

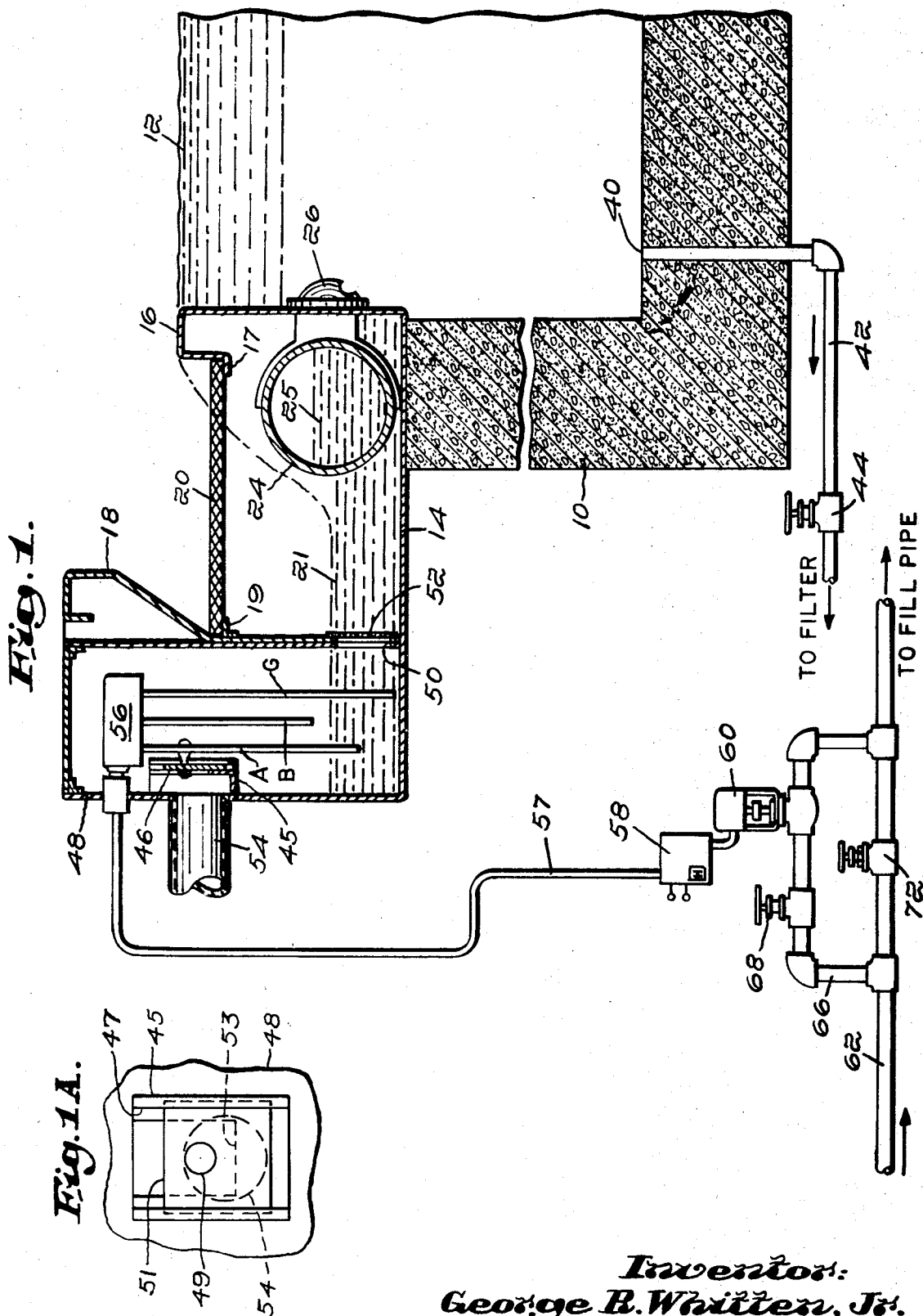
Nov. 3, 1970

G. R. WHITTEN, JR
SYSTEM FOR CONTROLLING WATER LEVEL AND RECIRCULATION IN
SWIMMING POOLS WITH GUTTERS

3,537,111

Filed June 25, 1969

3 Sheets-Sheet 1



Inventor:
George R. Whitten, Jr.
by **Thomson, Mrose & Ericson**
Attorneys

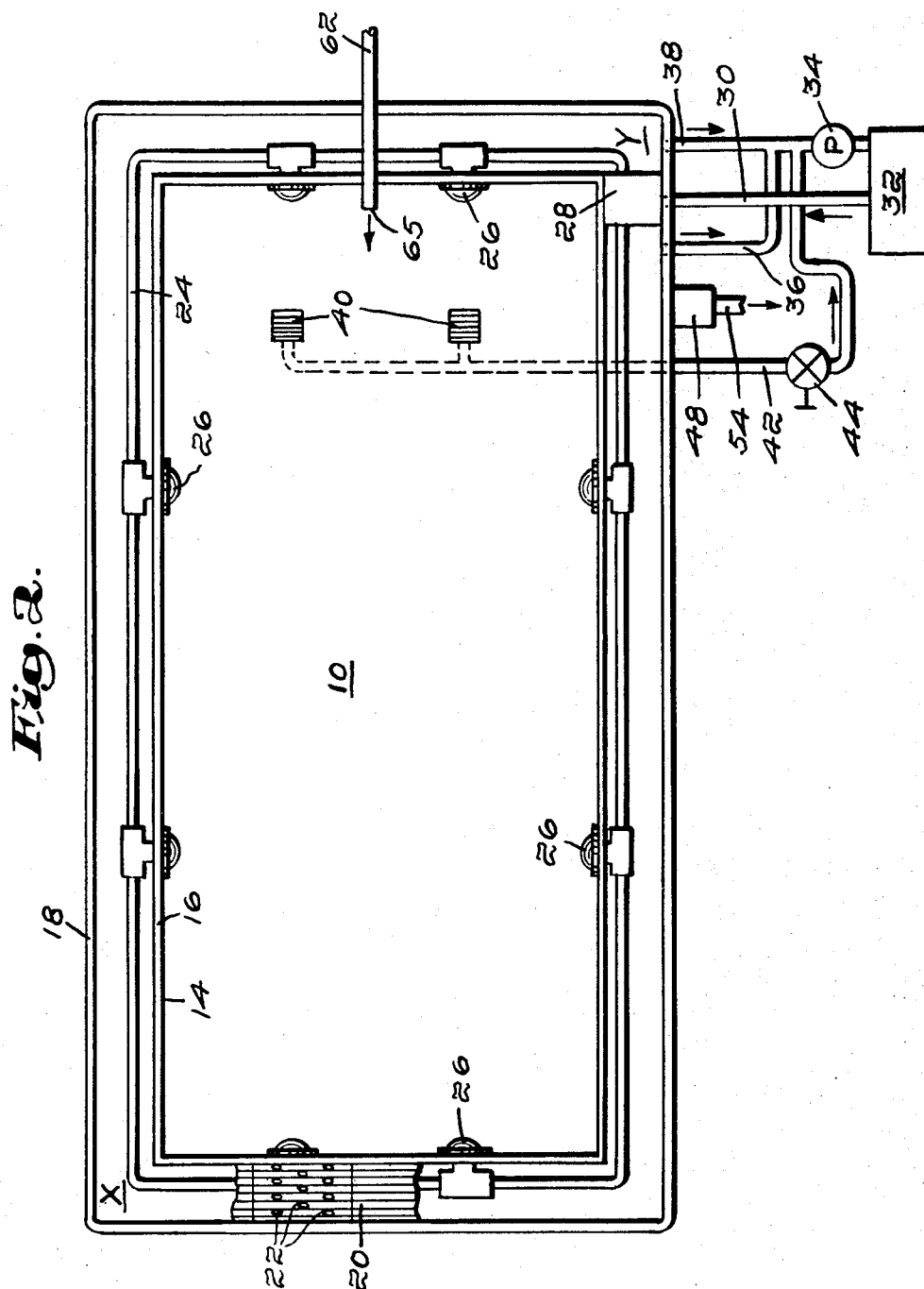
Nov. 3, 1970

970 G. R. WHITTEN, JR 3,537
SYSTEM FOR CONTROLLING WATER LEVEL AND RECIRCULATION IN
SWIMMING POOLS WITH GUTTERS

3,537,111

Filed June 25, 1969

3 Sheets-Sheet 2



Inventor:
George R. Whitten, Jr.
By Thomson, Mrose & Ericson
Attorneys

1

3,537,111 SYSTEM FOR CONTROLLING WATER LEVEL AND RECIRCULATION IN SWIMMING POOLS WITH GUTTERS

George R. Whitten, Jr., P.O. Box 307,
Bellingham, Mass. 02019

Filed June 25, 1969, Ser. No. 836,267

Int. Cl. E04h 3/16, 3/20

U.S. Cl. 4—172.17

13 Claims

ABSTRACT OF THE DISCLOSURE

A system for controlling water level and recirculation in a swimming pool, in a manner to maintain a continuous overflow into a recirculating gutter for skimming the pool, without unnecessary waste of water when surging occurs. A continuous overflow to the gutter under both quiet and turbulent surface conditions is insured by sensing the drainage flow level in the gutter, opening a valve to deliver make-up water directly to the pool if the gutter level drops as a result of an inadequate rate of overflow, and closing this valve if the gutter level rises to a normal maximum depth. The gutter level preferably also controls the relative proportions of flow from the gutter and from the pool main drain to a recirculating pump. Flooding of the gutter is limited by using a gutter cover with a calculated area of drain holes to limit the rate of overflow. Extreme pool flooding by heavy rains, valve malfunction, or operator error is prevented by an adjustable high-limit waste drain.

