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(54) ELECTRIC MOTOR ACTUATED STOP AND SELF-CLOSING CHECK VALVE

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Publication Classification

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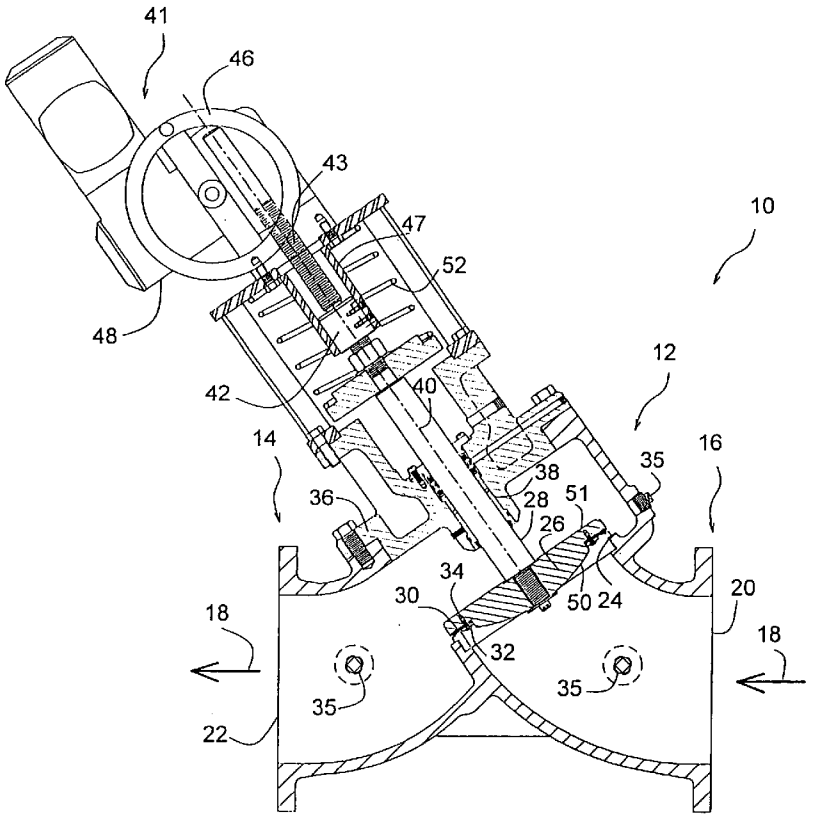
(52) **U.S. Cl.** **251/82**

(57) **ABSTRACT**

An electric motor actuated stop/check valve for industrial use such as liquid pumping systems which has a controlled opening and closing rate when liquid flow is in a forward direction but closes quickly upon reverse flow of liquid with no action from the electric motor actuator. A valve disc having an elongated disc stem contacts a valve seat when in a closed position to stop liquid flow. Actuation of the valve is by an electric motor which provides movement to an actuator rod which contacts the disc stem. The disc stem and the actuator rod are not connected which allows the valve disc and disc stem free movement, by action of the momentarily back-flowing liquid, to a back-flow preventing closed position when liquid forward flow is reversed. No action by the electric motor is required. A spring biasing the valve disc toward the closed position and a hydraulically operated valve closing-speed regulator reduces or eliminates slamming of the valve disc against the valve seat. In a preferred method of operation liquid surge pressure transients are reduced or eliminated and slamming of valve components is prevented.



