

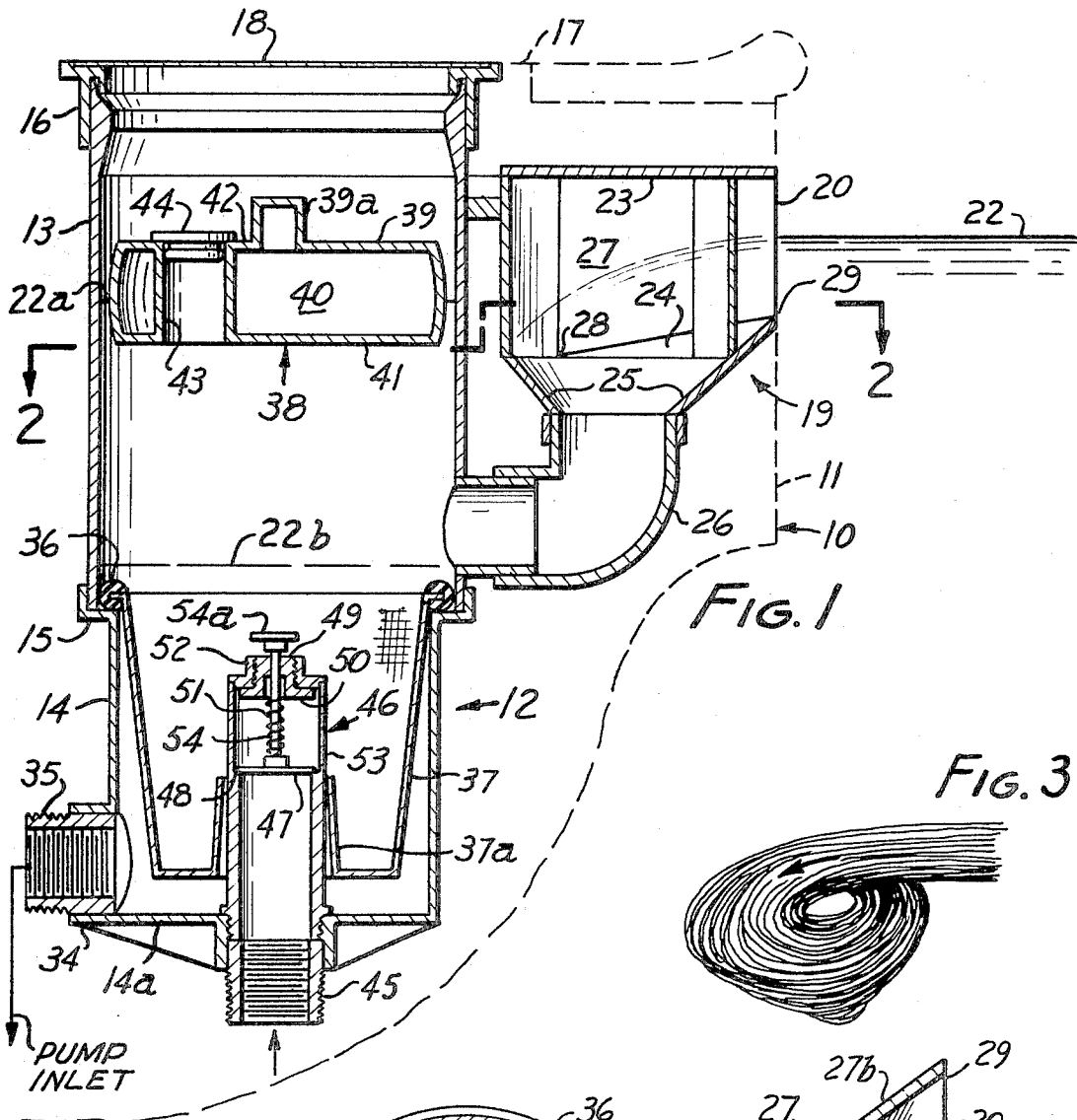


FIG. 1

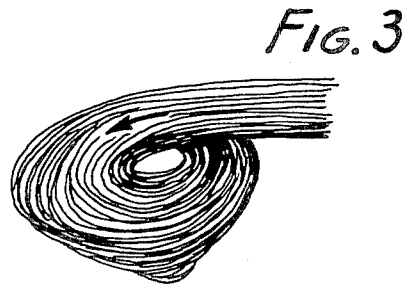


FIG. 3

