May 28, 1929. P. S. IVANHOFF 1,715,327

QUICK THROW MECHANISM

Filed June 22, 1927

Fig. 1.

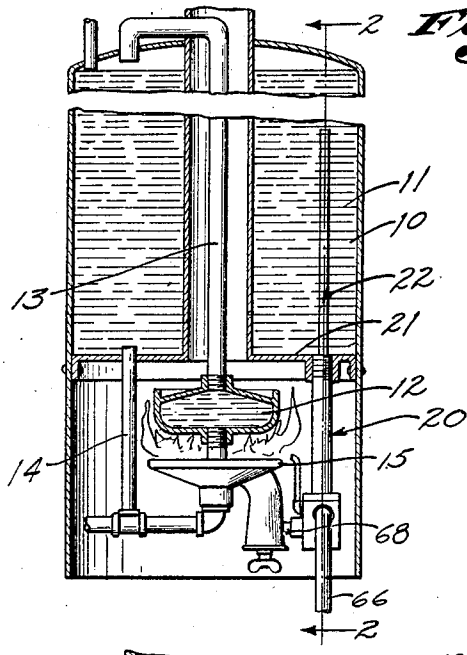


Fig. 2.

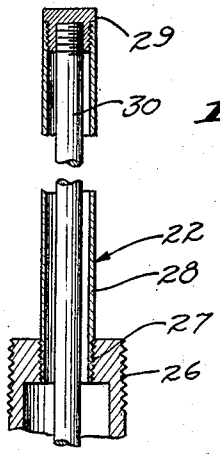


Fig. 4.

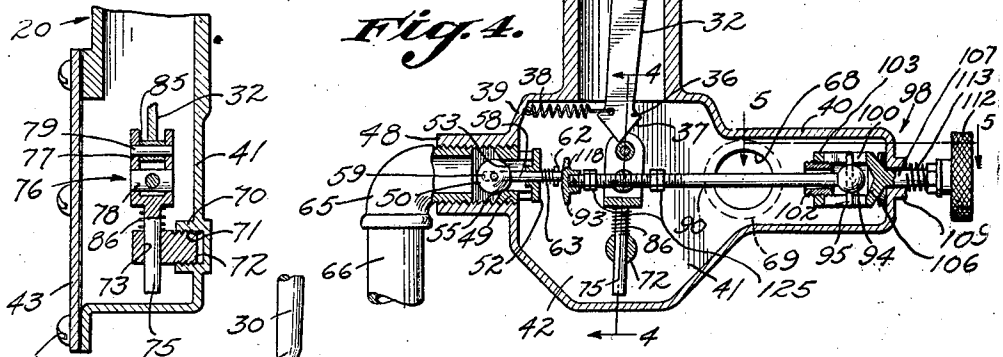


Fig. 3.

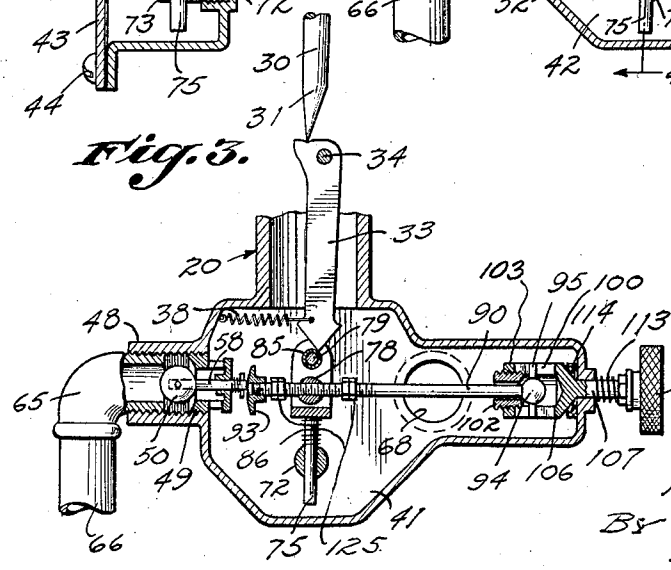
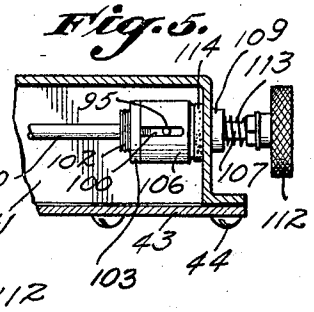


Fig. 5.



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UNITED STATES PATENT OFFICE.

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QUICK-THROW MECHANISM.

Application filed June 22, 1927. Serial No. 200,572.

My invention relates to quick-throw mechanisms and has for an object the provision of a novel mechanism of this type.