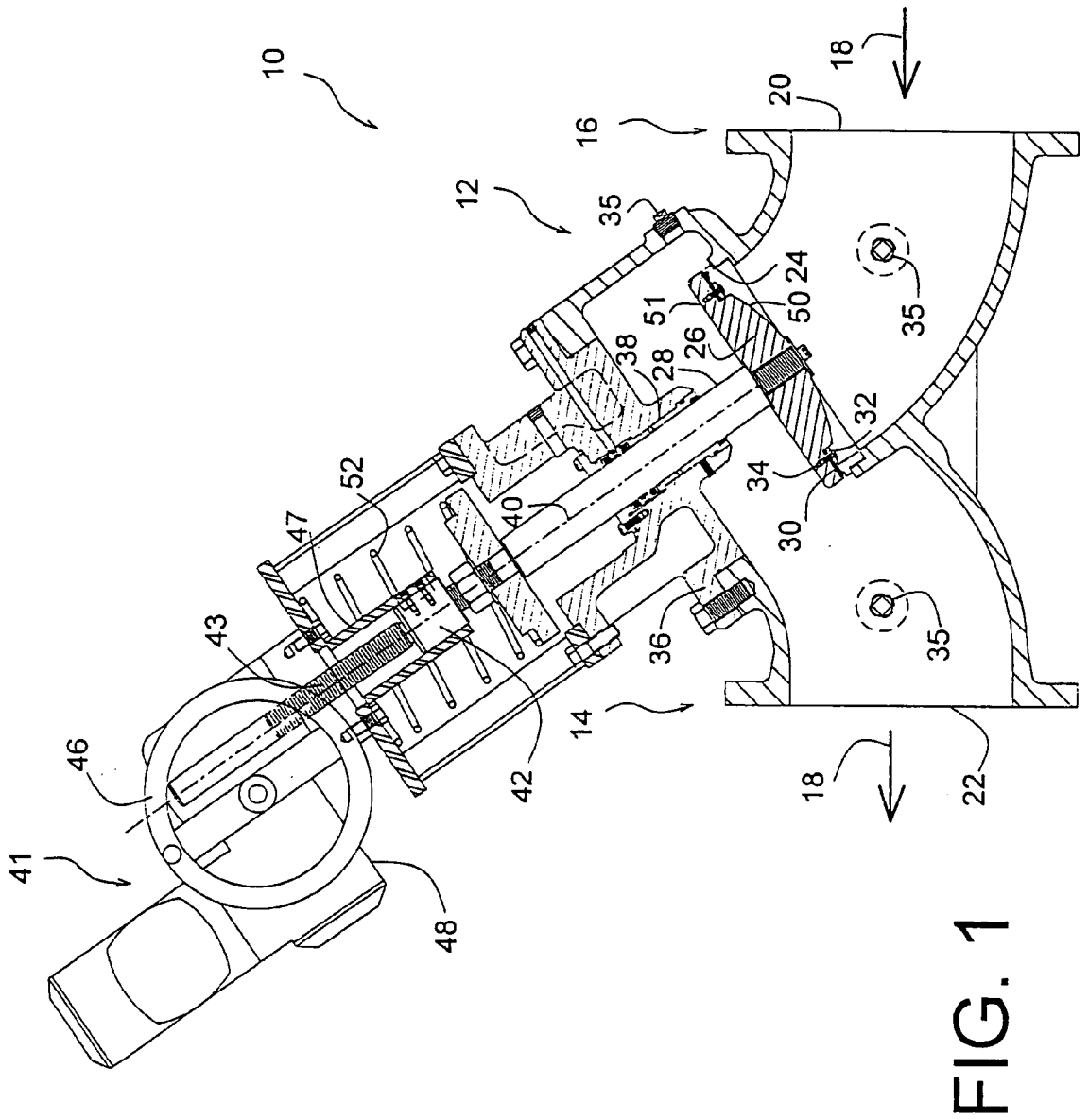

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FIG. 1

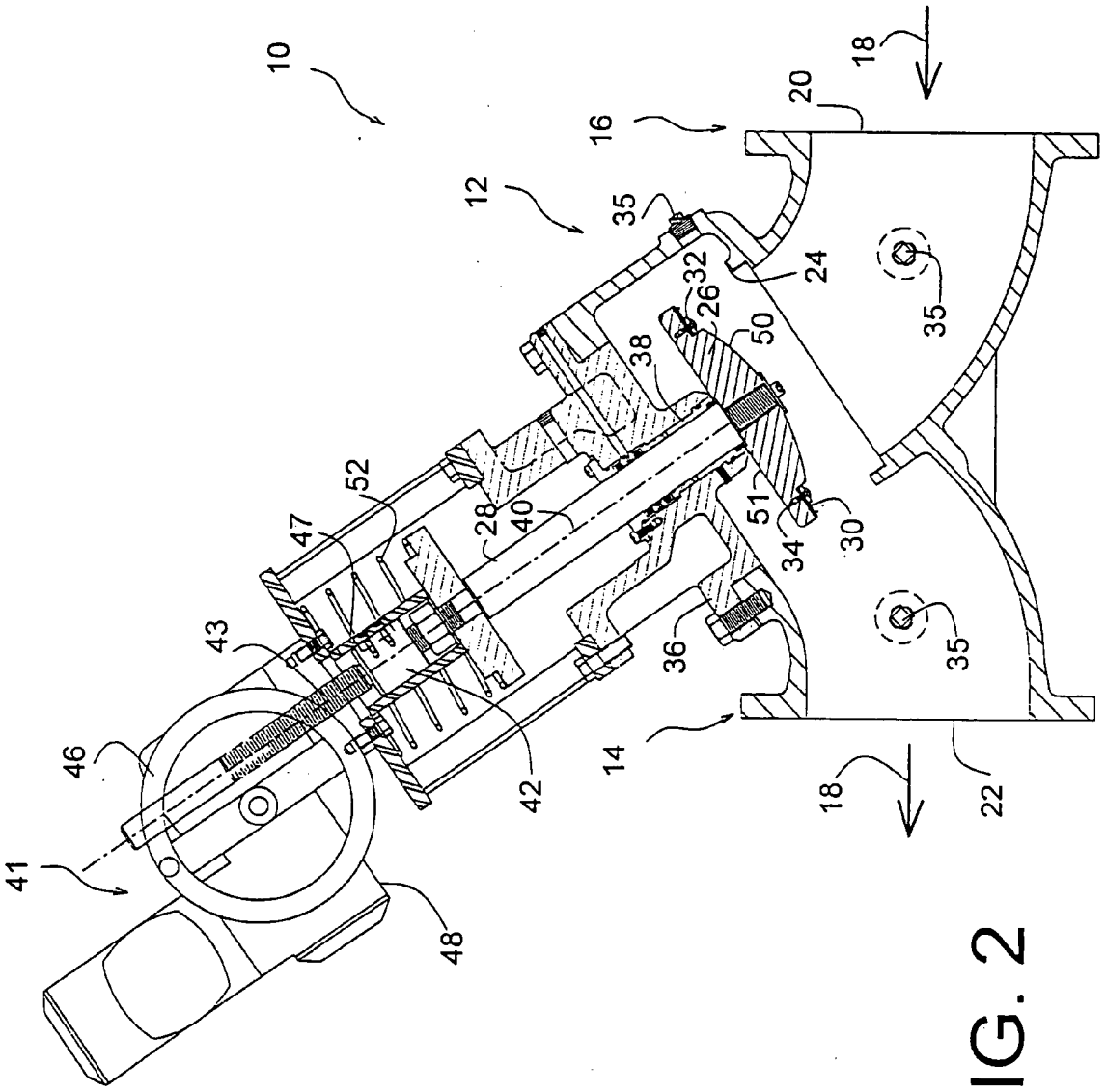
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FIG. 2

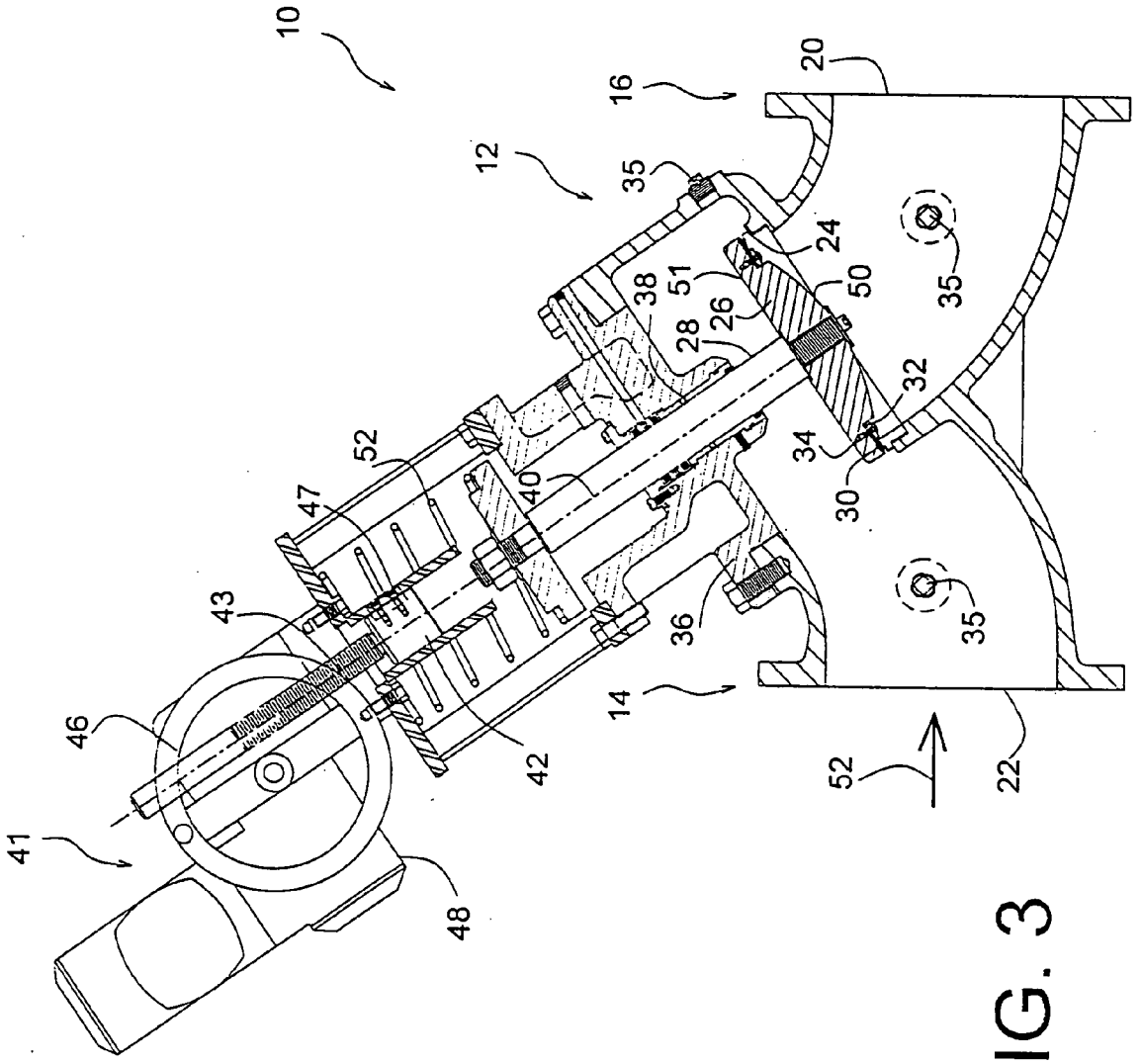
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FIG. 3

