July 19, 1966 J. B. VERNON 3,261,371

SWIMMING POOL CLEANING SYSTEM

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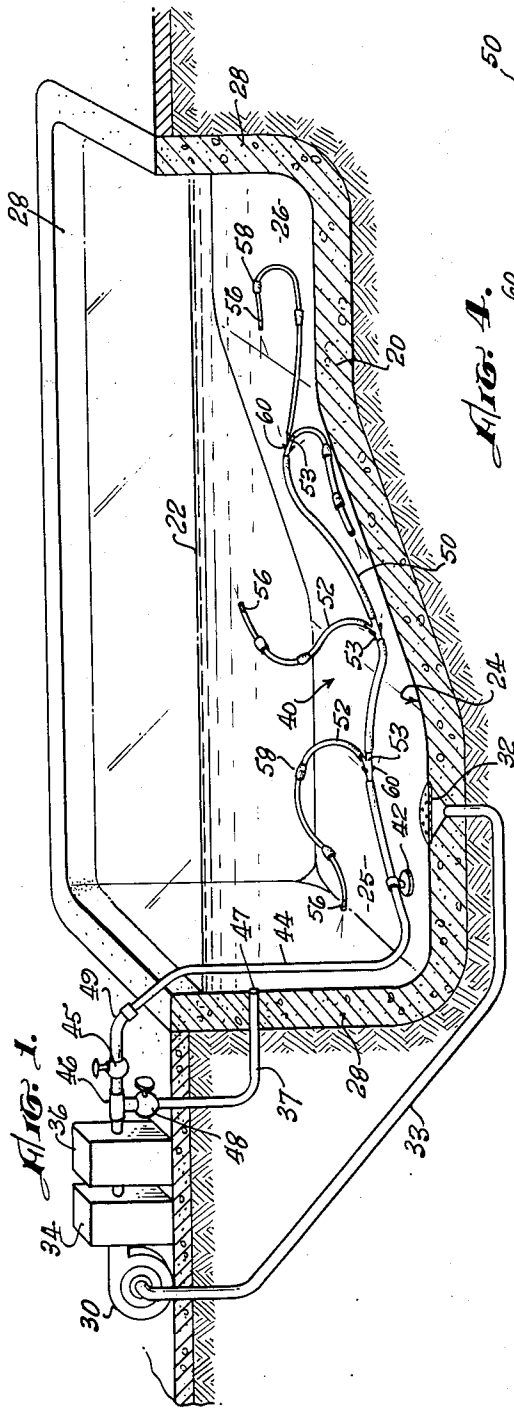


FIG. 1.

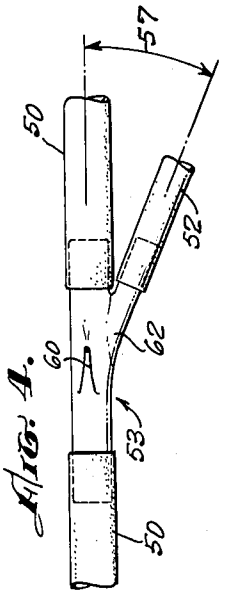


FIG. 4.

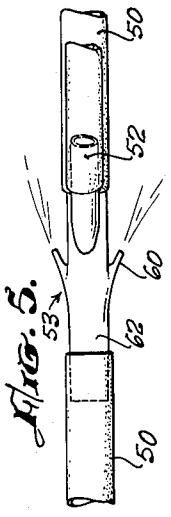


FIG. 5.

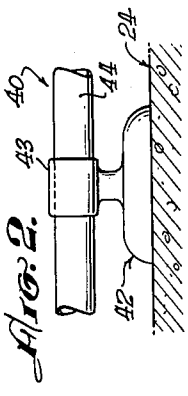


FIG. 2.

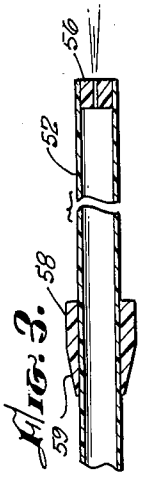


FIG. 3.

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FIG. 6.

