

[54] BACKFLOW PREVENTER

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Related U.S. Application Data

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[58] Field of Search 137/218, 454.6, 102, 137/494, 625.36, 454.2, 625.33, 625.34, 625.35, 625.39, 625.38

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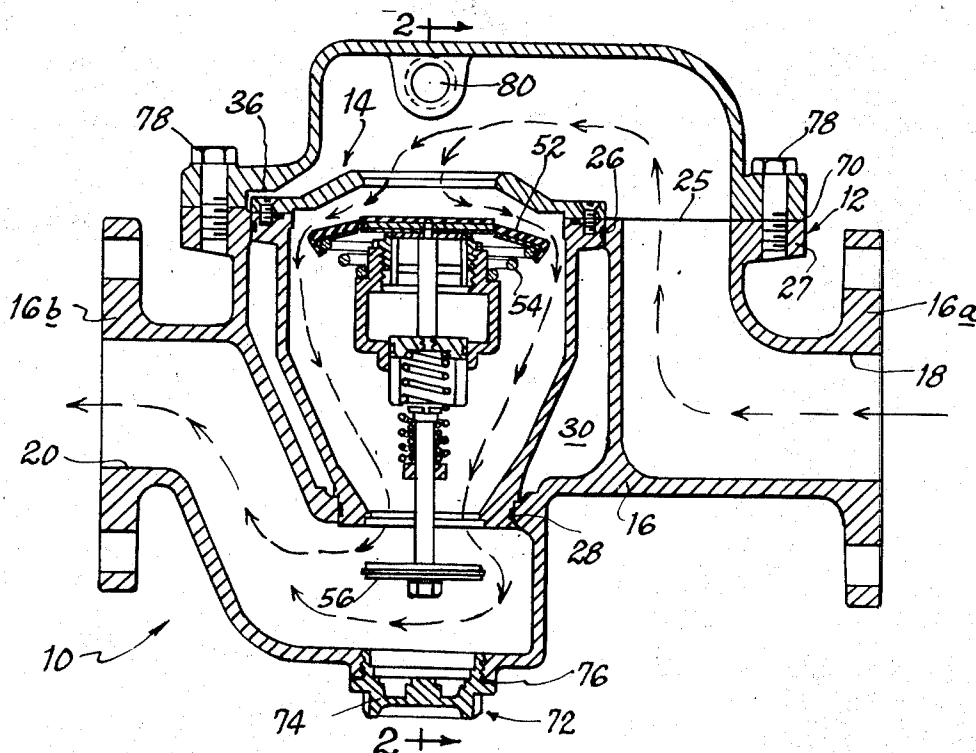
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[57] ABSTRACT

An in line assemblage of a cross-connection control valve that permits ready removal or insertion of a cross-connection control valve in a cartridge-like manner is achieved by providing a control valve module that includes a valved inlet and outlet and a venting port, and by providing an in line housing having a body shaped and arranged to receive therein in operative association the control valve module. The in line housing includes a removable cover which cooperates with the module to prevent dislocation of the module within the housing body, but when removed permits of rapid removal and accurate insertion of a module into the housing body.

