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SOFT SEATED GLOBE VALVE BODY CONSTRUCTION

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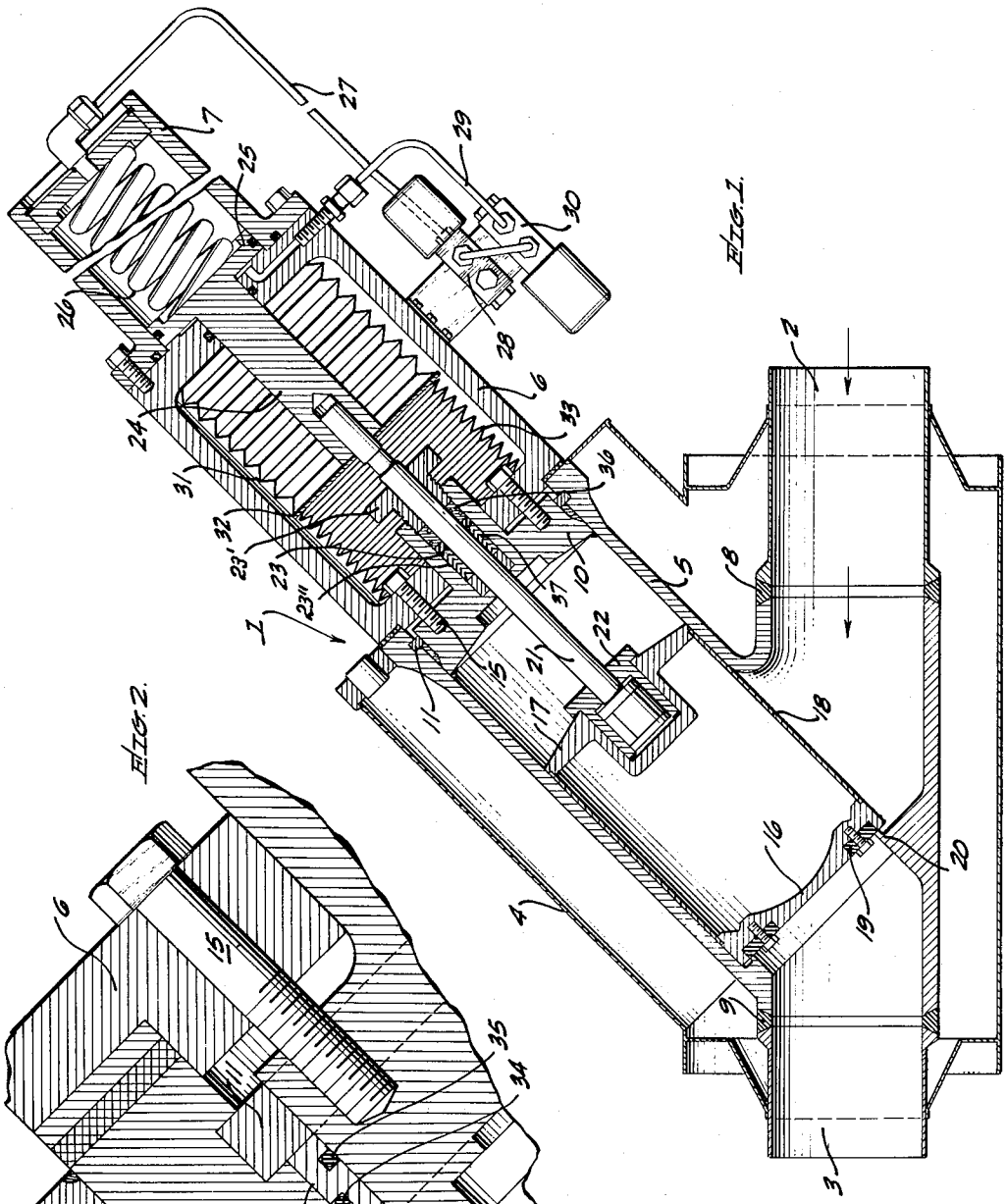


FIG. 1.



FIG. 2.

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# SOFT SEATED GLOBE VALVE BODY CONSTRUCTION

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This invention relates to a soft seated globe valve body construction, particularly applicable in the missile industry, and where the valve may be opened or closed from a remote position and where the control is electrically activated.