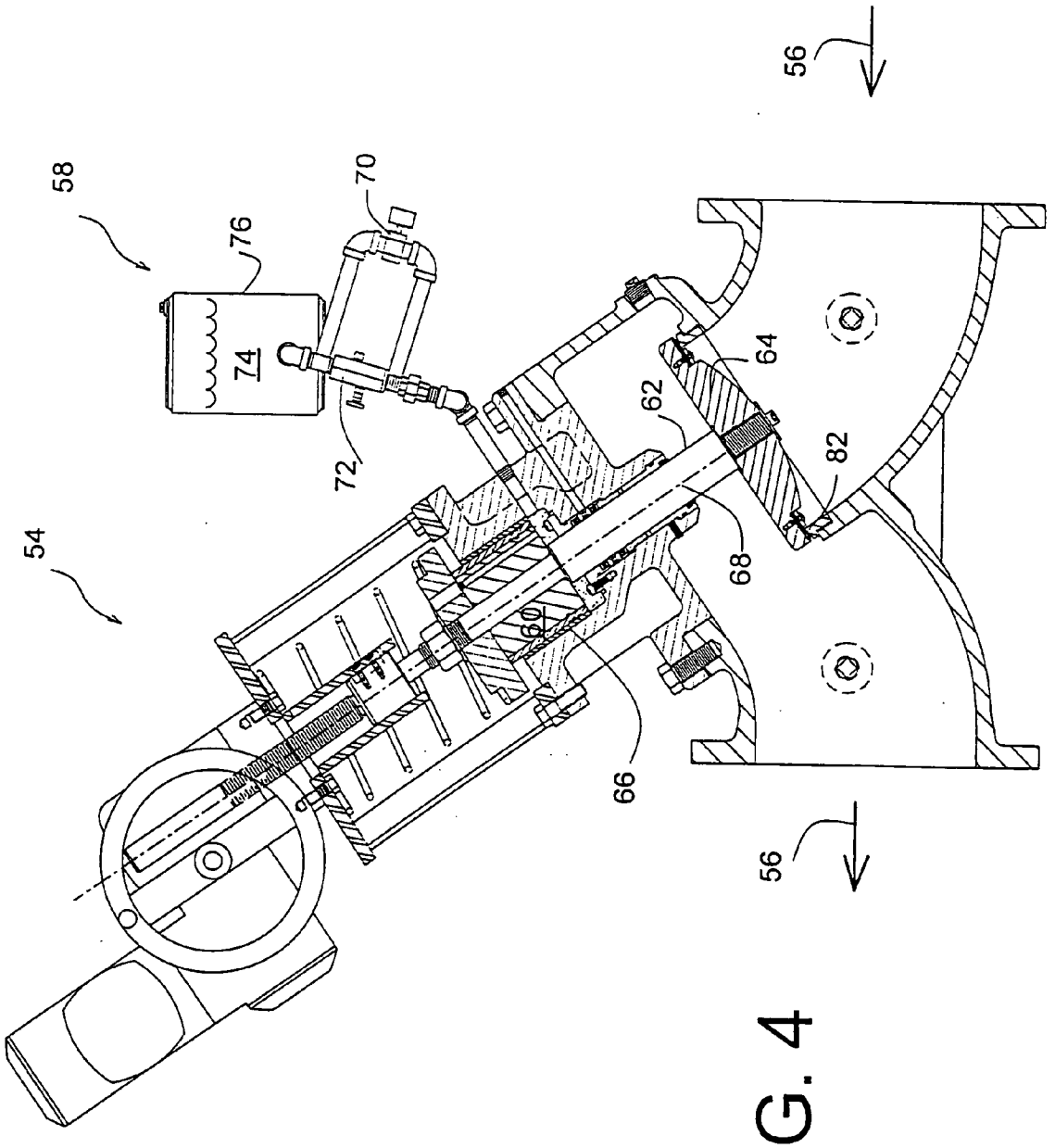

FIG. 4

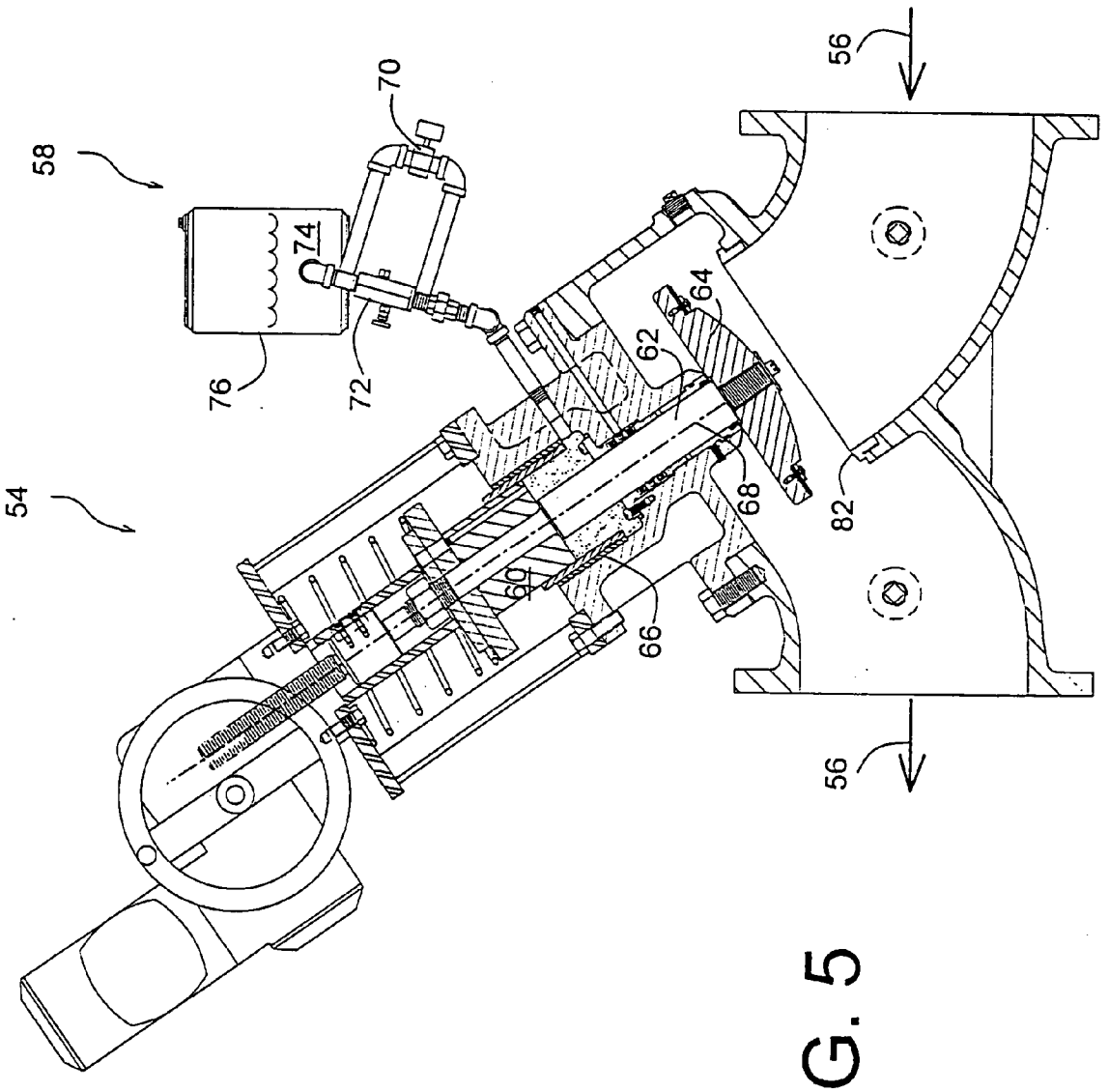

FIG. 5

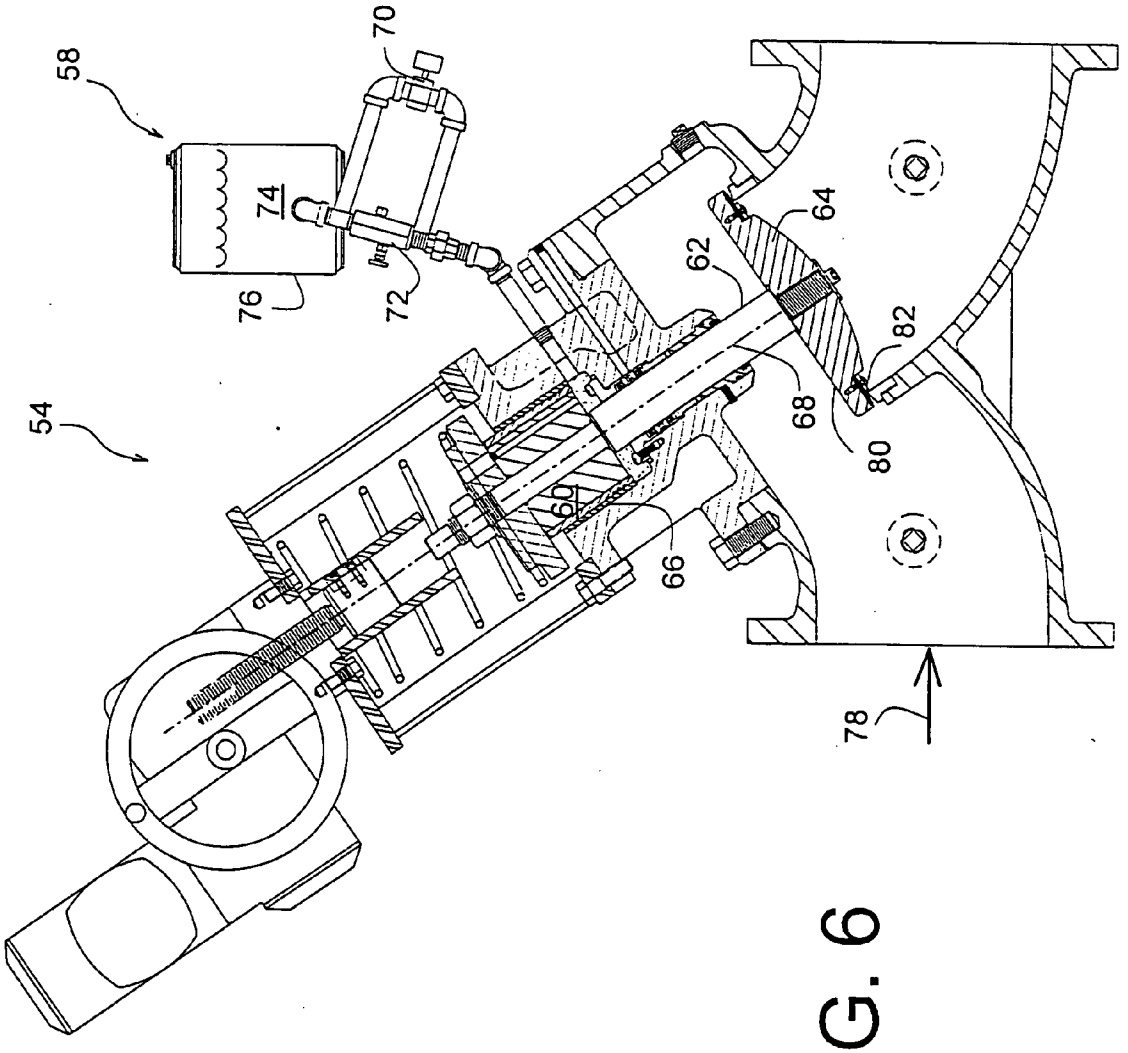

FIG. 6

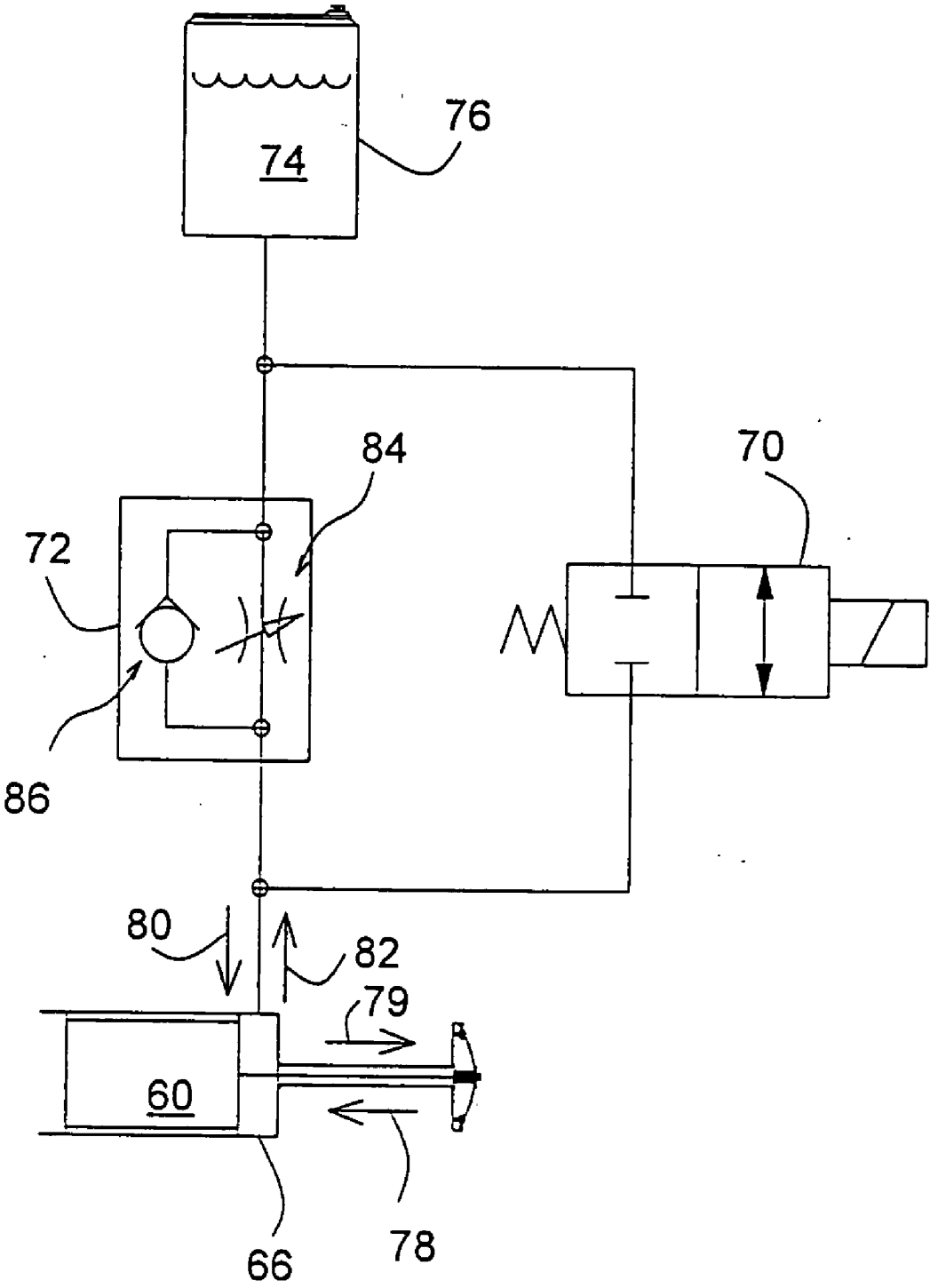

FIG. 7

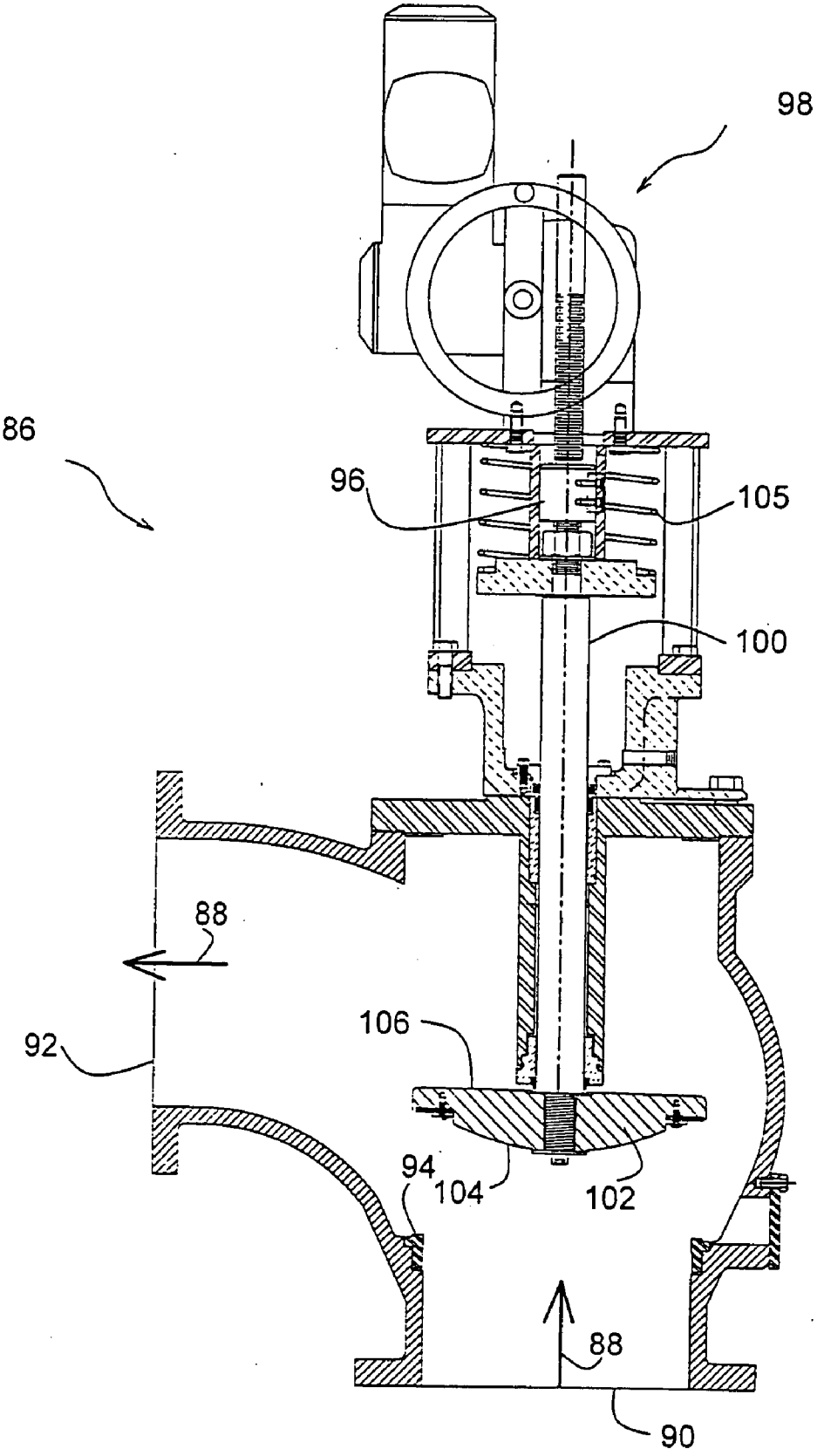

FIG. 8

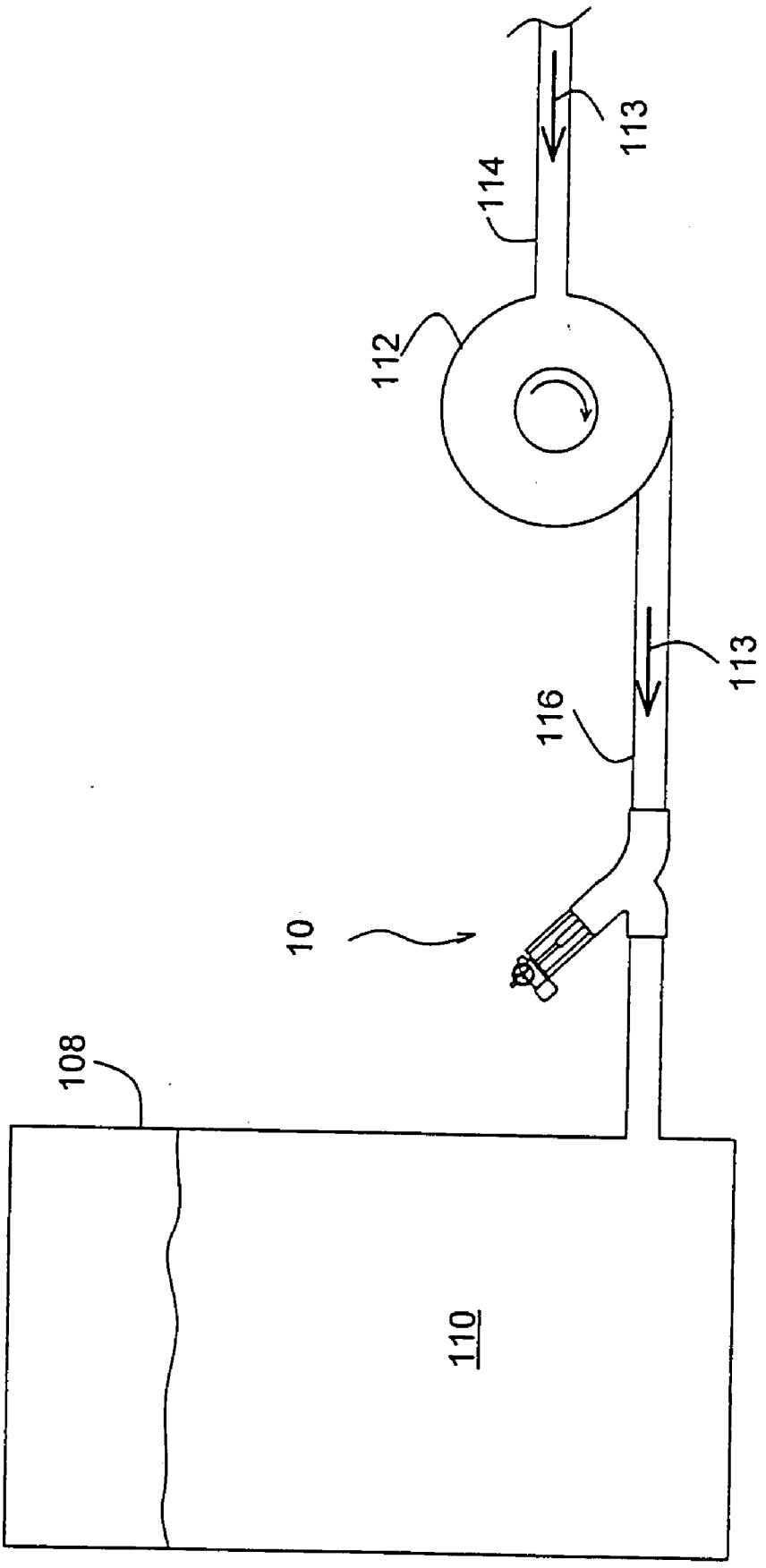

FIG. 9

ELECTRIC MOTOR ACTUATED STOP AND SELF-CLOSING CHECK VALVE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a Continuation of U.S. application Ser. No. 11/117,637, filed Apr. 28, 2005, which is a Continuation of U.S. application Ser. No. 10/942,062, filed Sep. 15, 2004, which is a Continuation-in-Part of application Ser. No. 10/617,435, filed Jul. 11, 2003, which is a Continuation-in-Part of application Ser. No. 09/507,273, filed Feb. 18, 2000. The contents of application Ser. No. 09/507,273 are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] This invention relates to electric motor actuated valves incorporating a check valve feature for controlling the flow of pumped liquids in applications such as are associated with municipal water supply or sewage treatment facilities and industry.

[0004] 2. Description of Related Art

[0005] Valves for controlling liquid flow and preventing its back-flow are known in the art and are commonly referred to as stop/check valves. Such valves can be actuated to control liquid flow by manual, hydraulic and other means.

[0006] U.S. Pat. No. 4,667,696 describes a stop/check valve which utilizes a ball which closes upon a valve seat to prevent liquid flow in a back-flow direction. Flow in a desired direction is regulated by a hand-cranked closing device acting on the ball.

[0007] U.K. Patent specification **141,148** describes a stop/check valve for fluid having a pressure plate extending from a clack into a path of return flow of the fluid so as to urge the clack to a closed position. In an embodiment having control of forward-flow, a hand-actuated spindle is used to position the clack.

[0008] U.S. Pat. No. 4,945,941 describes a stop/check valve having a feature facilitating movement of a valve disc to a closed position with back-flow of liquid by use of a ridge on the valve seat and a deflector ring on the valve disc to deflect the flow of the fluid. Control of the liquid for forward-flow is carried out with a hand-actuated valve stem.

