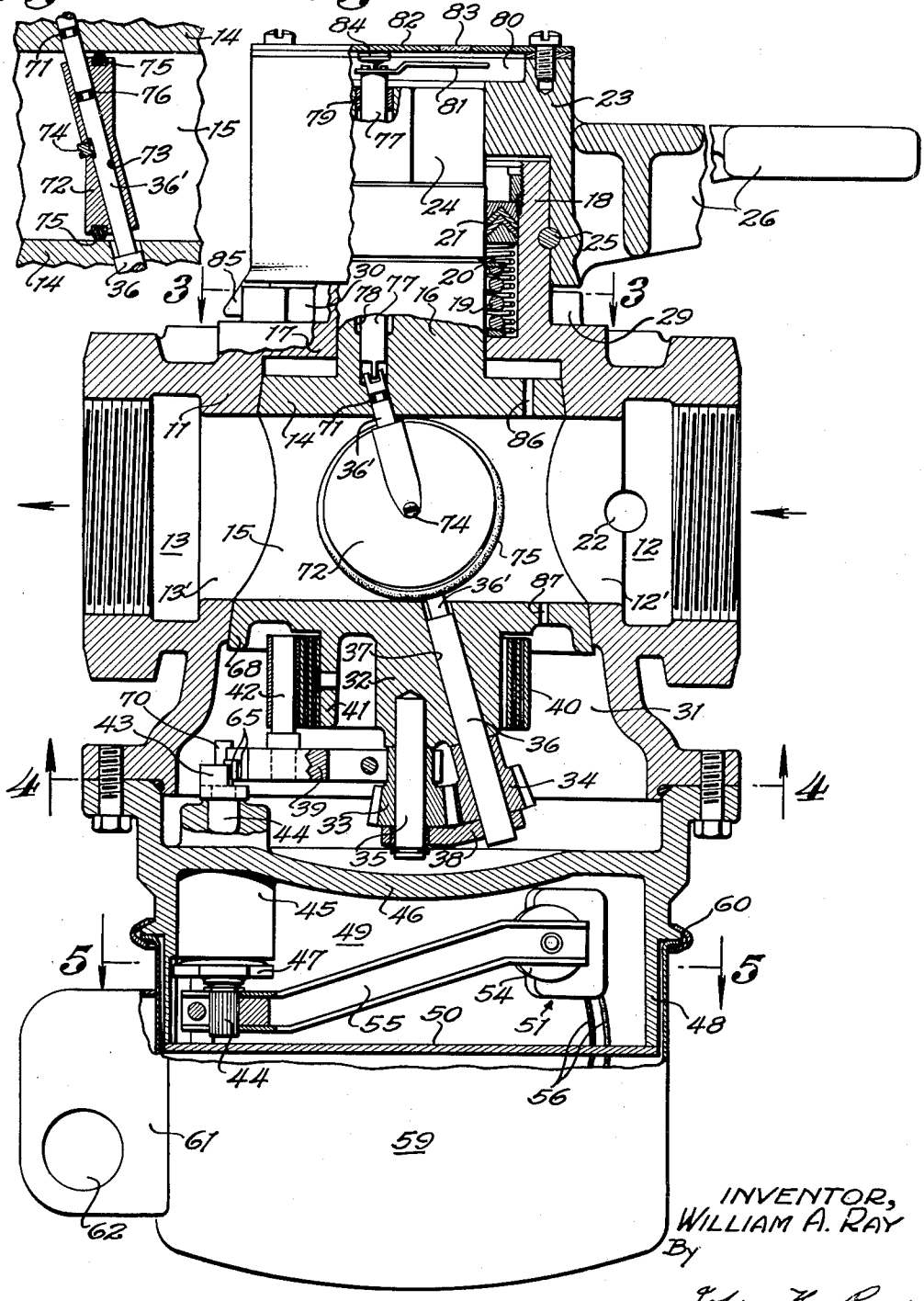
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VALVE STRUCTURE