An object of my invention is to provide a novel globe valve body construction of the character stated, in which the valve is positioned in a pipe line and where the valve is so arranged angularly to the flow stream that a relatively small amount of force is required to move the valve to either open or closed position.

Still another object of my invention is to provide a novel combination of parts which will effectively prevent leakage from the flow line whether the valve is open or closed.

Still another object is to provide a novel globe valve of the character stated in which the closure member or globe is formed as a hollow cylinder, this cylinder being movable in an angular direction to the center line of the flow stream.

Still another object of my invention is to reduce the thermal conduction through the body of the valve from the pipe or tubing system in which the valve is placed.

A feature of my invention resides in the use of a bellows diaphragm between movable parts of the valve within the body thereof to prevent atmospheric corrosion, and also to prevent any foreign particles from entering the valve.

Another object is to jacket the lower hollow body portion of the valve to maintain required temperatures at this point.

Other objects, advantages and features of invention may appear from the accompanying drawing, the subjoined detailed description and the appended claims.

In the drawing:

FIGURE 1 is a longitudinal sectional view of my soft seated globe valve.

FIGURE 2 is an enlarged vertical sectional view of the packing construction between units of the extended body.

Referring more particularly to the drawing, the numeral 1 indicates as a unit the extended body of my valve. At the lower end I provide an intake 2 and an outlet 3 which are preferably tubular in form, and the inlet and the outlet are preferably in axial alignment. The axial center line of the body 1 is arranged at an acute angle to the center line of the intake and outlet 2 and 3 and, therefore, to the pipe line in which the valve is placed. Thus the fluid flow through the parts 2–3 is at an acute angle to the longitudinal center line of the body 1 and the purpose thereof will be subsequently described. A jacket 4, preferably metal, surrounds the intake 2, outlet 3, and the lower portion of the body 1 so that this portion may be heated or cooled, or protected against heat transfer if this is desired. The jacket may be welded or otherwise fixedly secured to the portions of the valve which it surrounds, namely, the intake 2, the outlet 3, and a portion of the body 1.

The body 1 of the valve consists essentially of three superimposed parts as follows: A cylindrical lower body 5, a middle tubular section 6, and an upper cylinder section 7. The parts 5, 6, and 7 are preferably bolted to each other, or otherwise removably attached, and also



these parts are in axial alignment. The lower body portion 5 is welded to the intake 2 and the outlet 3, as shown at 8 and 9 respectively. The remaining parts of the body assembly 1 will be described in greater detail as the other parts of the valve are described.

It is of importance that the valve body 1 shall not leak at any of its component parts, and particularly that there be no leakage from the inside to the outside through the valve body. The connection between the lower portion 5 and the middle portion 6 of the valve body is shown in greater detail in FIG. 2, and consists of a head 10 which accurately fits within the lower portion 5 of the valve body. This head is held against displacement by the split ring 11 which projects from the inner wall of the body section 5. A ring 12 surrounds the head 10 and accurately fits the inner bore of the body section 5, and this ring bears against a tapered packing 13 which rests on a tapered wall 14 in the head 10. The bolts 15 extend from the middle section 6 and thence into the head 10, pulling this head tightly against the split ring 11, and also compressing the packing 13 to attain a tight and leakproof joint at this point in the assembly.

The closure member, which might be termed a globe, is reciprocally mounted within the lower section 5 of the body and consists of a bottom head 16 and an upper head 17. These heads are connected by a tubular shell 18 formed of a suitable metal, the tubular shell being welded or otherwise fixedly attached to the heads 16 and 17. A ring insert 19 is mounted on the lower face of the head 16 and this ring insert rests on the seat 20 in the flow passage of the ports 2–3. The seat 20 is angularly arranged relative to the center line of the ports 2–3 and is at right-angles to the center line of the body 1. In one position of the parts the insert 19 rests on the seat 20 to close the valve. In the closed position of the valve the shell or tube 18 extends across the intake port 2 at an angle, and the pressure on the upstream side of the valve is thus exerted at an angle against the globe or closure member of the valve. Thus only a component of the force of the pressure in the line is exerted against the soft insert 19, so that less force is required to unseat the valve, and also the full pressure of the line would not be exerted against the globe in its closed position. The inclined position of the globe thus acts somewhat like a gate, with the one face of the tubular portion 18 moving angularly through the flow passage of the valve.

