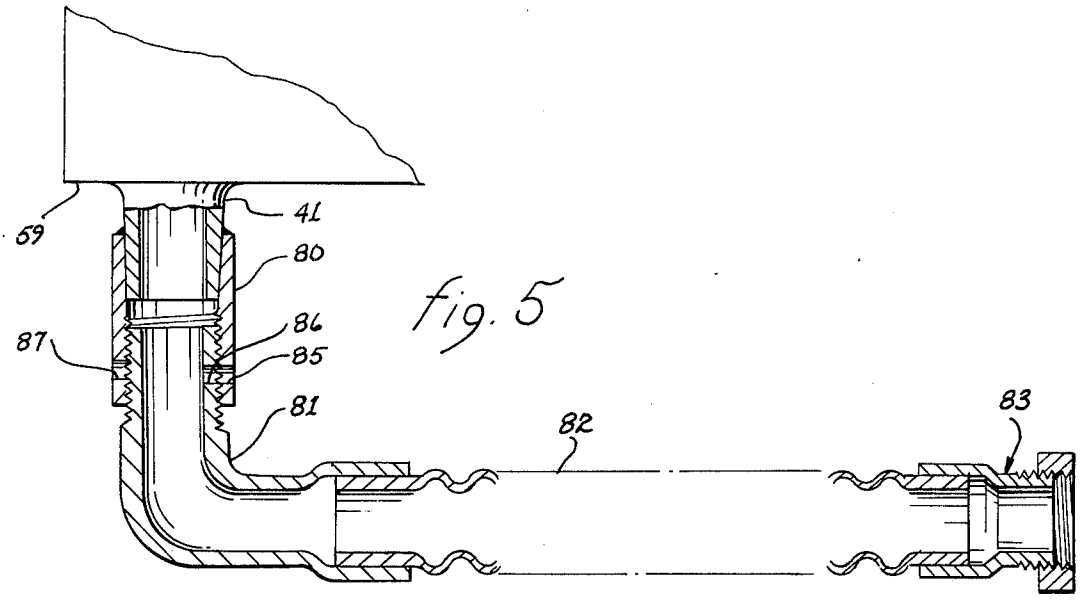


Fig. 5

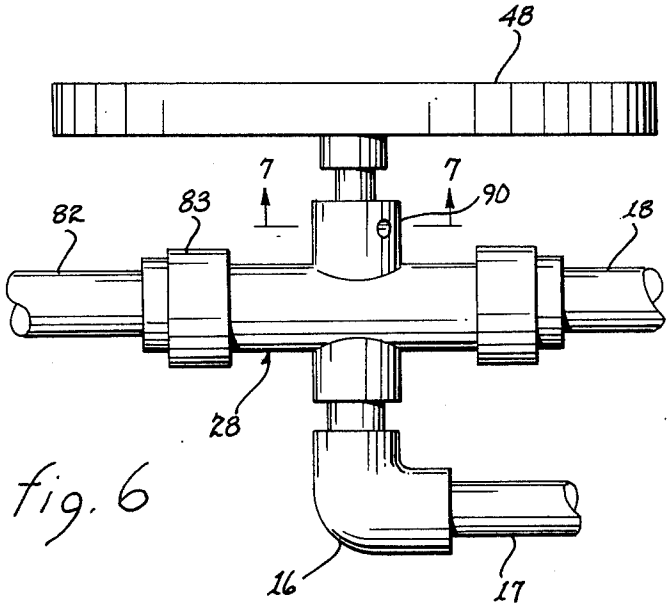


Fig. 6

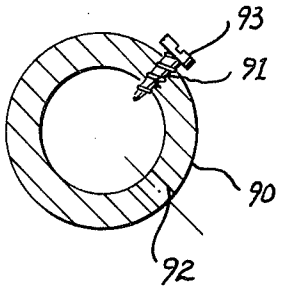


Fig. 7

POOL CLEANING APPARATUS

The present invention relates to pool cleaning devices, and, more particularly, to pool cleaning devices traveling along and continuously biased toward the edge of a pool.

