This invention relates to a system and apparatus for controlling the flow of water and recirculating water into reservoirs, such as swimming pools of either the indoor or outdoor variety. In swimming pools, it has usually heretofore been customary to supply replacement water and any recirculated water by way of inlets from which the water flowed into the pool from below the water level in the pool. Drainage of the pools has usually been accomplished by an outlet provided at the lowest point of the interior. In order to clean the pool and remove dirt, refuse and such impurities and contaminations as inherently tend to accumulate in swimming pools, it has been necessary, in the past, to have vacuum apparatus arranged to remove such material and the like from the pool bottom. It is in this way that such impurities as normally tend to float, particularly mucus and slime, which contaminate the pool water and which have marked tendency to accumulate and come to rest at the top of the pool surface are removed by withdrawing the water from beneath the pool water surface or from the lowest pool outlet. This requires circulating such water-containing substances, often accompanied by germs of contagious diseases, to an extent such that they pass through the entire pool volume, or at least a relatively large part thereof. The result is that contagious diseases are often spread and conveyed from one bather to another despite the use of disinfectants in the water.

The present invention seeks to overcome these and other objections of prior art arrangements by injecting all inlet water into the pool through inlets arranged in the pool bottom or in a trough or the equivalent located at appropriate distance beneath the upper edge of the pool, is supplied to a filter system from which it is fed through an appropriate pumping mechanism to be recirculated subsequent to filtering. The filtering removes those impurities which are displaced as overflow in the area of the pool wherein they are most prevalent and, following filtration, the displaced water can readily be circulated and added to the pool around its complete area, in contrast to readmittance at selected points. Generally speaking, the major portion of the impurities which are to be removed are found in the shallowest region of the pool where the largest volume of bathers can be expected to make use of the facilities. In installations where water removal is accomplished mainly at the deepest region of the pool it is apparent that impurities, dirt and other types of contamination must be circulated through the entire volume of the pool to a drain-off or draw-off point before removing them.

The present invention, by adding water replacements at the bottom of the pool and removing the water from the top surface of the pool, makes it possible to skim off the majority of contaminating solids before such contaminations sink to the bottom of the pool. This feature, of itself, lessens substantially the pool cleaning requirements and thus reduces operating costs. Frequently, chlorine is added to the pool inlet water. This can be done concurrently with or following the filtration according to the present invention. Replacement water is added, as required, in the recirculating mechanism prior to water filtration.

The invention, as herein disclosed, further offers better opportunity of uniform heat control of the pool volume by reason of removal of the water closer to the surface for addition, following recirculation, to the cooler water at the pool bottom. Various ways of carrying out the invention herein to be disclosed may be provided but in accordance with the present invention it will be apparent that included in the main purposes and objectives are those of controlling the amount of water in the pool with a high degree of accuracy and thus effecting a saving of a considerable amount of waste water (with the cost thereof) which would otherwise be paid for.

The department turnover regulations are more easily and cheaply met and dirt, contamination and slime more readily removed. By controlling the rate of inlet, the supply of replacement and recirculated water may be gaged better to the actual requirements of use of the pool. Other and further objectives of course will become apparent and be made evident from the description of the invention in one of its specific forms herein to be set forth.

As the invention is depicted by the accompanying drawings:

FIG. 1 will be seen to constitute a general plan view of one form of pool installation which may be provided;

FIG. 2 constitutes an elevation section taken substantially along the line 2-2 of FIG. 1;

FIG. 3 is an enlarged sectional view of one part of the inlet manifold for supplying inlet water to the pool and shows in particular, pressure flow control valves for admitting water into the manifold and, and;

FIG. 4 is a section showing the inlet manifold and inlet valves taken along the line 4-4 of FIG. 3.

Referring now to the drawings for further understanding of the invention, the pool installation proper is formed to provide a shape and capacity in accordance with the needs for conditions of the installation. While this may be any particular shape, the illustrated rectangular contour is assumed as being a widely used pattern which has long side-regions 11 and much shorter end-regions 13. The side walls 15 of the pool extend at one end and to a depth usually two to three times that customarily found at the opposite shallow end 17. As illustrated the deepest region 19 is a short way from the end wall 15. In most installations, the lower surface of the pool is formed by a gradually sloping bottom 25, which extends from the shallowest region opposite the end wall 17 to the region 19 of the pool and the more sharply sloping bottom 27 extending from the end wall 15 to the deepest region 19. The bottom surface is made relatively smooth in order that users of the pool will not receive injury from a rough bottom surface and also in order that the bottom surface may not be a medium whereby dirt and possibly collected in shallows and ridges. Further than this, by providing a relatively smooth bottom there is a smooth surface passage for permitting a complete withdrawal of the water from the pool at times when it is desired to drain the pool.

