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SWIMMING POOL WATER LEVEL CONTROL SYSTEM

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This invention relates to a water circulating system for swimming pools or the like, and in which the water of the pool is intended to be cleaned, as by passing it through a filtering tank.

This application is a continuation-in-part of an application filed March 29, 1954, Serial No. 286,287, the name of Donald J. Leslie, and entitled Swimming Pool Water Level Control System, now Patent No. 2,739,939, issued March 27, 1956.

One method of maintaining the water of a swimming pool clean is to skim the surface thereof continuously, since a major portion of foreign material collects at the surface. To this end, a skimming gutter is customarily provided, and a thin film of water is intended to flow over the ledge of the gutter from the main body of water, thence passed through a filtering tank, and back to the main body of water, with the assistance of a water pump.

For proper operation of the pump, the rate at which the water flows into the skimming gutter must precisely balance the rate at which the pump can withdraw this water. If such condition can be maintained, the pump continuously has its charge, thereby avoiding an air lock. Furthermore, this balanced relationship is important in order that the level of water in the gutter may be maintained sufficiently below the ledge for the skimming action to take place. This balanced condition is highly dependent upon a precise incremental height of water in the gutter as compared with the level of the ledge of the skimming gutter. If the water level in the pool is too low, water enters the gutter at a reduced rate and the pump runs dry. If the water level is below the ledge, no cleaning action whatsoever takes place. If the level is too high, the gutter becomes filled since the capacity of the pump has not increased, and soon the level of the gutter is the same as that of the main body of water, and no skimming action or surface flow takes place.

A float valve operated in response to a change in level of the water in the pool could be provided, adding water to the pool from an external source. In such a system, the operating mechanism would have to be set such that a very accurate level would be maintained with respect to the rate at which the pump withdraws the water over the ledge, in order to make best use of the pump. If the rate that the pump withdraws the overflow water be subject to change, such valve mechanism would have to be adjusted accordingly. Furthermore, such adjustment would be extremely critical, since even a few thousandths of an inch added to the water level would have a cumulative effect upon the system.

In the prior art, there is known and described a circulating system intended to overcome these disadvantages by utilizing a skimming gutter in which the level of water in the pool is automatically maintained within extremely close limits in accordance with the rate that the pump can handle the overflow. Use is made of a sump that is fed by the overflow water and that supplies the water for the pump. External water is introduced into the system in response to a lowering of the level in the sump. During steady state operation, external water is continuously supplied at a rate to replenish that lost through evaporation. The system ensures proper skimming for different circulating rates.

In said prior application, there is also disclosed apparatus for preventing the sump from running dry, such as might otherwise occur upon a sudden change in the rate of withdrawal of water from the sump. This pump continuously has a charge, ensuring against interruption of the skimming action.

It is an object of this invention to provide an improved system of this character, utilizing novel means to ensure proper operation of the system, especially during transient operation. A supplementary control by-passes water from the pool upon a lowering in the level of the sump. It is another object of this invention to provide a simple mechanism to accomplish these controlling functions.

This invention possesses many other advantages and has other objects which may be made more clearly apparent from a consideration of several embodiments of the invention. For this purpose, there are shown a few forms in the drawings accompanying and forming part of the present specification. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a diagrammatic view illustrating a swimming pool incorporating the present invention;

Figure 2 is an enlarged fragmentary sectional view illustrating the control mechanism illustrated in Fig. 1;

Figure 3 is a fragmentary view, similar to Fig. 2, illustrating a modified form of the present invention;

Figure 4 is a view, similar to Fig. 2, showing another modified form of the present invention; and

Figure 5 is a fragmentary sectional view, taken along a plane indicated by lines 5-5 of Fig. 4.

In the form shown in Figs. 1 and 2, a conventional form of swimming pool 10, formed in this instance of poured or sprayed concrete, is illustrated. It contains a main body of water 11. At one end of the swimming pool there is provided an outlet 12 of a water supply line 13 for maintaining the desired volume of water 11 in the pool 10. At the other end of the pool 10 is a scum gutter 14 adapted to receive water from the pool 10. It is generally of channel configuration. One side of the gutter 14 is formed by a vertical ledge 15, the upper edge of which cooperates with the upper surface 16 of the body of water 11 to produce a skimming action. The gutter 14 may be formed of concrete integrally with the pool, or in any suitable manner.

The gutter 14 is illustrated as extending only along one end of the pool 10, and the supply line 13 is illustrated as disposed at the opposite end of the pool 10. Accordingly, the flow of the upper level of water extends uniformly in one direction substantially throughout the length of the pool. A complete skimming action is thus provided. Other arrangements could be provided; the specific form herein illustrated serves merely as a basic organization in which the system incorporating this invention is used.