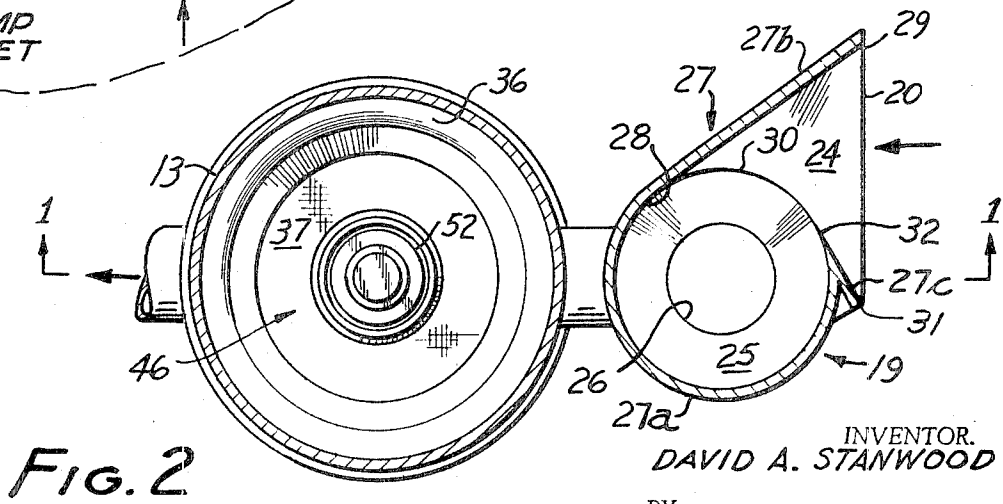
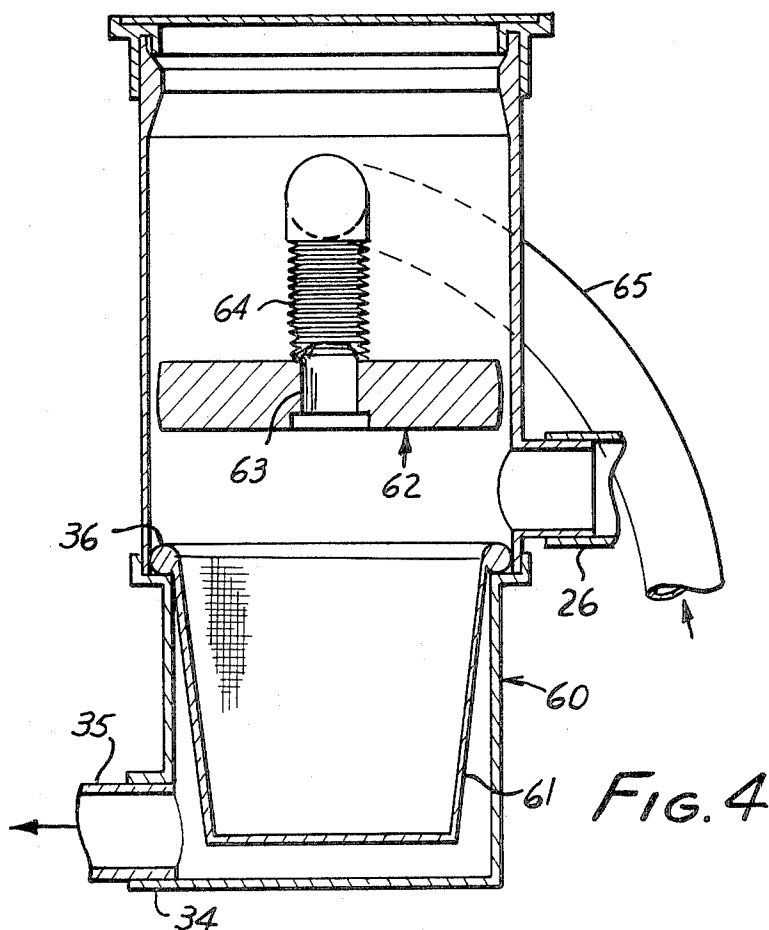
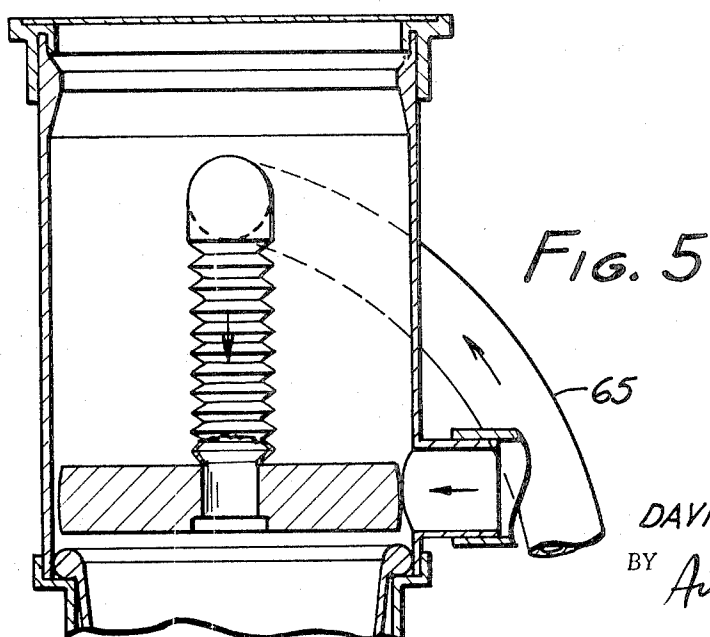


