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P. W. KNAUF

VALVE STRUCTURE

Filed May 29, 1922

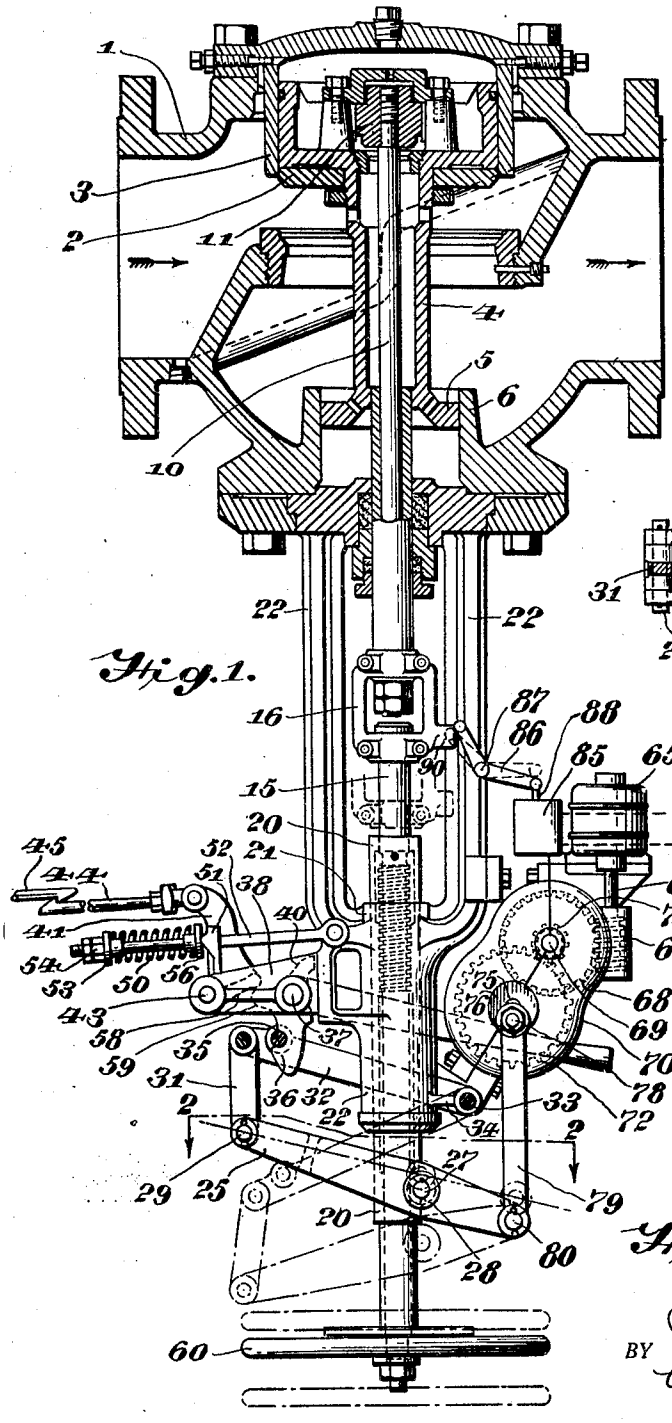


Fig. 1.

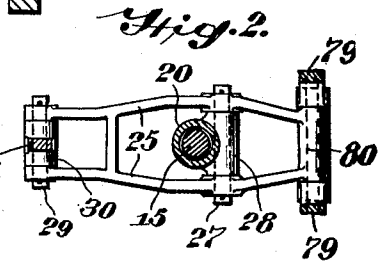


Fig. 2.

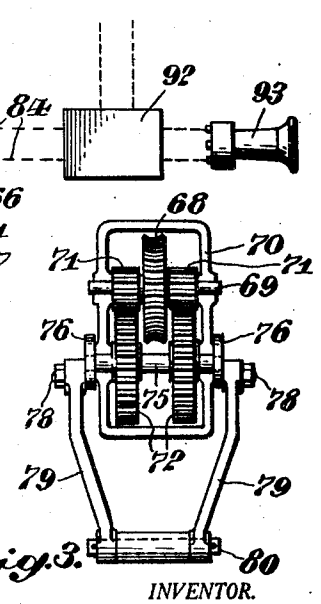


Fig. 3.

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UNITED STATES PATENT OFFICE.