If the surface 16 is slightly above the level of water in the gutter is substantially less, a film of water will flow over the ledge, producing the desired skimming action.

This upper film of water may be of the order of several hundredths of an inch in thickness. It will contain a substantial amount of any floating foreign material that may be in the pool.

Water received by the gutter 14 is intended to be re-
circulated by the aid of conduit means 17, a pump 18, and the supply line 13 leading back into the main body of water 11. A usually filter tank 19 is interposed in the recirculation path. A selectively adjustable valve 30 controls the flow of water in the conduit 17 to the pump 18. An outlet conduit 31 between the deep end of the pool 19 and the conduit 17 provides for the circulation of water from the lower levels of the pool, at which place additional foreign material may exist. A valve 32, similar to valve 30, is placed in the conduit 31 and is adjustable. It will first be assumed that the valve 32 is completely closed.

The level 16 must be maintained at a definite value as compared with the ledge 15 and the capacity of the pump 18 in order to maintain proper cleaning efficiency for the pool 10.

If the level 16 exceeds a certain amount for a given rate of withdrawal of the overflow water by the pump 18, the level of water in the gutter 14 must rise. The skimming action of the ledge 15 may be impaired by virtue of an equalization of levels on both sides of the ledge.

On the other hand, should the level 16 of the main body of water be less than a certain amount for a given rate of withdrawal, even to the extent of a few thousandths of an inch, improper operation of the pump will result. Thus, the system will be unable to inject air into the pump, thereby producing an undesired air lock. The skimming action will then be irregular. Also, the flow of water will be less than can be accommodated by the pump 18, and the system will not be operating at its peak efficiency.

To overcome these conditions, a sump 21 forms a part of a continuous recirculation path of the water. This sump 21 accommodates a relatively small body of water. It may be formed in an appropriate manner adjacent the gutter 14. This sump 21 maintains a charge for the pump 18 and determines a proper level of the surface 16. It is fed through an outlet conduit 22 from the gutter 14, and it feeds the conduit means 17 to the pump 18. The pump 18 withdraws water from the sump at a substantially constant rate for a given setting of the valve 30. Since the sump 21 is fed by the gutter 14, the level 23 of the sump must be constantly maintained below that of the ledge 15 so that proper skimming action results. If the rate of flow of water over the ledge 15 corresponds precisely to the rate of withdrawal of water by the pump 18 from the sump 21 filled with water, the system will be operating at its maximum circulating efficiency.

Since a certain volume of water must inevitably be lost from the sump 21 to the gutter 14 to the water 11 by evaporation and other causes, the level of the surface 16 of the pool 10 would ordinarily tend to lower with respect to the ledge 15. To overcome this tendency, an external supply line 20 (see Fig. 2) directly supplies water to the sump 21 as needed to maintain it at a certain level 23 below the level 16 of the pool. For this purpose a valve 24 is illustrated that is controlled by a float 25 in the sump 21. Should the level of the surface 16 lower such as to provide an insufficient flow of water into the sump 21, with respect to the rate of withdrawal therefrom, the float 25 will operate the valve 24.

By supplying water directly to the sump 21 rather than to the main body of water 11, it is insured that the pump continuously operates with a full charge of fluid. The water admitted to the sump 21 by the external supply eventually finds its way into the main body of water 11, thereby tending to increase the level 16. The external supply thus brings the system to an efficient equilibrium operating condition wherein the flow of water over this ledge is increased to an amount such that the rate of supplying external water into the sump 21 together with the rate of flow of water thereto from the skimming gutter 14 corresponds to the rate of withdrawal of water from the sump 21 by the pump 18. The level of the surface 16 is then maintained at a height to produce the maximum surface flow of water that can be handled by the pump 18.

The sump 21 will automatically accommodate itself such that the rate of flow of water over the ledge 15 corresponds substantially to the rate of withdrawal of water from the sump 21 for any rate of withdrawal of water by the pump 18. This follows since an increased rate of operation of the pump, for instance, produces an increased rate of flow of water over the ledge 15. The sump 21 thus supplies its own charge, except for that required to be introduced as a result of loss due to evaporation and the like. The steady state operating level in the sump is independent of the rate at which the pump 18 withdraws water from the sump.

If the rate of withdrawal of water from the sump 21 by the pump 18 is suddenly increased, the sump level lowers due to a slight amount of lag in the system, and due to the fact that the external supply conduit 20 is not sufficiently large to supply all the water required. To prevent the sump from running dry, water is by-passed from the pool 10 during this transient operation. In this manner, undesired air lock of the pump is avoided, and the continuity of skimming is unbroken.

