United States Patent

[11] **3,625,423**

[72] Inventor **Hans Meier**
Remscheid, Germany

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[73] Assignee **Joh. Vaillant KG**
Remscheid, Germany
[32] Priority **Mar. 21, 1969**
[33] **Germany**
[31] **P 19 14 463.9**

[54] **GAS-HEATED HOT WATER HEATER**
9 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **237/8,** 237/19
[51] **Int. Cl.** **F24d 3/08**
[50] **Field of Search** 237/8, 19; 236/25

[56] **References Cited**
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Primary Examiner—Edward J. Michael
Attorney—Darbo, Robertson and Vandenburgh

ABSTRACT: A shutter valve is located in the gas supply conduit of the gas burner of a water heating apparatus having several taps from which domestic water may be drawn. A venturi in the line leading to one of the taps produces a pressure differential in response to flow through that line. A diaphragm-type actuator is connected to the venturi and to the shutter valve to reduce the gas flow to the burner when that pressure differential occurs.

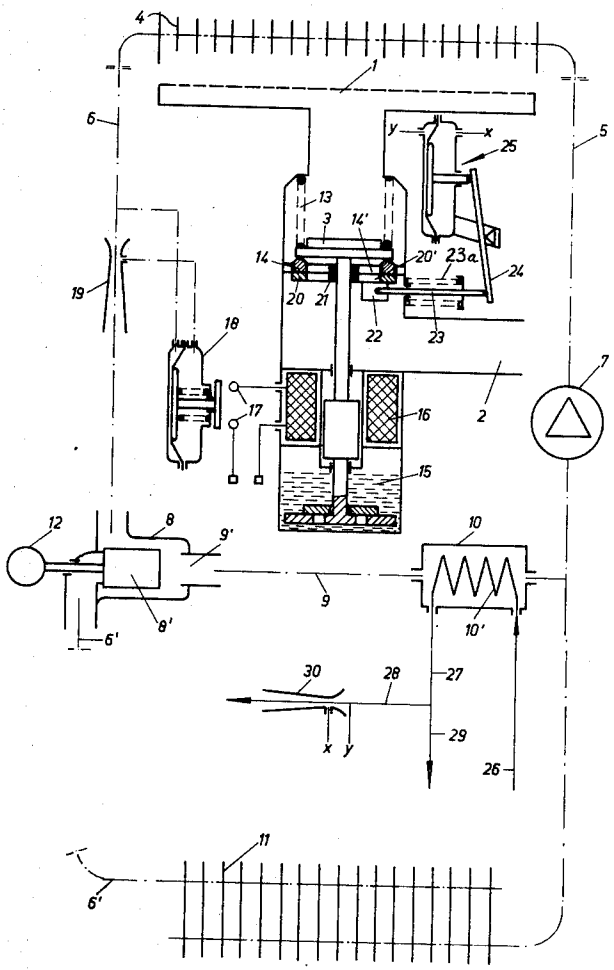

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Fig.1

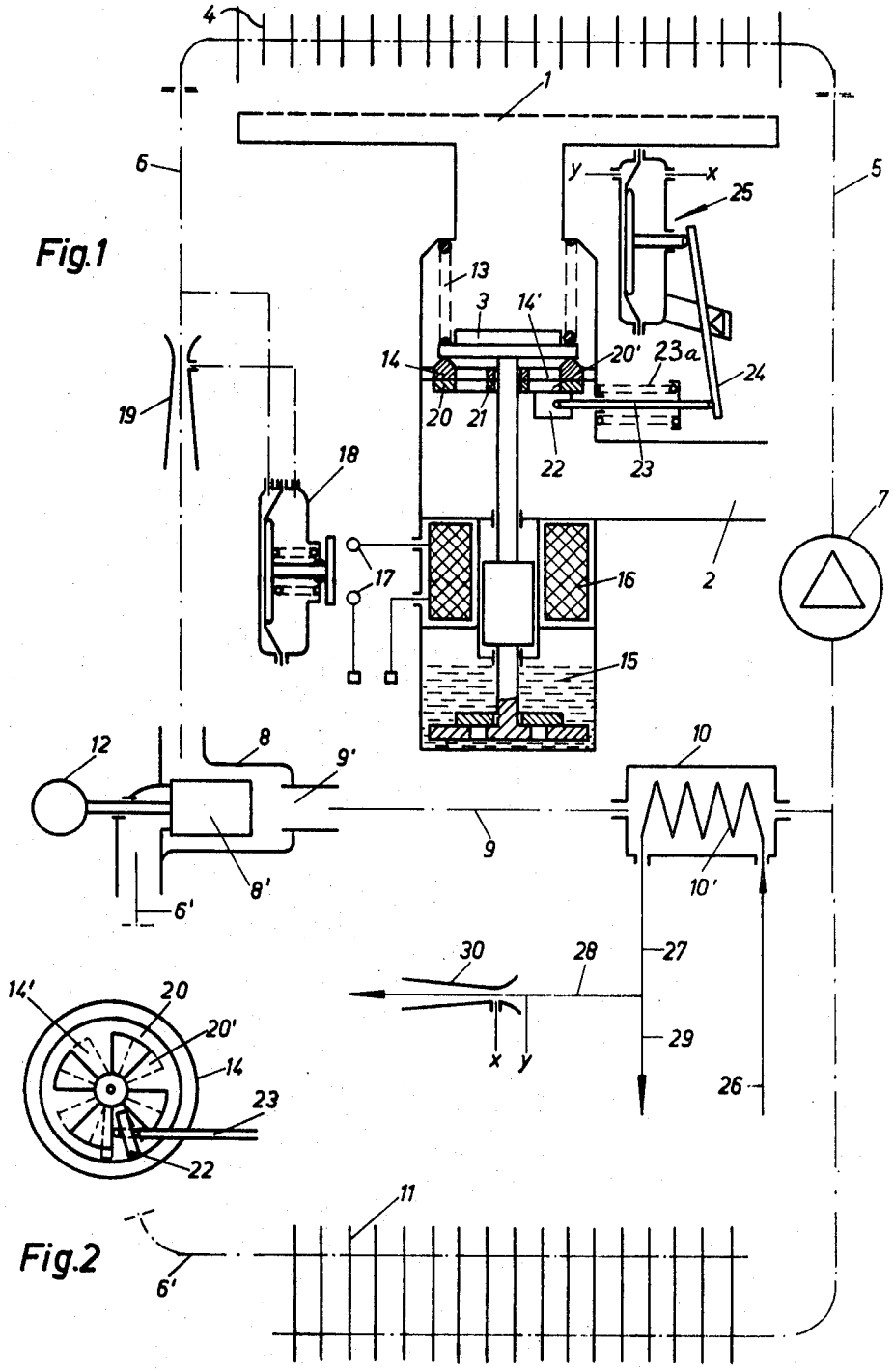

Fig.2

INVENTOR:
HANS MEIER
BY
Dabo, Robertson & Vandenburgh

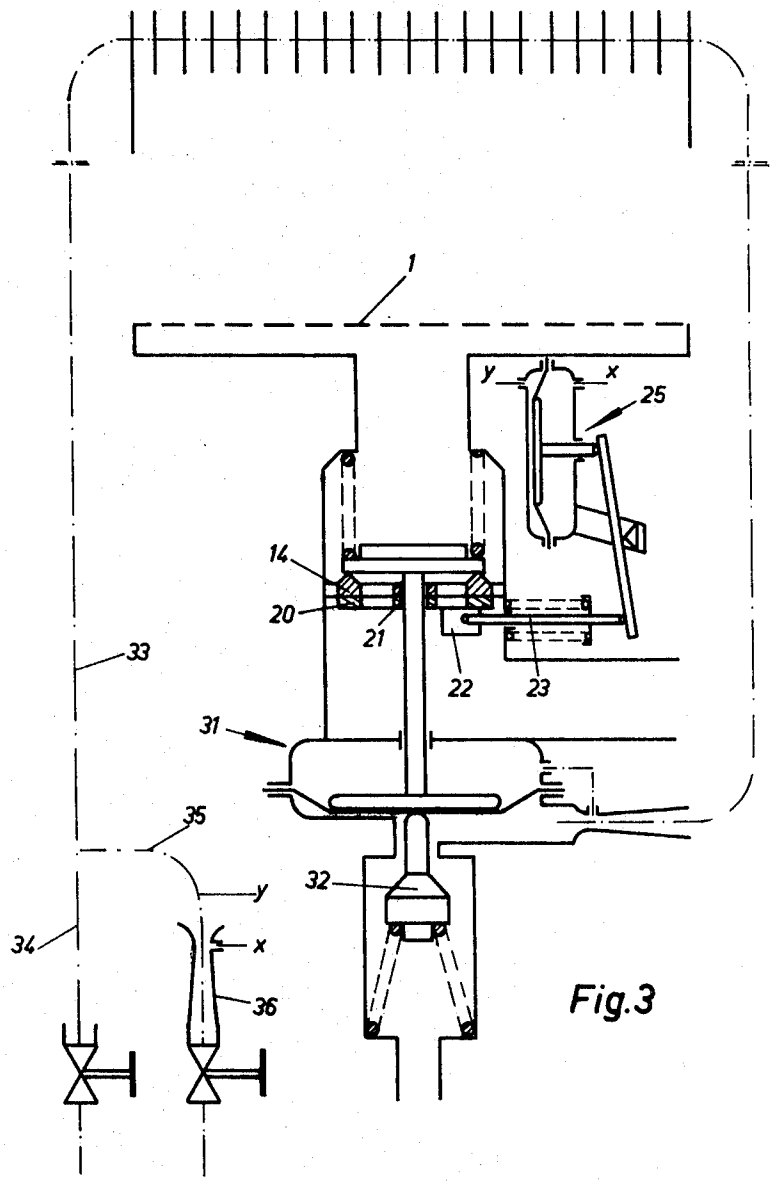

Fig.3

INVENTOR:
HANS MEIER
BY
Darbo, Robertson & Vandenburgh

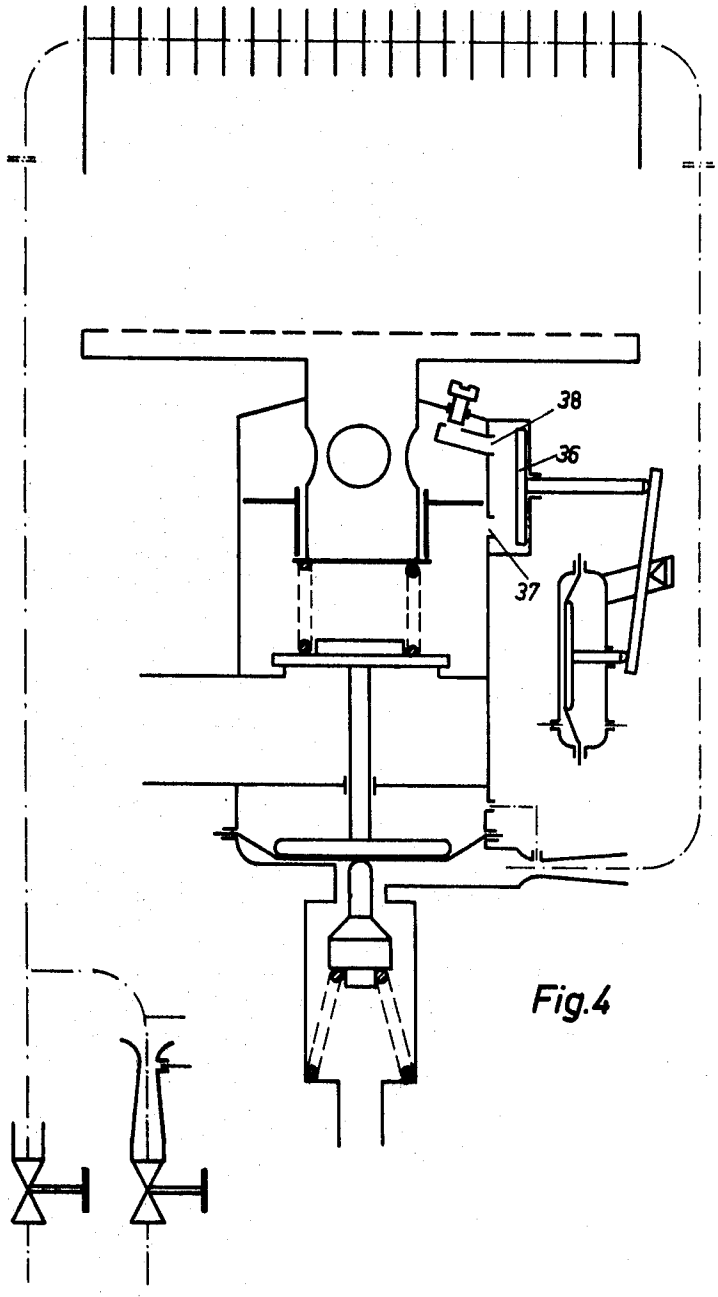

Fig.4

INVENTOR:
HANS MEIER
BY
Darbo, Robertson & Vandenburgh

GAS-HEATED HOT WATER HEATER

BACKGROUND OF THE INVENTION

1. Prior Art