To reciprocate the globe in the bottom portion 5 of the body I provide a valve stem 21, the lower end of which is fixedly attached in the head 17 by suitable means 22, either as here shown or otherwise. The stem passes through a packing gland 23 which is provided in the head 10. This packing gland again insures against leakage around the valve stem 21. The upper end of the valve stem 21 is secured in a piston rod 24 which depends from a piston 25 arranged within the cylinder portion 7 of the body. This cylinder portion 7 is bolted or otherwise secured to the top of the middle section 6. It also contains a coil spring 26 which bears against the piston 25 to press that piston downwardly, thus exerting this downward thrust through the rod 24 and the stem 21 to close the valve. The valve may be further urged into closed position by the pneumatic line 27 which extends into the top of the cylinder 7, and the air passing through this pipe is controlled by the solenoid valve 28, which valve is electrically controlled from a remote point. The valve may be opened pneumatically through the pipe line 29 which extends from the valve 30 and thence into the bottom of the cylinder 7 and below the piston 25. The valve 30 is also electrically controlled from a remote point, and the pressure in the pipe 29 is sufficient to overcome the tension of the spring 26 when the valve is opened.

To further insure the valve against leakage through the parts of the body 1, I provide a bellows diaphragm 31 within the middle 6 of the valve body 1, and this diaphragm extends from the upper end of the body section 6 to a disc 32 which is attached to the lower end of the piston rod 24. A second diaphragm 33 surrounds the packing gland 23 and extends from the disc 32 and thence to the lower end of the middle section 6 of the body 1. Thus the two diaphragms 31 and 33 will further insure against leakage throughout the length of the middle section 6 of the body; this portion being particularly susceptible to leakage because of the reciprocation of the piston rod 24 and the valve stem 21. In this manner I provide a valve which will operate under required pressures and which can be readily opened with a minimum amount of pressure required in the pipe 29, and also may be closed against a relatively soft seat, such as the insert 19, primarily by the coil spring 26, and secondarily by pneumatic pressure in the pipe 27.

In order to check the valve for possible leakage through the body portion, and particularly the cylinder section 5 of the body, when a vacuum occurs in the line and the valve the following procedure is used. When a line is prepared for service it is first purged with gaseous nitrogen, and this is followed by purging with liquid hydrogen. During this operation and the subsequent filling with liquid hydrogen a vacuum is created in the line component, such as this valve. When this occurs the seal 13 fails to retain this internal vacuum and allows outside air which might contain contaminants to enter the valve. This possible contamination also results in loss of cooling which is normally provided by the liquid nitrogen charge. To prevent leakage past the seal 13, I provide the O-rings 34 and 35 which are mounted in the ring 12 and serve to seal off the upper end of the body 5. When the temperature of the valve is above —125° F. the O-rings will provide a seal if the seal 13 fails to function properly. By the time the valve has cooled down to a temperature which would cause the rubber O-rings 34 and 35 to become ineffective, then the seal 13 would be operative. Thus there is a dual seal action which is effective both above —125° F. and below —125° F.

The same general arrangement is provided in the gland 23 where O-rings 36 can be provided above the normal chevron type gland packing 37, where the O-rings 36 will maintain a seal at temperatures above —125° F. The gland 23 includes a nut 23′ which threads into a gland cup 23″. The cup 23″ is an integral part of the head 10.

The temperature of the gas or liquid which passes through the pipe line in which the valve is mounted might be as low as —320° to —420° F. The fact that the O-rings 34–35 and 36 are placed at a point quite remote from the pipe line itself enables these rings to be at a materially higher temperature than the fluid in the pipe line and, consequently, material such as rubber or plastic can be used effectively. The packing 13 is preferably formed of a product known as "Teflon" or a similar product, and this packing will not pack-off effectively at very low temperatures. The O-rings 34–35 and 36, however, will pack-off at the lower temperatures and thus will effectively seal the valve against the intrusion of atmospheric air due to a partial vacuum which might exist in the pipe line. Thus I provide a packing as shown in FIGURE 2, and also a packing around the valve stem 21 which will effectively seal the valve, both against pressure from the inside of the pipe line or the intrusion of air as a result of the partial vacuum in the pipe line. The O-rings 34, 35 and 36, therefore, perform the function of preventing leakage through the valve due to a partial vacuum in the pipe line, while the packing 13 will seal off the valve, due to pressure within the pipe line. If air leaks into the pipe line it is difficult, or perhaps impossible, to reduce the temperature of the pipe line to a point where a fluid under very low temperature



can be transmitted through the line. The purging of the line by a low temperature gas paves the way for the introduction of a fluid at very low temperatures. Therefore, my packing in the valve will effectively function under both the gas and liquid phases in the pipe line.