8 Claims, 3 Drawing Figures



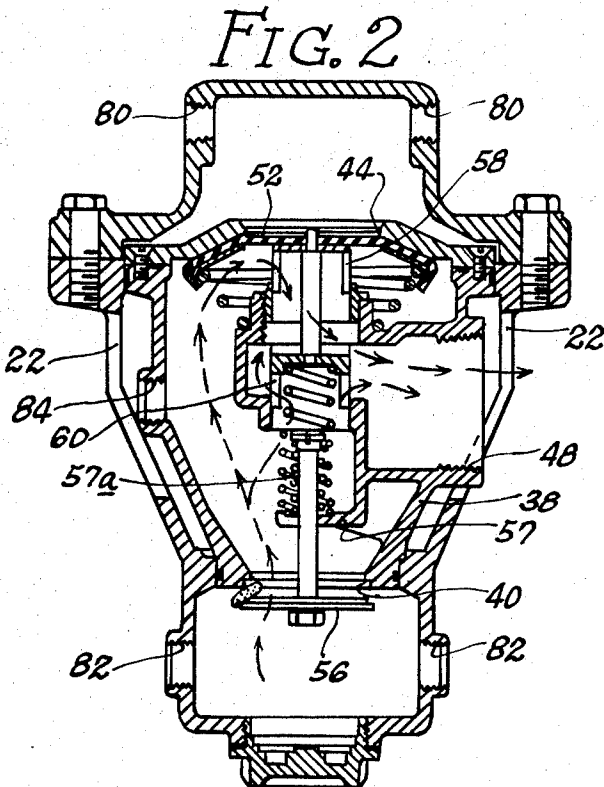