FIG. 2

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MEANS OF SKIMMING A POOL BY USE OF VORTEX

This invention relates to pool equipment, and particularly to means and method of skimming surface water of a pool for removal of debris.

Proper cleaning of the water of a pool such as a swimming pool depends in large measure on circulating and filtering the water drawn over a skimming ledge and into a tank generally referred to as a skim tank. Floating debris and the like thus passes out of the pool and can be collected in a suitable basket. Due to factors such as evaporation and splashing, followed by refilling the pool, the level of water in a pool is not maintained constant. In order to maintain proper flow from the surface of the pool to the filter despite changes of height of the water in the pool, weirs, for example, floating weirs have been used.

In such arrangements, the water passing over the skimming weir is received in the tank, which supplies the inlet of a pump which does the recirculating. The floating weir is pivoted on a horizontal axis, and is responsive to the level of water in the tank, and it operates to keep the level constant for any given flow rate determined by the pump. The weir performs this function over an ordinary range of variation of pool water level.

While this arrangement is operative throughout a substantial variation in the height of water in the pool, nevertheless there are limits to the range of operation of the floating weir. Thus, the level in the swimming pool may drop below the opening that feeds the weir, or so close to the weir axis, that the weir can no longer increase flows by lowering. In such circumstances, the tank will run dry and the pump will suck air. Apart from possible damage to the pump, this creates a nuisance as far as restarting the system is concerned.

In Baker U.S. Pat. Nos. 3,067,879 and 3,306,448, issued Dec. 11, 1962 and Feb. 28, 1967, respectively, there are shown and described skim tanks whose entrance throats are provided with floating weirs which function in this manner. These skim tanks protect automatically against the pump sucking air by closing a portion of the tank connected to the pump inlet automatically in response to the cessation of skimming action. The suction thus created in the tank portion in turn produces substantial bypass flow from an equalizer line or from the main drain as the case may be, and the pump accordingly is protected. By deliberate selection, the tank portion can be closed whatever the condition of the level in the swimming pool might be, in order to create suction for inducing flow through a vacuum line, for example.

In Baker U.S. Pat. No. 3,067,879, the specific means for closing off a portion of the tank to prevent sucking of air is the floating weir itself, which when the pool water level becomes too low, drops down on a seat to cover an opening to the tank. In Baker U.S. Pat. No. 3,306,448, the means for closing off the portion of the tank to prevent sucking air comprises in one embodiment a float in the form of a ball mounted on a guided rod which is vertically slidable so that the ball drops down on a seat, and in other embodiments by a toroidally shaped float restrained from floating away by a cage, so that the float drops down on a seat, when the water level becomes too low.