BACKGROUND AND BRIEF DESCRIPTION OF THE INVENTION

Contamination in swimming pools is introduced almost exclusively at the water surface, including atmospheric dust and debris, pollutant in rain water, and matter brought in by bathers. For this reason health authorities, including the U.S. Public Health Service and the Conference of State Sanitary Engineers, have published, in "Regulations Covering Public Swimming Pools," American Public Health Service, New York, standards requiring that all swimming pools over 1600 square feet in surface area shall have overflow gutters extending around the pool and capable of continuously removing 50% or more of the recirculated water for return to a filter. The remainder of the recirculated water may be taken from drains below the pool surface. Gutters are also required to prevent bathers' arms and legs from entering and being caught, and to serve as a handhold. Most State codes governing the design of public swimming pools conform to these standards. Thus the primary purpose of a gutter is met only if it continuously drains the total surface area of the pool to skim off contaminated water and deliver it to a filter for cleaning and recirculation.

This requirement is difficult to meet because the pool is subject to widely different surface conditions; it will be quiet for extended period when not in use, then turbulent when bathers enter the water. Some automatic flow control method is required to maintain a rate of supply adequate to continue the gutter overflow when the pool is quiet and empty; and to reduce the supply, when bathers raise the pool level and create surging or turbulence, so as to prevent the gutter from flooding. A flooded gutter is no more effective to skim the pool surface than a dry one.

