BY-PASS VALVE ASSEMBLY FOR POOL TYPE HEATER

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Abstract
In a pool-type heater, a by-pass passageway around the heat exchanger includes a valve of the flexible disc type under closing pressure against the valve seat, which valve is responsive to differential pressure of a predetermined magnitude across the liquid in the flow path through the heat exchanger, to flex away from its valve seat, to accordingly control by-pass flow. A thermal power unit in the flow path of liquid emerging from the heating means, applies supplemental closing pressure to the disc type valve in accordance with temperature of such water, to minimize excessive temperature rise said heat exchanger.

2 Claims, 8 Drawing Figures
BY-PASS VALVE ASSEMBLY FOR POOL TYPE HEATER

My invention relates to swimming pool-type heaters through which the water of the swimming pool is circulated to maintain the water at a desired pool temperature, and more particularly, the invention relates to means for protecting the heater in such a system.

Such type of heater usually heats with gas as the fuel, includes a heat exchanger involving heater tubes or coils through which the water to be heated flows. These tubes are usually of thin wall construction, and if insufficient water flows through them during heating, the tubes are apt to get too hot and cause deposition therein of calcium and other metal salts.

On the other hand, if flow through the heater tubes becomes too heavy, the heated tubes can become sufficiently cold to cause condensation of moisture thereon from the water vapors in the flue gas, and this could result in the rusting of sheet metal parts, etc., with the possibility also of dripping onto and extinguishing the pilot light, if not protected against such hazard.

To protect such heater against excessive high temperatures which might be sufficient to prematurely burn out the tubes or coils therein, and to further protect the heater against excessive low temperatures, sufficient to cause condensation on the outer surface of such tubes or coils, necessitates maintaining the temperature of the heater within a relatively narrow safe range during heating cycles, which narrow range of temperature may be between 105 and 110° F., as measured on the discharge side of the heater.

This problem is separate and apart from the operation of the pool system to maintain a desired pool temperature, which is accomplished by controlling the burner which supplies heat to the tubes or coils through which the water flows, which controls usually function by automatically causing the burners to go on or off in accordance with the need for adding heat to the water in the pool.

Among the objects of my invention are:

1. To provide a novel and improved pool type heater for use in swimming pool or like systems;
2. To provide a swimming pool type heater having novel and improved means for maintaining the heater temperature within a narrow range during heating cycles;
3. To provide a pool type heater having a novel and improved valve assembly means for maintaining the heater temperature within a narrow range during heating cycles; and
4. To provide a novel and improved by-pass valve assembly for a pool type heater.

Additional objects of my invention will be brought out in the following description of a preferred embodiment of the same, taken in conjunction with the accompanying drawings herein.

FIG. 1 is a three dimensional view of a pool type heater broken away to expose the interior, and showing the valve assembly of the present invention installed; FIG. 2 is a view in section through the valve assembly in its simplest form, and the heat exchanger with which it is associated; FIG. 3 is a view in section through a valve assembly, depicting a modification of the valve involved in the valve assembly of FIG. 2; FIG. 3A is a fragmentary view of the valve of FIG. 3, depicting it in its partially open condition; FIG. 3B is a view corresponding to FIG. 3A but illustrating the valve in a fully open condition; FIGS. 4-6 are views similar to that of FIG. 3, illustrating other embodiments of the invention.

Referring to the drawings for details of the invention, and more particularly to FIG. 1 of the drawings, the invention is depicted as applied to a heater of the type normally associated with swimming pool systems. This generally involves a housing 1 with a heat exchanger 3 in the upper region thereof and heating means 5 below which may take the form of a plurality of burners.

The particular heat exchanger illustrated is merely representative and includes an inlet 7 and a discharge 9 between which is a front manifold 11. The inlet feeds a pair of fin covered heat exchanger tubes 13 which terminate in a rear header 15 or manifold 17, which in turn conveys the liquid to a second pair of similar heat exchanger tubes 17 which in turn, terminate in the front header.

From this front header, a similar pair of heat exchanger tubes 19 extend rearwardly and terminate in a second rear header or manifold 21 which in turn, supplies a fourth pair of similar heat exchanger tubes 23 which terminate at the discharge of the heat exchanger.

This arrangement provides a main flow passageway through the heater for water being discharged from the filter or a swimming pool system, to be heated by the burners and then returned to the pool. The burners are controlled by the temperature of the water in the system.