Mechanical weirs such as floating weirs, although generally satisfactory, have sometimes given trouble due to such factors as physical breakage of the weir, or binding in the throat or entrance to the skim tank resulting in failure to rise and lower with the water level as well as might be desired, and the like.

An object of the present invention is to provide a skimming arrangement which does not require the use of a physical or mechanical weir such as a floating weir or the like.

In accordance with the present invention there is provided at the throat of the skimmer where the water enters from the pool, a vortexing structure which carries the water with its floating debris down through a vortex to a location or receptacle outside the pool.

According to a preferred feature the water carried through the exit conduit from the vortex is brought to a tank from where it can be pumped to circulate the water through a filter and back to the pool in a well-known manner. The vortexing

structure is configured to produce the vortex which culminates at the exit conduit from the vortexing structure.

The tank to which the vortex water is carried is preferably a type which will shut off from the atmosphere the water in the tank which is to be drawn by the pump. This can be done by use of a suitable float or stopper which comes down on a seat to shut off communication between a lower portion of the tank and the atmosphere in the usual way.

In the use of such an arrangement, when the circulating water pump is shut down, the water level in the tank as well as in the vortexing structure will come to the pool water level, and any floating debris captured in the tank will rise up to the surface of the water in the tank, allowing little or none of it to come back to the pool through the exit conduit from the vortexing structure. Any nonfloating debris in the tank will drop, and assuming the presence of the usual debris basket in the tank, will be deposited in the basket.

The foregoing and other features of the invention will be better understood from the following detailed description and the accompanying drawings of which:

FIG. 1 illustrates a vertical sectional view of an automatic skimming arrangement embodying this invention, taken at line 1—1 of FIG. 2;

FIG. 2 is a transverse sectional view taken at line 2—2 of FIG. 1;

FIG. 3 illustrates a liquid vortex obtained by the arrangement of FIGS. 1 and 2;

FIG. 4 is a vertical sectional view of a modified form of tank useable with the vortexing arrangement shown in FIGS. 1 and 2; and

FIG. 5 is a partial sectional view showing the tank of FIG. 4 during a condition of abnormally low water level.

In FIG. 1 there is illustrated a swimming pool wall 10, having a vertical surface 11 exposed to the water in the pool. A tank 12 may be embedded adjacent to or in the wall 10, and is adapted to receive water withdrawn from the upper surface of the pool.

In the present example, the tank 12 comprises two tank parts 13 and 14, which are upper and lower tank portions, respectively. The lower tank part 14 has an upper opening defined by an annular angle flange 15. The upper part has a lower opening defined by circular walls received within the angle flange 15.

The upper open end of the tank part 13 telescopes within a frame 16 that is carefully set in the decking 17 adjoining the top of the swimming pool wall 10. Alternatively, and as will be more fully understood hereinafter, tank 12 may be positioned some distance from wall 11 of the pool. A removable cover 18 seated upon the frame 16 provides access to the interior of the tank 12 as may be required.

There is set within the decking between the upper tank portion 13 and the vertical wall 11 of the pool a chamber 19, constructed to produce a vortex. Chamber 19 is enclosed on all sides except for its entrance opening 20 which registers with an opening in vertical pool wall. The normal pool water level 22 is at a position intermediate between the upper and lower walls of opening 20; hence, it enters into chamber 19 at a level intermediate between the upper wall or ceiling 23 and the entrance floor 24 at the entrance of the chamber. The forward or upstream end of the entrance floor 24 registers with the lowermost portion of opening 20. The floor of the interior part of chamber 19 back of the entrance floor, is in the form of a frustum of a cone 25 whose apex is at the center, the cone tapering downwardly and inwardly toward the center to meet the opening of an exit conduit 26. The portion of the entrance 20 to the vortex chamber which is above the entrance floor 24 and the conical chamber floor 25, is defined by a wall member 27 which rises vertically from the floors to the ceiling 23 of the chamber. The shape of this wall 27 is indicated in FIG. 2, the portion 27a around the part of the cone back of the entrance 20 being cylindrical, the part 27b extending from the cylindrical portion to one side of the entrance 20 being straight and the part 27c extending from the cylindrical part also being

straight but approximately perpendicular to part 27b, thereby providing a wide entrance paths along the entrance floor 24. The entrance floor 24 slopes downwardly from entrance 20 to its outer, upper circumferential rim 30.