There is arranged, according to the present invention, along the bottom of the pool a trough or trench, conventionally represented 29, which, as herein shown, extends generally longitudinally of the long dimension and
depending upon the pool size and width may also, in some instances, extend laterally, as indicated at 31, which region in the illustration shown is at the assumed deepest part of the pool.

An inlet manifold 33 is arranged to extend throughout the length of the trough or trench 29 and to be connected in appropriate manner, such as by the connecting pipe 37, with any appropriate source of inlet supply. In the preferred form, the inlet supply is derived from the conventionally represented inlet connection 36 to a suitable supply main (not shown) which feeds through the pipe 37 into a suitable pumping mechanism 39. There is also supplied to the pumping mechanism filtered water from the filter 41 which receives overflow water from the overflow tube 43 as a result of pool overflow, as will be later described.

There is arranged along the inlet manifold at various spaced positions, which may vary in separation in accordance with pool depth and volume variances at different pool regions suitable lead-off connections 45 from the manifold, which connections lead to flow-control valve mechanisms conventionally represented at 47 and at 47, (in section as in FIGURES 3 and 4). The valves 47 and 47' per se form no specific part of the present invention except as used in the combination. Valves of the type which are particularly suitable in this use are of the type shown and described in the patents granted to C. A. Brown No. 2,389,134 on November 20, 1945, and to L. A. Kempton, No. 2,454,929 granted November 30, 1948. The described valves are generally known as pressure controlled flow-control valves and comprise an orifice, such as 49, which is adapted to be flexed in such fashion as to effectively change its size inversely in proportion to the pressure exerted against it. The valves which may be of selected size are arranged at the outlets from the manifold 33, as above stated, at variable spacings dictated generally by the depth of the pool water in which may be assumed illustratively to level at the planes shown at 51 (see FIGURE 2). The described inlet valves also are of known fixed capacities. It is not a particular part of this invention as to the specific size of valve but it may be noted that valves of the character described may provide a flow capacity varying between say ½ gallon per minute up to 12 gallons per minute or more.

The specific size valve is selected in accordance with the flow-rate required or desired for the particular pool installation under consideration and is determined to some extent by the amount of replacement water required to meet the needs of the bathers using the pool, to meet the needs of sanitary requirements and to meet the needs of flow inlet determined by state of cleanliness or filth of the pool. The turn-over of water, therefore, is a controllable factor and may be regulated in accordance with the applied pressure as determined by the pumping mechanism. The valves are generally set so that depending upon the location along the manifold and the known depth of the water normally required at this point there will be a uniform addition of water throughout the complete pool. In the installation with an assumed controlled-flow rate for the valve selected and an assumed inlet pressure in the manifold, the water inlet at each of the particular valve positions 45 is readily determined. When the pool water reaches above the level indicated at 51 for overflow in the particular form of a diagrammed installation, the overflow passes into a pipe 39, or a trough 45 in depth is cut into the walls of the pool and extends along each side and each portion to connect to an outlet point 57 from which it flows into the tank 58 into which fresh water from supply 35 also flows. It will be noted that the outlet from pipe 35 terminates above the level of water in tank 58 so that there is no possibility of drain-off water getting into the pool. Water from the tank perhaps is then drawn off by pump 39 to be supplied to filter 41 by way of the connector 44. The recesses 55 in the pool side walls all slope very gradually towards the outlet connector point 57 so that all water passing above the lowermost region 59 of the trough will flow to be eventually recirculated after filtering. The overflow must always flow in a duct beneath the pool water surface and will be precluded from re-entering the pool volume until it has been recirculated.

In other installations it is preferred to permit the water in the pool to rise to the top of the pool side walls and to overflow and then to collect the overflow in any desired fashion for filtering and recirculation. The invention is equally applicable to such types of installations in which event the inlet connection 57 to the conduit 43 leading to the filter will of course be in an appropriately changed position.

Various chemicals such as chlorine and other suitable filtering agents may be added in well known fashion at the filtering point or along the passage 35 into the inlet manifold.

As the invention is diagrammed, the trough or trench 29 in which the inlet manifold and inlet valves are positioned is arranged to extend along the pool bottom, as above stated. In such form, the trench is covered by a grating conventionally represented 61 having closely spaced openings and closure sections with the inlet water passing through the openings 63 into the pool and the closure sections preventing bathers or users of the pool from stepping upon the inlet valve mechanisms proper with resulting injury to person or installation. It is, of course, apparent that the inlet manifold may be completely concealed and covered over along the pool bottom with only the particular inlet sections opened to permit ingress of water, in which event suitable grating, screens or the like may be provided to insure the inflowing water entering into the pool. The particular fashion by which covering is provided is not specifically a part of this disclosure other than as generally set forth.