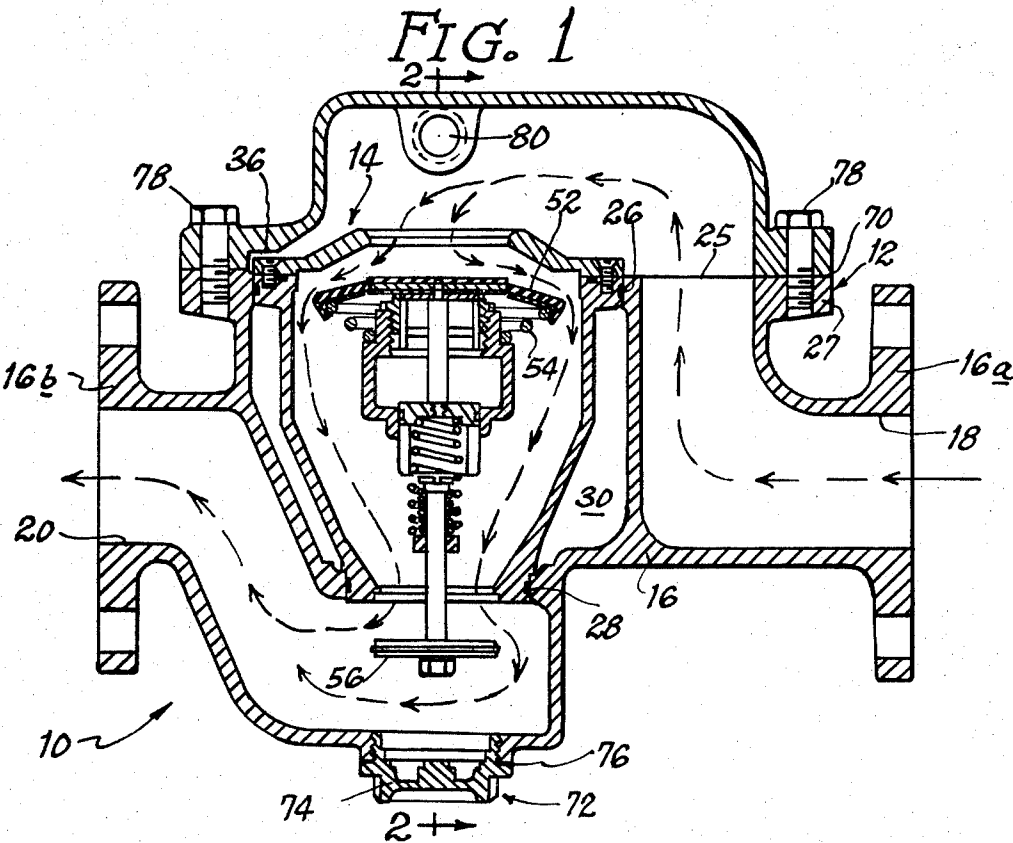
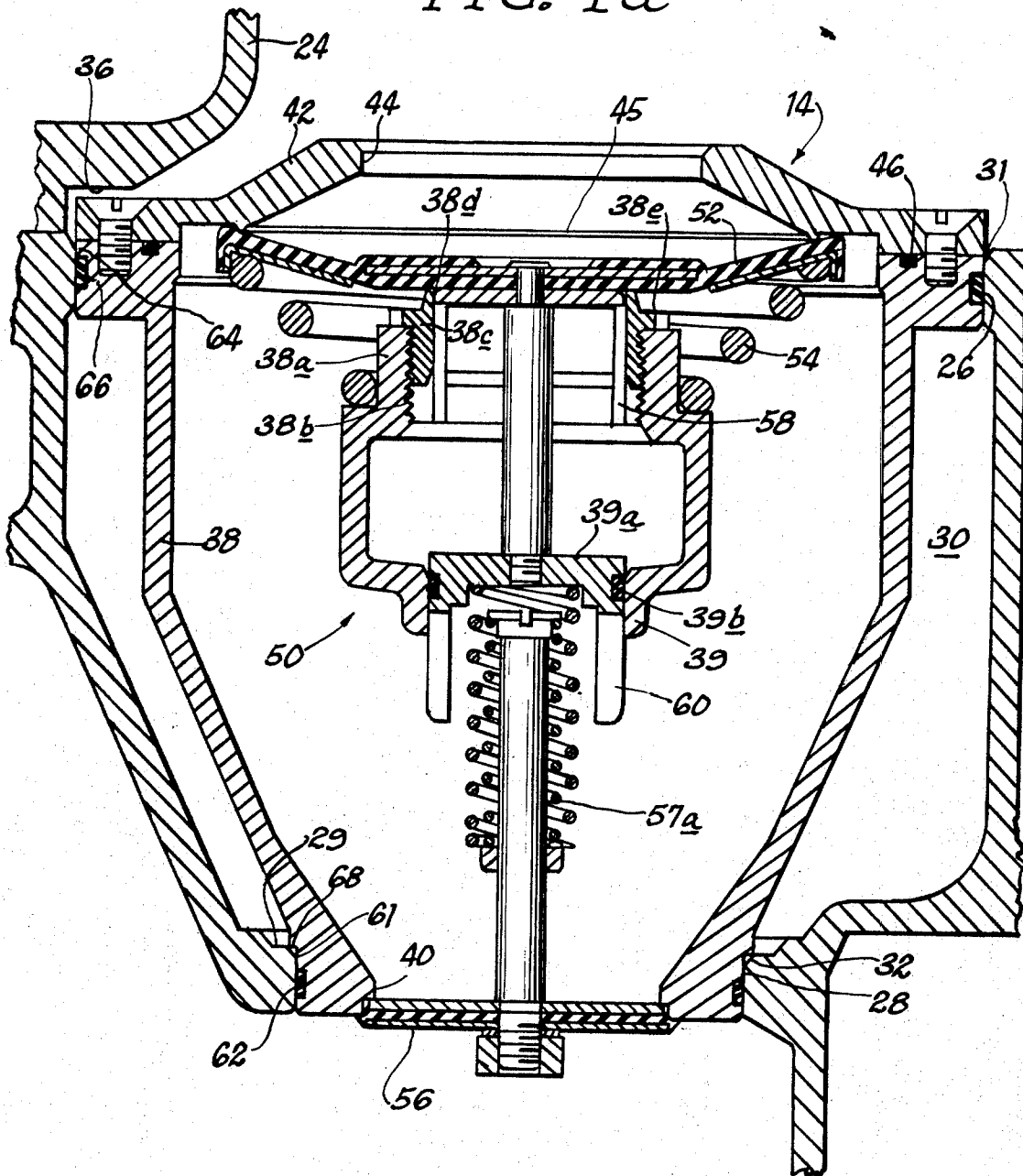