The circulating pump (not shown) withdraws water from the tank 12. For this purpose, the side of the lower tank portion 14, near the bottom thereof, has a conduit fitting 34 cooperable with a conduit 35 that leads to the pump inlet, as indicated by the arrow labeled "Pump Inlet."

A removable debris-collecting basket 37 having a rim resting on the annular flange 15 serves to collect debris and prevent it from passing through conduit 35 to the pump. The bottom and sides of the basket are formed of a suitable perforate or screening material which will allow substantially unimpeded flow of water through it while retaining the debris.

When the water level 22a in the tank drops significantly, a portion of the tank above the conduit fitting 24 must be sealed to prevent the pump from sucking air. For this purpose there is provided a floatable body 38 within the upper tank portion 13 above the basket 37. This is a flat circular disclike member comprising a wall 39 forming and enclosing an internal chamber 40 having a generally flat lower surface 41 and a generally flat upper surface 42. A protuberance 39a extending upwardly from wall 39 is provided for purposes to be hereinafter explained. The diameter of the circular member is such that it fits nicely within the cylindrical chamber member 13 and such that when it is brought down on the basket the flat lower surface wall 41 rests on a circular ring 36 into which the upper rim of the basket 37 is fitted. The ring 36 is in the form of a resilient O-ring which rests on the ledge 15. Thus when the floatable member 38 comes down on the O-ring, the O-ring acts as a seal and the member 38 thereby acts as a partition which seals off the upper tank portion 13 from the lower tank portion 14.

The floatable partition 38 is provided with a cylindrical opening 43 passing through it from top to bottom and normally sealed closed by a sealing plug 44. This provision, of the plug 44 in the opening is for a purpose to be explained later.

The weight of the member 38 in relation to its volume is such that it will float at the water surface 22a in upper tank portion 13 with a substantial portion riding below the water level. The level at which the member floats in the water can be adjusted as desired by the presence or absence of some filling material in the interior chamber 40. Thus, when the water level in 22a in tank 13 drops down close to the top of the basket 37 the lower wall 41 of the member will rest on sealing ring 36.

The lower chamber 14 has two sources of supply. One is the water flowing into tank 12 through conduit 26 from the vortex. The second source is an equalizer inlet 45 which communicates with the pool water at a level far enough below its normal level that it will not suck air. Ordinarily the conduit 45 will communicate with the pool water at the main drain at the bottom of the pool. Conduit 45 is brought through the bottom wall 14a of lower tank portion 14 and up through the bottom of basket 37 which is formed with a reentrant conical portion 37a extending up from the bottom of the basket and tapering inwardly to join the conduit 45 near the top of the conduit so that pool water entering the tank 12 in the direction of the arrow associated with conduit 45 will empty into the basket 37 before flowing out of the tank through conduit 35.

Communication between the tank and the equalizer inlet line 45 can be closed or regulated by a check valve mechanism 46 which may be suitable form. The particular form illustrated comprises a valve member 47 adapted to rest on an annular seat 48 of the incoming conduit. The valve member 47 is mounted on a stem 54 which passes through a threaded bushing 49 having a flange 50. Head 54a is mounted to the stem above the bushing. A spring 51 around the stem is compressed between the valve member 47 and the bushing 49 is threaded into a cap 52 supported by a number of columns extending upright from the conduit 45 and providing spaces therebetween through which water entering the basket from

conduit 45 may flow. By turning bushing 49 on its thread the flange 50 may be moved downwardly to further compress the spring to regulate the amount of pressure exerted by valve 47 against the water incoming from conduit 45. This will regulate the rate of flow of this water even to the point of shutting it off entirely.