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Fig. 2

Fig. 1




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VALVE STRUCTURE

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Fig. 5

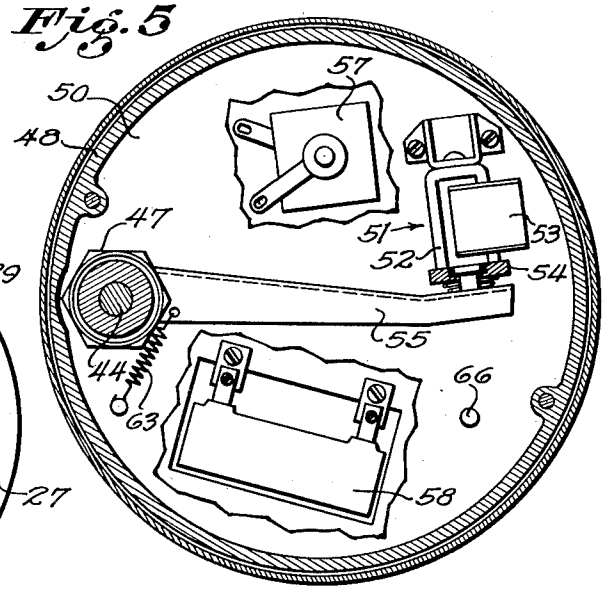



Fig. 3

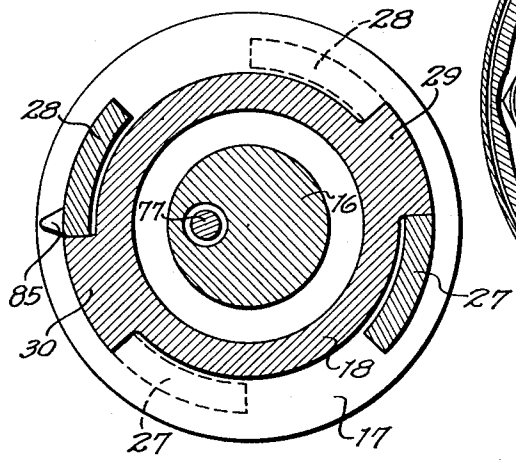



Fig. 6

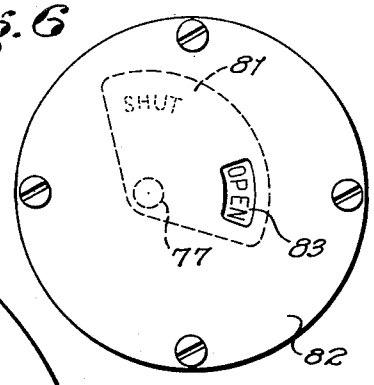



Fig. 4

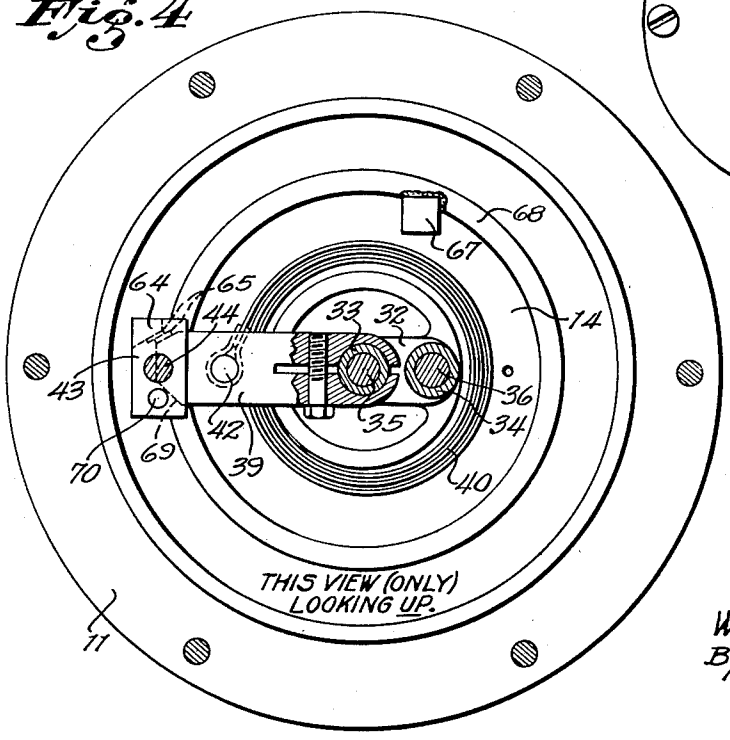
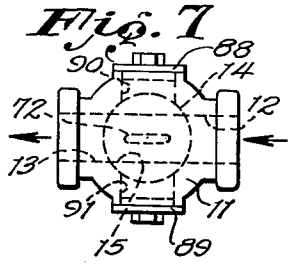