Having described my invention, I claim:

1. A valve of the globe type comprising an elongated body, said body consisting of a lower section, a head removably mounted in the upper end of the lower section, packing means between the head and the lower section, said packing means including a tapered packing engaging the head, a ring engaging the tapered packing, and a seal in the ring, a packing gland in the center of said head, and a valve stem extending through the packing gland.

2. A valve of the globe type comprising an elongated body, said body consisting of a lower section, a head removably mounted in the upper end of the lower section, a primary packing means between the head and a wall of the lower section, a secondary O-ring packing means positioned above the primary packing means and arranged between the head and a wall of the lower section, a packing gland in the center of said head, a valve stem extending through the packing gland, a piston reciprocally mounted in said head, a piston rod depending from the piston and secured to one end of the valve stem.

3. A valve of the globe type comprising an elongated body, said body consisting of a lower section, a head removably mounted in the upper end of the lower section, a primary packing means between the head and a wall of the lower section, a secondary O-ring packing means positioned above the primary packing means and arranged between the head and a wall of the lower section, a packing gland in the center of said head, a valve stem extending through the packing gland, a piston reciprocally mounted in said head, a piston rod depending from the piston and secured to one end of the valve stem, said packing gland including a low temperature packing therein engaging the stem, and a second O-ring packing above the low temperature packing, said O-rings also sealing said stem against leakage.

4. A valve of the globe type comprising an elongated body, said body consisting of a lower section, a head removably mounted in the upper end of the lower section, a packing means between the head and the lower section, a tapered seat on the head, a tapered packing resting on said seat, said tapered packing bearing against a wall of the lower section, a ring surrounding the lower section above said tapered packing, one face of the ring bearing against the tapered packing, a shoulder on the lower section, one face of said ring bearing against said shoulder, and an O-ring packing mounted in said first named ring, said O-ring packing bearing against the inner wall of the lower section.

5. A valve of the globe type comprising an elongated body, said body consisting of a lower section, a head removably mounted in the upper end of the lower section, a packing means between the head and the lower section, a tapered seat on the head, a tapered packing resting on said seat, said tapered packing bearing against a wall of the lower section, a ring surrounding the lower section above said tapered packing, one face of the ring bearing against the tapered packing, a shoulder on the lower section, one face of said ring bearing against said shoulder, and an O-ring packing mounted in said ring, said O-ring packing bearing against the inner wall of the lower section, and a second O-ring packing in the ring, the second O-ring packing bearing against the head.

6. A valve of the globe type comprising an elongated body, said body consisting of a lower section, a head removably mounted in the upper end of the lower section, a packing means between the head and the lower section, a tapered seat on the head, a tapered packing resting on said seat, said tapered packing bearing against a wall of the lower section, a ring surrounding the lower

section above said tapered packing, one face of the ring bearing against the tapered packing, a shoulder on the lower section, one face of said ring bearing against said shoulder, and an O-ring packing mounted in said ring, said O-ring packing bearing against the inner wall of the lower section, a packing gland in the center of said head, a stem rising from the globe and extending through the packing gland, and O-ring packing in the packing gland engaging said stem.

7. A valve of the globe type comprising an elongated body, said body consisting of a lower section, a head removably mounted in the upper end of the lower section, a packing means between the head and the lower section, a tapered seat on the head, a tapered packing resting on said seat, said tapered packing bearing against a wall of the lower section, a ring surrounding the lower section above said tapered packing, one face of the ring bearing against the tapered packing, a shoulder on the lower section, one face of said ring bearing against said shoulder, and an O-ring packing mounted in said ring, said O-ring packing bearing against the inner wall of the lower section, and a second O-ring packing in the ring, the second O-ring packing bearing against the head, a packing gland in the center of said head, a stem rising from the globe and extending through the packing gland, and O-ring packing in the packing gland engaging said stem.



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