Quick-throw mechanisms are required where a prime mover operates relatively slowly and where, at a given point in the movement of said prime mover, it is desired to effect a quick, complete movement of a control member of some kind such as a valve or an electric switch. One use of such mechanisms is to operate such control members in response to thermostats which are provided in thermostatically controlled water heaters, ovens, furnaces, ventilating systems, incubators, electric stoves and appliances, etc.

In quick-throw mechanisms previously produced it has been difficult to adjust the mechanism so as to accurately determine the point in the movement of the prime mover at which the quick movement of the control member would be caused. It is a further object of my invention to provide a quick-throw mechanism in which this adjustment may be readily and accurately made.

In many of the quick-throw mechanisms in use at present gravity is depended upon to perform one or more of the functions of the device so that it is necessary that it be disposed in a given position in order to work properly.

It is a still further object of my invention to provide a quick-throw mechanism which will operate equally well in any position in which it may be placed.

Another object of my invention is to provide a quick-throw mechanism which has few parts and is simple in construction and which therefore may be economically produced and will operate under all conditions of service without getting out of repair.

Other objects and advantages will be made manifest in the following description and in the accompanying drawings, in which

Fig. 1 is a diagrammatic view illustrating a thermostatic quick-throw gas valve incorporated in a hot water tank and embodying a preferred form of my invention.

Fig. 2 is an enlarged vertical sectional view taken on the line 2—2 of Fig. 1, and illustrating in detail the thermostatic quick-throw valve shown in Fig. 1.

Fig. 3 is a fragmentary view similar to Fig. 2 illustrating the parts of the quick-throw mechanism in different positions.

Fig. 4 is a vertical sectional view taken on the line 4—4 of Fig. 2.

Fig. 5 is a horizontal sectional view taken on the line 5—5 of Fig. 2

Referring specifically to the drawings, Fig. 1 shows a boiler tank 10 having a water chamber 11 and a heating retort 12 connected to the upper and lower ends of the chamber 11 by pipes 13 and 14. A gas burner 15 is disposed about the pipe 14 below the retort 12 and by heating the retort heats the water in the chamber 11.

A thermostatically controlled quick-throw gas valve 20 is screwed into a lower wall 21 of the tank 10 so that a thermostatic element 22 of the valve 20 extends upward into the water in the chamber 11. The gas valve 20 has a vertical tubular body 25, the upper end of which is provided with external threads 26 which are adapted to screw into a suitable opening in the tank wall 21, and internal threads 27 which are adapted to threadedly receive the lower end of a copper tube 28 of the thermostat 22.

The upper end of the tube 28 is closed by a plug 29 which carries a rod 30 extending downward through the tube 28 into the tubular body 25. The rod 30 has a pointed lower end 31 which engages with a cam member 32 which comprises a bell crank 33 pivoted at 34 upon the body 25 and extends downward from the lower mouth of the body 25 where it is provided with a head 36 having a peak-shaped cam surface 37. The engagement of the lower end 31 of the thermostat rod 30 with the cam member 32 is off center relative to the pivot 34 so that downward movement of the thermostat rod 30 causes the cam member 32 to swing toward the right. A spring 38 connects the lower end of the bell crank 33 to a side wall 39 of a quick-throw mechanism housing 40 which is provided upon the lower end of the body 25, as clearly shown in Fig. 2. The housing 40 has a back wall 41 which cooperates with the side walls 39 to provide a gas chamber 42, access to which is had by removal of a cover plate 43 which is normally connected to suitable flanges provided on the side walls 39 by machine screws 44. Extending outward from the left-hand side wall 39 is a nipple 48 which is provided with internal threads, in the inner portion of which a shell 49 of a gas inlet valve 50 is screwed. The shell 49 has a spider 52 extending into the chamber 42 which is foraminated to

provide a gas passage 53 extending through the shell 49. A valve seat 55 is formed in the outer mouth of the passage 53. A valve stem 58 passes centrally through the spider 52 so as to be axially guided thereby. A valve head 59, here comprising a ball, is mounted on the outer end of the stem 58 and is adapted to be seated upon the seat 55 or raised therefrom by the sliding of the stem 58 in the spider 52. A pin 62 is provided in the inner end of the stem 58 and a spring 63 is compressed between the spider 52 and the pin 62 to hold the valve head 59 against the seat 55.

An elbow 65 connects with a gas supply pipe 66 and is threadedly secured in the outer end of the nipple 48 to furnish a supply of gas to the gas valve 50.