The prior art is replete with various devices for agitating the water adjacent the bottom and sides of a pool to maintain foreign particulate matter in a continuous state of suspension. Some of these devices, such that shown in U.S. Pat. No. 3,291,145, incorporate a water driven timing mechanism for periodically emitting a water flow through selected nozzles. The variable water flow from the nozzles tends to cause the device to travel in a prescribed path about a pool. A plurality of other devices, represented by the following U.S. Pat. Nos. 3,032,044, 3,139,099, 3,170,180, 3,265,079 and 3,289,216, teach various pool cleaning devices suspended from and movable about an arm extending from the side of the pool. U.S. Pat. No. 3,580,511, illustrates a transportable manually operated device for directing a spray of water toward the sides of a pool. U.S. Pat. No. 3,718,148, describing a device invented by the present inventor, teaches a pool cleaning device for ejecting a spray of water from nozzles tangential to the cleaning head. The ejected water causes the cleaning head to rotate and simultaneously wash the walls of the pool. Other water nozzles bias the cleaning head toward the pool walls.

All of the above devices operate more or less successfully but each of them have certain drawbacks or disadvantages. One of the primary disadvantages of the prior art devices resides in the complexity and associated expense of the various components. As the market within which these devices are sold is highly competitive, it becomes mandatory to simplify each of the elements of any apparatus to the greatest extend possible and thereby reduce the component cost. Further, non-clogging, easily maintainable and preferably interchangeable components must be used to provide a high degree of reliability and low maintainance costs.

Further, pool cleaning devices must be capable of continuously agitating the water adjacent 100 percent of the submerged surface of the pool and they must be capable of adequately and effectively cleaning the exposed sides of the pool to prevent the formation of evaporation rings and deposition of surface oil and debris.

It is therefore a primary object of the present invention to provide a pool cleaning apparatus for scrubbing the submerged and unsubmerged sides of a pool.

Another object of the present invention is to provide a rotatable pool cleaning head biased into contact with the sides of a pool by a first set of water jets and impart a lateral motion to the cleaning head by a second set of water jets to cause the cleaning head to roll along the pool perimeter.

A further object of the present invention is to provide a means for maintaining a submerged contact between a pool cleaning head and the wall of a pool.

A still further object of the present invention is to provide a water feed line for a pool cleaning apparatus, which line does not entangle as the pool cleaning apparatus circumnavigates the pool.

A yet further object of the present invention is to provide pool cleaning apparatus which may be configured to rotate in either a clockwise or a counter clockwise direction.

A still further object of the present invention is to provide an inexpensive pool cleaning apparatus.

These and other objects of the present invention will become apparent to those skilled in the art as the description thereof proceeds.

The present invention may be described with greater clarity and specificity with reference to the following drawings in which:

FIG. **1** illustrates the components of the present invention disposed within a swimming pool.

FIG. **2** depicts the swivel connection intermediate the pool cleaning apparatus and the water feed line.

FIG. **3** illustrates an exploded view of the pool cleaning head.

FIG. **4** illustrates a cross-sectional view of the pool cleaning head manifold taken along lines **4—4,** as shown in FIG. **3.**

FIG. **5** illustrates a modification of the apparatus interconnecting the pool cleaning apparatus and the water feed line.

FIG. **6** illustrates a modification of the power jet for driving the pool cleaning apparatus.

FIG. **7** illustrates a cross-sectional view of the power jet taken along lines **7—7,** as shown in FIG. **6.**

Referring to FIG. **1,** there is shown a cross-sectional view of a swimming pool **1** filled with water, as indicated by water level **7,** and including the pool cleaning apparatus of the present invention. The pool **1** includes a bottom **2** having an essentially horizontal section and a sloping section, the latter terminating in a plurality of steps **4.** The side walls **3** are terminated by a combing **5** contiguous with the surrounding pool deck. A tiled surface **6** is disposed in proximity to the water level **7** and a water supply outlet **10** is located in one of the side walls **3** in general proximity to the intended water level.