SUMMARY OF THE INVENTION

[0009] The present invention provides an electric motor actuated valve to control liquid flow in a forward direction, prevent flow of the liquid in a reverse direction and carry out such control while eliminating or reducing liquid surge pressure transients and slamming of components within the valve. A discontinuous connection between a motor actuation component and valve seating components allows valve seating solely by means of liquid acting on the valve seating components to close the valve and prevent liquid back-flow. Such back-flow prevention occurs without action by the electric motor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. **1** is a vertical cross-section of a wye valve of the invention with an actuator rod in an extended position and a valve disc in a closed position;

[0011] FIG. **2** is a vertical cross-section of the wye valve of FIG. **1** with the actuator rod in a retracted position, the valve disc in an open position and liquid flow in a direction from an inlet port to an outlet port;

[0012] FIG. **3** is a vertical cross-section of the wye valve of FIG. **1** with the actuator rod in a retracted position and the valve disc in a closed back-flow preventing position;

[0013] FIG. **4** is a vertical cross-section of a wye valve embodiment of the invention having a closing speed regulator, an actuator rod in an extended position and a valve disc in a closed position;

[0014] FIG. **5** is a vertical cross-section of the wye valve of FIG. **4** with the actuator rod in a retracted position, the valve disc in an open position, and forward liquid flow in a direction from an inlet port to an outlet port;

[0015] FIG. **6** is a vertical cross-section of the wye valve of FIG. **4** with the actuator rod in a retracted position and the valve disc in a closed back-flow preventing position;

[0016] FIG. **7** is a schematic diagram of a valve closing speed regulator of the invention;

[0017] FIG. **8** is a vertical cross-section of an elbow valve embodiment of the invention with the actuator rod in a retracted position and the valve disc in an open position for forward liquid flow in a direction from an inlet port to an outlet port; and

[0018] FIG. **9** is a schematic diagram for describing a method of operating a pumping system with use of a wye valve of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0019] FIGS. **1**, **2** and **3** show an embodiment of the invention having a wye valve body which provides control of liquid flow when installed in-line with liquid conveying piping having a linear configuration. Wye valve **10** having valve body **12** is preferably installed in-line with use of flanges **14** and **16** which bolt together with matching flanges of the piping. Liquid flow is normally in the direction of arrows **18** and is referred to in this disclosure as forward-flow. In a typical application such flow would result from action of an up-stream pump. With forward-flow in the direction indicated by arrows **18** a port at **20** is referred to as an inlet port and the remaining port at **22** is referred to as an outlet port. Intermediate such ports and substantially perpendicular to the flow of liquid is a valve seat **24**. In a preferred embodiment the seat is annular in shape, is replaceable, and is fabricated of a metallic material such as bronze or stainless steel. The seat can be either threaded and held in place by complimentary threads or pinned in valve body **12**, which is preferably of a metallic material such as cast iron or ductile iron. Liquid flow is controlled by interaction of valve seat **24** and a valve disc **26** having an integral disc stem **28**. In FIG. **1** valve disc **26**, is disposed in a closed position whereat it is in contact with valve seat **24** so as to block the flow of liquid through the valve body. Valve disc **26** in the preferred embodiment is of cast iron or steel and can be fitted with a valve disc seat, **30**, of a resilient material such as rubber or UHMWPE (ultra high molecular weight polyethylene) to provide a more positive seal between the valve seat and the valve disc. Such valve disc

seat **30** is preferably retained by a bronze or stainless steel follower ring **32** attached to the valve disc with use of stainless steel screws **34**. Disc stem **28** is of stainless steel material. Clean-out/inspection ports **35** are provided in valve body **12** to view or gain access to the valve interior.

[**0020**] Disc stem **28** extends through a valve body cover **36** which in the preferred embodiment is provided with a bronze bushing **38** to enable substantially free movement of valve disc **26** and disc stem **28** along longitudinal axis **40** of the disc stem.

[**0021**] FIG. **2** depicts valve disc **26** and stem **28** after movement to a position referred to as the open position whereat liquid flow from inlet port **20** to outlet port **22** is enabled. Such flow position is contrasted with the valve disc position depicted in FIG. **1** which is referred to as the closed position.

[**0022**] The valve of the invention is used in-line to 1) stop flow in the forward direction, 2) control flow in the forward direction (from full flow to a restricted flow) and 3) prevent back-flow (flow in a direction opposite to forward-flow). In the preferred embodiment valve body **12** and valve seat **24** are dimensioned such that the net flow area is no less than the cross-sectional area of the piping to the inlet and outlet ports so as to minimize flow restriction by the valve. That is the liquid does not encounter a cross-section, perpendicular to the direction of flow, which is of less area than the cross-sectional area of the adjacent piping. Configuration of the valve body, valve seat and valve disc is such that dead or non-flow cavities do not exist within the valve body and the valve is therefore said to be "self-cleaning".

[**0023**] Operatively attached to valve body **12** is electric motor actuator **41** having actuator rod **42** positioned to act on valve stem **28**. Actuator rod **42** is preferably attached to a threaded shaft **43** which rotates through action of the electric motor to move it linearly along axis **40**. In event of loss of power or inoperability of the motor the threaded shaft can be actuated manually with a hand-crank **46**. Actuator rod **42** is prevented from rotating with the threaded shaft by an extension from the side of the actuator rod which extends into a slot in anti-rotation sleeve **47**. Gears linking electric motor **44** and hand-crank **46** to the threaded shaft are within housing **48**. A closed position of the valve as depicted in FIG. **1** is attained by action of actuator rod **42** against disc stem **28** to move the stem and valve disc **26** along longitudinal axis **40** to provide engagement of valve seat **24** with valve disc **26**. Contact of actuator rod **42** with disc stem **28** when in such closed position prevents an upward movement of disc stem **28** and valve disc **26** away from valve seat **24** which would result from pressure exerted on face **50** of valve disc **26** by liquid flowing in the direction indicated by arrows **18**. Such actuator rod **42** position against disc stem **28** also prevents back flow of liquid in a direction opposite to that indicated by arrows **18**.

[**0024**] FIG. **2** shows the position of valve **10** components when full flow of liquid in the forward direction is desired. Actuator rod **42** is at a retracted position by action of threaded shaft **43** rotated by electric motor **44**. Once the actuator rod is retracted valve disc **26** and disc stem **28** move in an upward direction along longitudinal axis **40** to position valve disc **26** to be spaced from valve seat **24** by sole action of the liquid flowing in the direction of arrows **18** and exerting pressure on face **50** of valve disc **26**. Actuator rod **42** is not connected to disc stem **28** and such lack of connection is an important feature of the invention and is relied on for prevention of back-flow of liquid which is described below. Although not shown, liquid flow can be regulated to selected rates by positioning valve disc **26** between extreme positions depicted in FIGS. **1** and **2**, however the valve is not normally used for such function.

[**0025**] As described above, the electric motor actuated stop and self-closing check valve of the invention can be used in municipal water supply systems or sewage treatment systems as a pump control and stop check valve although it is not limited to such usage. In normal operation liquid flow is in the direction indicated by arrows **18** with such flow provided by action of at least one pump upstream of the valve. In event of pump shutdown, either intended or by a power failure, back-flow of the liquid can occur when a valve to check such flow is not provided. Such back-flow is usually undesirable and is prevented by the valve of the invention without any action by the electric motor. Such feature is of importance when back-flow is caused by a power failure and power is not available to the electric motor.

[**0026**] In FIG. **3** such back-flow direction is indicated by arrow **52** and is in a direction from outlet port **22** toward inlet port **20**. In event of a pump shutdown liquid pressure provided by the pump and acting on face **50** of valve disc **26** would no longer be present and valve disc **26** would be free to move in a downward direction so as to cover valve seat **24** and prevent the back-flow of liquid. Such downward movement of the valve disc occurs by force of gravity acting on the freely moveable valve disc and disc stem and also by a momentary back-flow of liquid which results in pressure being greater on back face **51** than on front face **50** of valve disc **26**. Such pressure difference closes and holds the valve disc against valve seat **24** until such pressure difference is reversed, such as by restarting of the pump. Such free movement along disc stem longitudinal axis **40** can take place because of the lack of connection between disc stem **28** and actuator rod **42**.

[**0027**] A common problem with many check valves when a reversal of liquid flow direction occurs is "slamming" of the valve disc against the valve seat. Such slamming is greatly reduced in the valve of this invention by use of a compression spring **52** which biases the valve disc and its stem toward the closed position. Selection of spring characteristics is dependent on pressure of the liquid being pumped against valve disc face **50**. The spring is selected to be strong enough to assist in closing the valve when flow in the forward direction stops so that the valve is at least partially closed when the back-flowing liquid applies pressure to valve disc back face **51** and any slamming of the valve disc is reduced or eliminated because of the shortened distance it moves. The spring can not be so strong as to restrict flow in the forward direction in a significant amount. Spring **52** is shown in a partially compressed state in FIG. **2**, and in an extended state in FIGS. **1** and **3**.