When the cover plate 43 is in place the gas chamber 42 is a closed chamber from which gas may pass only by an opening 68 in the wall 41 which connects with a burner supply pipe 69 which leads to the gas burner 15. The housing wall 41 has a boss 70 which extends inward into the chamber 42 directly below the connection of the body 25 with the housing 40. The boss 70 is provided with a cylindrical recess 71 in which a rocking pin 72 is rotatably received. The rocking pin 72 has a transverse hole 73 formed therein through which projects a stem 75 of a secondary cam member 76. The cam member 76 has a forked head 77 mounted upon the upper end of the stem 75, the two arms of the fork being perforated at opposite points to rotatably receive a rocking pin 78 and a roller supporting pin 79, the roller supporting pin being disposed above the rocking pin 78. The rocking pin 78 is provided with a transverse internally threaded hole for a purpose to be described later. The roller pin 79 supports a cam follower roller 85 which is adapted to contact the peak-shaped cam surface 37 of the primary cam member 32. A compression spring 86 is disposed about the stem 75 between the head 77 and the rocking pin 72, this spring tending to urge the secondary cam member 76 upward towards the primary cam member 32. A control rod 90, as clearly shown in Fig. 2, is threaded at one end and is adapted to be screwed into and through the threaded transverse hole formed in the rocking pin 78. After having been threaded through this hole the projecting end of the rod 90 has a button 93 rigidly mounted thereon, the outer face of the button 93 being normally disposed in contact with the right-hand end of the valve stem 58. The opposite end of the rod 90 from the button 93 thereof has a ball 94 rigidly mounted thereon, the ball 94 being provided with a transversely projecting pin 95.

A control rod actuating mechanism 98 is mounted in one of the walls 39 substantially in alignment with and on the opposite side of the gas chamber 42 from the gas inlet valve 50. The control mechanism 98 includes a cylindrical shell 100 internally threaded at its mouth and slotted longitudinally on opposite sides, the shell being of such size as to receive the ball 94, the opposite ends of the pin 95 projecting into said slots. An externally threaded bushing 102 is placed about the rod 90 during its assembly and when the ball 94 is disposed in the shell 100 the bushing 102 is screwed into the threaded mouth of the shell. A lock nut 103 is then screwed over the extending portion of the bushing 102 against the end of the shell 100 so as to rigidly lock the bushing in place and confine the ball 94 in the shell 100. The shell 100 has a head 106 which cooperates with the bushing 102 to limit the endwise movement of the ball 94 and the rod 90. The head 106 has a stem 107 which projects out through a hole in a boss 109 provided in one of the walls 39, as clearly shown in Fig. 2. A manually operable wheel 112 is mounted on the outer end of the stem 107. A compression spring 113 disposed between the boss 109 and the wheel 112 stiffly urges the stem 107 outward so as to draw the shell head 106 into compressing relation with a packing washer 114 which is disposed about the stem 107 adjacent to the head 106. The packing washer 114 thus forms a tight seal between the shell head 106 and the boss 109 and permits the shell 100 to be easily rotated by the wheel 112. The outer surface 118 of the button 93 may have a spherical form generated about the center of the ball 94 for a purpose which will be made clear in the description of the operation.

The operation of my quick-throw mechanism as embodied in the thermostatic quick-throw valve 20 is as follows:

As previously stated, the ball 94 has a certain freedom to move to the right or left in the shell 100. This permits the rod 90 and the secondary cam member 76 to have a similar freedom. Urged by the spring 86, however, the secondary cam member 76 is constantly forced upward so that the roller 85 engages the peak-shaped cam surface 37 of the primary cam member 32. It depends upon which slope of the surface 37 is engaged by the roller 85 as to whether the secondary cam member 76 and the rod 90 are disposed at the right-hand or at the left-hand end of the path which they are free to move upon by virtue of the play of the ball 94 in the shell 100. As previously mentioned, the primary cam member 32 has the form of a bell crank 33 which is swung to the right as the lower end 31 of the thermostat rod 30 moves downward. This latter motion occurs as the water in the tank chamber 11 cools off. Fig. 2 shows the parts of the mechanism positioned as they would be when the water in the tank chamber 11 is between its minimum and maximum temperatures and with the secondary

cam member 76 and the rod 90 in right-hand position so as to permit the spring 63 to close the valve 50 and shut off the supply of gas through the hole 68 to the gas burner 15. Thus it is clear that with the gas burner shut off, the water in the tank chamber 11 will be gradually cooling off due to radiation and to use of the water from the service outlets.