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VALVE STRUCTURE.

Application filed May 29, 1922. Serial No. 564,316.

My invention relates broadly to valve structures of the general type shown in Letters Patent of the United States, No. 1,031,294, granted July 2, 1912, and has specific relation to means for causing movements of the valve within its casing when in open position and for indicating when the resistance to such movements exceeds a certain predetermined force.

In the employment of valve structures of the character under consideration the exterior surface of the valve and also the interior surface of the valve casing are apt and liable to become coated with scale or with a deposit which may interfere with the proper operation of the valve to open and close the same; hence the broad, general object of the invention is to provide novel and efficient means for preventing unnecessary tightening and tendency of the valve to stick in its casing due to the formation of scale or of deposit upon the surfaces thereof.

A further and more specific object of the invention is to provide novel means for causing reciprocation of the valve within its casing when in open position to thereby prevent the formation of scale or of deposits of any kind upon the contacting and co-operating surfaces.

A still further object of the said invention is to provide means for indicating automatically when the scale or deposit upon the valve and the interior of the casing or either are becoming or have become too thick so that the operation of the valve becomes difficult and requires the application of an unnecessary amount of force.

No attempt has been made to refer at this time to all of the objects and advantages of the invention, but other objects and advantages thereof will be pointed out in the detailed description thereof which follows or will be apparent therefrom. In order that the invention may be readily understood and its practical advantages fully appreciated reference may be had to the accompanying drawing forming a part of this specification and in which,—

Fig. 1 is a view partly in section and partly in elevation of a valve structure provided with means embodying my invention, which means is shown in elevation;

Fig. 2 is a transverse sectional view taken on the line 2—2 of Fig. 1; and

Fig. 3 is a view with a portion or section of the gear casing of the said means removed to show the gear wheels in said casing and their relation to each other, said view also showing in elevation links which are adapted to be reciprocated by crank disks secured to a shaft of certain of the said gears.

Although the invention is illustrated as applied to a trip valve structure of the character already indicated it will be understood that it may also be employed in connection with valve structures generally in which opening and closing of the valve is effected by reciprocating movement thereof.

Referring to the drawing: 1 designates the casing of a valve structure having a passage therethrough through which steam or the like is adapted to flow. Such passageway is adapted to be controlled by means of a valve 2 which is adapted to reciprocate in the hollow cylinder 3. The valve is provided with a guiding stem 4 which extends transversely of the passageway through the valve casing 1, and the outer end of which is provided with an enlarged disk like end portion 5 which is guided within a relatively short hollow cylinder 6 or the like integral with the portion of the casing opposite the hollow cylinder 3. Actuation of the valve is effected by means of an actuating rod, a portion of which is indicated at 10. The portion 10 extends upwardly through the valve stem 4 and is provided at its upper end with a pilot valve 11 which is movably secured and connected to the valve 2. The valve structure, including the pilot valve 11, is similar to the construction as disclosed in the Letters Patent above referred to, and as such structure constitutes no part of the present invention no further or detailed description thereof will be given.

The valve actuating rod comprises the part 10 and also the part 15 in alinement therewith, the said two parts being coupled together by means of the frame like coupling 16. The part 10 is adapted to move rectilinearly, but does not rotate while the part 15 is adapted both to rotate and to move rectilinearly with the part 10. It will be understood that the upper end of the lower part or section 15 of the actuating rod is rotatably connected with the lower part of the coupling frame 16.

The portion or section 15 of the valve actuating rod extends through a long tubu-

lar sleeve like member 20 which is slidably mounted within an opening through the yoke 21 and a tubular extension projecting outwardly therefrom, which yoke joins or connects the ends of the frame bars 22 which are suspended from the valve casing. The portion or section 15 of the valve actuating rod has screw threaded connections with the tubular sleeve like portion 20 and is adapted to move therewith or independently thereof.

A lever 25 comprising oppositely disposed bars rigidly connected together, as indicated in Fig. 2, is pivotally supported upon the opposite ends of a pivot bolt or shaft 27 which extends through a bearing 28 integral with or otherwise secured to the lower end of the tubular sleeve like portion 20. The left hand ends of the bars comprised in the lever 25 are provided with openings through which the opposite ends of a pivot rod or shaft 29 extends. The said pivot rod or shaft also extends through an opening in a sleeve 30 integral with the lower end of a link 31 the upper end of which is pivotally connected with the outer or swinging end of an arm or lever 32, the opposite or inner end of which is pivotally connected, as indicated at 33, to a bracket 34 upon the lower end portion of the tubular extension 22.