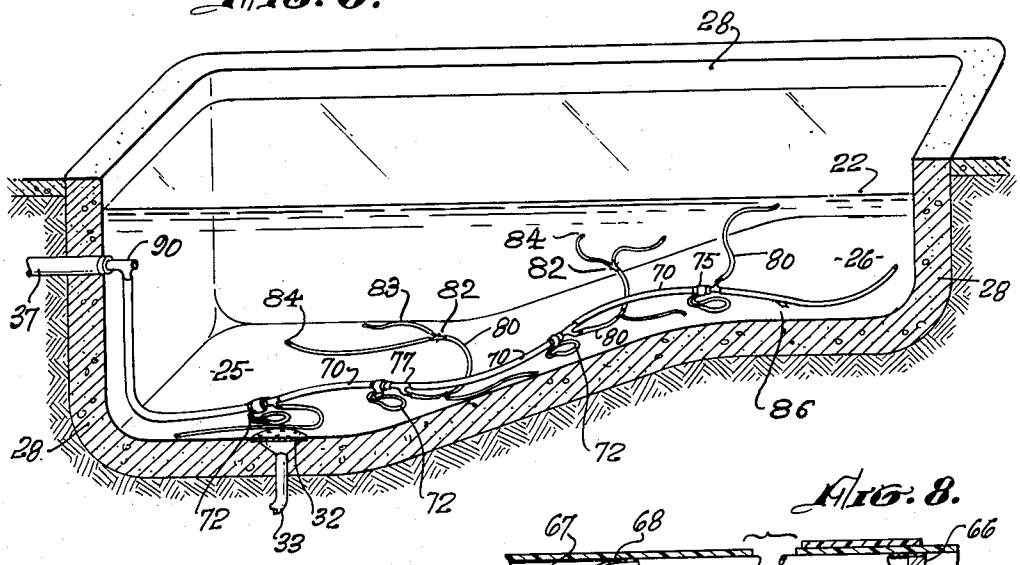


FIG. 8.

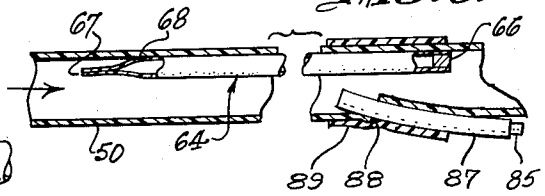


FIG. 7.

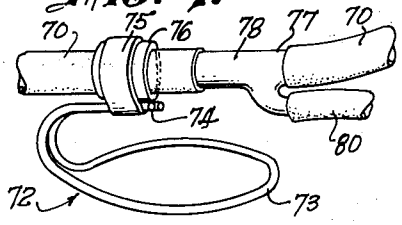


FIG. 9.

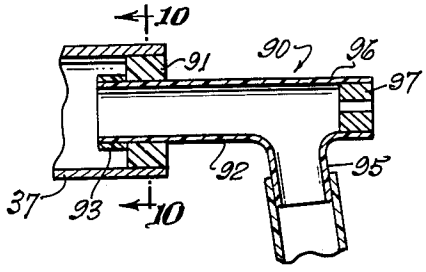
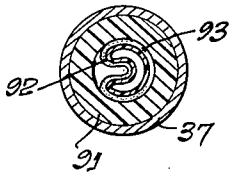


FIG. 10.



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SWIMMING POOL CLEANING SYSTEM

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6 Claims. (Cl. 134—168)

This invention has to do with automatic means for dislodging sediment from the walls and floor of a swimming pool so that it can be removed by normal circulation of the pool water through a conventional filter.

Several automatic pool cleaning systems for that purpose have been devised and are actually in use. Such existing systems distribute water under high pressure, usually from a special pump, through one or more nozzle outlets which are supported in the pool by various mechanical devices for moving them about the pool.

Such previously available systems are relatively complex and costly. Moreover, their operation ordinarily requires water under higher pressure than is conveniently obtainable from the power-driven circulating pump that is usually available for circulating water through the pool filter.

A primary purpose of the present invention is to provide an economical pool cleaning system that is simple and convenient to use and that operates satisfactorily with input water at the moderate pressure normally available directly from the filter circulating system of a conventional pool.