It is also economically desirable to avoid wasting the filtered and chlorinated water by dumping overflow surge into the sewer. One system currently in fairly widespread

2

use attempts to compromise between skimming and water economy by filling the pool only to a level lower than the gutter, and draining the pool surface into the gutters only through small openings at the corners of the pool. This allows surge capacity within the pool, but since the skimming action occurs only at a few points around the edge of the pool, it is completely inadequate to clean the surface and fails to meet the sanitary codes.

Most prior flow control methods are based on controlling the level of water in the pool itself, that is the surface height. This was formerly accomplished by means of float valves in a separate level control and surge tank. This avoids placing a float directly in the pool, which would be an obstruction to bathers, and also subject the float valve to wave action; and it provides capacity for surge displacement. The wave action is at least partially damped in a separate level control tank, connected to the pool below the surface; thus the control responds to the static pool level. One such system is described by my U.S. Pat. No. 3,386,107, granted June 4, 1968 and entitled "Level Control and Circulation System for Swimming Pools." Since a system of this type responds to the static pool surface level, it adds make-up water to the pool when the static level is below the overflow lip of the gutter, even though the pool surface may be turbulent and providing an overflow that is at least adequate, or even sufficient to flood the gutter. The excess water must be disposed of before the gutter can be effective again to skim the pool. The cost of a separate surge and level control tank also adds substantially to the total construction cost of the pool.