A water feed line **9** is attached to water supply outlet **10** to convey a flow of water to the various jets and outlets of the present invention. Water feed line **9** includes a sinkable water hose **11** extending from water supply outlet **10.** The sinkable hose **11** may be bisected with a swivel coupler **12** inserted therebetween. The coupler serves to relieve any twisting strains imposed upon hoses **11.** One end of a pair of floating hoses **13,** interconnected by another swivel coupler **25,** is attached to sinkable hose **11** by further swivel coupler **26.** The other end of floating hoses **13** is connected to a float coupler **14.** With the above described configuration of the water feed line **9,** a downwardly extending loop will be maintained in the line in proximity to the water supply outlet **10.** The downwardly extending loop will prevent the hose from entangling as the latter moves about the pool.

A float **15** extends upwardly from float coupler **14** and maintains the latter at a predetermined distance beneath the water level **7.** A "snake" or pool cleaning hose **17** is suspended from float coupler **14** by means of an elbow **16.** A stream of water is ejected from the extremity of hose **17** and causes the lower part of the hose to randomly traverse the surfaces of bottom **2** and side walls **3** to randomly direct a stream of water against the adjacent surfaces. The ejected water tends to agitate particulate matter which has settled on the bottom and side walls and retains the particulate matter in suspension.

A second float coupler **28** is connected to the first float coupler **14** by means of hoses **18** connected to one

another by a further swivel coupler **27.** Floats **19** may be added to hoses **18** to prevent the hoses from sinking and thereby drawing the two float couplers toward one another. If hoses **18** are floation hoses, floats **19** are not needed.

The second float coupler **28** includes a float **48** to maintain the float coupler at a predetermined distance beneath water level **7.** A further hose **17'** depends from float coupler **28** through another elbow **16'.** The further hose **17'** conveys a stream of water adjacent the surfaces of bottom **2** and side walls **3** to maintain the surrounding particulate matter in suspension.

Additional float couplers may be included without departing from the teachings of the present invention. The requirement for further float couplers is essentially predicated upon the hoses **17** and **17'** being capable of reaching the whole surface of the bottom **2** and side walls **3** when the float couplers are in proximity to the side walls.

The second float coupler **28** is connected to cleaning head **29** by a control arm **20,** a coupler **23,** a T fitting **21,** a control arm **24,** an elbow **30** and a swivel **31.** The leg of T fitting **21** extends upwardly and supports a power jet **22.** The power jet is set at an angle of 45° with respect to control arm **20** and directed away from cleaning head **29.** In this manner, the reaction force created by the water flowing out of power jet **22** will tend to cause the attached assembly to move in a direction opposite to that of the ejected water. Swivel **31** extends downwardly from cleaning head **29** off-center of the vertical axis of the cleaning head. Thereby, the reaction force acting upon swivel **31** will tend to cause the cleaning head to rotate about the swivel. The angular displacement of the cleaning head is limited by elbow **30** contacting one of a pair of stops **32** extending downwardly from cleaning head **29** on either side of the elbow.

A leading jet **37** is connected to a manifold disposed interior to dome **33** of cleaning head **29** through a coupler **36** at a location generally diametrically opposed to swivel **31.** The leading jet is generally oriented in the same direction as power jet **22** but selectively angularly non-aligned therewith. A part of the water flowing into the manifold through swivel **31** is discharged through leading jet **37.** The reaction force created by the ejected water from the leading jet will tend to cause cleaning head **29** to rotate in a direction opposite to that induced by power jet **22.**

A jet **35** extends radially from dome **33** and is interconnected to the manifold within the dome. Thereby, a part of the water within the manifold is ejected through water jet **35.** Water jet **35** is positioned above water level **7** such that the water ejected therefrom will strike and wash the tiles **6** of side wall **3** extending above the water level **7.**

A floation ring **34,** having a radially extending annular band about its lower edge, is disposed about dome **33** and extends outwardly therefrom. The buoyancy of the floation ring is established such that the annular band and below the water level **7.** Any contact between cleaning head **29** and side wall be by means of the annular band and below the water level. Thereby, the cleaning head will not scrape, rub or otherwise leave any marks upon the side wall **3** above the water level. Further, surface oils and debris will not be transfered to the exposed tiles **6.**

