

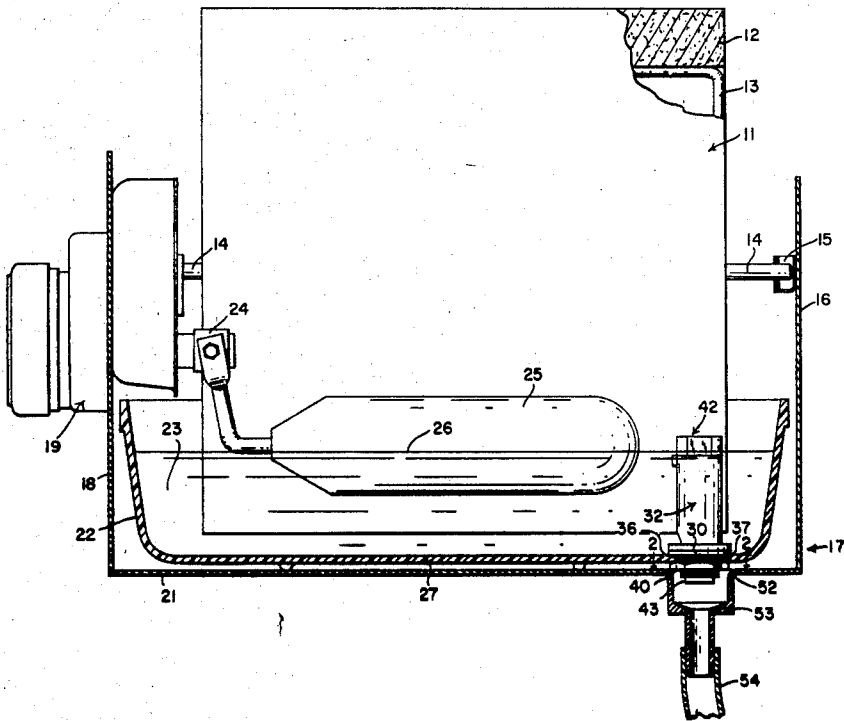
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[21] Appl. No. 837,624
[22] Filed June 30, 1969
[45] Patented July 27, 1971
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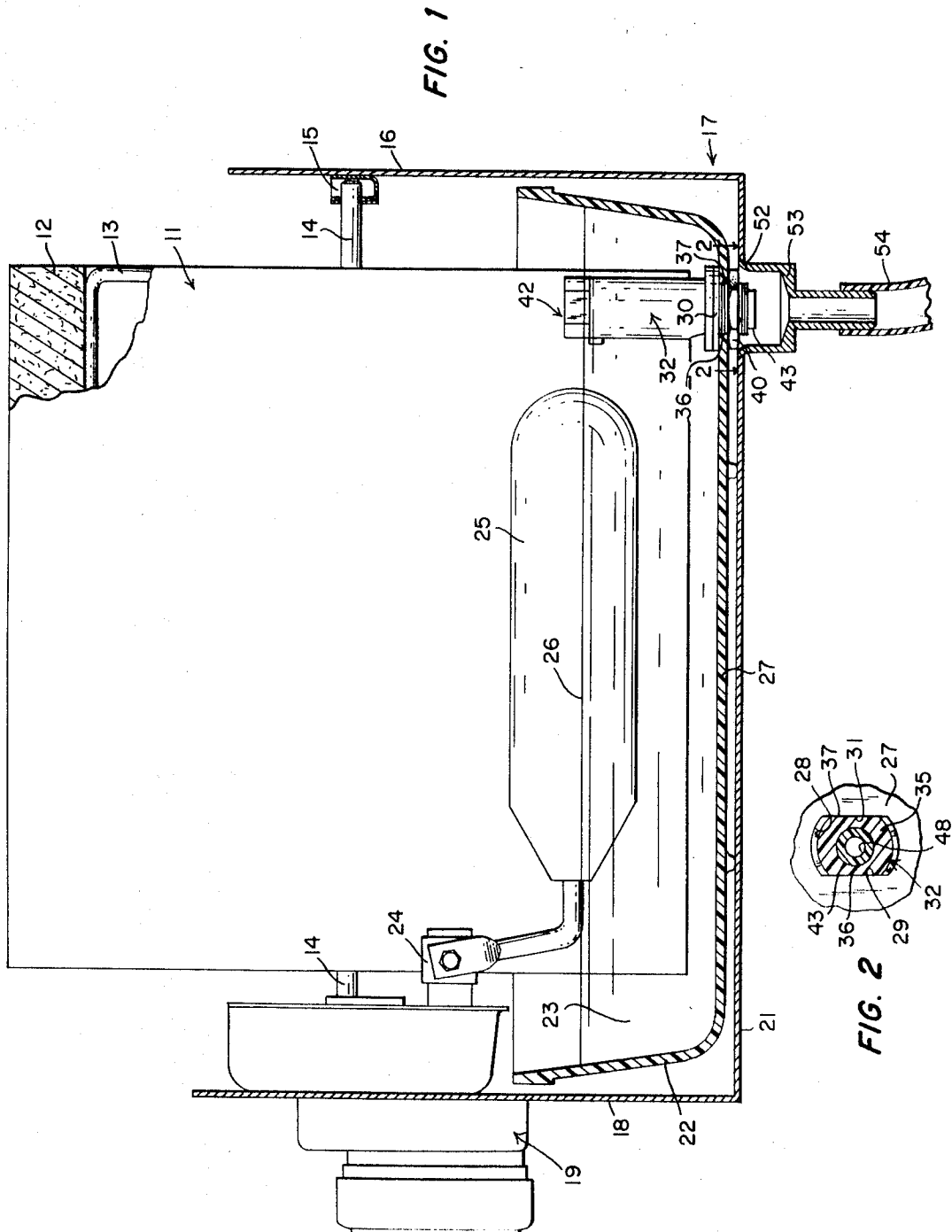
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[54] DRAIN VALVE FOR HUMIDIFIER
9 Claims, 7 Drawing Figs.
[52] U.S. Cl. 137/577,
126/113, 261/92, 4/206
[51] Int. Cl. F24f 3/14
[50] Field of Search. 137/1, 577,
589, 593, 588; 126/113; 261/97, 92; 4/206