[**0028**] FIGS. **4-6** show a second embodiment of a wye valve of the invention which includes a second component, in addition to the spring, to reduce or eliminate valve disc slamming. Wye valve **54** of FIGS. **4-6** with forward-flow indicated by arrows **56**, is similar to valve **10** of FIGS. **1-3**, with the exception of an added hydraulic closing-speed

regulator indicated generally at **58**. Such regulator consists of piston **60** attached to an upper end of disc stem **62**, cylinder sleeve **66**, solenoid valve **70**, check/needle valve **72**, hydraulic oil **74**, hydraulic oil reservoir **76**, and associated piping. Piston **60** is free to move linearly along axis **68** in cylinder sleeve **66** with movement of valve disc **64**. The hydraulic closing-speed regulator operates so as to slow down valve closing during a reversal of liquid flow direction with substantially no effect on valve opening speed. The hydraulic circuit of the closing-speed regulator is shown in schematic form in FIG. **7**. Shown are piston **60**, cylinder **66**, solenoid valve **70**, check/needle valve **72**, hydraulic oil reservoir **76** and hydraulic oil **74**. Solenoid valve **70** is open when energized and closes when not energized. Referring to FIGS. **4-7**, when valve disc **64** is "opening" with movement in the direction indicated by arrow **78** (FIG. **7**), flow of hydraulic oil is in the direction indicated by arrow **80**. When valve disc **64** is "closing" piston **60** moves in the direction indicated by arrow **79** and hydraulic oil flow is in the direction indicated by arrow **82**. During planned opening and closing, when loss of power is not a factor, and slamming of valve disc **64** is not a factor, solenoid valve **70** is energized and open so as to not require liquid flow through check/needle valve **72** (although a small flow can occur), and operational speed of the valve being operated by the electric motor is not affected.

[**0029**] During loss of power, when liquid flow is no longer in the direction of arrows **56** and back-flow is beginning in the direction of arrow **78** (FIG. **6**), liquid pressure against back face **80** of valve disc **64** could, without closing-speed regulator **58**, slam valve disc **64** against valve seat **82**. To eliminate such slamming solenoid valve **70** closes upon loss of power requiring flow of hydraulic oil through check/needle valve **72** in the direction indicated by arrow **82**. Valve **72** has two channels in parallel as best seen in FIG. **7**. One channel includes needle valve **84** which adjustably controls hydraulic oil flow rate and the remaining channel includes check valve **86** which permits flow only in the downward direction (as when valve disc is opening). During valve disc closing, caused by liquid back-flow, hydraulic oil flow is in the direction indicated by arrow **82** and the hydraulic oil is forced to flow through the restricted channel of needle valve **84** at a controlled rate, thus slowing the movement of valve disc **64** against valve seat **82** and eliminating slamming. Such rate of closing is regulated by adjustment of the needle valve opening.

[**0030**] FIG. **8** shows another embodiment of the invention, an elbow valve **86** for use in a liquid conveying pipeline wherein a 90° pipeline configuration is available for placement of a valve. Normal liquid flow in a forward direction is indicated by arrows **88**. During normal operation, liquid flows from entry port **90** to outlet port **92** through valve seat **94**. As in the wye valve of FIGS. **1-6** valve closure is carried out by movement of actuator rod **96** downward by action of electric motor **98** to contact disc stem **100** to dispose valve disc **102** to cover valve seat **94** and achieve a closed position. Elbow valve **98** of FIG. **8** is depicted in the open position wherein valve disc **102** is spaced from valve seat **94**. Operation of elbow valve **98** is the same as wye valve **10** (FIGS. **1-6**). The valve disc position depicted in FIG. **8** is maintained by pressure of the liquid acting against face **104** of valve disc **102**. In the event of flow stoppage in the direction indicated by arrows **88**, back-flow of liquid is prevented by the action of gravity and spring **105** on freely moveable valve disc **102** and disc stem **100**, and momentary action of the back-flowing liquid on back-face **106** of valve disc **102** to move such disc downward to contact valve seat **94** and terminate the back-flow. Continued pressure on back face (**106**) maintains the valve in the back-flow preventing position.

[**0031**] Although elbow valve **88** with solely spring means **105** for reducing or eliminating valve disc slamming is shown, such elbow valve can be provided with hydraulic closing speed regulating means as shown and described for wye valve **10** (FIGS. **4-6**) and operation of the two types of valves is the same.

[**0032**] A preferred method of operating a liquid pumping system utilizing a valve of the invention is schematically shown in FIG. **9**. The system can be used in applications such as a municipal water supply system or a sewage treatment system. In FIG. **9** tank **108** is filled with liquid **110** by means of pump **112** acting on it. Pump input line **114** supplies the liquid to pump **112** and it is discharged through pump discharge line **116** toward liquid tank **108**. An electric motor actuated stop and self-closing check valve **10** of the invention having a wye configured body is installed to function as a pump control and stop check valve in liquid discharge line **116**. A common problem in water and sewage systems utilizing such a pumping arrangement is liquid surge pressure transients and slamming of check valve components during pumping start-up and termination. Such problem is substantially eliminated with use of valve **10** in liquid discharge line **116**. In the preferred method of operation for pumping start-up, valve **10** is set to the closed position (FIG. **1**) prior to start-up of pump **112**. That is actuator rod **42** is extended to locate and hold valve disc **26** against valve seat **24**. The pump is then started followed by opening of valve **10** toward the flow position (FIG. **2**) at a selected rate with use of electric motor **41**. Such rate is controllable by motor control devices known in the art (not shown). Full flow position (FIG. **2**) is maintained during normal pumping operation. To achieve planned pumping shutdown without generating liquid surge pressure transients or valve component slamming, valve **10** is closed, or nearly closed, with use of electric motor **41** prior to shutdown of pump **112**. Following complete closure of the valve, or at a point nearing complete valve closure, the pump is switched off. Such sequential start-up and shut-down procedure can be conveniently controlled with use of switches and controls which coordinate the operation of the valve and the pump.

[**0033**] During normal pumping operation of the pumping system with flow of liquid in the direction of arrow **113**, and actuator rod **42** in the retracted position (FIGS. **2** and **3**) valve disc **26** is free to move in the direction toward valve seat **24** and close the valve to prevent back-flow of the liquid in the event of failure of pump **112** or loss of electrical power. No action is required by the electric motor for such back-flow preventing closing as the valve is closed by action of the liquid flowing in a direction opposite to the direction of arrow **113**. Spring **52** at least partially moves valve disc **26** toward the closed position during momentary liquid flow reversal from forward-flow to back-flow and valve disc slamming is eliminated or reduced. Such configuration and operating procedure for the pumping system enables conveying of liquid without undesirable liquid surging and slamming.

[0034] While specific materials and configurations have been set forth for purposes of describing embodiments of the invention, various modifications can be resorted to, in light of the above teachings, without departing from applicants' novel contributions; therefore in determining the scope of the present invention reference shall be made to the appended claims.

1-19. (canceled)

20. An electric motor actuated stop and self-closing check valve for controlling a forward-flow and a back-flow of a liquid in a liquid conveying line, comprising:

A. a valve body having an inlet port and an outlet port relative to said forward-flow of said liquid;

B. a valve seat disposed within said valve body intermediate said ports;

C. a valve disc disposed within said valve body having an elongated disc stem which extends through said valve body, said valve disc and said disc stem being free to move along a longitudinal axis of said valve stem to either:

(i) a closed position whereat said valve disc sealingly engages said valve seat to prevent said back-flow of said liquid, or

(ii) an open position whereat said valve disc is spaced from said valve seat;

D. an electric motor operationally attached to said valve body; and

E. an actuator rod moveable by action of said electric motor to be disposed at either:

(i) an extended position whereat said actuator rod contacts said valve stem and restrains said valve disc at said closed position preventing said forward-flow and said back-flow of said liquid, or

(ii) a retracted position whereat said actuator rod is retracted and said valve disc is free to move along said longitudinal axis without action by said electric motor, such that:

(a) the valve disc moves to said open position solely through action of said forward-flow of said liquid on said valve disc and said forward-flow of said liquid occurs through a portion of said valve body, and

(b) the valve disc moves to said closed position through action of a momentary back-flow of said liquid on said valve disc and said back-flow of said liquid is prevented.