Fig. 7




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# VALVE STRUCTURE

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Application June 16, 1952, Serial No. 293,813

18 Claims. (Cl. 137—614.17)

My present invention relates to valve structures, and more particularly to such structures which include a main closure member and supplemental or safety closure means, as well as means responsive to a condition (such as temperature or pressure) external of the valve structure for so controlling the operation of the safety closure means that in the event of establishment of an abnormal degree of said condition the safety closure means is operated to effect shut-off of flow through the structure.

This invention relates still more specifically to valve structures of the character described and wherein the main closure member has a passage therethrough for establishing communication between the inlet and the outlet of the valve structure; the most common examples of such valve structures being the rotary plug valve, and the "disk" valve whose passaged closure has a flat surface slidable on a flat surface of the valve casing.

A main object of this invention is to arrange the safety closure means so that it is carried by the main closure member and cooperates with the passage therein.

Another object of the invention is to construct and arrange the main closure member so that when the same is in flow-obstructing position the passage therein is isolated from the fluid in the system controlled by the valve structure, and the safety closure means can therefore be removed from the closure member for repair or replacement without affecting the system in any way.

Another object is to provide, in combination with a rotatable main closure member, safety closure means which also is rotatable to control flow through the closure-member passage.

Another object is to provide novel means for "resetting" the safety closure means to open position.

Another object is to provide means whereby the safety closure means can readily be removed from the closure member when the same is in closed position.

For full understanding of the invention, and further appreciation of its objects and advantages, reference is to be had to the following detailed description and accompanying drawing, and to the appended claims.

In the drawing:

Figure 1 is a sectional view of a valve structure embodying this invention; the main closure member, or plug 14, and the safety closure means, comprising disk 72, both being shown in open position;

Figure 2 is a fragmentary sectional view showing the safety closure disk in closed position;

Figures 3, 4 and 5 are transverse sections taken generally along the lines 3—3, 4—4 and 5—5, respectively, of Fig. 1; the section of Fig. 4, only, being viewed in an upward direction;

Figure 6 is a view of the top of cap 23; and

Figure 7 is a diagrammatic view, from above, showing the means for access to the safety closure disk when the plug is in closed position.

Referring now more particularly to the drawing, the numeral 11 indicates a valve casing having an inlet opening 12 and an outlet opening 13; the casing being formed



internally to provide a tapered seat or cavity for a correspondingly tapered main closure member or plug 14. The plug 14 has a transverse passage 15 therethrough which, in the position of the plug as shown in the drawing, is in register with the inner ends 12' and 13' of the inlet and outlet openings; the plug being rotatable on its seat through 90° to an alternate position wherein the plug-passage 15 is isolated from both of the opening-ends 12', 13', and flow through the casing is obstructed. At its top the plug 14 has a cylindrical stem 16 fitting in an opening through the top wall 17 of the casing; a tubular extension 18 of the wall 17 providing an annular space around the plug-stem, in which space is a spring 19, bearing against a snap-ring 20 on the stem, which urges the plug upwardly against its seat; a conventional seal or packing-ring 21 being provided around the upper portion of the stem. At the inlet of the casing is an opening 22 which serves as a connection for a pilot burner in the event that the valve structure is employed for supplying gaseous fuel to a main burner.