FIG. 1a



BACKFLOW PREVENTER

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of U.S. Pat. application Ser. No. 78,057 filed Oct. 5, 1970 now U.S. Pat. 3,636,968.

BACKGROUND OF THE INVENTION

Since cross-connection control valves are important for protection of community health by preventing contamination of water supply from backflows, it is also important that such control valves be readily serviced in the field in the event of a malfunction.

It is desirable that a cross-connection control valve of the type generally disclosed in my said co-pending application be adapted for typical in line installation and for ease of servicing in the field. It has heretofore been found desirable to provide control valve housings with laterally spaced upright attachment flanges that afford an in line layout wherein the attachment flanges of the valve housing bolt to attachment flanges of adjacent pipe sections.

Accordingly, it is an object of this invention to provide an in line installation of a cross-connection control valve wherein the valving functions are performed by a self-contained valve module that is operatively mounted within a housing body which is adapted for a permanent in line installation, and with the housing body provided with a removable cover that when separated from the housing body permits of ready removal of a malfunctioning module and accurate insertion of a functioning module into the housing body, so as to afford simple and rapid field servicing of malfunctioning cross-connection control valves.

Another object of this invention is to provide a cross-connection control valve that is characterized by its flexibility of construction and installation for purposes of both field servicing and for arrangement of discharge or venting therefrom in one of a plurality of alternate directions.

Still another object of this invention is to provide a cross-connection control valve having features thereof that provide for economy and effectiveness in construction.

SUMMARY OF THE INVENTION

By virtue of this invention there is provided a backflow preventer assembly which includes a housing and a modular cartridge-like valve assembly which is readily accessible when a top cover of the housing is removed, the module then being readily removed from or inserted into the body of the housing.

The valve assembly and the body of the backflow preventer are provided with mating surfaces which permit the valve to effectively direct flow through and to appropriate passageways without leakage therebetween. The housing and valve assembly are each provided with means for locating and maintaining the valve assembly module in a sealingly operative position in the housing body.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal cross-sectional view, taken substantially on a vertical plane through the longitudinal axis of a backflow preventer valve embodying the invention, and showing the valve in an open position;

FIG. 1a is a greatly enlarged fragmentary view of a portion of FIG. 1, but showing the valve in its normally closed position; and

FIG. 2 is a transverse cross-section view taken substantially on line 2—2 of FIG. 1, but with the valve in closed position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIGS. 1 and 1a, a backflow preventer assembly 10 is shown as including a housing 12 and a cartridge-type cross-connection control valve assembly 14. The housing 12 includes an elongated, hollowed body portion 16, which provides an inlet passageway 18 at one end, an outlet passageway 20 at the opposite end, and a pair of diametrically opposed venting or discharge ports 22 positioned at substantially right angles to the longitudinal axis of the body 16. A top cover 24 which is bolted to the body 16 forms part of the inlet passageway 18, as well as closing the access opening 25. The access opening 25 is generally defined by the inner periphery of the body flange 27 and when the cover is removed the opening 25 permits access to the interior of the body 16 and the valve 14. The ends of body portion 16 are provided with annular upright attachment flanges 16a and 16b adapted for typical bolting connection to similar attachment flanges of adjacent pipe sections (not shown).

The body portion 16 defines an internal circularly-shaped upstream seat 26 adjacent the downstream end of inlet passageway 18. A second, internal, circularly-shaped seat 28 is defined by the body portion 16 downstream of seat 26. The upstream and downstream seats 26 and 28 are co-axially aligned and arranged in a parallel-spaced relation. Both seats are machined to provide circular sleeve-like surfaces which will sealingly engage with mating outer surfaces provided on the valve assembly 14, while permitting rotation of module 14 relative to the sleeve-like seats. Between the two seats 26 and 28, there is defined an annular chamber 30, which is in communication with the venting or discharge ports 22 seen in FIG. 2.

The upstream side of the lowermost seat 28 is surrounded by an abutment shoulder 29, which operates to support the valve module by being engaged by an annular flange defined on the module. The uppermost ends of sleeve-seats 26 and 28 respectively, merge into beveled edges 31 and 32.

The cover 24 of housing 12 is provided with an inverted and downwardly facing shoulder 36 which is arranged in spaced relation above upstream seat 26, so as to closely overlie an uppermost portion of module 14 to prevent the upstream movement of the valve assembly 14 once the valve assembly 14 and the cover 24 are in position.