Through experimentation it has been learned that the action of the cleaning head **29** creates a partial vacuum within dome **33,** which vacuum causes the cleaning head to float lower than optimum. To relieve the vacuum, a plurality of holes **52** (see FIG. **3**) are formed in the top surface of dome **33.**

Where the steps **4** extend beyond the side wall **3** of the pool at a depth insufficient to clear the apparatus depending from cleaning head **29,** a rotatable disc **38** may be used. Disc **38** is connected to cleaning head **29** by means of a pipe **40** extending from the manifold to a depth sufficient to clear the adjacent apparatus. The diameter of the disc is equal to or greater than that of the adjacent apparatus such that the disc and not the apparatus contacts the riser of the step. Thereby, the disc **38** prevents the cleaning head **29** from becoming jammed against the underwater depending apparatus.

The details of swivel **31** will be described with respect to FIG. **2.** A hollow stud **41** is interconnected with and extends downwardly from the manifold within dome **33.** A sleeve **44,** having a radially extending lip **45** at its lower extremity, is secured within stud **41** by a screw **47.** Where dimensionally necessary, a spacer **46** may be inserted intermediate sleeve **44** and stud **41.** A further sleeve **42,** having a radially inwardly extending lip **43,** interlocks with lip **45** of sleeve **44.** Sleeve **42** is fixedly secured to the upwardly extending part of elbow **30.** Elbow **30** may be threadedly connected to control arm **24** as shown, or it may be adhesively connected thereto.

The construction of cleaning head **29** will be described in detail with reference to FIG. **3.** The floation ring **34** includes a sleeve **50** frictionally engaging the lower skirt of dome **33.** An annular band **51** extends radially from sleeve **50** and defines the outermost extremity of cleaning head **29** whereby it and only it will contact the side wall when the rotating platform is in proximity thereto.

A downwardly oriented cap **53** is centrally mounted within dome **33.** The cap includes an aperture **54** disposed in one wall thereof. The upper sleeve **61** of a dual swivel coupling **60** mates with cap **53.** An aperture **62** is disposed within sleeve **61** to mate with aperture **54.** Jet **35** includes a tube **56** extending interior to dome **33** through an aperture **55.** Tube **56** also extends through apertures **54** and **62** within cap **53** and sleeve **61,** respectively. When tube **56** is inserted through the respective apertures, sleeve **61** will be secured within cap **53.**

The lower sleeve **63** of dual swivel coupling **60** is mounted within a hollow stud **65** extending upwardly from manifold **59.** A screw **67** interconnects stud **65** and sleeve **63** through apertures **66** and **64,** respectively, to secure the manifold to the coupling.

As best illustrated in FIG. **4,** the manifold **59** includes an aperture **70** directed lateral to control arm **24** (see FIG. **1**) when the latter is angularly centered with respect to stops **32.** The purpose of aperture **70** is that of agitating the surface. A further aperture **71** is disposed in the bottom surface of manifold **59.** Aperture **71** directs a stream of water downwardly to agitate any particulate matter resting upon elements laterally protruding from side wall **3,** such as steps **4** shown in FIG. **1.**

The operation of the present invention will now be described. When a water valve (not shown) is opened, water will flow from water supply outlet **10** through water feed line **9.** A part of the water flow will be ejected through power jet **22** to establish a reaction force upon control arm **24.** The reaction force will tend to rotate cleaning head **29** about its vertical axis in a

counter clockwise direction. Simultaneously however, water will flow into manifold **59** with a part of the water being ejected through leading jet **37.**

If the cleaning head **29** is located within the pool but not adjacent one of the side walls **3,** the reaction force created by both the power jet and the leading jet will tend to propel the cleaning head forwardly and laterally until it contacts a side wall. When the annular band **51** contacts the side wall, it will usually not be at an angle normal to the side wall. Hence, the reaction force from the power jet and the leading jet, will cause the rotating platform to travel along the side wall while maintaining contact therewith. The frictional force established between the annular band **51** and the side wall **3** will cause dome **33** to roll along the side wall without corresponding rotation of manifold **59.** The jet **35,** rotated by dome **33** sprays water in a circular pattern about the dome and washes the side walls **3** extending above the water level. As the annular band **51** is below the water level **7,** it will not leave marks upon the exposed side wall, which marks would ultimately become baked by the sun and permanently disfigure the exposed side wall.