During normal skimming operation, the floatable member 38 floats at the position shown in FIG. 1 at the water surface 22a in the tank. If the water level 22 in the pool should drop substantially, for example to near or below the level of point 29 of the vortex chamber, little or no water would flow into the tank 12 through conduit 26 and the water delivered to the tank 12 from the vortex would have lost control, which would result in the emptying of tank 12 if it were not for the float 38 and equalizer line 45 arrangement. When the level in tank 12 drops from position 22a to a lower position 22b, the floatable partition member 38 coming down with the lowering water level will rest on O-ring 36 to seal off the lower tank portion 14 from the upper tank portion 13, before any substantial air enters the lower portion 14. The pump suction will maintain the partition 38 in its sealing position, and at the same time will open check valve 47 if it is not already open; or if it be already open somewhat, will open it further, by the exertion of the requisite force upon the check valve. The pump is now supplied entirely by the line 45 through which water is flowing in the direction of the arrow, to meet the demand of the pump.

It may sometimes be desired to operate the system with the check valve 47 set so that during normal operation the entire demand of the pump is met by the water supplied by the vortex chamber, in which case no water enters the tank 12 from the equalizer conduit 45. Under other circumstances it may be desired to supply the tank 12 both from the vortex chamber and from the equalizer line 45, in which case the check valve will usually be set so that about 15 percent of the water entering tank 12 is from the equalizer line and 85 percent from the vortex chamber, unless of course the vortex chamber becomes incapable of supplying the pump demand as when the pool water level drops, in which case the check valve opens sufficiently to permit the equalizer line 45 to supply the entire demand.

When the circulating pump is turned off the water in tank 12 is at the same level as the level of the pool water and the float 38 is floating at that level. When the pump is turned on for normal circulating operation it will draw water out of tank 12 which will lower the level of water in the tank down to some level 22a at which vortex water entering the tank from conduit 26 which together with the water from equalizer 45, if any, will supply the pump and thereby hold the tank water level at some equilibrium value lower than the level 22 of the pool water. Debris and dust and the like floating on the pool water surface and entering the vortex chamber through entrance opening 20 will be drawn into the vortex and thereby brought down with the vortex water through conduit 26 into tank 12 where most of it will be prevented from passing to the pump through conduit 34 by being caught in the debris basket 37. It will be recognized that the pool water level 22 should not be allowed to go so high that an effective vortex will not form; otherwise debris could simply remain floating on top in the chamber.

FIG. 3 illustrates the water of the vortex itself as it is formed at the vortex cone or sink 25. Water from the pool surface 22 flows along the entrance path through entrance 20 and over the downwardly sloping entrance floor 24 in the direction of the arrow. The vortex chamber wall section 27b deflects that portion of the water striking it, to a direction approximately tangential to the circular rim of the cone or sink. That portion of the incoming water striking wall section 27c will also be deflected to a direction approximately tangential to the rim of the cone. This wall construction, together with the downward slope of floor 24 to the sink 25 augments the tendency to form the vortex. The particular construction of FIG. 2 results in a vortex which rotates counterclockwise at the cone as illustrated in FIG. 3.

If it is desirable to vacuum the swimming pool, cover 18 may be removed from the skim tank and float 38 may be removed through the opening at the top of the skim tank. Plug 44 is then removed from opening 43 of the float and the float is reinserted back into the skim tank in a position upside down from that illustrated in FIG. 1 so that protuberance 39a is disposed downwardly from the float. The vacuum hose (not shown) for the vacuum cleaner may be fitted into opening 43 and extend through the opening of the skim tank. Float 38 is forced downwardly through the water in the tank so as to seal against O-ring seal 36. In this position, protuberance 39a contacts head 54a of the valve mechanism 46 to prevent the valve from opening. Hence, during the vacuum operation, water is drawn through the vacuum head and vacuum hose (not shown) through opening 43 of float 38 and out through conduit 35 to the pump. The float body 38 prevents operation of the vortex portion of the skimmer, and protuberance 39a prevents valve 46 from opening so that water will not enter from the equalizer line 45. Hence, during the vacuuming operation substantially all suction of the pump (not shown) will be applied to the vacuum line.