The cross-connection control valve assembly 14 includes an elongated annular hollow body 38 having an outlet port 40 at the downstream end thereof. A shaped and machined inlet cap 42 having a central inlet port 44 therein is secured adjacent its outer circular edge by screws to the upstream end of body 38. A seal 46 is provided inwardly of the screw connectors between cap 42 and body 38. The underside of cap 42 is provided with a downwardly projecting annular valve seat 45 and a frusto-conical abutment surface extending inwardly and upwardly from valve seat 45 to port 44. The annular body 38 includes a venting or discharge port defined

by laterally-extending sleeve 48 which is disposed intermediate the inlet port 44 and outlet port 40. The valving mechanism 50 and its method of operation in which the flow between the inlet port 44, the outlet port 40 and the discharge port 48 is fully described in the above identified co-pending patent application.

Briefly, under normal flow conditions the valves within housing 38 are in the positions shown in FIG. 1. There a spring-biased, upstream flexible disc 52 is urged to its flow position with its central portion seated on a valve seat to close off flow to discharge sleeve 48, and the outer annular portion of disc 52 is flexed downstream against frusto-conical spring 54 away from valve seat 45 so as to permit flow as illustrated by the arrows. The flow then urges the rigid, disc-shaped, downstream valve member 56 to its open position so as to permit the flow, shown by the arrows, to exit from the valve. The valve disc 56 is spring-biased toward closed position so that when there is no inlet flow the valve disc 56 will seal and close the outlet port 40. Similarly, when there is no flow the spring-biasing action flexes the outer portion of disc 52 against the inlet cap 42 thereby closing the valve assembly 14 to any further inflow.

The downstream valve disc 56 is controlled through an upright stem that extends through an apertured abutment wall 57 formed on valve body 38 and which serves as a seat for the restoring spring 57a for the valve disc 56. The interior of valve body 38 also includes two valves that control communication with discharge sleeve 48. There is an upper annular valve seat against which the underside of flexible disc 52 is to be pressed, and there is a lower valve sleeve 39 through which a valve member 39a slides carrying a sliding seal gasket 39b for sealing engagement with sleeve 39. The valve member 39a is connected to the central portion of disc 52 and moves in unison therewith between closed position of FIG. 1 and open position of FIG. 2 in which backflow occurs as shown by the arrows in FIG. 2.

In the event of backflow as in FIG. 2 it can be seen that the disc 56 closes the outlet port 40 which effectively prohibits the flow into the valve assembly 14. In the event that the valve disc 56 should be stuck or held in the open position by virtue of foreign matter caught between the disc 56 and the port 40, the flow into the valve assembly 14 urges the flexible disc 52 to move upwardly and into surface engagement with the inlet cap 42 and thus further closes the inlet port 44. It is seen in FIG. 2 that as the central portion of the flexible disc 52 moves upwardly a cup assembly 58 with slotted side walls also moves in the upstream direction thereby permitting flow to pass through the cup flange and into the chamber communicating with the discharge sleeve 48. Furthermore, this upstream flow causes a downstream-positioned slotted cup 60 to also move upstream and thereby permit further flow to exit through the discharge port 48.

As an improvement in the construction of the valve, the valve body 38 is shaped to provide an upper internal annulus 38a that is externally-shaped to provide a right-angular seat for the lower coil of spring 54 and with an upwardly elongated centering stud internally threaded at 38b to provide for separable coupling thereto of a valve seat annulus 38c. The valve seal annulus 38c has an inner circular wall for sliding cooperation with the slotted flange of cup 58 and has an upper tapered edge 38d that provides a valve seat for sealing engagement by compression with the underside of flex-

ible disc 52. The annulus 38c has spaced between the longitudinal ends thereof an outwardly extending flange 38e that is adapted to limit movement of the upper edge of annulus 38c relative to annulus 38a. This arrangement provides a valve seat 38d that is more flexible for purposes of manufacture and assembly.

FIG. 1a depicts the valve mechanism 50 in the no flow condition with the inlet port 44, outlet port 40 and discharge port 48 all being closed to flow.