A further object of the present invention is to provide a pool cleaning system of the described type which does not obstruct the pool, especially near the water surface, so that operation of the cleaning system does not prevent normal use of the pool by swimmers.

The invention further provides novel and useful fittings for assembling, positioning and connecting a pool cleaning system of the described type.

A full understanding of the invention and of its further objects and advantages will be had from the following description of certain illustrative manners in which it may be carried out. The particulars of that description, and of the drawings which form a part of it, are intended only as illustration and not as a limitation upon the scope of the invention, which is defined in the appended claims.

In the drawings:

FIG. 1 is a schematic perspective, partially in section, representing an illustrative embodiment of the invention;

FIG. 2 is an elevation representing an illustrative tube anchor;

FIG. 3 is an axial section representing an illustrative wear ring and tube end nozzle;

FIG. 4 is a plan representing an illustrative tube branch structure;

FIG. 5 is a side elevation corresponding to FIG. 4;

FIG. 6 is a schematic perspective representing an alternative embodiment of the invention;

FIG. 7 is a perspective representing a preferred form of anchor;

FIG. 8 is an axial section representing a float structure in accordance with the invention;

FIG. 9 is an axial section representing an illustrative fitting for connection of the cleaning system to a conventional pool outlet pipe; and

FIG. 10 is a section on line 10—10 of FIG. 9 showing the fitting during assembly or disassembly.

FIG. 1 represents a typical swimming pool in schematic perspective and in longitudinal section. The structural pool shell is shown at 20 and water surface at 22. The pool floor 24 typically comprises a substantially level bottom portion 25 and an inclined shallower portion 26. The pool side walls 28 may be essentially vertical, as shown, or may slant appreciably and join the floor in a more gradual curve. The pool is typically provided with a water circulating system comprising the motor driven pump 30, drawing water from an outlet 32 at the bottom of the pool via the pipe 33 and delivering it successively to a filter 34 and heater 36. Water from the heater, or from the filter if a heater is not present, is then normally returned to the pool via the pipe 37.

The cleaning system of the present invention, as shown in FIG. 1, comprises a system of flexible tubes indicated generally by the numeral 40, which lies normally for the most part on the pool floor. Water is supplied to the interior of tubing system 40 via the inlet tube 44. The intake end of that tube is typically connected to return pipe 37 of the filter system via a control valve 45 and a conventional T fixture 46. A control valve 48 is also provided in pipe 37 between the T and the pool return orifice 47. By regulating the valves 45 and 48 any desired proportion of the water from pump 30 can be caused to enter tube 44. The pressure of the water thus supplied to tubing system 40 is variable correspondingly from zero up to the capacity of pump 30. When the cleaning system is not in use, valve 45 may be closed and all water returned to the pool in conventional manner via orifice 47.

One point of tubing system 40 is anchored in an arbitrarily selectable position on the pool floor by the weight 42. The tubing is preferably secured to weight 42 in such a way that it extends essentially parallel to the pool floor and is spaced above the floor by a distance somewhat more than the tube diameter, as shown most clearly in FIG. 2. Weight 42 typically carries a ring 43 which encloses the flexible tube 44 and preferably fits the tube snugly when the latter is slightly expanded by internal water pressure. When the tube is not pressurized it can then be drawn easily through ring 43 to adjust the longitudinal position of the anchor along the inlet portion 44 of the tubing system.

Tubing system 40 as shown in FIG. 1 comprises a main tube 50 and a plurality of branch tubes 52 which branch from main tube 50 at longitudinally spaced points 53. Those branch points are preferably from about 5 to about 20 feet apart, depending upon such factors as the size of the pool and the detailed nature of the tubing. Each of the branch tubes 52 is preferably from about 10 to about 25 feet in length. The branch tubes may be of the same diameter as the main tube, but it is usually more convenient and effective to use smaller and lighter tubing for the branches in order to obtain maximum flexibility. Each tube branch terminates in a small nozzle 56, directed substantially along the tube axis and adapted to form a water jet of relatively high velocity. In preferred form of the invention, those nozzles are not metal fittings, but are formed by inserting small coaxially bored plastic plugs into the tube ends, and securing them by application of plastic solvent at the contact surface (FIG. 3). The weight of the tube is then only slightly increased by presence of the nozzle. Also wear of the tube then can not expose metal which might damage the plaster surface of the pool.