The embodiment of FIG. 4 is somewhat similar to that of FIGS. 1 and 2 in that a vortex chamber built and arranged in reference to the pool like that in FIGS. 1 and 2 is used together with its exit conduit 26. The skim tank 60 is quite similar to the tank 12 of FIG. 1 but differs in that the conduit 45 of FIG. 1 is omitted and correspondingly the basket 61 in FIG. 4 is of the ordinary type without the reentrant portion shown as 37a in FIG. 1. The conduit elements 34 and 35 leading to the pump inlet can be the same as in FIG. 1. In FIG. 4 the floatable element or partition 62 is constructed and functions similar to the floatable member 38 of FIG. 1 but differs in that the element 62 is provided with a central opening 63 through it into which there is inserted the lower end of a bellows hose 64. The upper end of the bellows connects with a conduit 65 which communicates with the pool water, ordinarily at the main drain at the bottom of the pool.

When the circulating pump is being operated, and the tank 60 is receiving water through conduit 26 from the vortex being created in the chamber, the float 62 is up off the top of the basket in the position shown in FIG. 4. When, however, the water level in the tank 60 drops as by lowering of the pool water level the float comes down with the dropping water level in the tank until it seats on O-ring 36 at the top of the basket in a manner similar to the sealing of the float 38 in FIG. 1. Since the conduit 65 is held in its fixed position near the top of the tank as shown in FIGS. 4 and 5, the bellows 64 distends as shown in FIG. 5.

It will be recognized that use of a vortex according to the present invention makes it possible to eliminate the usual mechanical or floating weir for skimming a pool. As the vortex performs a function much like that of a mechanical or floating weir, it may aptly be referred to as a "vortex weir." The use of the vortex according to this invention is not limited to use with the particular tanks illustrated and described herein, which are given for the purpose of example rather than of limitation.

The vortex may be used to send pool surface water to other locations outside the pool such as for example tanks or regions of different types. Ordinarily, of course, it will be desired to incorporate the vortex as part of a circulatory system by which pool surface water is pumped through a filter and sent back to the pool. Skim tank 12 may be located some distance from the pool wall, and may even be adjacent the filter. In such case, conduit 26 is extended to provide connection between the vortex chamber 19 and skim tank 12. Thus, the deck 17 of the pool is not obstructed by the cover of the skim tank.

It will be recognized also that modifications may be made without departing from the scope of the invention. For example, the vortex chamber need not be constructed precisely as illustrated in the drawings. While the area of the vortex is illustrated as the cone 25 which acts as a sink for the vortex, some other form of sink may be used which will produce the vortex, for example a sink with curved sides.

I claim:

1. In a skimmer for skimming liquid with floating debris, if present, from the surface of a pool, a vortex chamber having a floor, an entrance to the floor and an exit opening from the floor, said floor sloping downwardly and inwardly to the exit opening from an upper and outer region of the floor at the entrance, to form a sink which empties downwardly through the exit opening, said entrance being adapted for passage of surface liquid from the pool to the chamber, and being constructed and arranged to direct incoming liquid from the pool to the chamber floor in a downward direction and with a tangential component relative to the exit opening, thereby augmenting the tendency of the incoming liquid to flow in the form of a vortex at the chamber floor down to the exit opening so that the liquid passing through the exit opening carries debris with it.

2. Apparatus according to claim 1 in which the entrance communicates with the floor and is provided with wall means positioned to allow the entrance to direct the incoming liquid substantially tangential to the sink, so that the incoming pool liquid forms the vortex commencing at or near the level of the pool surface from where it extends down into the sink to the exit opening.

3. Apparatus according to claim 1 in which the sink floor is substantially frustoconical.

4. Apparatus according to claim 1 in which the entrance has an entrance floor inclined relative to the horizontal, and one side of said entrance floor is higher than its other side and higher than the floor of the sink.

5. Apparatus according to claim 4 in which the floor of the entrance is shaped to form substantially a continuation of the shape of the sink floor.

6. Apparatus according to claim 4 in which the wall means includes a wall portion at the side of the entrance opposite the higher side of the entrance floor.

7. Apparatus according to claim 6 in which the wall means includes a wall portion at the same side of the entrance as the higher side of the entrance floor.

8. Apparatus according to claim 1 in which a receiving tank is connected to said exit opening for receiving the liquid and debris from the vortex.