The present invention resides in a valve assembly 27 capable of being installed in by-pass relationship to the heat exchanger, such valve assembly including a valve which is responsive to the differential pressure developed in the water between the inlet and discharge of the heat exchanger, to maintain the temperature range of the heat exchanger during heating cycles, to within a rather narrow range of temperatures, by altering the volume of flow liquid through the main passageway provided by the heated exchanger.

In addition to controlling such valve by the differential pressure across the heat exchanger, the normal closing pressure applied to the valve may be supplemented or increased in the event the water temperature in the heated exchanger should for some extraordinary reason, increase excessively.

In its simplest form, the valve assembly involves a valve body or housing 29 which includes substantially parallel passageway 31 and 33 adapted to line up with the inlet and discharge of the heat exchanger for connection thereto, such passageways being interconnected by a by-pass 35. At that end of the by-pass passageway, lying in proximity to the inlet to the heat exchanger, is a valve seat 39 against which normally seats a valve 41 of a flexible disc type, and preferably one of conical shape in which a flexible rim 43 bears against the valve seat.

This valve is normally retained in its seated position by a valve stem 45 extending along the by-pass passageway and which is adjustably anchored in a plug 49 installed in the wall of the passageway 33 connecting with the discharge of the heat exchanger.

The valve stem is threadedly coupled to the plug, the normal pressure of the valve being assured by un-
threading the valve stem until such normal seating pressure is realized, and such adjustment is then maintained by a lock nut 51 on the valve stem, which is then threaded into engagement with the plug to maintain such adjustment.

When the differential pressure across the heat exchanger exceeds the normal seating pressure of the valve, the valve will flex to an open position, to a degree depending on the excess of the differential pressure over the normal seating pressure, to allow for bypass of water in accordance with such opening of the valve.

Since the differential pressure across the heater is for the most part attributable to the condition of the filter in the pool system, it will be maximum due to maximum flow, when the filter has been backwashed, and will thereafter decrease as sediment accumulates in the filter and flow decreases. Thus, in the absence of other probable intervening causes, the valve should be open to normal maximum open condition when the filter is clean and gradually close as the filter accumulates sediment.

For example, should the flow volume through the heat exchanger increase, which under normal conditions would tend to excessively lower the temperature of the heat exchanger, the pressure differential will increase and increase the opening of the valve to bypass more water, and thereby avoid such drop in temperature.

On the other hand, should the volume flow through the heat exchanger drop, which under normal conditions would tend to result in an increase in the temperature of the heat exchanger, the pressure differential will decrease, thus permitting the valve to move toward its closing position to cause more water to flow through the heat exchanger to avoid such rise in temperature.

The disc type valve illustrated, is of great advantage in the foregoing system, in that the flexing movement of the valve to control the flow opening into the by-pass passageway, involves no sliding friction, and, accordingly, will not be adversely effected by any sand, dirt or scale which might be present in the water flowing in the system.

In the embodiment of the FIGS. 3, 3A and 3B, the valve 41 is slidably mounted on its valve stem 55 which, at its other end, is fixedly anchored in the wall of the passageway connecting with the discharge from the heat exchanger.

Normal seating pressure of the valve against its valve seat 39 is accomplished by a compression spring 57 on the valve stem between the valve and a stop 59 on the valve stem, the spring being preferably of a calibration such that it will give, when the differential pressure across the heat exchanger just exceeds that value which will produce a full flexing action of the valve.

Thus when the differential pressure reaches that value which will produce maximum valve opening, due to flexing of the valve, then any further increase in the differential pressure will normally slide the valve from its normal position on its valve stem, to a position away from the valve seat to expose, to maximum, the by-pass, as depicted in FIG. 3B.

In the embodiment of FIG. 4, the valve is fixedly mounted on one end of the valve stem 61 as in the embodiment of FIG. 2, while the other end of the valve stem is exposed to the action of a thermal power unit 63 supported in the flow stream of liquid emerging from the heat exchanger.

To support such thermal power unit, an opening in the wall of the valve assembly passageway 33 connecting with the discharge from the heat exchanger, is closed by a cap 65 carrying a bracket in the form of one or more ribs 67 extending from the cap and terminating in an inwardly threaded cup 69 having an opening in its bottom to permit installation of the unit in the cup with its heat sensitive end 71 exposed. The thermal power unit has a piston extending therefrom in the direction of, and into contact with the proximate end of the valve stem.