ABSTRACT: A combined drain and overflow valve assembly adapted for upright mounting in the water reservoir of a humidifier comprises a hollow casing having a lateral inlet port and a hollow core rotatably mounted in the casing. The core has a longitudinal passage open at both upper and lower ends for overflow discharge, and is formed with a small diameter drain port and a larger diameter flush port both intersecting that passage and adapted respectively to register with said inlet in different rotative positions of the core.





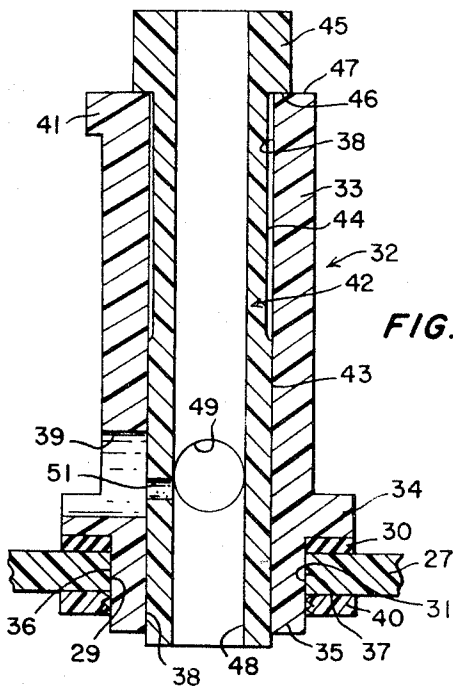


FIG. 4

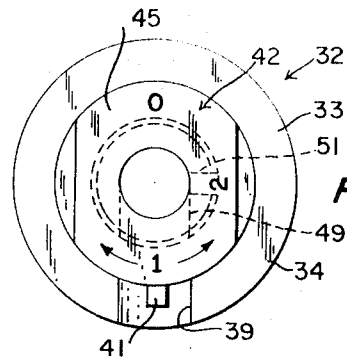


FIG. 5

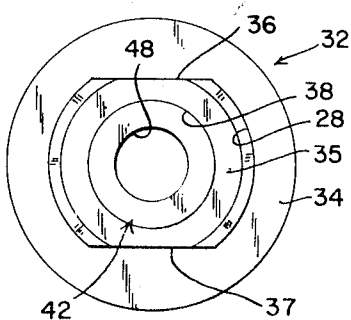


FIG. 6

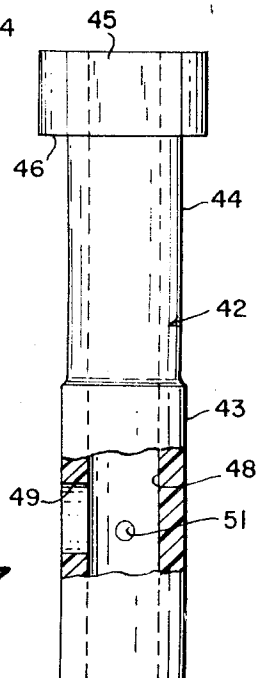


FIG. 7

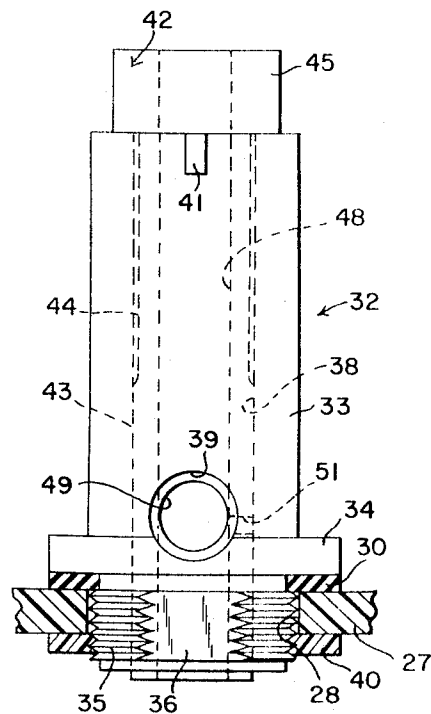


FIG. 3

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DRAIN VALVE FOR HUMIDIFIER

BACKGROUND AND HISTORY OF INVENTION

This invention relates to humidifier assemblies of the type wherein a slowly rotating drum rotates with its lower sector immersed in a body of water to pick up water which is then evaporated therefrom into air to be humidified, usually the hot air supply in a central heating system.

Humidifiers of this type currently provide on the drum an annulus or so-called pad of open pore foamed polyurethane as the vehicle for picking up the water and providing large area contact with the dry heated air to be humidified. While this material is water resistant in that it does not absorb or react chemically with water or the various impurities such as alkalis and the like in the usual public water supply, problems are being encountered in that after a period of operation solid material derived from the water collects in the pad pores and passages clogging them, and in time rendering the pad incapable of picking up water or permitting passage of air through it. The pads have to be periodically replaced or cleaned but usually the loss of efficiency is gradual and the humidifier may be practically ineffective for long periods without such being detected.

Water in the usual city and other public supply has long been known to contain carbonates, sulfates, chlorine compounds and many other impurities, depending on the locality and the purification treatments. These impurities are known to precipitate or crystallize to form solids deposits particularly when the water is heated.

The water body in the humidifier is automatically maintained at a constant level by a float operated valve or the like, which intermittently operates to introduce fresh water into the body. The water in the body usually becomes hot because the humidifier is usually mounted at the warm air discharge conduit of the furnace, and heat is obtained both by conduction through the housing and from the warm air.

The water picked up by the drum pad contains the impurities but only water is evaporated therefrom into the air stream. As a result solids precipitated, crystallized, or otherwise deposited out of the water during evaporation remain on the rotating drum and are carried back into the body of water where, because of their relatively low attraction to the drum surfaces, most of the solids deposit into suspension in the water body. In time the solids concentration in the body increases toward saturation, and as the concentration increases more and more solids are picked up each time by the drum and gradually the drum pad becomes choked by the accumulated solids retained thereon and therein.