The prior art includes a gas-heated hot water heater comprising a circulating water heater with a heat exchanger for heating domestic water by the circulating water. Therein, the heat exchange is disposed in a connection line short-circuiting the heating circuit with provision for priority being given to the heating of the domestic water by the circulating heating water when domestic water is drawn. In this connection, it is prior art to provide an automatic control device for providing full gas supply during the heating-up period and, in some instances, also when domestic water is drawn with a throttled gas supply during heating operation. This attained by providing a water actuator responding to a dynamic differential pressure in the short-circuiting portion of the heating circuit, which throttles the gas supply when the connection line is shut off or throttled. Thus, the changeover of the hot water heater to throttled performance is made dependent on the water flow through the heating circuit containing the radiators. This water flow is derived in the conventional manner, for instance, by means of a venturi tube or an apertured restrictor as dynamic differential pressure or by the flow resistance of the radiators between supply and return flow conduits. In this prior arrangement, the restrictor is provided by a pair of stops rotatable with respect to each other and having cutout portions, the diaphragm-type actuator engaging one of the stops in a rotating sense against the action of a spring.

In such apparatus, domestic water heating would always be effected with full performance of the appliance. Frequently, this is not desirable. Full performance of the apparatus is, for instance, required if large amounts of hot water such as for filling a bathtub or for shower bathing shall be tapped. A smaller output is required at other locations where, for instance, water is tapped for filling the relatively small lavatories. For