It is desirable to control the inlet flow to the tank 58 so that replacement water is supplied but there will not be an excess to overflow the tank. Accordingly, it is within the concept of this invention to include in the tank 58 a float control which operates either by suitable linkages or by the suitable closure of electrical contacts to open and close a suitable valve in the inlet line 35 where the level of water in the tank 58 is at an optimum height such that no replacement water is immediately required. The float valve operates to shut off the supply in the inlet line 35. Where loss of water in the tank 58 occurs by reason of losses within the pool, it is apparent that the float valve will ride lower and, consequently, through suitable mechanical linkages or electrical contacts may be used to open a suitable valve such as the valve 67 to provide the water inlet.

It will be noted that in the line 33 feeding from the filter 41 into the manifold a pair of valves 71 and 73 are provided. These valves control the filling or emptying of the pool proper. Normally, unless it is desired to drain the pool, the valve 73 is closed so that water flows into the pool after being filtered in the filter 41 through the valve 71 and the line 33. However, when it is desired to drain the pool, the valve 71 is closed and the valve 73 opened so that the pool may drain through the outlet tube 75 which will then be supplied with water from the pool draining outwardly through the line 33 and the valve 73.

Various changes and modifications to the described arrangement may be provided to meet regulatory demands, water turn-over, heating or cooling of the water and modifications of the filter cycle as well as the rate of recirculation. These units, not here shown for reasons of simplicity, are usually connected between the overflow pipe 43 and the manifold but this is not essential to the operation thereof. Water draining from tank 58 is then supplied through the appropriate selection of pump and filtering operating rates determined by the use of the pool.
and regulatory requirements. Where the described installation is provided the cleaning requirements are reduced very substantially because the majority of the dirt, impurities and contaminations are removed without being circulated through the pool volume as a whole. Repairs to the inlet system, if necessary, can be made readily by merely removing the grating 61 as the trench or trough cover.

Having now described the invention what is claimed is:

1. A supply system for replacing water in a reservoir which comprises an elongated inlet manifold extending along the reservoir substantially below the desired water surface level, a plurality of controlled-flow inlet devices connected at selectively spaced points to the manifold to pass water from the manifold into the reservoir, means to supply water to the manifold and therefrom to the controlled-flow devices, orifice means in said controlled-flow devices being adapted to vary in size responsive to manifold pressure changes to provide a stabilized pre-selected inlet flow to the reservoir from each device so that the entering water flow rate into the reservoir may be selectively proportioned to the water depth and volume at the location of each regulator.

2. A supply system for replacing water in a reservoir as claimed in claim 1 wherein the elongated inlet manifold extends in a substantially longitudinal path along the lower surface of the reservoir.

3. A supply system for replacing water in a reservoir which comprises an elongated inlet manifold extending in a direction substantially longitudinally along the bottom surface of the reservoir, a plurality of controlled-flow inlet devices connected at spaced intervals along the manifold, said controlled-flow devices each having a controllable size orifice determined by manifold pressure to admit water from the manifold to the reservoir, and water-passing means to supply the manifold water supply to the controlled-flow devices to maintain a pre-selected inlet flow volume proportioned to the reservoir depth and volume at the location of each regulator and to maintain a pre-selected balance between all said devices.

4. A swimming pool supply system for supplying water to pool structures having variable depth which comprises a supply manifold extending substantially longitudinally of the pool and substantially at the bottom region thereof for supplying inlet water for replacement and recirculation, the manifold pressure being adapted to change at the supply and at varying distances along the manifold therefrom, a plurality of controlled-flow inlet devices spaced along the manifold to supply inlet water to the pool, each controlled-flow inlet device having an orifice of variable size determined by instantaneous manifold pressure and being of such capacity relative to each other as to maintain a selected inlet flow volume at different pool regions along the manifold which is proportioned to the reservoir depth at the region of each regulator, means to receive and filter overflow water from the reservoir, and means to recirculate the filtered overflow with fresh water replacement to the manifold for supplying the pool.

5. The supply system claimed in claim 4 comprising, in addition, water-passing screening means covering the flow-regulator devices to preclude direct access thereto.

6. The swimming pool supply system claimed in claim 4 including, in addition, a trough for containing each supply manifold, the trough extending along the pool bottom for substantially a longitudinal distance corresponding to the length of the pool, and a second trough extending in the direction transverse to the pool length in the region of substantially greatest water depth for housing a second supply manifold, and a water-passing screening means covering each trough in a plane substantially corresponding to the pool bottom to provide a smooth bottom surface and to preclude direct access from the reservoir to the flow-regulator devices.

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