At the top of the structure is an inverted cup-shaped cap 23 having in its top wall a square opening which fits the squared extremity 24 of the plug-stem; the side wall of the cap fitting freely on the extension 18 and being held thereon by a pin 25 cooperating with a circumferential groove in the extension. Extending laterally from the cap 23 is a handle 26 whereby, through the cap and plug-stem, the plug 14 can be rotated between its alternate controlling positions; rotation of the plug being limited to an angle of slightly more than 90° by portions 27 and 28 at the bottom of the side wall of cap 23 which are engageable with a pair of lugs 29 and 30 projecting from the top of the casing, as can be seen in Fig. 3; the portions 27 and 28 also being shown in that figure by broken lines in their moved positions.

At its bottom the casing 11 is hollow and provides a compartment 31 below the plug 14. In this compartment and projecting generally centrally from the bottom of the plug is a boss 32 whereon a pair of intermeshed gears 33 and 34 is mounted. The gear 33 is rotatable on a pin 35 coaxial with the plug and pressed in an opening in the boss 32. The other gear 34 is secured to a rod 36 which freely fits a bore 37 inclined at an angle of 15° to the axis of the plug and extending through the boss to the plug-passage 15. A strap 38 below the gears, and attached to the lower end of pin 35, holds the gears in place.

Tightly clamped at one end to the shank of gear 33 is an arm 39 which is urged in a direction toward the viewer as seen in Fig. 1 by the force of a coiled band-spring 40 secured at one end to a projection 41 of plug 14, and at its other end to a pin 42 projecting from arm 39. It is to be understood that the force of spring 40 is insufficient to effect rotation of the plug.

As shown in Figs. 1 and 4 the arm 39 is held stationary due to the engagement of its outer end with a latching member 43 secured to the upper end of a vertical rod 44 fitting freely in an opening through a boss 45 on a plate or cover 46 which is sealingly clamped to the open bottom end of the casing 11; there being conventional packing means (not shown) inside boss 45, and compressed by a gland nut 47, for preventing leakage around rod 44.

Depending integrally from the cover 46 at its periphery is a skirt 48 which forms below the cover a compartment 49 which is closed at its bottom by a plate 50. Mounted in this compartment is an electromagnet 51 (see Fig. 5), comprising a U-shaped core 52 and a coil 53, which cooperates with an armature 54 carried by one end of an arm 55 which is clamped at its other end to the lower end of rod 44; the armature being mounted on the arm, in conventional manner, so that its surface can conform exactly to the pole faces of the core. The leads 56 of

the electromagnet extend through an opening in plate **50** for connection in a suitable electric circuit which may include an A. C. rectifier **57** and a dropping resistor **58** (Fig. 5) mounted within a housing **59** which is clamped at its top by a channeled ring **60** to a circumferential projection of skirt **48**. At the left of the housing **59** is a junction box **61** having an opening **62** for a wiring cable.

The circuit of electromagnet **51** is adapted to be controlled by means, external of and remote from the valve structure, responsive to a condition such as temperature or pressure; the condition responsive means being arranged to effect energization of the electromagnet while the condition is normal, but to effect its deenergization in the event of establishment of an abnormal degree of the condition.

The parts are shown in Figs. 1, 4 and 5 in the positions assumed while electromagnet **51** is energized and after the arms **39** and **55** have been "reset" to these positions; the arm **55** being held, due to the attraction of armature **54** by core **52** and against the force of bias spring **63** (Fig. 5), in a position wherein a beveled portion **64** of the latching means **43** is in engagement with the beveled end of arm **39** so that movement of that arm under the influence of spring **40** is prevented. To reduce wear, the engaging portions of the latching means and arm **39** are tipped with tungsten carbide alloy, as indicated at **65**.

If the electromagnet **51** is deenergized the arm **55** is released and moves under the force of its bias in a direction toward the viewer as seen in Fig. 1 into engagement with a stop-pin **66** (Fig. 5); the arm **39**, then being unlatched, moving under the force of spring **40** in a direction toward the viewer as seen in Fig. 1, this movement of arm **39** being arrested by a stop member **67** (Fig. 4) welded to the skirt **68** of plug **14**. The movement of arm **39**, when unlatched, causes counterclockwise rotation of gear **33** and clockwise rotation of gear **34** and rod **36** (as viewed from above) through an angle of 90°.