Each of the branch points or junctions 53 is so formed that the branch tube joins the main tube at an acute angle, as typically shown at 57 in FIG. 4. Angle 57 is preferably from about ten to about thirty degrees, and the vertex of the angle is directed toward anchor weight 42 and the inlet end of the main tube. Moreover, in the vicinity of each branch point 53 one or more small nozzles are provided, opening out of either the main tube or the branch tube and directed longitudinally in the direction away from anchor weight 42. Such a jet orifice or nozzle is shown illustratively at 60 in FIGS. 4 and 5, formed as part of a Y fitting 62 which is typically molded of plastic and which provides the branch structure for the tubes.

A nozzle **60** may be provided, if desired, on each face of the Y, as shown.

An important aspect of the present invention is the use of plastic tubing of unusually thin wall construction which is correspondingly light in weight and highly flexible. Such tubing can be produced conveniently of plastic materials such as the well known vinyl plastics, of which vinyl acetate and vinyl chloride polymers and copolymers with suitable additives are illustrative. That type of material has the further advantage that sections of tubing can be connected together or to tube fittings of similar material by wetting the contacting surfaces with a suitable volatile organic solvent for the plastic. Evaporation of the solvent produces a strong bond between the two elements.

For the present purpose the wall thickness of the main and branch tubing is typically from about 0.010 to about 0.050 inch for a tubing diameter from one quarter to one inch. With such proportions and with suitable selection of material the tubing is very soft and flexible, collapsing readily under its own weight when out of the water, and being suitably flexible when subject to moderate internal water pressure. Moreover, the weight of the submerged tubing is very small, especially since the density of plastic is only about 25% greater than that of water. With the described type of tubing and the described tubing configurations it is possible to obtain high mobility of the entire tubing assembly over the pool floor and walls with small water jets and with only moderate water pressure.

The effective weight of the submerged tubing can be further reduced, in accordance with another aspect of the invention, by providing float structure that is distributed along its length. A preferred type of such float structure is arranged internally of the tubing, as shown illustratively in FIG. 8. A flexible tube **64**, typically of the same material as main tube assembly **40** but of relatively small diameter, is sealed at both ends, as by inserting a solid plastic plug **66**. Such sealing may be produced alternatively, as at **67**, by wetting the inside wall of the tube with solvent and pressing the opposite walls together while the solvent evaporates. The resulting tube float **64** is then inserted inside the primary tube, which may be either the main tube **50** or one of the branch tubes **52**. The float tube is preferably secured near its upstream end to the inside wall of the outer tube, as indicated at **68**. The rest of the length of the float is preferably left free of the outer tube wall, since the assembly then retains maximum flexibility. A single float may extend the entire length of the main tubing system, or individual floats of any desired lengths may be provided, preferably retained in their respective sections of the system, as by adhering them to the tube wall as already described. The wall thickness of the float tubing may be made sufficient to prevent its collapse when subjected to the full pump pressure for which the device is intended. It is generally preferred, particularly if relatively high pressure is anticipated, to seal into the float tube compressed gas at sufficient pressure to overcome the water pressure. Very thin-walled tubing may then be employed. For example, after sealing one end of the tube section, the open end is slipped over a nipple through which suitable compressed gas, typically air, is supplied. A clamp is then applied to the tube close to the nipple. The open end can then be sealed by inserting a plug or by squeezing the walls together. After drying of the solvent the clamp may be removed.