If pool **1** includes steps extending into the pool at a depth insufficient to clear the apparatus depending from the cleaning head, disc **38** is attached to guide the cleaning head around these obstructions.

Through experimentation, it has been found that excellent results are achieved if power jet **22** is oreinted at an angle of 45° with respect to control arm **24.** The biasing of the cleaning head **29** against the periphery of pool **1** is essentially controlled by leading jet **37.** The bias may be increased by angularly reorienting leading jet **37** from a position essentially parallel from that of power jet **22** to a more outwardly directed angle.

The swiveling capability of control arm **24** with respect to the cleaning head **29** will present the unit from becoming stalled should it strike a side wall at an angle of 90° with respect to the reaction force created by the power and leading jets. In such a case, control arm **24** and manifold **59** will swivel with respect to dome **33** to allow the force exerted by the power and leading jets to be angularly reoriented from that of the initial position. The reorientation will quickly create a lateral force upon dome **33** and the latter will resume its travel along the periphery of the pool. The imbalance of reaction forces created by the power and leading jets is further enhanced is the angle therebetween is large.

Through experimentation, it has been learned that swivel **31** and stops **32** may be deleted by incorporating a flexible hose in place of control arm **24,** such a modification is illustrated in FIG. **5.** A sleeve **80** is adhesively secured to stud **41** and threadedly interconnects an elbow **81** to the stud. A flexible hose **82** is secured to elbow **81** and extends lateral to manifold **59.** The flexible hose **82** terminates in a fitting **83.**

Sleeve **80** includes a pair of diametrically opposed apertures **85** and **87** disposed within the threaded portion of the sleeve. A similar sized aperture **86** is disposed within the threaded portion of elbow **81** to selectively cooperate with one of apertures **85** or **87.** By orienting aperture **86** with aperture **85,** as shown, a jet of water will be ejected therefrom. The reaction force of this jet of water will essentially correspond to the reaction force established by the leading jet **37** disposed at the other end of manifold **59** (see FIG. **3**) and be oriented in essentially the same direction. Thereby, the travel of the cleaning head **29** will be in a direction opposite that of the water ejected through aperture **85** and leading jet **37.** As the force exerted by the ejected water will be essentially equal, the manifold **59** will not tend to rotate with respect to flexible hose **82.**

Previously, the swivel **31** interconnecting the power jet **22** and the manifold **59** permitted a lateral bias to be applied to the cleaning head **29** when it became stalled against a wall of the pool **1.** With the modification as shown in FIG. **5,** such stalling is prevented by the flexible nature of hose **82.** The force exerted by the power jet **22,** assuming the cleaning head to be positionally stalled, will tend to bend the flexible hose in one direction or the other because the reaction force established by power jet **22** is in non-alignment with the flexible hose. When the flexible hose **22** bends, the force exerted by the power jet will be translated to a lateral force acting upon the cleaning head, which lateral force will cause the cleaning head to begin traveling the pool perimeter.

The inclusion of a separate fitting and the necessary couplers to form power jet **22** can be circumvented by a modification to the second float coupler **28,** as shown in FIG. **6.** By connecting fitting **83** directly to the float coupler **28,** the control arms **24,** coupler **23,** T-fitting **21** and power jet **22** may be deleted. To obtain the necessary reaction force of power jet **22,** a pair of apertures **91** and **92,** see FIG. **7,** are disposed within the upper neck **90** of float coupler **28.** These two apertures are oriented at an angle of approximately 45° with respect to a horizontal center line passing through the float coupler.