To reset the arms **39** and **55** (and gears **33**, **34**) to their previous positions, the plug **14** is rotated by means of handle **26** in clockwise direction as viewed from above. When, by this rotation of the plug, the arm **39** (in engagement with stop member **67** carried by the plug) has been moved through slightly less than 90°, its beveled surface **69** (Fig. 4) engages a pin **70** projecting from the latching member **43**; continued movement of arm **39** effecting, through pin **70**, rotation of the latching member and rod **44** such that the arm **55** is rocked, against the force of its bias, to a position wherein its armature **54** is in contact with the electromagnet core **52**. If the electromagnet is then in energized condition, the arms **39** and **55** will be retained in the positions shown in Figs. 1, 4 and 5 when the plug is returned to its previous position. In the event that the electromagnet is not energized, the resultant movement of arm **55** (under the force of its bias) as the plug is returned will render the latching member ineffective to hold arm **39**.

The gear-rod **36** has a reduced extension **36'** which extends through the plug-passage **15**, centrally thereof, into a conforming opening in the top wall of that passage; a portion of the rod-extension within that opening being grooved for an elastic sealing-ring or O-ring **71**. Mounted on the rod-extension **36'** within the passage **15** is a disk **72** having an elongated bore **73** (see Fig. 2) at an angle of 15° to the plane of the disk and fitting the rod-extension; the disk being locked to the rod-extension as by a set-screw **74**.

The rim or edge of disk **72** is grooved for a ring **75**, of elastic material such as rubber, which, when the disk is transverse to the passage **15** as shown in Fig. 2, is compressed into sealing engagement with the cylindrical wall of that passage. A seal **76** of the O-ring type is provided around a portion of the rod-extension **36'** within bore **73** to prevent leakage through that bore between opposite sides of disk **72** when the same is in the position of Fig. 2.



At its top the rod-extension **36'** has a slot-and-tongue connection with a rod **77** which extends upwardly through a vertical opening **78** to a point slightly above the top of the plug-stem **16**; a guide bushing **79** for rod **77** being provided at the upper end of the opening. On top of rod **77**, and within a shallow recess **80** in the top surface of cap **23**, is an indicator segment **81**; this recess being covered by a plate **82** having a window **83**. A light spring **84** serves to maintain operative connection between rods **77** and **36'**. As can be seen in Fig. 6, the segment **81** bears the legends "Open" and "Shut"; the legend "Open," visible through window **83** in Fig. 6, indicating the present flow-controlling position of disk **72**.

The flow-controlling position of plug **14** is indicated by a pointer **85**, on the lower end of cap **23**, which cooperates with legends (not shown) on the valve casing. Vents **86** and **87** are provided in the plug to equalize fluid pressure above and below it.

In the diagrammatic view of Fig. 7 means are disclosed whereby the disk **72** can be removed, as for replacement of its sealing ring **75**. These means comprise covers **88** and **89** threadedly mounted in the outer ends of openings **90** and **91** in casing **11**. When the plug **14** is in closed position the openings **90** and **91** are in register with the plug-passage **15**. To remove the disk, one or both of the covers **88** and **89** is unthreaded and the set-screw **74** loosened. The plate **46**, covering the bottom of the valve casing, is then removed. By disconnecting strap **38** the gear **34**, together with rod **36** and its extension **36'**, can be withdrawn; the disk **72** then being free for removal through one of the openings **90, 91**.

As is clear from the previous description of the operation of arms **39** and **55** and gears **33** and **34**, the supplemental or safety closure means constituted by disk **72** is retained in open position while the electromagnet **51** is energized and the plug **14** is in open position. In the event of deenergization of the electromagnet and resultant unlatching of arm **39** the safety closure disk **72** is rotated to close passage **15** (this condition being indicated in Fig. 2) under the force of spring **40**; the indicator segment **81** moving to display the legend "Shut."