The float diameter is selected, with due regard for its wall thickness and for both the wall thickness and diameter of the main tube, to provide the desired degree of buoyancy to the assembly. It is ordinarily preferred that the assembly be nearly weightless in the water. The small jets that have been described are then able to move the tube system freely about the pool without requiring high pressure. For example, an illustrative combination that has been found satisfactory for most purposes is a primary tube of 0.750 inch inside diameter and 0.035 inch wall thickness, and a float tube of $\frac{3}{16}$ inch inside diameter and $\frac{1}{16}$ inch wall thickness. An advantage of the described float structure is that the buoyant action may be distributed substantially uniformly along the length of the tube system. Moreover, the float is concealed within the main tube where it is out of the way and free from damage. Yet only a small portion of the cross-section of the main tube is occupied, producing negligible interference with the flow of water. By eliminating any float structure on the exterior of the main tubes, their free movement over the pool floor is not encumbered.

The provision of distributed float structures has the further advantage of reducing the abrasion of the very thin walled tubing that might otherwise result from its continuous movement over the pool floor. That abrasion can be further reduced by providing wear rings at spaced intervals on the exterior of the primary tubes. Such wear rings typically comprise collars **58** of plastic of tapered section, as shown best in FIG. 3, with the apex **59** of the section directed upstream. The ring then offers minimum restriction to the sinuous tube movement. Rings **58** may be cemented in selected positions along any of the tubes, but it is ordinarily preferred to slip them over the tube without cementing, so that they are adjustable longitudinally of the tube. The ring diameter is then so selected that each ring is effectively anchored in position when the tube is filled with water.

In operation of the described pool cleaning system, the inlet end of tube **44** is connected to pipe outlet **49**, and anchor **42** is adjusted to the desired position along tube **44**. The entire tube assembly is then lowered into the water and positioned as desired in the pool by means of anchor **42**. Pump **30** is preferably initially turned on with valve **45** closed and valve **48** open to direct the return water to the pool via the normal return pipe **37**. Valve **45** is then gradually opened, and valve **48** partially or wholly closed, until the desired flow of water is obtained through tube assembly **40**. The escape of water, at the moderate pressure thus produced, from end nozzles **56** and also from intermediate nozzles **60** produces respective thrusts tending to move each portion of the tube assembly longitudinally toward anchor **42**. Those reaction thrusts cause both the main tube sections **50** and the end portions **52** to move sinuously over the pool floor, the ends waving gently back and forth over arcs that vary with the movement of the main body of the assembly. During the course of that movement, all portions of the pool floor and walls within range are periodically subjected to the action of one or more of the water jets. Any sediment in the pool is thus repeatedly loosened and effectively held in suspension until it is removed through grate **32** with the circulating water and deposited in filter **34**. That movement takes place essentially wholly on the floor of the pool and does not obstruct the surface except for the single stationary inlet tube **44**, which can also be eliminated if desired as described below. Ordinarily, the entire pool area can be cleaned effectively with the tube assembly in one position, particularly when that assembly comprises three or four branch tubes, as illustrated. If the tube assembly includes only a single side branch it may be desirable occasionally to shift anchor **42** to insure reaching all parts of the pool, though that is usually not necessary for pools of relatively small size.

In the modification of the invention shown illustratively in FIG. 6, the main tube **70** corresponds in many respects to tube **50** of FIG. 1, but is anchored at a plurality of spaced points by anchor structures **72**. Each of those structures comprises a single section **73** of plastic covered metal wire bent into generally circular form with the ends curved up out of the plane of the circle to form short arms **74** parallel to each other and to that plane (FIG. 7). Tube **70** is secured to arms **74** in any desired manner. As illustrated, a short section of thick walled tubing **75** is mounted on arms **74** to form an eye through which primary tube **70** may be slipped. The anchor posi-

tion is then readily adjustable along the tube, but is effectively stable when the latter is rounded to full size by internal water pressure. Eye **75** may be mounted on arms **74** by stretching a short section of thin walled tube **76** over the assembly and cementing it firmly in place, typically by use of plastic solvent as already described. Anchors **72** may conveniently be formed of plastic insulated electrical cable of commercially available type. No. 1 cable, which is approximately ½ inch in diameter, is ordinarily a satisfactory size.