Attempts to solve the problem have included periodic introduction of tablets that chemically attack the solids, but even where this is helpful it depends upon the judgement and attention of the householder, so that in general it is not an entirely satisfactory solution.

In the present invention, solids concentration in the body of water is limited and held below safe values by continuously draining at a predetermined rate a very small amount of the water out of the water body into a waste outlet, preferably the rate of drain being sufficient to maintain the concentration of solids in the water body at a value that does not exceed the mineral content of the supply water, and this novel method and a special valve for accomplishing it constitute important objects of the invention. The invention also contemplates an improved humidifier drain control valve assembly which can be adjusted between the predetermined rate small flow drain position to a more open position where it permits rapid thorough flushing of the tray or other container for the body of water at desired intervals, this being particularly useful when the solids accumulate beyond safe limits or periodic maintenance. The valve assembly of the invention is also preferably constructed to serve as an overflow valve whether the valve assembly is closed or in drain or flush positions, this being a safety measure to take care of improper operation of

the float valve. The foregoing features of the valve assembly contribute to provide important objects of the invention.

Further objects will appear in conjunction with the attached claims and the accompanying drawings wherein:

FIG. 1 is a side elevation mainly in section showing a rotary drum humidifier incorporating the invention according to a preferred embodiment;

FIG. 2 is a section substantially on line 2-2 of FIG. 1 showing mounting of the valve assembly on the tray bottom;

FIG. 3 is an enlarged side elevation showing the valve assembly, and showing in section its attachment to the tray bottom;

FIG. 4 is essentially a vertical section through the valve assembly of FIG. 3, showing detail of the valve casing and core;

FIG. 5 is a top plan view of the valve assembly;

FIG. 6 is a bottom plan view of the valve assembly; and

FIG. 7 is a side elevation, partially broken away and sectioned, showing the valve core.

PREFERRED EMBODIMENTS

FIG. 1 illustrates a rotary drum-type humidifier wherein the drum 11 comprises an annulus 12 of nonabsorbent water pickup material such as open pore polyurethane foam mounted on a skeleton frame 13 secured to a generally horizontal shaft 14 that has one end supported in a bearing device 15 on a sidewall 16 of a stationary sheet metal housing 17.

The other end of shaft 14 is suitably rotatably mounted on the opposite sidewall 18 of the housing and is connected to a motor and gear reduction unit 19 externally mounted on that wall.

Supported on the bottom wall 21 within the housing is a tray 22 which is preferably an integral molded plastic unit resistant to corrosion by water. Normally tray 22 contains a body of water 23 in which the lower peripheral sector of annulus 12 is immersed. The level of water in the tray is automatically maintained by a valve assembly 24 controlled by a float 25, the normal water level being indicated at 26.

In operation drive unit 19 slowly rotates drum 11, at about 1 revolution per minute, the lower sector of annulus 12 picking up water from body 23 and the upper part of annulus 12 being traversed by air to be humidified.

The foregoing humidifier drum and drive structure and operation in general are essentially as disclosed in Stiles U.S. Pat. No. 3,408,880, and the float-operated valve may be that disclosed in Powers U.S. Pat. No. 3,099,286.

In the invention the tray bottom wall 27 is formed with a noncircular aperture 28, which may be circular except for opposed parallel flat sides 29 and 31. Mounted upright at aperture 28 is a two part combination overflow and drain valve assembly 32.

Referring to FIGS. 2 and 3, valve assembly 32 comprises as one part a casing 33 having at its lower end an enlarged radial flange 34 and a threaded boss 35. Boss 35 has flat sides 36 and 37, and is sized to nonrotatably fit tray aperture 28. As shown in FIG. 3, the threaded boss 35 extends through aperture 28 to mount a nut 40. A resilient gasket 30 surrounds the casing between flange 34 and the tray bottom, so that when nut 40 is drawn tight the casing 33 is nonrotatably secured fluidtight in upright position within the tray.

Valve casing 33, as shown in FIG. 6, has a cylindrical through bore 38 of uniform diameter, and bore 38 is intersected by a lateral intake port 39 at the upper side of flange 34. At its upper end casing 33 is formed with a lateral projection 41 preferably aligned vertically with the center of port 39 and a flat side 36 of the boss. Casing 33 is preferably a single unit molded of solid water resistant vinyl plastic material.

