

Sept. 4, 1962

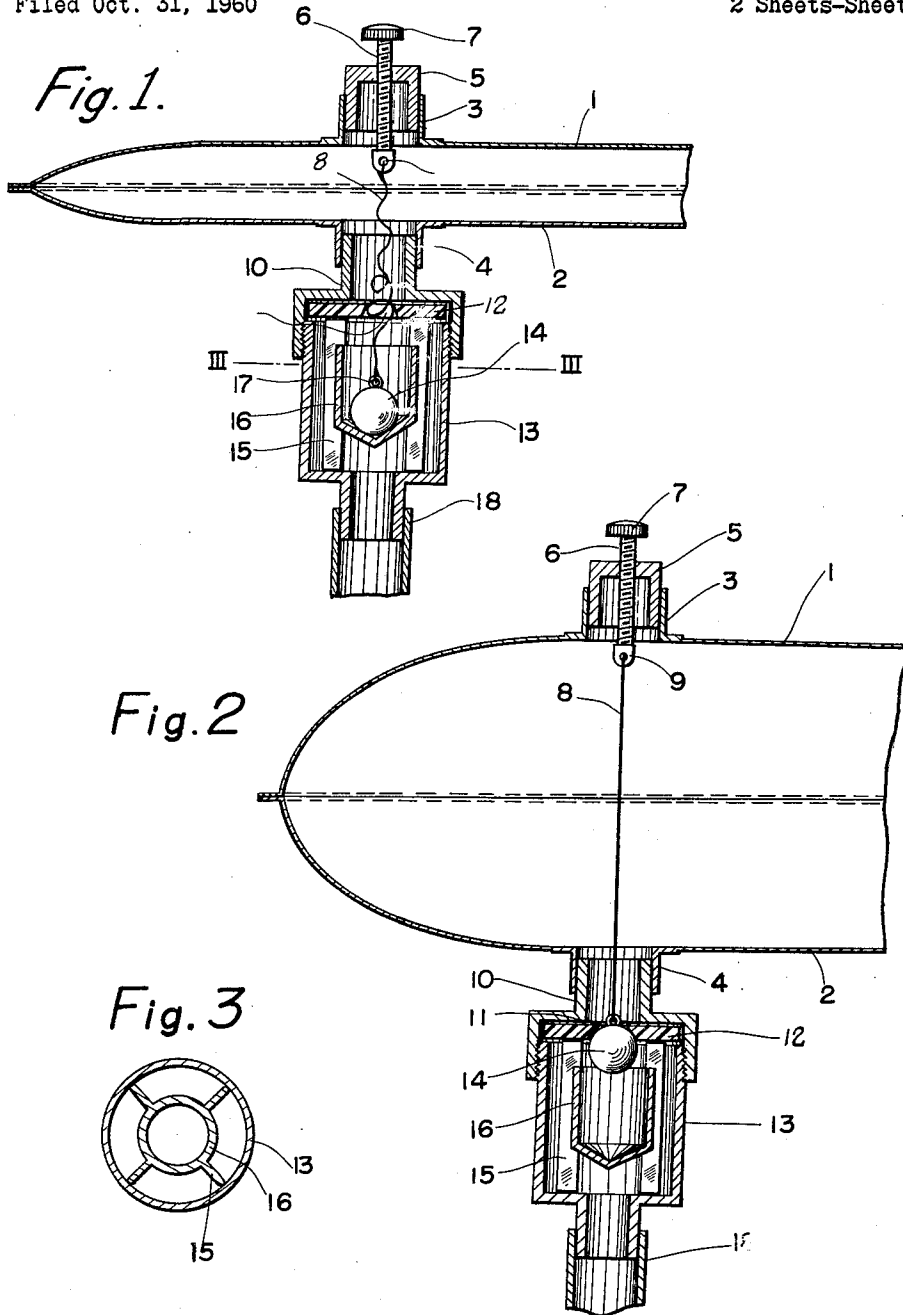
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3,052,228