When the plug is rotated to closed position the disk **72** also is rotated (gear **34** rolling on stationary gear **33**) to its passage-closing position, and in the return movement of the plug toward open position the disk is concurrently opened; it being assumed that arm **39** is latched. Rotation of the disk is always in the same direction as that of the plug; the disk moving through 90° relative to the plug, and through 180° relative to the valve casing, in the rotation of the plug between its alternate (open-closed) controlling positions. In the event that while the plug is open the disk has moved to passage-closing position in response to deenergization of the electromagnet, the disk will remain stationary relative to the plug while the same is rotated to reset the latching means. If the latching means were released while the plug were closed, the disk would remain in closed position when the plug was subsequently opened—unless the latching means was first reset by movement of the plug through a small angle (5°) beyond its closed position, as previously described.

In its broader phases this invention comprehends the use of safety closure means of a type other than of the butterfly type disclosed in the drawing, such as another plug rotatable within the main plug to control flow through the main-plug passage; or means of the type comprising a "gate" reciprocable transversely to the plug-passage and withdrawable into an opening in one end of the plug.

The specific embodiment of my invention herein shown and described is obviously susceptible of modification without departing from the spirit of the invention, and I intend therefore to be limited only by the scope of the appended claims.

I claim as my invention:

1. In a valve structure: a valve casing having an inlet and an outlet opening; a closure member movable between alternate controlling positions relative to said casing and having a passage therethrough; said inlet and outlet openings each having an end extending to said closure member; said opening-ends and said passage being so arranged that when the closure member is in one of said positions communication is established between said inlet and outlet openings by way of said passage, and when the closure member is in the other of said positions both of said opening-ends are closed by the closure member; supplemental closure means in said closure member passage and movable to open and close said passage; and means operated by movement of said closure member for effecting corresponding movement of said supplemental closure means, the arrangement being such that when the closure member is in said other of its controlling positions the supplemental closure means is in passage-closing position.

2. In a valve structure: a valve casing having an inlet and an outlet opening; a closure member movable between alternate controlling positions relative to said casing and having a passage therethrough; said inlet and outlet openings each having an end extending to said closure member; said opening-ends and said passage being so arranged that when the closure member is in one of said positions communication is established between said inlet and outlet openings by way of said passage, and when the closure member is in the other of said positions both of said opening-ends are closed by the closure member; safety closure means in said closure-member passage and movable to open and close said passage; means biasing said safety closure means to closed position; means operated by movement of said closure member for moving said safety closure means to open position; and means responsive to a condition external of the valve structure for then maintaining the safety closure means open while said condition is normal and the closure member is in said one position.

3. A valve structure as defined in claim 2, and including means so interconnecting said closure member and said safety closure means, and cooperating with said condition responsive means, that movement of the closure member to said one position effects said movement of the safety closure means to open position while said condition is normal.

4. A valve structure as defined in claim 2, and wherein at least a portion of said closure-member passage is cylindrical, and said safety closure means comprises a disk rotatable in said passage-portion to effect sealing engagement between the rim of the disk and the wall of the passage-portion.

5. In a valve structure: a valve casing having an inlet and an outlet in alignment; a closure member movable between alternate controlling positions relative to said casing and having a linear passage therethrough adapted to establish communication between said inlet and outlet when the closure member is in one of said positions, the closure member being effective when moved to its other position to obstruct communication between said inlet and outlet; safety closure means in said closure-member passage and movable to open and close said passage; means biasing said safety closure means to closed position; means operated by movement of said closure member for moving said safety closure means to open position; and means responsive to a condition external of the valve structure for then maintaining the safety closure means open while said condition is normal and the closure member is in said one position.

6. A valve structure as defined in claim 5, and including means so interconnecting said closure member and said safety closure means, and cooperating with said condition responsive means, that movement of the closure



member to said one position effects said movement of the safety closure means to open position while said condition is normal.

7. A valve structure as defined in claim 5, and wherein at least a portion of said closure-member passage is cylindrical, and said safety closure means comprises a disk rotatable in said passage-portion to effect sealing engagement between the rim of the disk and the wall of the passage-portion.