In operation, one of apertures **91** and **92** is closed off by means such as a screw **93.** A jet of water will thence flow through the remaining open aperture and establish a reaction force acting upon the float coupler **28.** The selection of aperture **91** or **92** is dependent upon whether the rotating platform is to travel clockwise or counter clockwise about the perimeter of the pool.

With the arrangement of parts shown in FIG. **3,** the cleaning head **29** will travel in a counter clockwise direction. In a clockwise direction is desired because of the configuration of the pool, or other requirements, one of the stops **32** is momentarily dislocated to permit **180°** rotation of elbow **30.** The leading jet **37** must also be reversed and the power jet **22** must be realigned and directed away from the other side of control arm **24.** Similarly, if the rotation of the cleaning head **29,** incorporating the modifications shown in FIGS. **5, 6** and **7,** is to be altered, elbow **81** is rotated within sleeve **80** until aperture **87** mates with aperture **86;** aperture **92** within neck **90** is opened by removing screw **93** and inserting the latter within aperture **91.** Leading jet **37** must also be reversed.

From the above description, it will become apparent to those skilled in the art that the use of the modifications illustrated in FIGS. **5, 6** and **7,** eliminate all moving parts from the present invention except that of the dual swivel coupling **60** intermediate dome **33** and manifold **59.** Thus, the expense of the present invention has been reduced, maintainance requirements have been substantially decreased and the complexity has been minimized.

While the principles of the invention has now been made clear in an illustrative embodiment, there will be immediately obvious to those skilled in the art many modifications of structure, arrangement, proportions, the elements, materials, and components, used in the practice of the invention which are particularly

adapted for specific environments and operating requirements without departing from those principles.

I claim:

1. A pool cleaning apparatus for washing the bottom and side walls of a pool, which pool includes a water supply outlet disposed in one of the side walls, said apparatus comprising in combination:

a. a cleaning head movable about the surface of water within the pool, said cleaning head including:

1. a water manifold for receiving and distributing a flow of water; and

2. a dome freely rotatably supported on said manifold, said dome having a vertical axis of rotation and being rotated on said axis with respect to the manifold by contact with the side wall as the cleaning head moves along the side wall;

b. hose means operatively connected to the water supply outlet for supplying a flow of water to said water manifold; said hose means including means for connecting the hose to the manifold and for allowing relative movement between the hose and manifold at least in a horizontal direction;

c. power jet means extending from said hose means upstream of said connecting means for urging rotation of said cleaning head in a first direction about the vertical axis;

d. leading jet means extending from said manifold downstream of said connecting means for urging rotation of said cleaning head in a second direction about the vertical axis, said leading jet means, in combination with said power jet means, propelling said cleaning head forwardly and laterally; said leading and power jet means being normally positioned at a predetermined angular relation to each other, which angular relation may be varied during operation of the apparatus, should the cleaning head become stalled against the side wall, as the power jet causes said hose to move horizontally about said connecting means, thereby to change the angle of the effective repulsive force applied to the cleaning head by said leading and power jets and unstall the cleaning head;

e. a flotation ring disposed about said dome for supporting at least a part of said dome above the surface of the water, said flotation ring including an annular band extending radially outwardly from said dome below the surface of the water such that only said annular band contacts the side wall of the pool when said cleaning head is adjacent the side wall, said dome being rotated by the friction existing between said annular band and the side wall due to the forward and lateral movement of said cleaning head;

f. water jet means extending radially from said dome and rotating with said dome for directing a flow of water against the side wall above the water level of the pool to wash the unsubmerged part of the side wall; and

g. at least one snake extending from said hose means for randomly spraying a flow of water against the submerged side walls and bottom of the pool; whereby said power jet means and said leading jet means cooperate to prevent stalling of the cleaning head in a fixed position along the side wall and propel said cleaning head about the perimeter of the pool while said water jet means and said snake wash the unsubmerged side walls and the bottom of the pool.

2. The apparatus as set forth in claim **1** including at least one float coupler attached to said hose means for supporting said hose means in proximity to the water surface of the pool.