21. The electric motor actuated stop and self-closing check valve according to claim 20 further comprising a spring, said spring provides a selected bias to said valve disc and disc stem toward said closed position.

22. The electric motor actuated stop and self-closing check valve according to claim 21, wherein said spring is a compression spring.

23. A method of controlling a forward-flow and a back-flow of a liquid, which comprises:

A. providing a valve body having an inlet port and an outlet port, relative to said forward-flow of said liquid, said valve body comprising:

(i) a valve seat disposed within said valve body intermediate said ports,

(ii) a valve disc disposed within said valve body having an elongated disc stem which extends through said valve body, said valve disc and disc stem being free to move along a longitudinal axis of said valve stem to either:

(a) a closed position whereat said valve disc sealingly engages said valve seat to prevent said back-flow of said liquid, or

(b) an open position whereat said valve disc is spaced from said valve seat,

(iii) an electric motor operationally attached to said valve body, and

(iv) an actuator rod moveable by action of said electric motor to be disposed at either:

(a) an extended position whereat said actuator rod contacts said valve stem and restrains said valve disc at said closed position preventing said forward-flow and said back-flow of said liquid, or

(b) a retracted position whereat said actuator rod is retracted and said valve disc is free to move along said longitudinal axis without action by said electric motor;

B. extending said actuator rod to said extended position through action of said electric motor to contact said valve stem, and thereby moving said valve disc to said closed position and restraining said valve disc in said closed position;

C. providing said forward-flow of said liquid when said forward-flow of said liquid is desired by:

(i) pumping said liquid through action of an electric pump in said forward-flow direction;

(ii) retracting said actuator rod to a retracted position through action of said electric motor; and

(iii) moving said valve disc to said open position through action of said forward flow of said liquid;

D. stopping said forward-flow of said liquid; and

E. preventing said back-flow of said liquid by moving said valve disc to said closed position through either:

(i) action of a momentary back-flow of said liquid within said valve body, whereby said momentary back-flow moves said valve disc to said closed position, or

(ii) moving said actuator rod to said extended position, thereby moving said valve disc to said closed position.

24. The method according to claim 23 further comprising biasing said movement of said valve disc during said moving of said valve disc to said closed position by action of said momentary back-flow step.

25. The method according to claim 24, wherein said dampening step further comprises biasing said movement of said valve disc step by action of a spring.

26. The method according to claim 25, wherein said spring a compression spring.

27. The method according to claim 23, wherein said valve body further comprises a hydraulically operated valve disc closing-speed regulator operatively attached to said valve body to control said closing speed of said valve disc, wherein said closing-speed regulator comprises:

A. a cylinder operatively attached to said valve body;

B. a piston operatively attached to said disc stem for movement within said cylinder along its longitudinal axis; and

C. a hydraulic oil reservoir with connecting piping to said cylinder, said connecting piping having a check/needle valve.

28. A liquid conveying line for controlling a forward-flow and a back-flow of a liquid comprising:

A. an inlet pipe having for transporting said liquid;

B. an outlet pipe having for transporting said liquid;

C. an electrical pump for creating said forward-flow of said liquid; and

D. a valve body, wherein said valve body comprises:

(i) an inlet port relative to said forward-flow of said liquid, said inlet pipe being coupled with said inlet port;

(ii) an outlet port relative to said forward-flow of a liquid, said outlet pipe coupled with said outlet port;

(iii) a valve seat disposed within said valve body intermediate said ports;

(iv) a valve disc disposed within said valve body having an elongated disc stem which extends through said valve body, said valve disc and said disc stem being free to move along a longitudinal axis of said valve stem to either:

(a) a closed position whereat said valve disc sealingly engages said valve seat to prevent said back-flow of said liquid, or

(b) an open position whereat said valve disc is spaced from said valve seat;

(v) an electric motor operationally attached to said valve body; and

(vi) an actuator rod moveable by action of said electric motor to be disposed at either:

(a) an extended position whereat said actuator rod contacts said valve stem and restrains said valve disc at said closed position preventing said forward-flow and back-flow of said liquid, or

(b) a retracted position whereat said actuator rod is retracted and said valve disc is free to move along said longitudinal axis of said valve stem without action by said electric motor, such that the valve disc moves to said open position solely through action of said forward-flow of said liquid on said valve disc and said forward-flow of said liquid occurs through said inlet pipe, through said inlet port, through said valve body, through said outlet port, and through said outlet pipe;

wherein, in the event of a failure of said electric pump or said electric motor, said back-flow of said liquid is prevented by action of a momentary back-flow of said liquid within said valve body acting on said valve disc, thereby moving said valve disc to said closed position.

29. The liquid conveying line of claim 28, wherein said valve further comprises a spring for providing a selected bias to said valve disc and said disc stem toward said closed position.

30. The liquid conveying line of claim 29, wherein said spring is a compression spring.

31. The liquid conveying line of claim 28, wherein the liquid is water.

32. The liquid conveying line of claim 28, wherein said valve body further comprises a hydraulically operated valve disc closing-speed regulator operatively attached to said valve body to control said closing speed of said valve disc, wherein said closing-speed regulator comprises:

A. a cylinder operatively attached to said valve body;

B. a piston operatively attached to said disc stem for movement within said cylinder along its longitudinal axis; and

C. a hydraulic oil reservoir with connecting piping to said cylinder, said connecting piping having a check/needle valve.

33. A method of operating a liquid pumping system comprising:

A. providing a liquid;

B. pumping said liquid in a forward-flow direction through action of a pump through an inlet pipe into an inlet port of a valve body, said valve body comprising:

(i) said inlet port relative to the forward-flow of said liquid, said inlet pipe being coupled to said inlet port;

(ii) an outlet port relative to said forward-flow of said liquid;

(iii) a valve seat disposed within said valve body intermediate said ports;

(iv) a valve disc disposed within said valve body having an elongated disc stem which extends through said valve body, said valve disc and said disc stem being free to move along a longitudinal axis of said valve stem to either:

(a) a closed position whereat said valve disc sealingly engages said valve seat to prevent a back-flow of said liquid, or

(b) an open position whereat said valve disc is spaced from said valve seat,

(v) an electric motor operationally attached to said valve body; and

(vi) an actuator rod moveable by action of said electric motor;

C. retracting said actuator rod through action of said electric motor to a retracted position, whereby said valve disc is free to move along said longitudinal axis without action from said electric motor;

D. moving said valve disc to said open position through action of said forward-flow of said liquid;

E. transporting said liquid through a portion of said valve body, through said outlet port, and through a portion of said outlet pipe;

F. stopping said pumping step, and thereby stopping said transporting step; and

G. preventing said back-flow of said liquid through said valve body by either:

(i) extending said actuator rod through action of said electric motor to an extended position whereby said actuator rod contacts said valve stem and restrains said valve disc at said closed position, thereby preventing said forward-flow and back-flow of said liquid, or

(ii) moving said valve disc through action of a momentary back-flow of said liquid to said closed position, thereby preventing said back-flow of said liquid.

34. The method according to claim 33 further comprising biasing said movement of said valve disc through action of a momentary back-flow of said liquid to said closed position.

35. The method according to claim 34, wherein said biasing step further comprises biasing said movement of said valve disc through action of a momentary back-flow of said liquid to said closed position by action of a spring.

36. The method according to claim 35, wherein said spring is a compression spring.

37. The method according to claim 33, wherein said valve body further comprises a hydraulically operated valve disc closing-speed regulator operatively attached to said valve body to control said closing speed of said valve disc, wherein said closing-speed regulator comprises:

A. a cylinder operatively attached to said valve body;

B. a piston operatively attached to said disc stem for movement within said cylinder along its longitudinal axis; and

C. a hydraulic oil reservoir with connecting piping to said cylinder, said connecting piping having a check/needle valve.

38. The method according to claim 32, wherein the liquid is water.

39. The method according to claim 32, wherein the liquid is sewage.

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