The other part of valve assembly 32 is a core 42 of similar plastic material rotatably mounted in casing bore 38. Core 42 has its cylindrical lower end 43 sized to be frictionally snug and substantially watertight but rotatable between definite angular positions within bore 38, and it is relieved at 44 to

reduce the turning friction. The upper end of core 42 is an enlarged head 45 having a flat underside 46 adapted to seat on the corresponding flat upper end 47 of casing 33.

Core 42 is provided with a uniform diameter through bore 48 open at top and bottom. Bore 48 is intersected near its lower end by a large diameter lateral flush port 49, and at a circumferentially displaced location, preferably about 90° with a relatively small lateral drain port 51.

Ports 49 and 51 are disposed with their centers in slightly displaced planes, and when core 42 is pushed down into casing bore 38 to seat its head on the upper casing end 47 such locates the centers of ports 39 and 49 in substantially the same transverse plane. Port 51 is slightly below this center plane but it opens fully into port 49 when the two are aligned.

As shown in FIG. 3, the diameter of flush port 49 may be only slightly smaller than that of inlet port 39. In a working embodiment, port 39 is about one-quarter inch in diameter and port 49 about three-sixteenth inch in diameter. Port 51 on the other hand may be only about one-sixteenth inch in diameter. Passage 48 is about seven thirty-second inch in diameter.

The upper surface of core head 45, see FIG. 5, carries three index marks, namely 0, 1 and 2 as shown. When the valve core 42 is turned to this FIG. 5 position, index 1 lines up with the index projection 41 to indicate that flush port 49 is aligned with intake port 39. When index 2 is turned to line up with index 41, this indicates drain port 51 in alignment with intake port 39. When index 0 is lined up with index 41, this indicates that intake port 39 is closed and that the valve assembly is open only at the top for overflow relief. Preferably head 45 is flat-sided for turning.

Referring to FIG. 1, the bottom housing wall is apertured at 52 below the valve assembly open lower end and has secured thereto a depending spout 53 the lower end of which may be coupled to a flexible drain conduit 54.

During normal operation the parts are disposed as shown in FIG. 1, with valve assembly 32 adjusted to the drain position where the index 2 aligns with projection 41 and drain port 51 is open to intake port 39. It will be noted that intake port 39 is located as low as practically possible within the body of water in the tray so that draining takes place from the region of greatest concentration of solids in the water. Also the upper end of valve assembly 32 is above the normal water level 26, so that there is normally no overflow.

Thus water continuously drains out of body 23 at a constant rate determined by the size of port 51, and this is continuously effective to reduce the solids concentration in the water body, particularly since it may be noted that the drained water is replaced periodically by fresh supply water due to float valve action. In normal operation the furnace discharges hot air only intermittently in response to the usual thermostat calling for heat, but the humidistat usually keeps motor 19 activated to rotate the drum during periods beyond the actual evaporation periods. During these extended periods the pad is moving through water that is being cleared of solids faster than during the evaporation periods, and this results in an increased automatic pad cleaning action as solids are loosened from the pad and deposited in the water body during these extended periods.

In a practical embodiment the port 51 is about one-sixteenth inch in diameter, providing a drain rate of about one-half gallon per hour, and this has been found to maintain the solids content in water body 23 at an average value not greater than the mineral content of the usual supply water entering valve 24 under all conditions of operation of the humidifier.

Instead of the continuous drain provided when the index is at setting 2 of FIG. 5, it may be preferred to maintain the valve assembly normally closed and periodically flush out the tray when solids concentrations increase. For this the valve core is turned from a closed position wherein index 0 is aligned with projection 41 until index 1 is aligned with projection 41, thereby aligning the flush port 49 with the inlet port 39 and greatly increasing the drain rate through the intake port. With valve 32 in the index 1 position and the water supply shutoff the tray may be drained for servicing.

The drain rate may be even further varied by rotating the core to different positions of overlap of the flush and inlet ports, to provide a continuous drain rate in normal operation where abnormal solids concentrations are encountered.