The power thermal unit is retained in the cup by a cylindrical retainer 74 threaded into the cup and having an opening in its exposed end in which the valve stem freely passes for engagement by the piston of the thermal power unit. The length of the valve stem is such as to apply the desired normal closing pressure to the valve under normal conditions.

Being that the thermal power unit will expand with an increase in temperature of the water emerging from the heat exchanger, it will follow that the resulting forward movement of the piston 73 will supplement the normal closing pressure against the valve. It will therefore take a greater differential pressure to effect flexing of the valve in the valve opening direction, or will result in a partial or complete closing of the valve from a previously open condition, thereby forcing greater volume of water through the heat exchanger, which will have the effect of bringing the temperature of the water down. And such lowering of temperature will effect a partial cooling of the thermal power unit, with a resulting partial or complete removal of such supplemental closing pressure applied by it against the valve.

In connection with this embodiment, a location of the outlet from the valve assembly housing out of alignment with the discharge from the heat exchanger and in the direction of the input to the valve housing, will have a beneficial effect in that the colder water entering the input to the valve assembly housing and flowing through the by-pass passageway to the outlet, is not apt to contact the thermal power unit and adversely effect its desired exposure to the heated water emerging from the heat exchanger.

Referring to the embodiment of FIG. 5, the valve stem 77 of the valve 41 extends in a direction opposite to those of the preceding embodiments, and is adjustably anchored in a plug 79 installed in the wall of the valve housing passageway 31 leading to the inlet of the heat exchanger. The normal valve seating pressure is determinable by the extent to which the valve stem is threaded into the plug and such adjustment is maintained by a lock nut 81 on the valve stem threaded into pressure engagement with the plug.

This arrangement permits of the use of a spider 83 to supplement pressure against the valve, in accordance with the thermal response of a thermal power unit 63 disposed in the path of flow of the liquid emerging from the heat exchanger, in a manner similar to that described in connection with FIG. 4. The resulting piston movement of the thermal power unit, is applied to the spider through a connecting stem 85 against a compression spring 87 disposed in the retainer between the end of the stem and the forward end of the retainer.

To assure that the spider will apply pressure uniformly about the rim of the valve, the spider is formed
with a central aperture to receive a guide stem 89 emerging from the proximate side of the valve.

It will be appreciated that with this construction, the valve, under normal conditions of operation, may still be flexed in the direction of opening in response to the build up of adequate differential pressure across the heat exchanger, but in response to the build up of excessive temperature in the water emerging from the heat exchanger, the resulting expansion of the thermal power unit will drive the spider forward against the restoring force of the spring 87, and move the valve toward closing position, to cause more water to flow through the heat exchanger to bring its temperature down.

Referring to the embodiment of FIG. 6, it represents a combination of the features of the embodiment of FIG. 3 with the thermal response feature of FIG. 5. Thus the valve 41 is slidable mounted on its stem against the restoring resistance of spring 57 which abuts against the stop 59. The valve stem terminates within the thermal power unit retainer in the manner of the spider stem 85 of FIG. 5.

Since the valve stem in this assembly cannot very well be anchored in the wall of the passageway 33 as in FIG. 3, the valve stem protrudes from the opposite side of the valve as an extension 91 into the passageway 31, where it is supported in a boss 93 on the interior wall of the passageway 31.

From the foregoing description of my invention in its preferred form, it will be apparent that the same is subject to alteration and modification without departing from the underlying principles involved, and I accordingly do not desire to be limited in my protection to the specific details illustrated and described, except as may be necessitated by the appended claims.

I claim:

1. A valve assembly for a pool-type heater for water comprising a housing having a pair of flow passages therethrough, one for coupling to the inlet of a heater and the other to the discharge from the heater, a bypass interconnecting said flow passage, a valve seat spanning said by-pass, a flexible disc-type valve held with its rim against the discharge side of said valve seat by means bearing against the center of said flexible valve, said means bearing said flexible valve against said valve seat including a valve stem anchored at an end remote from the valve, a compression spring encircling the stem and fixed thereto, said valve mounted on the other end of said stem and in sliding relationship therewith and being engaged by said spring whereby small pressure differentials between the inlet and discharge passages will cause a flexing of said valve while large pressure differentials will cause the valve to slide away from the valve seat thereby allowing for water to by-pass said heater in proportion to the magnitudes of the pressure differentials.

2. A valve assembly in accordance with claim 1, characterized by said flexible disc-type valve being somewhat conical in shape.

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