SOLAR HOT WATER HEATER HAVING AN AUTOMATIC WATER SUPPLY VALVE

Filed Oct. 31, 1960

2 Sheets-Sheet 1



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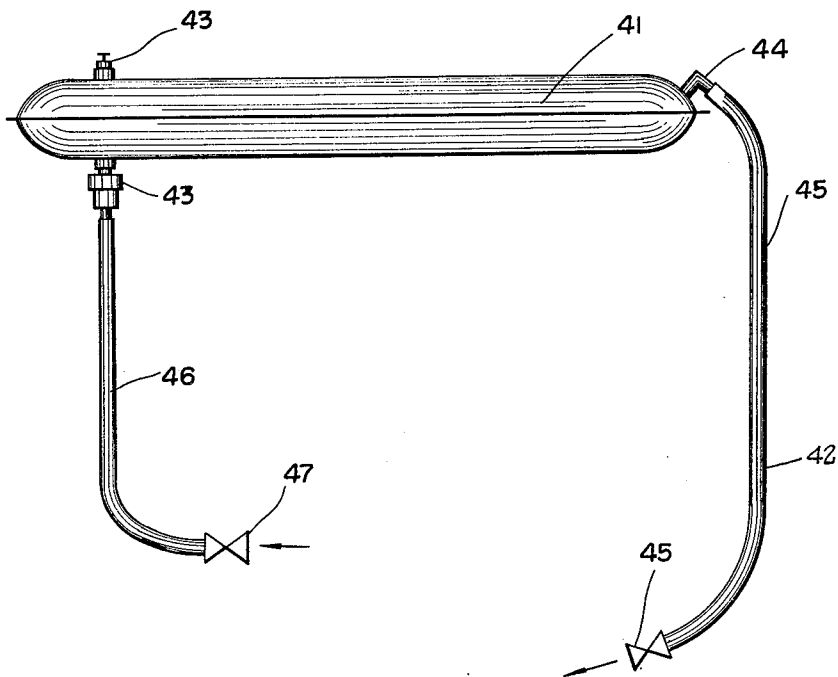
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Fig. 4



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Filed Oct. 31, 1960, Ser. No. 66,109

Claims priority, application Japan Aug. 16, 1960

2 Claims. (Cl. 126—271)

This invention relates to a solar heat hot water heater.

A hot water heater of bag-like shape constituted of soft plastics, for example, polyvinyl chloride sheets, which are superposed with their perimeters sealed together is disclosed in my copending application for letters Patent Serial No. 66,134 filed October 31, 1960. This hot water heater normally being provided with a water supply pipe, water discharge pipe and an overflow pipe was of relatively simple construction. While the fact that its construction is simple is in itself a valuable characteristic, on the other hand, there is apt to occur inconveniences from an operational standpoint. For example, while the amount of water to be placed in the bag-like water tank is controllable by means of the length of the overflow pipe, it frequently happens that excess water overflows from the overflow pipe as to unnecessarily wet the outside of the tank. And troubles arise in that this wetting becomes the cause of dust to adhere which results in the prevention of the effective utilization of the solar heat. Furthermore since only a water supply port and water discharge port have been provided, it would be considered as being only operated on a so-called batch system.

Therefore, an object of this invention is to provide a hot water heater provided with a water supply valve which is capable of automatically stopping the supply of water and thus remove the defect as to overflowing in the conventional hot water heater of this type.

Another object of the invention is to provide a water supply valve capable of maintaining at all times a constant quantity of water in the water tank by automatically feeding water thereto when decrease of the hot water occurs whereby the discharge of hot water and feeding of cold water is carried out continuously.

The accompanying drawing illustrates a preferred embodiment of the present invention, wherein:

FIG. 1 is a fragmentary sectional side elevation of the solar hot water heater provided with a water supply valve of the present invention;

FIG. 2 is a fragmentary sectional side elevation of the hot water heater showing the state when filled to capacity with water;

FIG. 3 is a cross-section taken along line III—III of FIG. 1; and

FIG. 4 is a side elevation showing a continuous water supply and discharge system.