this purpose, the full performance of the apparatus is too great. In apparatus of the aforesaid type this will lead, for instance, to an undesirably strong heating of the circulating water and, hence, of the tapped domestic water. This becomes noticeable in a particularly disagreeable manner in circulating water heaters of great output.

2. Present Invention

The present invention relates to a gas water heating apparatus having several taps in which the gas supply to the burner is controlled as a function of the flow through at least one of the taps.

It is an object of this invention to avoid the aforesaid disadvantages of the prior apparatus.

According to the invention, in a gas-heated hot water heating apparatus having several taps this is attained by having a restrictor incorporated in the gas supply conduit to the burner, which is adjustable to a reduced gas flow cross section by a flow sensor connected between hot water heater and one of the taps. Thus, the gas supply to the burner is throttled automatically in dependence on a flow sensor and operation is effected with reduced heating output when water is drawn at a specific tap which belongs, for instance, to a lavatory.

In one embodiment, the passageway for flow of the domestic water is already branched internally of the apparatus to form two conduit branches from the water heater and the flow sensor is arranged in one of these conduit branches.

The arrangement may be such that the flow sensor is formed by a venturi tube and a diaphragm-type actuator, that the gas restrictor is a pair of stops rotatable with respect to each other and having cutout portions, and that the diaphragm-type actuator engages one of the stops in a rotating sense against the action of a spring.