The arm or lever 32 is provided with a transversely extending rod or bar 35 adjacent its outer free or swinging end which is adapted to be engaged by a catch 36 which is pivoted at 37 to a bracket 38 projecting laterally from the extension 22. The upper end of the catch 36 is provided with an extension 40 which is adapted to contact with a part of the bracket 38 to limit the outer swinging movement of the catch when it is released from the rod or bar 35. The catch releasing mechanism comprises an arm 41 pivoted upon a cylindrical stud or shaft 43 at the outer end of the bracket 38. A rod 44 is connected to the upper end of the pivot arm 41, the outer end of which arm has operative connection with the inner end of a rod or bar 45, as indicated, which latter bar is adapted to be actuated by some such means as is indicated in Figs. 2, 3, or 4 of the Letters Patent above referred to. Upon release of the rod 44 two springs 50 (only one of which is shown) which press against the part 51 connected with the arm 41 cause pivotal movement of the arm 41 and of the part 51 toward the right. The said springs 50 are coiled about two rods 52 (only one of which is shown) and bear at their outer ends against washers 53 retained by nuts 54 upon the outer end portions of the said rods 52. The inner ends of the said springs are seated against bearing washers 56 which in turn are seated against the part 51.

A relatively short arm or projection 58 also having connection with the arm 41 is adapted to contact with an outwardly extending projection 59 upon the catch 36 and depresses the same to cause movement of the catch 36 to disengage the same from the rod or bar 35. The relatively short projection 58 is operated to effect pivotal movement of the catch 36 upon release of the bar 45 with respect to the outer end of the rod 44. Upon release of the catch 36 the lever 25 together with the tubular screw threaded sleeve 20, the valve actuating rods connected therewith and the valve are adapted to descend automatically to close the valve. Their position, after such descent, is indicated by dotted lines in Fig. 1.

By means of the hand wheel 60 secured to the lower end of the part or section 15 of the valve actuating rod said part or section may be rotated to effect adjustment thereof with respect to the tubular sleeve like part 20 to thereby open and close the valve when the catch 36 is in engagement with the rod or bar 35 upon the arm or lever 32.

For the purpose of effecting reciprocating movement of the valve actuating rod comprising the sections 10 and 15 and the valves 2 and 11, when the latter is in open position, I have provided certain mechanism which will now be described. The said mechanism comprises a motor 65, the shaft 66 of which is provided with a worm 67 which is in engagement with a worm wheel 68 mounted upon a shaft 69 supported in bearings upon the gear casing 70. The shaft 69 is provided with two small pinions 71 upon opposite sides of the worm gear 68. These pinions are in engagement with larger gears 72 supported upon a shaft 75 mounted in bearings upon the said gear casing. The said shaft 75 is provided at its outer ends outside of the casing 70 with crank disks 76 having eccentrically situated crank pins 78 thereon with which the upper ends of links 79 are connected. The lower ends of these links are pivotally connected by means of a pivot bolt 80 to the right hand end of the lever 25. It wil be seen, therefore, that upon rotation of the crank disks 76 and the crank pins 78 carried thereby the links 79 will be caused to move up and down causing an up and down or oscillating movement of the lever 25 about the pivot 29 supported in the lower end of the link 31 the upper end of which is supported upon the outer end of the bar 32 which is held in stationary position by means of the catch 36. Such up and down or oscillatory movements of the lever 25 causes reciprocating movement of the tubular sleeve like member 20 and of the valve actuating rod connected therewith, and consequently of the valves 2 and 11 which have connection with the upper end of said valve actuating rod. Such reciprocating movements of the valves 2 and 11 with respect to each other and of the valve 2 with respect to the hollow cylinder 3 tends to keep

the relatively moving contacting surfaces free from scale or deposits which might cause the parts, particularly the valve 2 and the hollow cylinder 3, to bind or possibly stick together thereby rendering the same difficult of operation. It is quite essential that these relatively moving parts shall be kept in condition to move relatively to each other readily in order that if the catch 36 should be released from the rod or bar 35 the arm 32 together with the parts attached thereto may descend automatically in the manner as heretofore described.