For this purpose, a by-pass conduit 26 is provided that extends between the pool 10 and the sump 21, and is opened by the external line 20 and the interconnected water incapable of supplying sufficient water to the sump 21. A valve 27 of any suitable form, controlling, and normally preventing, flow of water through the conduit 26, is opened upon a drop in the level of water in the sump. The by-pass valve 27 may open as soon as the level in the sump recedes from the normal level indicated; or, optionally, it may be so arranged as to open only after a material drop in the sump level. A float 28 is attached to the end of a pivotally movable valve operating arm 29. In the dotted-line position of the level 23 shown, corresponding to a substantial lowering of the level of water in the sump, the valve 27 is open, by-passing water into the sump conduit 26, and preventing further lowering of the level in sump 21.

The level in the sump 21 gradually rises as water is introduced into the system through the external supply conduit 20. The float 28 gradually moves upwardly to close the valve 27. Steady state operation is again resumed.

Should the rate of withdrawal of water from the sump 21 be suddenly reduced, the pool 10 momentarily will discharge more water over the ledge 15 than it receives from the supply outlet 12. The level of the surface 16 will then rise above the cut-off position of the float 25. The level 16 above the ledge 15 will then drop to a point in which the discharge rate into the gutter 14 substantially balances the rate of withdrawal by the pump 18.

Evaporation soon reduces the water in the system, and the level in the sump 21 then drops below the cut-off position of the float 25, and normal steady state operation resumes for a reduced rate of circulation. The level of the sump 21 may normally be sufficiently below the top of the ledge 15 so as to ensure that even in the event of an extreme rise in the level of the sump 21, such as occasioned by a sudden increase of rate of withdrawal of water from the sump 21 by the pump 18, the sump water does not rise sufficiently to impair proper skimming action.

By utilizing the sump construction 21 with a float 25 directly responsive to an increased capacity of the pump 18, the system can smoothly adjust itself for operation according to the condition of the pump 18 and the setting of the value 30.

The present system makes it possible to use a small size pump 18, minimizing the cost of a circulating system, but yet insuring that the level of the surface 16, to which corresponds precisely to the requirements of the pump 18.

Since the sump 21 is small in volume in comparison
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with any normal rate of flow of water over the ledge 15, the level 23 of the sump is extrasensitive to such rate of flow. A substantial change in this level 23 will be caused by even a slight change in flow of water over the ledge 15, such as may be caused by a loss in height of the surface 16 of a few thousandths of an inch. Accord-

ingly, the float valve 24 can be of ordinary construction, and yet the float 25 operating the valve will effectively provide for a change in the flow of water over the edge 15, the level 23 of the sump is extrasensitive to such rate of flow.

If the valve 32 is opened during the operation of the skimming system, precisely the same skimming action results. A portion of the pump capacity is then used for recirculating water from the bottom of the pool 10, and not all of the pump capacity is useful for withdrawing water from the sump 21 and keeping the level of water in the pool 10 above the skimming edge. The combined setting of the valves 30 and 32 determines the rate of withdrawal of water from the sump 21 for a given operating condition of the pump 18. The combined set-

ting of the valves 30 and 32 determines the skimming rate, rather than the valve 30 alone.

In the form shown in Fig. 3, a single float 33 operates both a valve operator 34 for the by-pass valve 27 as well as the valve 24 cooperating with the external supply line 20. To accomplish this purpose, the valve operator 34 is connected to this single float 33.

Since the operator 34 is movable in an arcuate path different from that of the float 33, a flexible connection 35, such as a chain, is provided between the valve operator 34 and the float 33. A weight 36 at the movable end of the valve operator 34 urges it downwardly and maintains the flexible connection 35 but whereby the operator 34 accurately follows the movement of the float 33. The operation is similar to that described in the form shown in Figs. 1 and 2.

In the form shown in Figs. 4 and 5, a movable rectangular plate 37 forms a part of the skimming ledge 38. Normally, the top edge 39 of the plate 37 is contiguous with the top surface of the skimming ledge 38. Upon a lowering in the level of water in the sump 21 below its normal steady state operating position, the plate 37 tilts so as to lower its top edge 39 and admit water at an increased rate to the sump 21. In this manner, it is ensured that a sufficient charge is provided for the pump, such as may be required upon a sudden increase in the circulation rate.