I am aware of another previous proposal to use a sump separated from the pool by a ledge which sets a level for overflow, and a make-up water supply valve feeding directly into the sump under the control of a float. A drain valve was connected to the same float for draining the sump to a recirculating pump whenever the sump tended to overflow. The system could not correct flooding of the sump to the pool level by rain or over-filling; the skimming overflow action could therefore become stopped, and could be restored only by withdrawing water from the system under manual control. No peripheral gutter was provided; its function was performed only at the region of the sump along one edge of the pool, where overflow under surging conditions would occur only intermittently. The system also required the construction of a separate sump tank; furthermore, this sump had to be placed at poolside, rather than located remotely at a location which would both be more convenient and less obstructive of the deck around the pool. The proposed system was not widely adopted because of these difficulties.

It is the primary object of this invention to provide an improved level control and drainage system for swimming pools having peripheral drainage gutters; and particularly to insure that the relative levels in the pool and the gutter are maintained within limits that produce continuous skimming overflow around the total perimeter of the pool, and prevent either flooding or interruption of flow under all conditions of the pool, either quiet or turbulent. It is another object to obtain proper control of level and drainage without wasting treated pool water to the sewer, and without requiring a separate surge or level control tank to be constructed. Other objects and advantages of the invention will appear as the following description proceeds.

Briefly stated, I provide means for detecting the level of drainage flow in a peripheral gutter, or the limits of a range of levels. The gutter has an overflow lip or weir at the desired pool depth, and delivers the overflow to a recirculating pump and filter, which may also draw

water from drains under the pool surface. The detecting means controls a valve in a make-up water supply line which feeds the pool directly, or may feed the recirculating pump if pre-filtration is desired. The control is arranged to open the make-up valve if the drainage flow falls below a level that will guarantee maintenance of continuous overflow all around the periphery of the pool, taking the provision of an hydraulic gradient in the gutter into account. If the drainage flow should rise beyond a normal operating level, which is sufficiently lower than the gutter lip to allow ample space in the gutter to receive abnormal flow caused by pool surge, the control closes the make-up valve and discontinues the supply to the pool.

In one form of the invention, the proportions of the total recirculating flow which are taken from the gutter and from the main pool drains below the surface of the pool, are adjusted by manual valves. The proportion of the recirculating flow taken from the gutter normally exceeds 50%. However, in an alternative form, I provide for increasing the rate of drainage of the gutter under flooding conditions. I connect means for detecting the level of the drainage flow, to control the main drain valve. The control is arranged to partially close the main drain valve, to reduce the proportion of the recirculating flow which is drawn from the main drains, whenever the gutter flow substantially fills the gutter space reserved for surge and approaches the level of the overflow drain pipe. The effect of this is to increase the rate of flow taken by the recirculating pump from the gutter, and thus hasten a drop in the drainage overflow in the gutter to a suitable operating level. As this level returns to normal, the control reopens the main drain valve to restore the original proportions of the recirculating flow taken from the gutter and the pool.

Higher than normal pool levels, substantially higher than the overflow lip of the gutter, may be occasioned by a large number of bathers entering the pool, or by rain. I allow the pool to accommodate this excess water without either flooding the gutter, or stopping the skimming action, by covering the gutter with a grill having drain holes whose total area is calculated to admit a maximum flow rate that is less than the recirculating flow rate that can be handled by the gutter.

I also prefer to provide an overflow drain in the gutter, which has an adjustable overflow weir at a still higher level, to drain water from the system in the event that overflowing, valve failure, or heavy rains increase the pool volume excessively; in that case, some waste of pool water becomes unavoidable.

DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out the subject matter which I regard as my invention, it is believed that a clearer understanding may be gained from the following description of preferred embodiments, referring to the accompanying drawings, in which:

FIG. 1 is a cross-sectional view in side elevation of a pool and gutter system incorporating one form of the improved level and drainage control system;

FIG. 1A is a fragmentary view in front elevation of an adjustable overflow drain weir incorporated in the system;

FIG. 2 is a plan view of the system;

FIG. 3 is a view similar to FIG. 1, but showing a modification of the control system.