The circuit through the motor, indicated by the dash lines 84, is adapted to be opened and closed by a switch 85. The switch 85 is adapted to be controlled by a lever 86 pivoted at 87 upon one of the side bars 22 of the stationary frame previously referred to. The outer end of said lever is connected to a rod or bar 88 which extends into the switch 85 for actuating its contacts. The coupling 16, previously referred to, is provided with a laterally extending trip projection 90 which is adapted to contact with the inner end of the lever 86 and pivotally move the same when the valve 2 is moved into open position. When the said valve 2 is in such open position, as illustrated in the drawing, the said lever 86 is in position to close the circuit 84 through the motor 65, and current may pass through the circuit and the motor to operate the latter, which operation causes reciprocatory movements of the valve actuating rod and the valve connected to the upper end thereof, as previously described. Upon closure of the valve 2 the coupling 16 descends, as is apparent, so that the lever 86 is permitted to turn in the opposite direction, and its outer end is elevated to open the switch and thereby interrupt the passage of current through the motor 65. Such interruption of the current interrupts the operation of the means for causing reciprocatory movements of the valve actuating rod and of the valves connected therewith so that the said valves remain uninterruptedly in closed position.

It is important that means be provided for indicating, preferably audibly, that the valve 2 is offering too great a resistance to movements thereof. Such condition may be brought about, as already indicated, by the formation of scale or by deposits upon the contacting relatively moving surfaces of the valve 2 with the hollow cylinders 3 and 6. For the purpose of automatically indicating such condition and that the valve is offering too great a resistance to its movement I have provided an overload circuit breaker indicated in outline at 92 within the circuit 84, which circuit breaker is provided with contacts or means for closing a circuit through an alarm, such as a klaxon horn 93. It will be apparent that upon the overloading of the circuit 84 by reason of the resistance against movement offered by the valve 2 the circuit through the motor 65 will be broken and simultaneously the horn 93 or other form of signal which may be used will be operated to call the attention of the person in charge to the conditions. The importance of providing means for indicating when the valves are tending to bind and thereby offering too great resistance to the forces tending to move them will be apparent when it is realized that the structure, as disclosed, is adapted to be tripped automatically to permit the valves to automatically close, as above described, in case the necessity for such closure should arise. Valves of the character herein disclosed are well adapted for use, and, in fact, are largely used as emergency shut-offs in case of breaks in the steam pipe line for turbines to arrest the steam flowing to individual turbine units before an accident can get beyond the control of the person in charge; also on turbines for starting and in connection with their emergency governor to protect the same against overspeed.

Having thus described my invention what I claim and desire to secure by Letters Patent is:

1. In a valve structure, the combination of a valve, means for opening and closing the same, and means having connection with the said opening and closing means which is inoperative when the valve is in closed position but which becomes operative upon the opening of the said valve to reciprocate the opening and closing means continuously and to effect continuous reciprocation of the valve when the latter is in open position.

2. In a valve structure, the combination of a valve, means for opening and closing the same, power means having connection with the said valve opening and closing means for operating the latter to cause movements of said valve when in open position, and means for automatically putting the said power means in operation upon the opening of the said valve.

3. In a valve structure, the combination of a valve, and a casing therefor, means for opening and closing said valve, power means having connection with the said opening and closing means for actuating the latter to cause movements of the said valve when in open position, and means adapted to be actuated upon the opening and closing of said valve to put the said power means into and out of operation.

4. In a valve structure, the combination of a valve, a valve actuating rod having connection therewith, a movable sleeve like member through which the said rod extends and with which the said valve actuating rod has adjustable connection, power means,

connection between said power means and the said sleeve like member for actuating the latter to cause movements of the said valve actuating rod, and means for automatically putting the said power means into and out of operation upon the movements of said valve actuating means into and out of position to open and close the said valve.

5. In a valve structure, the combination of a valve, a valve actuating rod, a movable member with which the said valve actuating rod is connected, the said rod and member being relatively movable with respect to each other and also movable in unison, a lever adapted to be supported at one end and connected intermediate its ends to said member, power means, connections between said power means and the opposite end of said lever for causing oscillatory movements thereof to effect reciprocatory movements of the said member, the actuating rod connected thereto and the valve connected to said rod.