The external periphery of the annular body 38 adjacent the outlet port 40 is provided with a circular surface 61 which is adapted to matingly but rotatably cooperate with the downstream sleeve-seat 28. In order to assure sealing engagement therebetween, a gasket, or annular O-ring, 62 is also provided. The upstream end of the housing 38 is also provided with an external circular peripheral surface 64 which matingly but rotatably cooperates with the upstream sleeve-seat 26. An annular O-ring 66 is also provided so as to assure sealing engagement between the surface 64 and the seat 26. Adjacent the upstream end of circular surface 61 the body 38 is provided with an outwardly-extending support flange 68 that is arranged to engage the shoulder 29 formed on body portion 16.

The lateral extent of sleeve 48 from the axis of module 14 is less than the radius of circular surface 64 so that there is no obstruction to entry of module 14 into position within body portion 16. The rotatability of module 14 relative to sleeve-seats 26 and 28 permits of selective alignment of discharge sleeve 48 with one or the other of the two openings 22 in body portion 16, thereby affording flexibility in arranging for direction of discharge although the housing 12 is at a fixed attitude.

In order to prevent dislocation by upstream movement of the assembly 14 (in the event of a back pressure for example) the cover restraining shoulder 36 is aligned to engage a substantial portion of peripheral edge of the inlet cover cap 42. The shoulder 36 is disposed just slightly upstream of the upstream edge of the inlet cap 42 so that in the event the valve housing 14 pushed upwardly by back pressure, the inlet cap 42 will abut the shoulder 36 and thus valve 14 will not unseat from the seats 26 and 28, thus assuring retention of sealing thereat.

A gasket 70 is provided at the access opening between the body 16 and cover 24 so as to prevent leakage from the interior of the backflow preventer to the exterior thereof. The housing 12 is also provided with a trap-like cleanout 72 at the lowest portion of the outlet passageway 20. As can be seen from either FIG. 1 or 2, the cleanout includes a threaded plug 74 and its associated annular gasket 76; in order to clean out the preventer assembly, the plug is merely unscrewed from the body and the housing cleaned.

In normal operation water flows through the inlet passage 18 in the body 12, through the passage 18 as defined by the cover 24 and into the inlet 44 defined in the inlet cap 42 of the valve assembly 14. The valve mechanism 50 permits the water to continue to flow through the valve assembly 14 and exit the assembly at the outlet port 40 from which the water flows into the outlet passageway 20 and into the rest of the system. It will be appreciated that this is the only direction the flow can take as a result of the various seals and valving arrangement 50. In the event of a back pressure, i.e., flow into the valve assembly outlet 40 as seen in FIG.

2, the flow enters the outlet port 40 and by virtue of the mechanism 50, it is directed through the discharge sleeve 48. In a back-siphonage condition, i.e., a reduced pressure on the inlet side of the valve assembly 14, the valve assembly will be closed to flow through the outlet 40 as well as through the inlet 44.

In the event that the valve assembly 14 requires servicing, the cover 24 is removed by disengaging the bolts 78 and lifting the cover 24 from the body 12. This exposes the valve assembly 14 which may be removed by lifting it upwardly. The valve assembly 14 may then be serviced or a new assembly may then be inserted. After the servicing procedure is completed, the housing is closed by replacing the cover 24 and bolting it to the body 16 by means of the bolts 68.

Other modular cross-connection control valve assemblies could be used provided they: are of a cartridge-like construction; include the appropriate surfaces for seating the assembly in the body; include means for isolating the inlet, outlet and discharge ports from each other; and have the appropriate restraining shoulders. Thus, this invention is not limited to the particular internal construction of the valve assembly 14.

As seen in FIG. 2, a plurality of tapped holes are provided in housing 12 and in module body 38 for purposes of attachment of accessories such as pressure measuring means. Thus, cover 24 is provided with a pair of diametrically opposed and tapped holes 80 to which a pressure sensing device may be connected to measure static pressure upstream of module 14. Only one hole 80 is required, but presence of a second hole provides flexibility in installation. Similarly, a pair of tapped holes 82 are provided in the housing 16 so that pressure downstream of module 14 may be measured and observed. A pressure tap 84 on module housing 38 located diametrically opposite discharge sleeve 48 provides means for checking pressure in module 14 between the inlet and outlet ports thereof, and one of the openings 22 provides access to tap 84 from outside of housing 12.