In another embodiment, the hot water heater is designed as a circulating water heater including a heat exchanger for heating domestic water by the circulating water, with the heat exchanger being disposed in a connection line short-circuiting the heating circuit, when domestic water is tapped. A venturi tube is arranged in the heating circuit adapted to be short-circuited, by which a second diaphragm-type actuator is operable, and that the rotatable stop is also operable by the second diaphragm-type actuator. Thus, a single stop is provided which throttles the gas supply both during heating operation only and also when tapping water at specific taps. Throttling of the gas supply may be effected to differing performance values of the different modes of operation.

DESCRIPTION OF DRAWINGS

FIG. 1 schematically illustrates a circulating water heater embodying the invention, and including a heating system;

FIG. 2 illustrates the restrictor for throttling the gas supply;

FIG. 3 illustrates a modified embodied form of the invention; and

FIG. 4 illustrates another modification of the invention.

DESCRIPTION OF SPECIFIC EMBODIMENTS

The following disclosure is offered for public dissemination in return for the grant of a patent. Although it is detailed to ensure adequacy and aid understanding, this is not intended to prejudice that purpose of a patent which is to cover each new inventive concept therein no matter how others may later disguise it by variations in form or additions or further improvements. The claims at the end hereof are intended as the chief aid toward this purpose, as it is these that meet the requirement of pointing out the parts, improvements, or combinations in which the inventive concepts are found.