Referring more particularly to the drawings, the water supply valve of the present invention comprises an upper structure to be mounted in a top sheet consisting of an adjusting rod 6 and its supporting member 5 and a lower structure to be mounted in a bottom sheet 2 consisting of a ball valve 14 connected by means of a cord 8 to the aforesaid adjusting rod 6, a receptacle 16 in which the aforesaid ball valve 14 is contained with spacers 15 being provided therearound, a packing 12 provided with a hole 11, which, acting in conjunction with said ball valve 14 stops the flow of water and a casing 10, 13 in which the foregoing are fitted. If the invention is described still more concretely, it is as follows: In FIG. 1, 1 is the top sheet of the bag-like water tank and 2 is its bottom sheet. It is preferable that the top sheet be transparent and the bottom be black. As the material, polyvinyl chloride sheets are suitable in view of their strength as well as from the cost standpoint. In the top sheet 1 and bottom

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sheet 2 at a place facing each other insertion openings 3 and 4 are respectively provided. In the insertion opening 3 a cylindrical member 5 is inserted, and in the central top part thereof is screwed a threaded adjusting rod 6. This adjusting rod 6 is provided at its top with a finger piece 7 and at its lower extremity an eyehole piece 9 for passing the cord 8 through. The eyehole piece 9 is threaded with inside threads and is attached to the lower extremity of rod 6 as to be freely removable. In the insertion opening 4 a stepped cylindrical member 10 is inserted. In this stepped cylindrical member at its shoulder a packing 12 having a hole 11 in its center is pressably fitted by means of the upward pressure of another stepped cylindrical member 13. In the stepped cylindrical member 13 a receptacle 16 provided with several spacers surrounding it is fitted. The drawing illustrates a receptacle 16 provided with four spacers. The top and bottom ends of each of the spacers, as shown in FIG. 1, are fitted as to come in contact with the bottom surface of the packing 12 and the bottom of the stepped cylindrical member 13. And, as shown in FIG. 3, the side edges of each of the spacers are fitted so as to make contact with the internal side walls of the cylindrical member 13. The ball valve 14 is made of a material of a higher specific gravity than water, for example, a non-corrosive metal, and it is connected to the adjusting rod 6 by means of the cord 8 which is tied to an eyehole 17 of said ball valve 14. In a state in which the water tank is not full as in the case shown in FIG. 1, the cord 8 hangs down in a slackened state. A hose 18 for feeding and discharging water is coupled to the bottom end of the stepped cylindrical member 13.

If water is fed from the hose 18 to the water tank, which is in a state as shown in FIG. 1, the water is delivered into the water tank via the hole 11 of the packing 12 after passing through the clearance formed by spacing the receptacle 16 and the cylindrical member 13 by means of spacers 15. As the water in the tank increases, the top sheet 1 is pushed upwards and concomitantly the slack in the cord 8 is gradually taken up. The ball valve 14 then after hanging plumb finally closes the hole 11 of the packing 12, thus functioning as a valve as to stop any further flow of water from the hose 18.

On the other hand, when it is desired to discharge the hot water from the tank, by opening the lower end of the hose 18 the closure of the hole 11 by means of the ball valve 14 is automatically opened by water pressure, and hot water is discharged. As the hot water is discharged, the top sheet 1 descends and concomitantly the ball valve 14 also descends and finally comes to a rest at the bottom of the receptacle 16, as shown in FIG. 1. This is followed by the slackening of the cord 8 as to result in a state as shown in FIG. 1. The discharge of water continues until the top sheet 1 and the bottom sheet 2 finally come in contact with each other.

As is apparent from the structure as hereinabove described, in the present invention it is possible to control the amount of water that is put into the water tank by making up-and-down adjustments of the adjusting rod 6 by means of screwing. Needless to say, adjustments are also possible by suitably changing the length of the cord 8 or the extent that the cylindrical members 5 and 10 are inserted in their insertion openings 3 and 4 respectively. Also, since the receptacle 16 is maintained by means of the spacers 15 such that it hardly moves in either a vertical or a horizontal direction, it is not affected by the pressure of water during feeding and discharging of water. Therefore, a fixed position is insured for the ball valve 14 to rest at all times. If no provision is made for such a receptacle, the ball valve 14 being caused to bounce about would render the opening and closing of the valve uncertain. Therefore, it would not be possible for the

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device to perform the function as an automatic water supply valve, an object of the present invention.