8. In a valve structure: a valve casing; a closure member comprising a plug seated in a conforming cavity in said casing; said casing having an inlet opening and an outlet opening each extending to said cavity; said plug having a passage therethrough adapted, when the plug is in one controlling position, to register with said openings and establish communication therebetween, said plug being rotatable on its seat to another position wherein said passage is out of communication with said openings; safety closure means in said plug-passage and movable to open and close said passage; means biasing said safety closure means to closed position; means operated by rotation of said plug for moving said safety closure means to open position; and means responsive to a condition external of the valve structure for then maintaining said safety closure means in open position while said condition is normal and said plug is in said one position.

9. A valve structure as defined in claim 8, and including means so interconnecting said plug and said safety closure means, and cooperating with said condition responsive means, that movement of the plug to said one position effects movement of the safety closure means to open position while said condition is normal.

10. A valve structure as defined in claim 8, and wherein at least a portion of said plug passage is cylindrical, and said safety closure means comprises a disk rotatable in said passage-portion to effect sealing engagement between the rim of the disk and the wall of the passage-portion.

11. A valve structure as defined in claim 8, and wherein said safety closure means is rotatable relative to said plug to open and close said plug-passage.

12. A valve structure as defined in claim 8, and wherein said safety closure means is rotatable relative to said plug generally on the axis of the plug to open and close said plug-passage.

13. In a valve structure: a valve casing; a closure member comprising a plug seated in a conforming cavity in said casing; said casing having an inlet opening and an outlet opening each extending to said cavity; said plug having a passage therethrough adapted, when the plug is in one controlling position, to register with said openings and establish communication therebetween, said plug being rotatable on its seat to another position wherein said passage is out of communication with said openings; supplemental closure means in said plug-passage and movable to open and close said passage; and means forming, between said supplemental closure means and said casing, a connection such that rotation of said plug between its flow-controlling positions effects movement of said supplemental closure means relative to the plug between corresponding flow-controlling positions relative to the plug passage.

14. A valve structure as defined in claim 13, and including means responsive to a condition external of the valve structure for maintaining said connection effective only while said condition is normal.

15. In a valve structure: a valve casing; a closure member comprising a plug seated in a conforming cavity in said casing; said casing having an inlet opening and an outlet opening each extending to said cavity; said plug having a passage therethrough adapted, when the plug is in one controlling position, to register with said openings and establish communication therebetween, said plug being rotatable on its seat to another position wherein said passage is out of communication with said openings; safety closure means in said plug-passage and rotatable rela-

tive to the plug to open and close said passage; means biasing said safety closure means to passage-closing position; means forming, between said safety closure means and said casing, a connection such that rotation of said plug between its flow-controlling positions effects rotation of said safety closure means between corresponding flow-controlling positions; and means responsive to a condition external of the valve structure for maintaining said connection effective only while said condition is normal.

16. A valve structure as defined in claim 15, and wherein said connection-forming means comprises means mounted on said plug for rotation generally about the axis thereof.

17. In a valve structure: a valve casing; a closure member comprising a plug seated in a conforming cavity in said casing; said casing having an inlet opening and an outlet opening each extending to said cavity; said plug having a passage therethrough adapted, when the plug is in one controlling position, to register with said openings and establish communication therebetween, said plug being rotatable on its seat to another position wherein said passage is out of communication with said openings; safety closure means in said plug-passage and rotatable relative to the plug, generally on the axis of the plug, to open and close said passage; means biasing said safety closure means to passage-closing position; a member rotatably mounted on said plug coaxially therewith and operatively connected to said safety closure means; and



means responsive to a condition external of the valve structure and effective, only while said condition is normal, to hold said member stationary relative to said casing so that rotation of said plug then effects rotation of the member and of said safety closure means relative to the plug; the arrangement being such that, while said condition is normal, rotation of the plug to said one position effects rotation of the safety closure means to passage-opening position.

18. A valve structure as defined in claim 17, and wherein at least a portion of said plug-passage is cylindrical, and said safety closure means comprises a disk rotatable in said passage-portion to effect sealing engagement between the rim of the disk and the wall of the passage-portion.


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