6. In a valve structure, the combination of a valve which is adapted to be opened and closed with means having operative connection with the said valve for effecting continuous reciprocating movement thereof when the same is in open position, the said means operating only upon the opening of said valve.

7. In a valve operating structure, the combination of a valve for controlling the supply of steam to an instrumentality to be operated thereby, means for opening and closing the same, a power device independent of said instrumentality, means intermediate said power device and the valve opening and closing means for actuating the latter when in position to open said valve to cause movements thereof and of the said valve, and means actuated upon the opening and closing of said valve to control the operation of said power device.

8. In a valve structure, the combination of a valve, means for opening and closing said valve, a motor, connections between said motor and the said valve opening and closing means for causing movements of the said valve when in open position, a switch device for controlling the flow of current through the said motor, a lever for controlling the said switch, and means for actuating the said lever upon the opening and closing of the said valve to open and close the said switch to thereby put the said motor into and out of operation upon the opening and closing of the said valve.

9. In a valve structure, the combination of a valve, a valve actuating rod for moving the said valve to open and close the same, a slidably supported tubular member through which the said valve actuating rod extends and with which it is adjustably connected, means having connection with the said tubular member for reciprocating the same when the said valve is in open position, and means whereby operation of the said last mentioned means is adapted to be effected upon the opening of said valve.

10. In a valve structure, the combination of a valve, a valve actuating rod for causing movements of the said valve, a slidably supported tubular member through which the said rod extends and with which it is adjustably connected, a lever pivoted intermediate its ends to said tubular member, means for supporting one end of said lever in elevated position, a link connected to the opposite end of said lever, a motor, connections between said motor and said link for effecting reciprocatory movements of the latter to thereby effect oscillatory movements of the said lever to thereby effect reciprocatory movements of the said tubular member and the valve actuating rod connected therewith, a circuit for supplying current to said motor, and means for closing said circuit when the said valve is in open position, the said means being adapted to move into position to open the said circuit and thereby interrupt the operation of the said motor upon the closing of said valve.

11. In a valve structure, the combination of a valve, a rod for actuating said valve, a slidably supported tubular member through which the said rod extends and to which it is adjustably connected, a lever having pivotal connection intermediate its ends with the said tubular member, means for supporting one end of the said lever in elevated position, means for releasing said lever, means having connection with the opposite end of said lever for effecting oscillatory movements thereof to thereby cause reciprocatory movements of the said tubular member, the said means comprising a motor for effecting operation thereof, and means adapted to put the said motor into and out of operation upon the opening and closing of said valve when said lever is held in elevated position.

12. In a valve structure, the combination of a valve, means for opening and closing the same, means for causing movements thereof when in open position for the purpose of keeping the contacting and relatively moving surfaces clean, and means for indicating when the resistance offered by the said valve to said movements exceeds a certain predetermined force.

13. In a valve structure, the combination of a valve, means for effecting movements of said valve when in open position for the purpose of keeping the contacting and relatively movable surfaces clean, an audible signal, and means whereby said signal is adapted to be operated when the resistance offered by the said valve to the said movements exceeds a certain predetermined force.

14. In a valve structure, the combination

of a valve, means to open and close the same, electrical means for effecting reciprocation of the said valve when in open position for the purpose of keeping the contacting and relatively movable surfaces free from scale or other deposit, means whereby the said electrical means is put into operation upon the opening of said valve to effect continuous reciprocatory movements thereof, and means for indicating when the resistance to the movements of said valve shall exceed a certain predetermined force.

15. In a valve structure, the combination of a valve, a valve actuating rod for opening and closing said valve, means having connection with the said rod for reciprocating the same when the valve is in open position to cause reciprocatory movements of the said valve, a motor for driving said means, a switch which is adapted to be operated upon the opening of said valve to close the circuit through the said motor, a signal, and means for automatically opening the said circuit and sounding the said signal in case the resistance offered by the said valve to the said reciprocatory movements shall exceed a certain predetermined force.

16. In a valve structure, the combination of a valve, a hollow cylinder into which said valve extends, means for opening and closing said valve, and means which is inoperative when said valve is in closed position, but which is rendered operative upon the opening of said valve to cause continuous relative movement between said valve and said hollow cylinder for the period during which said valve remains in open position.

In testimony whereof that I claim the foregoing as my invention I have hereunto signed my name this 24th day of May, 1922.

PAUL W. KNAUF.