It will be understood that numerous changes and modifications can be made to the embodiment shown herein without departing from the spirit and scope of this invention.

What I claim and desire to secure by Letters Patent of the United States is:

1. In a valve to prevent contamination of a source of incoming water by backflow, the combination of: a valve module having an intake, an outlet, a discharge passageway through which backflow that enters from said outlet is shunted to avoid backflow passing through said inlet into the source of incoming water, and valve means in the module for controlling ordinary flow from intake to outlet while closing off the discharge passageway and for directing backflow from outlet to discharge passageway while closing off the intake, housing means for receiving therein the valve module and including spaced inlet means and an outlet means and a module-receiving chamber provided between the inlet and outlet means; the housing providing spaced circular sleeves adjacent the module-receiving chamber, a circular abutment shoulder surrounding one of said sleeves, at least one opening in the housing to said module-receiving chamber to provide for backflow discharge from the housing; and a removable cover on the housing for providing access to the module-receiving chamber; and the valve module in-

cluding a casing having defined thereon spaced circular seal portions of a size adapted to effect simultaneous mating cooperation with the spaced circular sleeves on the housing, an outwardly-extending flange on the valve module adjacent one of the circular seal portions positioned for engagement with the circular abutment shoulder on the housing to locate the module in position in the module-receiving chamber of said housing, and sealing means between each pair of circular mating surfaces on the module and housing.

2. A device as in claim 1 wherein the housing is provided with a removable cover shaped and arranged to partially define the inlet means of the housing and a portion of the cover being arranged to be positioned adjacent and overlap the module in close relation thereto to serve as means for limiting any tendency of upstream movement of the module when the cover is in place on the housing.

3. A device as in claim 1 wherein the housing has two openings therein arranged transversely of the line of flow between inlet and outlet and diametrically of each other to permit of selective alignment of the discharge passageway of the module through one of the said two openings, so as to provide for flexibility of installation for the housing.

4. A device as in claim 3 wherein the casing of the valve module is provided with a pressure tap therein diametrically opposite of the discharge passageway of the module, and the housing and housing's cover are each provided with a pair of diametrically opposed pressure taps therein, so as to provide for flexibility of arrangement of pressure measuring attachments to the housing and to the valve module therein.

5. A device as in claim 1 wherein the circular sleeves in the housing are of different diameter and the circular abutment shoulder surrounds the sleeve of lesser diameter.

6. A device as in claim 1 wherein the housing opening is spaced between the planes of said spaced circular sleeves.

7. In a valve to prevent contamination of a source of incoming water by backflow, the combination of: a valve module having an intake, an outlet, a discharge passageway through which backflow that enters from said outlet is shunted to avoid backflow passing through said intake into the source of incoming water, and valve means in the module for controlling ordinary flow from intake to outlet while closing off the discharge passageway and for directing backflow from outlet to discharge passageway while closing off the intake; housing means for receiving therein the valve module and including spaced inlet means and an outlet means and a module-receiving chamber provided between the inlet and outlet means; the housing providing spaced circular seats adjacent the module-receiving chamber, an abutment shoulder adjacent one of said sleeves, and at least one opening in the housing to said module-receiving chamber to provide for backflow discharge from the housing; and the valve module including casing means having defined thereon spaced circular seal portions of a size adapted to effect simultaneous mating cooperation with the spaced circular seats on the housing, an outwardly-extending portion on the valve module adjacent one of the circular seal portions positioned for engagement with the abutment shoulder on the housing to locate the module in position in the module-receiving chamber of said housing,

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and sealing means between each pair of circular mating surfaces on the module and housing.

8. A device as in claim 1 including selectively operable means spaced from the abutment shoulder with the module positioned substantially between said means and abutment shoulder for limiting movement of the

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module, whereby when said selective operable means are in one position the module is held assembled in the housing means and when in another position the module may be removed from the housing means.

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