While the automatic water supply valve of the present invention, when mounted in a conventional bag-like hot water heater, functions very effectively as a constant quantity water supplying device as described hereinabove, if, as shown in FIG. 4, a water valve 43 of the present invention is mounted in a hot water heater in which a discharge pipe 42 projects from the upper surface of a tank 41, since it would be possible to simultaneously discharge hot water from a water discharge pipe 42 and feed water from a supply valve 43, the loss of time which occurs in the conventional hot water heater of this type in which the hot water is first discharged and the tank rendered empty before cold water is fed anew would be obviated. Thus, in this case, if the hot water is gradually discharged while simultaneously an equal amount of cold water is fed, the continuous heating of water also becomes possible.

When the invention is described in further detail, a water discharge tube is connected to an elbow 44, which is mounted at an inclined surface near the upper surface of the top sheet as shown in FIG. 4, and to its lower end a valve or a cock 45 is attached. A water supply tube is connected to a hydrant 47. When the valve or cock 45 is opened hot water is discharged from the elbow 44, and at the same time, on account of the top sheet descending, the valve of the water supply valve 43 opens as a result of its action as described hereinabove, and cold water from the hydrant 47 is fed into the tank. As the specific gravity of hot water is less than that of cold water, unless its discharge is effected very violently, the replacement of the hot water with cold is effected almost perfectly. Moreover, if the discharge of the hot water is performed gradually, only the hottest part near the top of the tank is continuously removed and is continuously replaced by cold water. In addition, if the hydrant 47 is closed and the valve of cock 45 is opened, the hot water of the tank can be discharged completely and the tank emptied in accordance with the principle of a siphon.

Having thus set forth the nature of the invention, what I claim is:

1. In a bag-shaped solar hot water heater made of soft plastic comprising a top sheet and a bottom sheet, said sheets consisting of rectangular sheets of soft plastic, said sheets being superposed and the edges thereof being heat sealed, an insertion opening provided in each of said top and bottom sheets so as to face each other, a water level controlling mechanism fitted in the insertion opening of said top sheet consisting of an adjusting rod and its cylindrical supporting member, and a valve mechanism fitted in the insertion opening of said bottom sheet consisting of a ball valve connected by means of a cord to

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said adjusting rod, a receptacle for arresting said ball valve, said receptacle being provided with spacers, and a packing for stopping the flow of water in cooperation with said ball valve, the valve mechanism characterized in that said receptacle is cylindrical in shape and provided with a conical bottom, a cylindrical casing, said receptacle being mounted in substantially the central part of a space within said cylindrical casing by means of the said spacers which extend radially as well as upwards and downwards from said receptacle, said receptacle being secured within the space of said casing by the upper ends and bottom ends of said spacers coming in contact with respectively the underside of said packing and the inner bottom of said casing, and the side edges of said spacers with the inner side surfaces of the casing; said casing constituted by coupling together one above the other of the larger ends of two stepped cylindrical members, the upper stepped cylindrical member at its smaller end being inserted in the insertion opening of the bottom sheet while the lower stepped cylindrical member at its smaller end being connected to a water supply and discharge hose; said packing being provided in the inner surface of a shoulder portion of said upper stepped cylindrical member thereby serving as a seal between the upper and the lower stepped cylindrical members, the packing provided with a small round hole in the center thereof; said ball valve being made of a material having a greater specific gravity than water; said cord connecting the ball valve and the adjusting rod having a length about equal to the height when the hot water heater is completely filled with water; and said adjusting rod being adjustable upward or downwards in the cylindrically shaped supporting member fitted in the insertion opening of the top sheet by means of a screw.

2. A solar hot water heater made of soft plastic in which the water supply and discharge valve defined in claim 1 is installed, and further including a water discharge pipe provided at an upper edge of that portion of said top sheet which presents an inclined surface when said hot water heater is completely filled with water, thereby making it possible to effect the feeding and discharging of water simultaneously as well as continuously.

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