3. The apparatus as set forth in claim **2** wherein said hose means includes a plurality of serially connected lengths of hose and a swivel coupler disposed intermediate adjacent lengths of hose to prevent snarling of said hose means.

4. The apparatus as set forth in claim **3** wherein a first one of said lengths of hose connected to said water supply outlet is sinkable and a second one of said lengths of hose connected to said first length of hose is floatable; whereby, said first and second lengths of hose will define a downwardly directed loop from the water supply outlet to preclude said cleaning head from becoming entangled with said hose means.

5. The apparatus as set forth in claim **1** where said hose means includes rigid control arm means operatively connected to said connecting means and extending upstream therefrom for supporting said power jet means.

6. The apparatus as set forth in claim **5** wherein said connecting means comprises a swivel connection affording limited angular movement in the horizontal plane to said control arm means; whereby, the reaction force exerted by said power jet means is angularly redirected when said cleaning head encounters an obstruction otherwise tending to limit further movement of said cleaning head.

7. The apparatus as set forth in claim **6** wherein said power jet is directed at an angle of 135° with respect to said control arm means.

8. The apparatus as set forth in claim **2** wherein said power jet means is disposed within said float coupler.

9. The apparatus as set forth in claim **1** including a rotatable disc centered upon the vertical axis of said cleaning head and disposed below said water manifold to engage the side wall of the pool when said annular band encounters an indentation in the adjacent section of the side wall.

10. The apparatus as set forth in claim **1** wherein said connecting means includes a flexible length of hose connected between said manifold and said power jet whereby said flexible length of hose will tend to angularly redirect the reaction force generated by said power jet means upon said cleaning head to urge said cleaning head around obstructions in its path.

11. The apparatus as set forth in claim **10** wherein said power jet means is directed at an angle of 135° with respect to said flexible hose.

12. A swimming pool cleaning apparatus for washing the bottom and side walls of a pool that includes a water supply outlet disposed in one of its side walls, said apparatus comprising, a buoyant cleaning head movable about the surface of water within the pool and including a water manifold for receiving and distributing a flow of water; hose means operatively connectable to the water supply outlet of the pool for supplying a flow of water under pressure to said water manifold, said hose means including means for connecting the hose in fluid communication to the manifold and means for allowing relative horizontal movement between the hose and manifold; first jet means on said hose, upstream of said means for allowing horizontal movement, for forming a first water jet from water flowing in said hose; second jet means operatively associated with said manifold for forming a second jet of water from

water under pressure in said manifold, said first and second jets being normally located in a predetermined angular relation to each other to produce a combined reaction force propelling said cleaning head forwardly along and laterally against the sidewalls of the pool; said means for allowing horizontal movement allowing the angular relation of said jet means to be varied under the influence of said first jet means should forward movement of the cleaning head become stalled, thereby to change the angle at which the combined reaction force is applied to the cleaning head and unstall the head.

13. The apparatus as defined in claim **12** wherein said means for allowing horizontal movement comprises a swivel; means for limiting movement of said hose on said swivel; and wherein said hose includes a rigid control arm operatively connected between said swivel and said first jet means.

14. The apparatus as defined in claim **13** wherein said first jet means is mounted on and supported by said control arm.

15. The apparatus as defined in claim **12** wherein said means for allowing horizontal movement comprises a flexible length of hose connected between said connecting means and said first jet means.

16. The apparatus as defined in claim **15** wherein said connecting means has an aperture formed therein opening in substantially the same direction as said second jet means, to form a third jet of water cooperating with said second jet means to propel said cleaning head.

17. The apparatus as defined in claim **12** wherein said cleaning head includes a dome rotatably mounted on said manifold and water jet means extending radially from said dome; and means for providing fluid communication between said manifold and said water jet means while allowing rotary movement of the water jet means thereby to produce a jet of water directed against the sidewall of the pool.

18. The apparatus as defined in claim **12** including at least one snake hose section connected in fluid communication to said hose and extending therefrom to a free end for producing a randomly moving spray flow of water against the submerted side walls and bottom of the pool.

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