In FIG. 1 a gas burner 1 is illustrated schematically. It is supplied with gas from a conduit 2 through a gas valve 3. As is conventional, the gas burner 1 is positioned below a heating section (not shown) closed at the top by a multiple fin block 4 acting as a heat exchanger. Connected to the input and output sides of a multiple fin block 4 are return flow conduit 5 and a supply flow conduit 6, respectively, of a circulation heating system. A circulating pump 7 is connected in the return flow conduit 5. The supply flow conduit 6 leads to a changeover valve 8 which has a connection 9' leading to bypass line 9. From the changeover valve 8 a branch 6' of the supply flow conduit leads to the room radiators 11, to which the return flow conduit 5 also is connected.

The bypass 9 directly communicates the supply flow conduit 6 with the return flow conduit 5 through a heat exchanger 10. Heat exchanger 10 has a coil 10' through which domestic water flows. In the illustrated setting of the changeover valve 8 the supply flow conduit 6 communicates with the connection line 9 so that the circulating pump 7 generates a water circulation in a small circulation circuit through the multiple fin block 4, the supply flow conduit 6, the changeover valve 8, the connection line 9 and return 5. At the same time, the heating circuit containing the radiators 11 and the branch 6' of the supply flow conduit is short-circuited.

The changeover valve 8 includes a valve closure 8' which is moved axially by a servomotor 12. Closure 8 also is designed as thermostatic expansion body. A changeover valve 8 of the type indicated is more fully described in the German Pat. application No. V 29,774 X/36e, DBP 1,266,944. As long as domestic water is drawn through coil 10', the changeover valve 8 remains in the illustrated position. As soon as the draw of domestic water is interrupted, the valve closing body 8' is shifted towards the right by the servomotor 12, but it does not shut off the opening 9' of the connection line 9 until the supply water in the supply flow conduit 6 has exceeded a specific temperature.

Thus, during the initial heating-up period, the changeover valve 8 assumes such a position that the communication of the supply flow conduit 6 is open to both conduit branch 6' and the connection line 9. Therefore, with relatively cold supply water, a large amount of water flows through the connection line 9 due to the smaller flow resistance and only a small amount of water flows to the radiators 11 through the conduit branch 6'. As the temperature of the supply flow water in-

creases the body 8' expands and the greater becomes the proportion of the water flowing through the conduit branch 6' and the smaller becomes the proportion of the water flowing through the connection line 9. Ultimately, the connection line 9 is shut off altogether and the total amount of water then flows into the heating circuit through 6'.

The gas valve closure 3 is urged by a spring 13 to the seated position on a valve-seat ring 14. The closure 3 is raised from the valve-seat ring 14 by an electromagnet 16 provided with a dash pot device 15. The electromagnet 16 is energized through contacts 17 which are closed by a diaphragm-type water actuator 18. The diaphragm-type water actuator 18 connects to a venturi tube 19 arranged in the supply flow conduit 6. As long as the circulating pump 7 is operating to produce water circulation in the system, a differential water pressure is generated at the venturi tube 19, causing the water actuator 18 to respond and the magnet 16 to be actuated. By this arrangement, acting as a water deficiency safety device, the gas valve 3 is held open water deficiency safety device, the gas valve 3 is held open while the circulating pump 7 is operating.

A gas restrictor is connected in front of the gas valve 3 (FIG. 2) to throttle the gas flow. In the disclosed embodiment, this gas restrictor takes the form of a shutter valve comprising a rotatable stop 20, rotatably mounted on a collar 21 of the valve seat ring 14. The stop 20 has four solid sectors between which are openings. Sectors 20' cover corresponding sector-shaped apertures 14' of the valve-seat ring 14 to a greater or lesser extent depending upon the rotational position of stop 20. A downwardly projecting radial lug 22 is provided on the rotatable stop 20 and is engaged by a driving pin 23. The driving pin 23 is urged outwardly by an encircling spring 23*a* toward the position at which the shutter valve is fully open. Against that urging the shutter valve is rotated toward the closed position by a water actuator 25, moving lever 24 and pin 23.

The water actuator 25 has two connections *x* and *y* leading to two connections *x* and *y* respectively on venturi 30 and line 28. The coil 10' in the heat exchanger 10 communicates with the house water supply 26. The domestic water heated in the coil 10' is passed on through the hot water conduit 27. The conduit 27 is divided into the branch conduits 28 and 29. When the tap provided at the end of the branch conduit 29 is opened, there is no effect on actuator 25 and the position of stop 20 so that the shutter valve remains fully open. However, when hot domestic water is drawn through the branch conduit 28, a pressure differential is created between pipes *x* and *y* at venturi 30. This pressure differential (acting through connections *x* and *y*) causes water actuator 25 to rotate stop 20 to reduce the gas flow to burner 1 to a predetermined extent. The maximum water flow through branch 28 is less than that though branch 29 due to the presence of venturi 30 in branch 28. The extent to which the gas flow is reduced is correlated with this difference in maximum water flow.

According to FIG. 3, the invention may also be used in a normal gas-heated instantaneous water heater which is not designed as a circulating water heater and whose water actuator 31 has a volumetric water regulator 32. The hot water output of this apparatus is distributed into two branch conduits 34 and 35 connected to the output line 33. Though both branches the same, relatively small, amount of water can be drawn. While the amount of water which can be tapped from the first branch 34 is heated by the full gas load, when hot water is drawn from the second branch 35, there is a pressure differential at connections *x* and *y* of the flow sensor. In response to this pressure differential, actuator 25 partially closes the shutter valve 14, 20 to reduce the gas flow to the burner. This flow sensor includes a venturi tube 36 arranged in branch conduit 35. The differential pressure water actuator 25 and shutter valve are similar to the embodiment of FIGS. 1 and 2.

For drawing large amounts of water, such as when filling a tub, cold water is admixed to the water heated with the full load (branch 34) to a relatively high temperature. The same, relatively small, amount of water having a lower temperature and heated with partial load is, for instance, suited for filling a lavatory from branch 35.

As illustrated in FIG. 4, changeover to partial load can also be effected through a throttle valve 36 in the bypass channel 37, 38 of the volumetric gas governor designed in the conventional manner.

I claim:

1. In a gas water heater apparatus having a water line leading to a plurality of taps and including a gas burner with a gas conduit leading to the burner, the improvement comprising:
   - a water flow sensor in one water line leading to one of the taps;
   - an adjustable gas flow restrictor in said conduit; and
   - control means connected to said sensor and to said restrictor for reducing the as flow in the conduit in response to the flow of water in said one line.

2. In an apparatus as set forth in claim 1, wherein
   - said sensor includes venturi;
   - said restrictor is a shutter valve including a rotatable stop; and
   - said control means includes a diaphragm-type differential pressure actuator operatively connected to said stop and connected to the venturi.

3. In an apparatus as set forth in claim 2 including spring means operatively associated with said rotatable stop for urging said stop in one direction, said actuator being connected to move the stop in the other direction against said urging.

4. In an apparatus as set forth in claim 3 which apparatus is a circulating water heater with feed and return lines and a heat exchanger device for heating domestic water with a portion of the device connected as a bypass between said feed and return lines, wherein
   - said flow sensor being operatively connected to said heat exchanger device to respond to flow through said device only.

5. In an apparatus as set forth in claim 4, wherein said heat exchanger has a domestic water conduit, said taps being downstream of said domestic water conduit.

6. In an apparatus as set forth in claim 1 which apparatus is a circulating water heater with feed and return lines and a heat exchanger device for heating domestic water with a portion of the device connected as a bypass between said feed and return lines, wherein
   - said flow sensor being operatively connected to said heat exchanger device to respond to flow through said device only.

7. In an apparatus as set forth in claim 6, wherein said heat exchanger has a domestic water conduit, said taps being downstream of said domestic water conduit.

8. In an apparatus as set forth in claim 3 and having a finned block heat exchanger heated directly by the burner heat, said heat exchanger having a conduit through which the domestic water flows, said line being connected to said conduit downstream thereof.

9. In an apparatus as set forth in claim 1 and having a finned block heat exchanger heated directly by the burner heat, said heat exchanger having a conduit through which the domestic water flows, said line being connected to said conduit downstream thereof.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,625,423 Dated December 7, 1971

Inventor(s) Hans Meier

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 1, line 8 "exchange" should be -- exchanger --; Col. 1, line 16 after "This" insert -- is --; Col. 2, line 58 after "as" insert -- a --; Col. 3, lines 19-20 after "open" delete " water deficiency safety device, the gas valve 3 is held open " ; Col. 3, line 52 "though" should be -- through --; Col. 3, line 60 "Though" should be -- Through --; Col. 4, (Cl.1) line 22 "as" should be -- gas --; Col. 4, line 25 (Cl. 2) after "includes" insert -- a --.

Signed and sealed this 20th day of June 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

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* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334