Referring to FIGS. 1 and 2, a first form of the system is shown operatively connected with a swimming pool 10 having a peripheral gutter 14 surrounding its edges. The surface level 12 of water in the pool is controlled by the elevation of a drainage lip or weir 16 formed along the inner edge of the gutter. The generally rectangular shape of the gutter forms a trough for carrying off water overflowing from the pool for filtration and recirculation

back to the pool; in this manner, the pool surface is continually skimmed off, carrying debris, dust, and other foreign matter and pollutants to the filter system for removal from the pool.

The lip 16 terminates in a flange 17, which cooperates with a flange 19 attached to the outer wall of the gutter to support an access cover and grill 20. This grill is made up in short sections, some of which are perforated by groups of holes 22 to allow overflow from the pool to pass into the gutter at spaced intervals around the entire periphery of the pool. The total area of these holes is limited to a value calculated to restrict the drainage to a rate less than the recirculating flow that can be handled by a pump 34, and preferably to about 80% of the recirculating flow. The calculation takes into account a pool level or head somewhat higher than the lip 16, to allow for the displacement of water by the largest number of bathers expected. The hole area should be sufficient, when the water is at a normal level only slightly higher than the lip 16, to drain a minimum of 50% and a maximum of 80% of the recirculating flow rate. Thus the pool affords a reservoir for excess surge displacement, without interrupting the proper skimming action of the gutter, and without requiring any drainage of the treated pool water to the sewer.

The grill 20 blocks any large objects such as leaves which could clog the filter system, and serves as a seat or step, as well as a means to keep swimmer's arms and legs from being caught in the gutter. The lip 16 projects above the grill to form a convenient hand-hold. The outer wall of the gutter terminates in an overhanging flange 18, and the upper surface of this flange is set flush with the deck (not shown) which surrounds the pool. The exposed surfaces of the gutter may have an abrasive-blasted anti-skid finish for safety, and this structure is preferably made of stainless steel. The grill 20 may be coated with polyvinyl chloride or other plastic material to round all edges, both for safety and to facilitate passage of small debris such as hair, lint, and dirt articles, into the gutter.

The lip 16 of the gutter has a uniform elevation all around the pool to ensure overflow around the total perimeter of the pool. At one corner Y of the pool, the gutter drains into branches 38 and 36 of an outlet pipe; two outlet branches are used because an inlet manifold 28 subdivides the gutter at this point. The outlet pipe feeds a recirculating pump 34. Water is also drawn from main drains 40 at the bottom of the pool, connected to the pump 34 by a pipe 42, which has a manual valve 44 for the purpose of controlling the relative proportions of the total recirculating flow which are drawn from the gutter and from the pool. If the gutter tends to flood because of extreme surging in the pool, the attendant may partially close the valve 44 temporarily, to increase the rate of drainage from the gutter.

The pump 34 forces the drained water through a filter 32 of any conventional and suitable type, and the filtered water is returned to the pool by a pipe 30, the manifold 28, a fill pipe 24 which extends within the gutter 14 around the pool, and a series of inlet nozzles 26 which are spaced around the pool and project through the inner wall of the gutter.

The pool may be filled with water drawn from city mains by a make-up pipe 62, which is ordinarily connected to a fill pipe or spout 65 that overhangs the edge of the pool. This fill spout is at a height over the pool surface dictated by local sanitary codes, for the creation of an "air-break" to prevent any pool water contamination from flowing back into the city mains. In some locations where the water supply is unclean and no air-break is required, the make-up pipe 62 could be connected to the inlet of the pump 34 to prefilter the supply.

A manual valve 72 is placed in the make-up pipe line to enable the pool to be filled under manual control; this valve is normally closed. A branch pipe 66 by-passes

the manual valve 72 for the purpose of automatic control of the make-up supply in accordance with the invention. A manual valve 68 in the branch pipe is normally open, but is closed when manually filling the pool by means of the valve 72.