A slot 40 is provided in the wall of the skimming ledge 38 for accommodating the plate 37. The bottom wall 41 of the slot 40 slopes in a direction across the skimming ledge 38, the slot being deeper on the outside of the ledge than on the inside. The slot 40 provides rectangular openings on the pool and sump sides of the ledge 38. Pins 42 mount the plate 37 for pivotal movement about a hori-

zontal axis at the upper end of the sloping bottom wall 41 of the slot 40 at the pool side of the slot. The axis of movement of the plate 37 is substantially coincident with the lower edge of the plate 37. The width of slot 40 is sufficient to accommodate the plate 37. A light wiping seal structure (not shown) may be provided between the side and bottom edges of the plate 37 and the slot 40 if desired.

The plate 37 is inclined to a vertical plane, extending outwardly of the pool from its pivotal mounting diagonally of the ledge slot 40. A deep opening through the rear gutter wall and the bottom of the gutter trough is contiguous with the slopping bottom wall of the slot 40 and provides communication between the gutter 14 and the sump 21.

A float 44, influenced by the level of water in the sump 21, determines the angular position of the plate 37 and the relative height of its operative top edge 39. An arm 43 is pivoted at opposite ends to the float 44 and the plate 37, and extends through the deep opening in the outer gutter wall for this purpose. The arm 43 and plate 37 move angularly in accordance

with the position of the float 44. Angular movement of the arm 43 is permitted by virtue of the deep opening in the gutter wall and the sloping bottom wall of the ledge slot 40.

The arm 43 is of such size and shape that during normal steady state operation, the plate edge 39 is located on a line substantially coincident with the top edge of the ledge over which the water falls.

If the operation of the pump is stopped, water is withdrawn from the sump 21 at a rate faster than is supplied by flow over the skimming ledge 38 and the external conduit 20, as described in connection with the previous forms. The level 23 in the sump lowers during this tran-

sient operation. The float 44 follows the downward movement of the level 23 and tilts the plate 37 toward the horizontal plane, lowering the top edge 39. Accordingly, the rate of flow over the top edge of the plate 37 in-

creases to ensure that the sump 21 does not run dry.

Shortly the sump 21 gradually returns to its normal operating level, and the plate 37 is tilted toward the verti-

cal plane, the top edge 39 of the plate 37 returning to its normal operating position with respect to the top edge of the skimming ledge 38.

Since the plate 37 is substantially inclined to the vertical during normal operation, a sudden rise in the level in the sump 21, such as results from a pump stoppage, has no effect on the operation of the pump, does not occasion a lowering in the top edge 39 of the plate 37.

The inventor claims:

1. In a liquid circulatory system having a container for a body of liquid, and a pump for circulating liquid withdrawn from the container back to the container; the improvement comprising skimming means adjacent the top of said container permitting the flow of surface liquid in said container thereby, a liquid sump in un-

restricted liquid flow communication with said skimming means for accumulating substantially a predetermined level of liquid therein during balanced operation of the system, said sump feeding the intake of said pump, means for adding additional liquid to said sump from an ex-

ternal source said liquid adding means including a sump liquid level responsive means for controlling the addition of liquid to said sump by said liquid adding means in relation to the drop in liquid level in said sump below said predetermined level, thereby maintaining the liquid level in said sump at substantially said predetermined level, whereby losses of liquid from said system are promptly replaced to permit continued surface flow by said skimming means, and means by-passing said skimming means for conducting liquid from said container to said sump in controlled relation to a lowering of the sump liquid level below said predetermined sump liquid level, whereby substantially continual and uninterrupted skimming of the surface of liquid contained in said container is effected.

2. In a system as set forth in claim 1, the by-passing means being a conduit between the sump and the con-
tainer and opening in the container at a level lower than that of the skimming means, and further including con-
duit closure means responsive to sump liquid level for opening said conduit when sump liquid level falls below said predetermined level.

3. In a system as set forth in claim 1, the skimming means comprising a substantially vertical wall over which the liquid in said container can pass, and the by-passing means comprising a pivoted mounted plate accommo-
dated in a slot in said wall, and having an upper edge adapted to lie substantially contiguous with the top of said wall, and plate controlling means responsive to a lowering of the sump liquid level below said predetermined level for causing a tilting of said plate to lower its upper edge below said top of said wall.

4. In a system as set forth in claim 3, the plate con-
trolling means comprising an operating arm secured to
said plate, and means secured to said arm responsive to sump liquid level.

5. In a system as set forth in claim 4, the pivot axis of said plate extending substantially along the bottom of said slot, and said sump liquid level responsive means secured to said arm being a float.

6. In a system as set forth in claim 1, the additional liquid adding means including a valve means, the by-passing means including a valve means, an operating arm for each of said valve means, said sump liquid level responsive means comprising a float cooperating with both said arms.

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