In the system of FIG. 6 a branch tube **80** is connected to main tube **70** adjacent each of the anchors **72**. The anchor is preferably adjustable along the main tube on the upstream side of each branch, as indicated in FIG. 7. Alternatively, ring **76** may be omitted, and the anchor may be fixedly secured directly to the neck portion **78** of the branch fitting **77**. In either case, it is preferred to arrange the branch fittings essentially as shown in FIG. 7, so that the branch tube is initially parallel to the main tube and positioned just below it in spaced relation to the pool floor. The branch tube is then free to move gack and forth under the main tube, and has equally free access to the pool floor on both sides of the main tube. With this arrangement it is desirable to provide float structures to hold the main tube clear of the floor between anchors. Suitably spaced conventional floats may be used, but distributed float structures of the type already described are preferable.

The present modification has the advantage that it can be placed in the pool in a wide variety of arrangements. As typically shown in FIG. 6, it is effective for cleaning the entire floor area of the pool. Alternatively, the anchors may be so placed that preference is given to any desired portion of the pool, which may require special attention.

FIG. 6 further illustrates connection of the inlet end of the tube assembly to the regular water return pipe **37** of a pool, which is equally applicable to the system of FIG. 1. That connection can be made very conveniently by means of a fitting **90** shown illustratively in FIGS. 9 and 10. That fitting is designed to interlock with a pipe having an internal flange **91**, which is standard equipment on many swimming pools, or can readily be provided. Fitting **90** is formed of flexible plastic with an inlet portion **92** of a diameter to fit inside flange **91**. An external flange **93** on the end of portion **92** interlocks with pipe flange **91** to retain the fitting securely in the pipe, as in FIG. 9. To remove the fitting, portion **92** is manually folded to bring flange **93** within a circle smaller than the internal diameter of pipe flange **91**, as indicated in FIG. 10. When so distorted, the fitting may be freely slipped in or out of the pipe.

Fitting **90** preferably includes also a T, with one leg **95** adapted to receive the inlet end of the tube assembly. The other leg **96** of the T is provided with an open water outlet through which part of the flow from pump **30** (FIG. 1) is returned to the pool. The diameter of that return orifice is typically reduced, as by insertion of the internal flange element **97**, to a value selected for each installation such that a satisfactory flow and pressure will be produced in the pool cleaning assembly. Selection of element **97** thus generally corresponds functionally to the described adjustment of valves **45** and **48** in FIG. 1. The connection of the pool cleaning system to the regular water return pipe **37** has the advantage that the deck surrounding the pool is then completely free, and the pool cleaning system is confined to the interior of the pool close to the floor and side walls. Operation of the system can then continue without interfering with normal use of the pool.

Particularly for larger pools, some or all of the branch tubes **80** of FIG. 6 may have further branch points, as shown illustratively at **82**, from which secondary tubes **83**, preferably of somewhat smaller size, branch off at an acute angle. In addition to the jet nozzles **84** at the free ends of all the branch tubes, it is usually desirable to provide intermediate jet nozzles at intervals of 5 to 15 feet along each tube. The latter may be placed at branch points, as illustrated in FIG. 1, or may be between branch points, as indicated at **86** in FIG. 6. Additional secondary branch tubes and intermediate jets may be provided in a similar manner in the modification of FIG. 1.

A particularly convenient and economical manner of inserting such intermediate jet nozzles in the present type of thin walled tubing is illustrated in FIG. 8. A short section of very small and relatively stiff tube **87** is inserted in a small slit **88** in main tubing **50** and cemented with solvent in the manner already described. A protective band **89** is then applied in the form of a section of tubing that is expanded if necessary to surround main tube **50** at the nozzle insert, and cemented firmly in place. The desired size of nozzle orifice can be obtained by cementing in the end of tube **87** a suitably selected smaller tube **85** to form the actual nozzle.

For clarity of illustration in the drawings the tube diameters are generally shown larger than those actually used in accordance with the invention, and the wall thickness of the several tubes is also generally represented larger in proportion to the diameter than the preferred relation, described above. In FIG. 6 the wear rings **58** of FIG. 1 are omitted for clarity. In some pool installations it is more convenient to connect the pool-cleaning system by means of a T between the pump and filter. A strainer is then preferably provided to remove from the water delivered to the cleaner any particles larger than about 0.05 inch. It will be understood that many other changes may be made in the particulars of the illustrative described embodiments without departing from the proper scope of the invention, which is described in the appended claims.