Automatic flow control is obtained by a motor-operated valve 60 in the branch pipe, which is controlled by an actuating control circuit 58 and an electrical water-level control sensor 56, connected by a cable 57. The sensor 56 is mounted in a housing 48, adjacent to the inlet manifold 28 and against the outer wall of the gutter 14, to detect the drainage flow level in the gutter. The housing 48 is open to the gutter through a port 50, having a screen 52 to keep out any small debris that might adversely affect the proper operation of the sensor 56.

The sensor 56 has a ground or reference probe G which extends substantially to the bottom of the gutter so as to remain submerged at all times, a low-limit probe A, and a high-limit probe B. The low-limit probe terminates at a height from the bottom of the gutter which is substantially equal to the hydraulic gradient around the gutter between the corner Y and the opposite corner X. The level of the drainage flow 21 in the gutter will fall below this level only if the gutter is substantially dry in the region of the corner X, and this would occur only if there were insufficient overflow from the pool. The control circuit 58 is constructed and arranged to open the valve 60 in the event that the flow level 21 drops below the tip of the probe A, to add make-up water to the pool and thus increase the rate of overflow.

The high-limit probe B terminates at a height from the bottom of the probe A which corresponds to a normal maximum operating depth of the overflow 21 measured at the high point X of the gutter. In the housing 48, the tip of the probe B is therefore spaced from the bottom of the gutter a distance equal to the hydraulic gradient of the gutter plus the normal maximum depth of the overflow 21. If the overflow reaches any higher level, there is an excess drainage from the pool, whether caused by surge, turbulence, wave action, rain, or excess filling. The control circuit 58 is constructed and arranged to close the valve 60 in the event that the flow level 21 rises above the tip of the probe B, to stop the flow of make-up water from the supply pipe 62 into the pool.

In the event that the drainage overflow 21 is at any level between the low limit determined by the probe A, and the high limit determined by the probe B, the valve 60 remains in the position in which it was placed at the last preceding passage of the water level past the tip of either probe. The drainage level 21 therefore normally cycles slowly between operating level limits set by the two probes; when any event occurs which causes the level to pass the other probe, the valve is re-adjusted to restore the level within the operating limits. The two probe tips are spaced apart sufficiently to provide a "dead-zone" or range of intermediate levels in which no control action occurs; if they were at the same or substantially the same levels, the system might hunt, or cycle continuously.

The water-level control sensor 56, the actuating control circuit 58, and the motor-operated valve 60 are all conventional and commercially available; for example, they are obtainable from the Minneapolis-Honeywell Regulator Company. No detailed description of the circuitry is therefore believed to be necessary.

The space within the gutter above the tip of the high-level probe B and below the restricted drain openings 22 in the grill 20 is available to receive surge overflow from the pool. If a surge fills the gutter above the level of the probe B, the make-up valve 60 will close until the overflow level 21 is dropped back below the tip of the probe A by normal draining action of the recirculating system.

The volume of the pool above the grill 20 and the lip 16 is also available for excess displacement or surge caused by large numbers of bathers, heavy rains, valve

failure, overfilling or any other cause. As previously explained, the drain holes 22 have a total area which limits the drainage through the grill 20 to a rate less than the capacity of the pump 34. This limitation is effective as long as the pool level does not rise above the grill 20 more than a certain depth or head on which the calculation of hole area is based, which depth is enough to accommodate the displacement of the greatest number of bathers that the pool is designed for. But it may sometimes occur that the pool level rises still higher, because of overfilling, heavy rains, valve failure, or other causes. The increased head above the grill 20 increases the rate of flow into the gutter, and correspondingly raises the level of the flow 21, so that it becomes necessary and desirable to drain some water from the pool. For this purpose, I provide an adjustable overflow drain within the housing 48, comprising a box 45 having a frontal opening 53, and a sliding gate 46 which is slidable in ways 47 formed in the box. The upper edge 51 of the gate forms a weir whose height can be set by the operator, by removing a cover 53 from the housing 48 and moving a handle 49 attached to the gate. A waste pipe 54 opens through the back of the housing 48 into the box 54, and leads to a waste drain or sewer (not shown). By setting the height of the weir appropriately, the operator can set an upper limit on the flooding depth of the pool, choosing an appropriate balance between flooding limits and drainage of excess pool water.