9. Apparatus according to claim 8 in which the receiving tank is provided with means for withdrawing the liquid from it.

10. Apparatus according to claim 8 in which the receiving tank has an upper portion and a lower portion in communication with each other when the liquid is at a normal level in the upper portion and the connection to tank from the exit opening leads into the upper portion, means adapted to seal off the upper and lower portions from each other when the liquid level is abnormally low in the upper portion, an outlet from the lower portion adapted to be connected to the suction line of a pump and a bypass conduit leading to the lower portion and operative when the upper and lower portions are sealed from each other, to supply liquid from a source to the lower portion and thereby supply the pump.

11. Apparatus according to claim 10 in which the means adapted to seal off the upper and lower portions from each other comprises a float seat at the junction of the upper and lower portions and a float above the float seat, which floats on the liquid in the upper portion at a distance above the seat during normal skimming operation, and which floats down on the seat when the liquid level in the upper portion recedes due to reduced flow into it from the chamber.

12. Apparatus according to claim 11 in which the float contains a member which blocks the entrance to the tank from the conduit when the float engages the seat.

13. In a skimmer for skimming surface water from a pool, a tank of the type having an upper portion and a lower portion in communication with each other when the water is at a normal level in the upper portion, means adapted to seal off the upper and lower portions from each other when the water level is abnormally lower in the upper portion, an outlet from the lower portion adapted to be connected to a suction line of a pump, and a bypass conduit leading to the lower portion and operative when the upper and lower portions are sealed from

each other, to supply water from a source to the lower portion and thereby supplying the pump, said sealing off means comprising: a movable floatable body having an upper surface and a lower surface, within the upper tank portion, and a seat at the junction of the upper and lower tank portions on which either the upper or lower surfaces of the floatable body can rest to seal off the upper and lower portions from each other, said body having a passage way through it from the upper to the lower surfaces, and a removable plug closing said passage way to prevent flow of liquid through it when the lower surface of the body is engaging the seat in the normal operating position of the floatable body, a valve means located in the lower tank portion adapted to open when the upper and lower portions are sealed from each other by the lower surface of the floatable body and also adapted to be actuated to a closed position to shut off flow through the bypass conduit, actuating means at the said upper surface of said body positioned to engage and actuate the valve means to shut the valve means when the body is inverted from the normal operating position so that when the body is placed so that said upper surface engages the seat, in said inverted position, the actuating means actuates said valve means, whereby a vacuum hose fitted to said opening when the plug is removed, can draw water from the pool in a cleaning process and send said water through the opening into the lower tank portion to supply the pump.

14. Apparatus according to claim 13 in which the actuating means is a protuberance at the upper surface of the floatable body.

15. In a skimmer for skimming liquid with floating debris, if present, from the surface of a pool, a chamber having a floor provided with an exit opening, said exit opening being within the floor, said chamber and floor, being positioned, constructed and arranged so that liquid from the pool surface flows into the chamber and onto the floor, so that the liquid entering the chamber forms a vortex at and above the exit opening, a receiving tank connected to said exit opening for receiving the liquid and debris from the vortex, said receiving tank having an upper portion and a lower portion in communication with each other when the liquid is at a normal level in the upper portion, said connection to the tank from the exit opening communicating with said upper portion, means adapted to seal off the upper and lower portions from each other when the liquid level is abnormally low in the upper portion, an outlet from the lower portion adapted to be connected to the suction line of a pump and a bypass conduit leading to the lower portion and operative when the upper and lower portions are sealed from each other, to supply liquid from a source to the lower portion and thereby supply the pump.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,628,664 Dated December 21, 1971.

Inventor(s) David A. Stanwood

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

<u>In the Patent</u>	
Column 1,	line 29 "flows" should be --flow
	line 46 "inducting" should be --inducing--
Column 2,	line 47 "nd" should be --and--
	57 after "in" insert --the--
Column 3	line 2 "paths" should be --path--
	line 17 "24" should be --26--
	line 38 after "provision" cancel the comma (,)
	line 46 cancel "in"
	line 66 after "be" insert --any--
	line 72 after "49" insert --which--
	line 73 after "columns" insert --53--
Column 4,	line 15 "line" should be --conduit--
	line 26 "line" should be --conduit--
	line 48 cancel "which"
Column 5,	line 9 after "the", (first occurrence) insert --top

Signed and sealed this 27th day of June 1972.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents