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(11) Publication number:

0 418 580 A1

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: **90116113.3**

(51) Int. Cl.⁵: **E03C 1/10**

(22) Date of filing: **22.08.90**

(30) Priority: **19.09.89 US 409570**

Lawrence, Massachusetts 01842(US)

(43) Date of publication of application:
27.03.91 Bulletin 91/13

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(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IT LI LU NL SE

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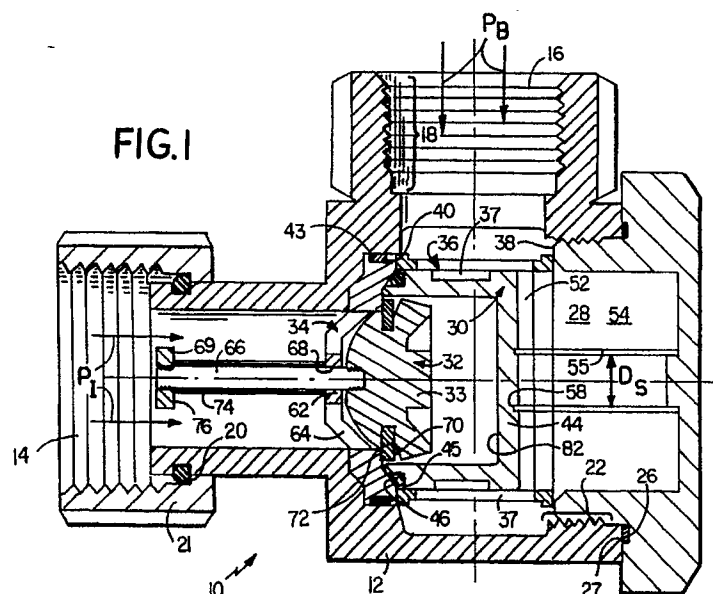
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(54) **Dual check valve.**

(57) A dual check valve backflow preventer (10) includes a valve body (12) defining a volume (28) and an inlet (14) and an outlet (16) for flow of liquid through the valve. Disposed within the valve body (34) are first and second valve seats, and first and second check valve assemblies. Each valve assembly includes a valve element (30,32), a seal (72,46) mounted upon the valve element and, e.g., springs (55,74) that urge the seal into engagement with the valve seat (34). The first valve element (30) is mounted for movement within the valve body (44) along a

valve axis, between a closed position and an open position for flow of fluid from the inlet toward the outlet. The second valve element (32) is mounted for movement independent of the first valve element (30), along the same valve axis, also between a closed position and an open position for flow of fluid from the inlet toward the outlet. The first valve element (30), at least in closed position, overlaps the position of the second valve element (32) in open position.



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DUAL CHECK VALVE

The invention relates to backflow preventors of the dual check valve type.

In many circumstances, e.g., in connection of public utility water feed lines to domestic systems, it is desirable to provide enhanced protection against flow of water back into the utility lines, e.g., should a loss of pressure occur, by provision of two or more backflow preventors or check valves.

In low risk situations, and particularly where cost is important, e.g., for single-family domestic use, the dual check valve type backflow prevention may be employed.

One such dual check valve (Series 7, sold by Watts Regulator Company of North Andover, Massachusetts) has two separate check valve modules disposed in sequence within a body for independent operation. A dual check valve (sold by The Ford Meter Box Company, Inc. of Wabash, Indiana) has two interacting valve elements, i.e., the second valve element is urged into sealing engagement by a spring bearing on the first valve element, thus, the valve elements are not separate. Ames Company, Inc., of Woodland, California, sells a dual check valve consisting of two, separate check valves placed in sequence in inlet piping for this purpose.

SUMMARY OF THE INVENTION

According to the invention, a dual check valve backflow preventer comprises a valve body defining a volume and an inlet and an outlet for flow of liquid through the volume of the valve body, and, disposed within the valve body, a first valve seat and a second valve seat, a first check valve assembly comprising a first valve element, a first seal mounted upon the first valve element and means for urging the first seal mounted on the first valve element into sealing engagement with the first valve seat, and a second check valve assembly, separate from the first check valve assembly, comprises a second valve element, a second seal mounted upon the second valve element, and means for urging the second seal into sealing engagement with the second valve seat, the first valve element is mounted for movement within the valve body along a valve axis, between a closed position and an open position for flow of fluid from the inlet toward the outlet, and the second valve element is mounted for movement independent of the first valve element along the valve axis between a closed position and an open position for flow of fluid from the inlet toward the outlet, and the first

valve element, at least in closed position, overlapping the position of the second valve element in open position.

Preferred embodiments of the invention may include one or more of the following features. The valve body further defines an access opening sized for removal and replacement of components in the back flow preventer within the volume, and the valve body further comprises a cap for sealed closure of the access opening. The first valve element has the form of a cup, and the second valve element, at least in its open position, extends within the cup. The dual check valve backflow preventer further comprises a removable valve seat body means defining the first and second seats, preferably the valve seat body means comprises a first valve seat body element defining the first valve seat and a discrete second valve seat body element defining the second seat. The second check valve assembly further comprises a mounting member, and the means for urging the second valve element into sealing engagement comprises a spring disposed between the mounting member and the second valve element, preferably the second valve element further comprises an elongated element extending through the mounting member. The mounting member further defines the second valve seat. The means for urging the first valve element into sealing engagement comprises a spring disposed between the first valve element and the valve body.

These and other features and advantages will be seen from the following description of a presently preferred embodiment and from the claims.

Preferred Embodiment

We first briefly describe the drawings. Fig. 1 is a side section view of a dual check valve of the invention; Figs. 1A and 1B are face and side section views of the valve seat body of the dual check valve of Fig. 1; and Fig. 2 is a similar side section view of another embodiment of the valve seat body.

A dual check valve 10 of the invention includes a valve body 12 defining a flow inlet 14 and a flow outlet 16. The valve body at the flow outlet is threaded 18 for joining to a piping connector of, e.g., a domestic water supply system. The body at the flow inlet defines an axial groove 20 for receiving a swivel meter nut 21 for attachment of the valve to a domestic water meter. The body 10 is

also threaded at 22 for receiving in threaded engagement, access cap 24, with O-ring 26 disposed therebetween in groove 27 for maintaining a leak-tight seal.

Disposed within the volume 28 defined by valve body 12 are first check valve element 30 and second check valve element 32. The check valve elements are separate and mounted for independent operation. Also disposed with the volume of the body is a valve seat body 34, shown also in Figs. 1A and 1B, held in place by cage 36 disposed to extend between rim 38 of access cap 24 and valve seat body surface 40. (Cage 36 defines one or more orifices 37 for flow of water therethrough.) The valve seat body defines a groove 42 within which there is disposed O-ring 43 for water-tight seal about the seat body.

First check valve element 30 includes a cup-shaped body 44 defining a groove 45 within which there is disposed a first sealing ring 46, positioned to engage sealingly upon seat surface 48 of valve seat body 34. Valve element 30 is disposed in sliding engagement within cylindrical orifice 52 defined by cage 36 and aligned cylindrical orifice 54 of cap 24. Spring 55, disposed between cap 24 and valve element 30, urges the sealing ring 46 into sealing engagement with seat surface 48. Spring 55 has an inner diameter D_s , predetermined for interference fit about shoulder 56 of cap 24 at one end and annular orifice 58 defined by the valve element 30 at the other end. In this manner, cap 24, spring 54 and valve element 30 are joined integrally, with the valve element free to move axially (along axis A) relative to the cap, in response to water inlet pressure (P_i).

Also disposed within the volume 28 of the valve body 12, disposed about inlet 14 and held in place by valve seat body 34, is second check valve element mounting member 62, an integral element of valve seat body 34. Member 62 defines one or more orifices 64 for flow of water therethrough. Second valve element 32 includes an elongated element 66, in threaded engagement with valve body 33, that extends through corresponding orifice 68 in member 62 and terminates in threaded engagement with retaining nut 69.

Check valve element 32 defines an annular groove 70, within which there is disposed a second sealing ring 72, sized and constructed for sealing engagement upon sealing surface 49 of valve seat body 34. The second check valve element further includes a spring 74 engaged between the mounting member 62 and the undersurface 76 of nut 69, the spring 74 urging the second valve element into sealing contact with the valve seat surface. Nut 69 and spring 74 further act to limit axial travel of second valve element 32 in response to inlet pressure P_i to a distance that is less than the depth of

the cup portion of first valve element 30 (between the surface of member 62 and the inner base surface 82 of cup portion 44), thereby to maintain independent operation of the separate check valve elements, even when the second valve element 32 has failed and is fully open (right-most position) and the first valve element 30 is in sealing engagement (left-most position).

The dual check valve 10 of the invention is installed in a domestic water supply line with the valve inlet 14 connected to a water meter (not shown) and the outlet connected to a domestic system (also not shown).

In the absence of inlet water pressure, separate first and second check valve element 30, 32 are urged independently by springs 55, 74, respectively, to cause first and second sealing rings 46, 72, respectively, into sealing engagement with respective valve seat surfaces 48, 49.

Upon application of inlet pressure P_i , the check valve elements are urged out of sealing engagement. If inlet flow ceases (or if a backflow pressure P_b from outlet 16 exceeds the level of inflow pressure P_i), springs 55, 74 urge both check valve elements back into sealing engagement, thereby to prevent potentially contaminating flow from the domestic system back into the utility system. Due to the nature of the separate dual check valves of the invention, should either check valve fail, the other operates independently to check backflow.

In order to inspect or repair or replace the components of valve 10, cap 24 is unthreaded and removed from body 12, drawing spring 55 and first check valve element 30 from within the valve body, and allowing removal of cage 36. Valve seat body 34 and the second check valve element 32 with spring 74 may thereafter be removed as a unit. Any or all of these components, and/or O-rings or seals, may be repaired or replaced with the valve body still in place in the piping, and the dual check valve 10 reassembled for operation.

Other elements are within the following claims. For example, valve seat body 34' (Fig 2) may be formed as two discrete elements, including a first valve body element 133 defining first valve seat surface 48' for first check valve element 30, and a second valve body element 134 defining second valve seat surface 49' for second check valve 32 and mounting member 62'.

Claims

1. A dual check valve backflow preventor comprising:
a valve body defining a volume and an inlet and an outlet for flow of liquid through the volume of said valve body, said inlet and said outlet being oriented

at approximately 90 degrees to one another and, disposed within said valve body,

a first valve seat and a second valve seat,

a first check valve assembly comprising a first valve element, a first seal mounted upon said first valve element, and first check assembly means for urging said first seal mounted upon said first valve element into sealing engagement with said first valve seat, and

a second check valve assembly, separate from said first check valve assembly, comprising a second valve element, a second seal mounted upon said second valve element, and second check valve assembly means, separate and independent of said first check valve assembly, for urging said second seal mounted upon said second valve element into sealing engagement with said second valve seat, said second check valve assembly means for urging disposed out of contact with said first check valve element,

said first valve element mounted for movement within said valve body along a valve axis, between a closed position and an open position for flow of fluid from said inlet toward said outlet, and

said second valve element mounted for movement separate and independent of said first valve element along said valve axis between a closed position and an open position for flow of fluid from said inlet toward said outlet, and

said first valve element, at least in said closed position, overlapping the position of said second valve element in said open position.

2. The dual check valve backflow preventer of claim 1 wherein said valve body further defines an access opening sized for removal and replacement of components of said back flow preventer within said volume, and said valve body further comprises a cap for sealed closure of said access opening.

3. The dual check valve backflow preventer of claim 1 wherein said first valve element has the form of a cup, and said second valve element, at least in its open position, extends within said cup.

4. The dual check valve backflow preventer of claim 1 further comprising a removable valve seat body means defining said first and second seats.

5. The dual check valve backflow preventer of claim 4 wherein said valve seat body means comprises a first valve seat body element defining said first seat and a discrete second valve seat body element defining said second seat.

6. The dual check valve backflow preventer of claim 1 wherein said second check valve assembly further comprises a mounting member, and said means for urging said second valve element into sealing engagement comprises a spring disposed between said mounting member and said second valve element.

7. The dual check valve backflow preventer of

claim 6 wherein said second valve element further comprises an elongated element extending through said mounting member.

8. The dual check valve backflow preventer of claim 6 or 7 wherein said mounting member further defines said second valve seat.

9. The dual check valve backflow preventer of claim 1 wherein said means for urging said first valve element into sealing engagement comprises a spring disposed between said first valve element and said valve body.

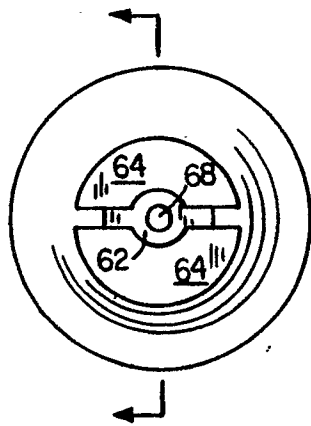


FIG. 1A

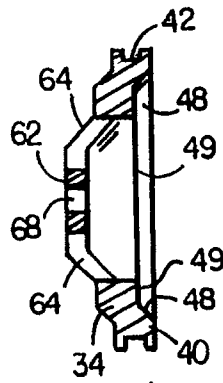


FIG. 1B

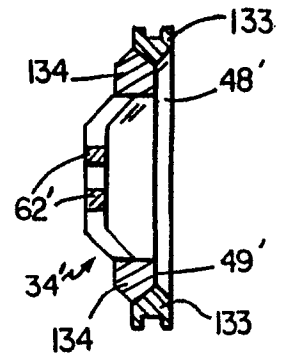
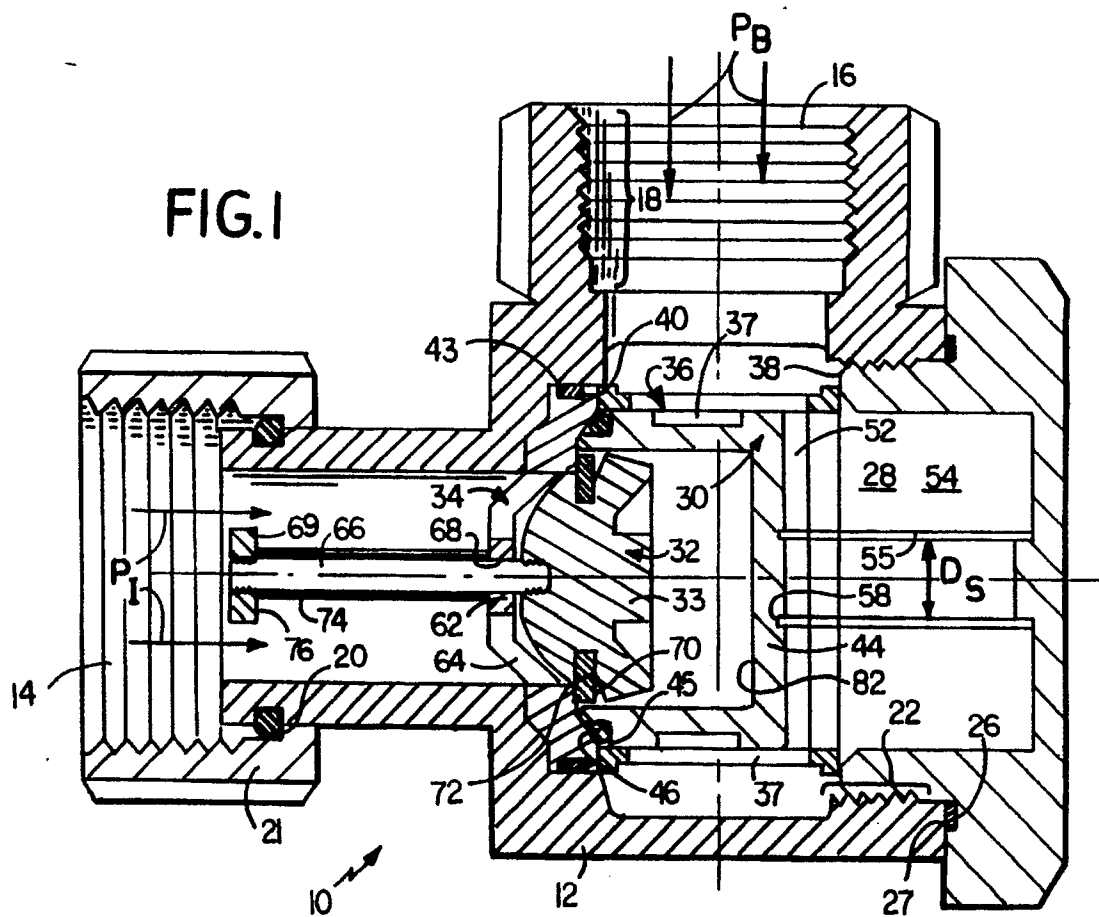


FIG. 2





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Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 11 6113

DOCUMENTS CONSIDERED TO BE RELEVANT					
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)		
A	US-A-4 284 097 (BECKER et al.) * Figure 2 * - - -	1,2,6-8	E 03 C 1/10		
A	US-A-4 172 469 (BOEHRINGER) * Claim 1; figures 1,2 * - - -	1,3			
A	AT-B-3 668 03 (ZIKESCH GmbH) - - - - -				
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)		
			E 03 C F 16 K		
The present search report has been drawn up for all claims					
Place of search The Hague		Date of completion of search 19 December 90	Examiner VAN BEURDEN J.J.C.A.		
<table><tr><td>CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention</td><td>E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons ----- &: member of the same patent family, corresponding document</td></tr></table>				CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention	E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons ----- &: member of the same patent family, corresponding document
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