A modification of the system is shown in FIG. 3, in which parts similar to those of the preceding embodiment are similarly numbered. The overflow drain means 45, 46 is omitted from this view for greater clarity. In this form the relative proportions of the recirculating flow which are drawn from the gutter and from the main pool drains, as well as the make-up water supply, are subject to control by the level of the drainage flow 21 in the gutter.

A motor-operated main drain valve 86 is placed in the main drain pipe 42, and is controlled by an actuating circuit 84 similar to the circuit 58. An electrical water-level sensor 80 has the ground probe G, and probes A and B connected to the control circuit 58 as before to control the make-up valve 60. In addition, the sensor is provided with a drain-opening probe C and a drain-closing probe D, which are connected along with the ground probe G to the control circuit 84. The probe C terminates at a level between probes A and B, within the normal operating limits of depth of the overflow 21. The probe D terminates near the level of the drain 54, that is, near the highest level of the gutter space reserved to handle surge flooding from the pool. The control circuit 84 is constructed and arranged to open the main drain valve 86 in the event that the overflow 21 drops below the tip of the probe C, and to close the valve if the overflow rises above the tip of the probe D. If the overflow is between the tips of these probes, the valve 86 remains in the position in which it was placed at the last preceding passage of the water level past the tip of either probe C or D.

In operation, let it be assumed first that the overflow 21 has dropped below probe A. Both the make-up valve 60 and the main drain valve 86 will be open, so that water will be added to the pool, and the recirculating flow will be drawn by the pump 34 about equally from the gutter 14 and the main drains 40. As the pool level 12 rises, the overflow will increase; and as probes A and C become immersed, no change in the valves will occur. The pool will continue to fill until the overflow reaches probe B, which will then shut off the make-up valve 60. Under normal circumstances, the water overflow level 21 will then cycle between probes A and B, as governed by conditions in the pool, and the overflow will be continuous. A drop below probe C will produce no change in the main drain valve 86 because this valve is already in the open position.

In the event that the overflow rises enough to reach the drain-closing probe D, because of rain, excess surge, or any other reason, and the entire reserve surge capacity of the gutter is therefore filled, the main drain valve 86 will be wholly or partially closed. This causes the pump 34 to draw at least the majority of the recirculating flow from the gutter, and thus expedites draining it to a normal operating level. I prefer to draw a maximum of about 90% of the recirculating flow from the gutter, and therefore do not arrange the valve 86 to close completely.

At this point, both of the valves 60 and 86 are closed, and the gutter is drained rapidly by the recirculating system. As the overflow level is reduced below the tips of probes D and B, no change is made in the closed settings of the valves 60 and 84. A drop past the probe C re-opens the valve 86, and thus restores the normal proportions of the recirculating flow drawn from the gutter and the main drain, respectively. In the event that the flow 21 should nevertheless continue to drop past probe A, below the normal operating overflow level, this would re-open the make-up valve 60.

It should be understood that the principle of using the level of the overflow drainage in the gutter to control the pool level in a manner to maintain a proper skimming action, can be applied in several ways. The detected drainage level may control either the supply of water to the pool, the division of the recirculating flow taken from the gutter and the pool, or both.

What I claim is:

1. A system for controlling water level and drainage in a swimming pool, comprising:

a gutter having an upper lip extending around the periphery of the pool and arranged to drain water overflowing from the surface of the pool; filtering means; means communicating with said gutter for recirculating the drained water from said gutter through said filtering means to the pool; means for detecting the level of the water drainage flow in the gutter; water supply means including a make-up valve connected for supplying additional water to the pool; and control means connected to said detecting means for response to the level of said drainage flow, said control means being operatively connected to close said make-up valve in response to a rise in the level of said drainage flow above a first predetermined elevation tending to fill said gutter but lower than the elevation of said lip, and to open said make-up valve in response to a drop in the level of said drainage flow below a second predetermined elevation tending to exhaust said gutter and not higher than said first predetermined elevation.

2. A system as recited in claim 1, in which said lip has a substantially uniform elevation around the periphery of the pool.

3. A system as recited in claim 1, in which said recirculating means is constructed and arranged to recirculate the drained water at a predetermined rate, together with a grill enclosing said gutter and arranged not higher than said lip, said grill being formed with drain holes whose total area is calculated to admit drainage from the pool at a rate less than said predetermined rate of recirculation when the pool level has no more than a predetermined head above said grill, whereby a volume within the pool and above said lip is available for surge displacement without interrupting drainage from the pool to the gutter.

4. A system as recited in claim 3, together with overflow drain means communicating with said gutter at a height above said first predetermined elevation to drain excess water from the system.

5. A system as recited in claim 4, in which said drain means includes an adjustable weir inlet for controlling the

minimum water level within the gutter which will produce drainage of water from the system.

6. A system as recited in claim 1, in which said detecting and control means are constructed and arranged to remain inactive during the event of a decrease in the depth of the drainage flow in said gutter below said first predetermined level, and to remain inactive during the event of an increase in the depth of the drainage flow in said gutter above said second predetermined level, said second level being spaced below said first level to prevent hunting of the control means and continuous readjustment of said make-up valve.

7. A system as recited in claim 1, in which said detecting means comprises an electrical level sensor having a first probe with a tip extending to said first level in said gutter, a second probe with a tip extending to said second level in said gutter, and a ground probe with a tip extending substantially to the bottom of said gutter to remain immersed in said drainage flow, said drainage flow serving as a conductor to complete an electrical circuit from said ground probe to either of said first and second probes whose tip is immersed in said drainage flow.

8. A system as recited in claim 1, said recirculating means including main drain means communicating with the pool below the surface thereof, said recirculating means being arranged to drain water in parallel flows from said pool and said gutter.

9. A system as recited in claim 8, said main drain means including a drain valve for controlling the relative proportions of said parallel flows drained from said pool and from said gutter.

10. A system for controlling water level and drainage in a swimming pool, comprising:

a gutter having an upper lip extending around the periphery of the pool and arranged to drain water overflowing from the surface of the pool; filtering means; means communicating with said gutter for recirculating the drained water from said gutter through said filtering means to the pool; means for detecting the level of the water drainage flow in the gutter; water supply means including a make-up valve connected for supplying additional water to the pool; said recirculating means including main drain means having a drain valve, and communicating with the pool below the surface thereof, said recirculating means being arranged to drain water in parallel flows from said pool and said gutter; and control means connected to said detecting means for response to the level of said drainage flow, said control means being operatively connected to close said make-up valve and said main drain valve in response to a rise in the level of said drainage flow above predetermined elevations tending to flood said gutter but lower than said lip, and to open said make-up valve and said main drain valve in response to a drop in the level of said drainage flow below predetermined elevations tending to exhaust said gutter and not higher than said first-mentioned flood levels.

11. A system as recited in claim 10, said control means being operatively connected to close said make-up valve in response to a rise in the level of said drainage flow above a first one of said flood elevations, to open said make-up valve in response to a drop in the level of said drainage flow below a first one of said exhaust elevations, to close said main drain valve in response to a rise in the level of said drainage flow above a second one of said flood elevations, and to open said main drain valve in response to a drop in the level of said drainage flow below a second one of said exhaust elevations.

12. A system as recited in claim 11, in which said elevations are spaced apart in the following order of decreasing depth below said lip; first exhaust elevation, second exhaust elevation, first flood elevation, second flood elevation.

13. A system as recited in claim 10, in which said lip has a substantially uniform elevation around the periphery of the pool.

3,386,107 6/1968 Whitten.
3,391,790 7/1968 Lerner ----- 210—169
3,490,081 1/1970 Ogden ----- 4—172.17 XR

References Cited

UNITED STATES PATENTS

1,820,981 9/1931 Fever ----- 137—392
2,739,939 3/1956 Leslie ----- 4—172.17 XR
2,932,397 4/1960 Ogden ----- 210—169
3,363,767 1/1968 Ellis ----- 210—169 10

5 LAVERNE D. GEIGER, Primary Examiner
H. K. ARTIS, Assistant Examiner

U.S. Cl. X.R.

210—169