In all positions of the valve core, passage 48 is available to act as an overflow whenever the water level rises above the top of head 45. In practice bore 48 should be large enough to pass water at the maximum rate of inflow through the float controlled valve 24.

The invention therefore provides a system and novel valving structure wherein solids concentration levels in the humidifier water reservoir are held to a safe maximum, and this results in more efficient humidifier operation over longer periods without requiring special maintenance. Replacement of humidifier pads is greatly reduced. The valve assembly may be adjusted to the various settings without dismantling the humidifier, and similarly the tray may be flushed out periodically without removing it from the humidifier.

It has been found that making the valve assembly 32 in two parts each on integral member made of a vinyl resin material is an extremely beneficial part of the invention. Vinyl is very pliable, so that it is possible to build more interference fit relationship into the parts for increasing the seal between them, while permitting the designated positions. Moreover vinyl has certain natural lubricating qualities, perhaps enhanced by the water in which the valve assembly is located.

I claim:

1. In a humidifier assembly of the type having means defining a reservoir containing a body of water from which water is extracted continually for evaporation into an associated warm airstream or the like and wherein the water level of said body is continually replenished automatically during normal operation, means for controlling the solids content of said body of water comprising valve means for continuously draining water from said body at a predetermined rate, said valve means comprising a valve casing secured to said reservoir and formed with a lateral inlet and a movable flow control member in said casing having a drain flow passage and a lateral drain port opening to said passage and adapted to register with said inlet, said flow control member also having a lateral flush port open to said passage and adapted to register with said inlet.

2. In the humidifier assembly defined in claim 1, said flow control member being a rotatable element internally formed with said passage and provided with said drain and flush ports in circumferentially spaced relation.

3. In the humidifier assembly defined in claim 2, cooperating index means on said valve casing and control member for indicating which port is registered with said inlet.

4. In the humidifier assembly defined in claim 2, said valve casing being secured upright in said reservoir and said control member passage having an open upper end disposed above the normal water level in said reservoir for emergency overflow.

5. In the humidifier assembly defined in claim 2, said casing being a hollow element secured at its lower end in fluidtight assembly in an aperture at the bottom of said reservoir, and said rotatable control element being hollow and slidably and rotatably disposed in an internal bore in said casing whereby said control element may be readily removed for cleaning, said rotatable element having means for limiting axial sliding thereof into said casing.

6. A combined drain and overflow valve assembly adapted for upright mounting in the water reservoir of a humidifier, comprising a hollow casing having a lateral inlet port, and having means below said inlet port for securing the casing within an aperture in the bottom of said reservoir, and a hollow flow control element rotatably mounted in said casing and having an internal drain passage open at both upper and lower ends of said element and a lateral drain port intersecting said passage and adapted to register with said inlet in a rotative position of said control element, there being a larger lateral flush port in said control element intersecting said passage and adapted to register with said inlet in another rotative position of said control element.

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7. The valve assembly defined in claim 6, including cooperating index means on the control element and casing for indicating whether the drain or flush ports are registered with the casing inlet.

8. The valve assembly defined in claim 7, wherein said valve assembly is a two part unit consisting essentially of molded vinyl plastic water-resistant casing and control member parts.

9. In a humidifier assembly, means providing a reservoir for containing a body of water, means for continually extracting water from said body for evaporation into an associated warm airstream, an inlet having a valve for supplying water to said reservoir, means responsive to the water level in said reservoir connected to control said inlet valve to automatically maintain a predetermined normal water level in the reservoir, means for controlling the solids content of said body of water comprising

valve means for draining water out of said body at a predetermined rate, said drain valve means comprising an upright hollow open ended valve casing secured over an outlet opening in said reservoir and a hollow open ended valve element rotatably mounted in said casing with its upper end disposed above said normal water level so that the open upper end of said element is exposed for overflow relief should excess water be supplied to said reservoir, and means providing lateral openings in the lower ends of said casing and valve element adapted to be aligned in a position of rotation of said valve element for continually draining water out of said reservoir at a predetermined rate, the interior of said hollow valve element providing an overflow relief passage large enough to pass water at the maximum rate of inflow through said inlet valve.

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