I claim:

1. An automatic cleaning system for a swimming pool having a filter, a power-driven pump, and pipe means for circulation of water from the pool through the pump and filter with return to the pool, said system comprising in combination

a thin-wall flexible main tube anchored at one end with a predominant portion of its length extending along the pool floor,

at least one thin-wall flexible branch tube branching at a small acute angle from said portion of the main tube with essentially its entire length extending along the pool floor, the vertex of the acute angle being directed toward the anchored end of the main tube,

axially directed first nozzle means at the free ends of the branch tube and of the main tube,

second nozzle means opening outward from the main tube intermediate its length and directed longitudinally thereof and away from the anchored end,

and conduit means for supplying water under pressure from the pump to the interior of the main tube to cause water jet emission from said first and second nozzle means, reaction thrust from such jet emission exerting longitudinal forces on the tubes to cause all said tubes to move sinuously in an effectively random manner over the pool floor.

2. An automatic pool cleaning system as defined in claim **1**, and including

an anchor comprising a unitary plastic-covered metallic rod having a central portion curved in a plane to form a substantially closed figure adapted to rest at an arbitrarily selected point on the pool floor, and having end portions curving out of said plane and terminating in substantially straight and mutually parallel terminal sections that are spaced from said plane at a region thereof within said figure and by a distance exceeding the diameter of said main tube, and a ring formation mounted on said terminal sections with its axis parallel thereto,

the main tube being anchored at said one end by passing through said ring formation, the ring being of such internal diameter as to be adjustably movable longitudinally of the tube when the later is empty and to resist such movement when the tube is supplied with water under pressure.

3. An automatic pool cleaning system as defined in claim 1, and wherein

said second nozzle means comprises

a plastic nozzle tube section of smaller diameter than the main tube mounted on the wall of the main tube essentially parallel thereto and passing through that wall at a transverse slit therein,

a flexible plastic tube section of larger diameter than the main tube telescopically enclosing the latter and also enclosing part of the projecting length of the nozzle tube section,

and plastic sealing material bonding said smaller tube and said larger tube to the main tube and forming a water impermeable seal therebetween.

4. An automatic pool cleaning system as defined in claim 1, and wherein

said conduit means is releasably connected to said pipe means at the return to the pool and has a side opening of selectable size for bypassing to the pool a definite proportion of the circulated water for controlling the pressure of water supplied to the main tube.

5. An automatic pool cleaning system as defined in claim 1, and including

elongated flexible float means of outer diameter less than the inner diameter of the main tube, the float means being mounted within the main tube and extending throughout a major portion of the length thereof,

the buoyancy of the float means being selected to nearly balance the submerged weight of the main tube to facilitate the sinuous movement thereof while maintaining substantial contact of said predominant portion of the length of the main tube with the pool floor.

6. An automatic cleaning system for a swimming pool having a filter, a power-driven pump, and conduit means for circulation of pool water through the pump and filter, said system comprising in combination

a thin-walled flexible main tube having an inlet at one end,

a plurality of weights connected to the main tube at longitudinally spaced points thereof and adapted to anchor said points of the main tube at respective variably selectable definite positions on the pool floor, each weight holding the main tube essentially parallel to the pool floor and spaced therefrom by more than the diameter of the branch tubes defined hereinafter,

float means connected to the main tube intermediate said branch points and having sufficient buoyance to hold the main tube clear of the pool floor to form a bridge between each pair of weights,

a plurality of branch tubes connected at one end to the main tube closely adjacent the respective weights, each branch tube leading from said connection essentially parallel to the main tube and to the floor and spaced therebetween and directed away from the adjacent weight, the branch tubes being deflectable to slidingly contact the pool floor over essentially their entire lengths, passing freely from one side to the other of the main tube through the respective bridges, jet forming axially directed orifices at the free ends of the respective branch tubes,

and means for supplying water from the pump to the inlet of the main tube to cause water jet emission from said orifices, reaction thrust from such jet emission causing the branch tubes to move sinuously over the pool floor in siding contact therewith beneath and on both sides of the main tube.

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