As the water cools the lower end 31 of the rod 30 moves down swinging the primary cam member 32 to the right against the tension of the spring 38 until the roller 85 passes over the peak of the cam surface 37. As this occurs the compression spring 86 is released to force the secondary cam member 76 upward, the engagement of the roller 85 with the opposite slope of the cam surface 37 at this time causing the secondary cam member 76 and the rod 90 to be thrown to the left with a quick movement into the position in which these parts are shown in Fig. 3. In this movement the button 93 engages the end of the valve stem 58 so as to open the valve 50 to permit gas to pass therethrough into the gas chamber 42 and thence by way of the opening 68 and the pipe 69 to the gas burner 15, this gas being ignited by a suitable pilot light which is constantly burning adjacent to the burner 15.

As the flame from the burner 15 heats the water in the retort 12 and in the tank chamber 11 and its temperature rises to the desired maximum, the lower end 31 of the rod 30 is drawn upward so as to relieve the bell crank 33 from its pressure and to permit the spring 38 to swing this bell crank to the left so that the peak of the cam surface 37 will again be passed over by the roller 85, but in the opposite direction from that previously described for the opening of the valve 50. As the roller 85 passes over the peak of the cam surface 37, the secondary cam member 76 and the rod 90 snap from their left position to their right position and the pressure of the button 93 against the valve stem 58 is relieved, permitting the spring 63 to close the valve 50 and stop the flow of gas to the burner 15.

The number of degrees of temperature between minimum and maximum temperatures is a function of the fixed proportions of the mechanism and is therefore consequently a constant quantity.

The absolute values of maximum and minimum temperatures, or those at which the valve 50 is closed or opened respectively, are determined by the position of the secondary member 76 on the rod 90. This position is changed when the hand wheel 112 is rotated, this being due to the threaded engagement of the rod 90 with the rocking pin 78.

It may be easily understood that the exact arrangement of parts shown in the drawings is not essential to the working out of the invention, but that various modifications might be made without departing from the spirit of the invention or the scope of the appended claims. For example, it might be immaterial whether or not the cam surface 37 was provided upon the primary cam member 32 or upon the secondary cam member 76 so long as the roller follower 85 was provided upon the other of these two members. I therefore desire to be limited only by the liberal interpretation of the appended claims.

If it is found desirable, stops 125 comprising pairs of nuts screwed upon the threaded end of the rod 90 may be disposed on opposite sides of the rocking pin 78 so as to limit the adjustment of the rod 90 relative to the pin 78. As each of the stops would be formed by two nuts threaded on the rod 90, each of the stops could be given a fixed adjusted position by bringing the nuts which comprise it into pressural contact with each other. These stops would necessarily be of such an outside diameter as to permit them to pass between the arms of the forked head 77 so as to come in contact with the rocking pin 78 and thus limit the longitudinal adjustment of the rod 90 relative to the rocking pin 78 in a given direction. In case stops, as above described, were used upon the rod 90 longitudinal movement of the rocking pin 78 in the forked head 77 would be prevented by any suitable means provided in the construction of the secondary cam member 76. Thus the rod 90 would at all times be disposed equidistant from the two arms of the forked head 77.

It is to be understood that while a hand wheel 112 is shown for the rotation of the rod 90, any suitable mechanism may be employed for this purpose and that indicia may be provided upon this rod rotating means and the housing shell 40 so as to indicate the temperature at which the quick-throw mechanism will operate for a given position of this rod rotating means.

I claim as my invention:

1. In a quick-throw mechanism, the combination of: a primary cam member adapted to move relatively slowly, a substantial component of said slow movement being in a given direction; a quick-throw member adapted to move quickly, a substantial component of said quick movement being in a direction parallel to said component of said slow movement; means for limiting said quick movement of said quick-throw member; a secondary cam member associated with said quick-throw member so as to partake of said limited quick movement thereof; means for yieldably urging said secondary cam member against said primary cam member in a direction transverse to said direction of movement of said primary cam member, one of said cam members having a peak-shaped cam surface over which the other cam member rides, the passage of said other cam member over the crest of said peak causing said quick

movement of said secondary cam member and said quick throw member, said quick-throw member having a screw-thread engagement with said secondary cam member; and means for rotating said quick-throw member to vary the cooperative relationship of said cam members and thus vary the time of the quick-throw movement relative to the movement of the primary cam member.

2. In a quick-throw mechanism, the combination of: a primary cam member adapted to move relatively slowly, a substantial component of said slow movement being in a given direction; a quick-throw member adapted to move quickly, a substantial component of said quick movement being in a direction parallel to said component of said slow movement; means for limiting said quick movement of said quick-throw member; a secondary cam member associated with said quick-throw member so as to partake of said limited quick movement thereof; means for yieldably urging said secondary cam member against said primary cam member in a direction transverse to said direction of movement of said primary cam member, one of said cam members having a peak-shaped cam surface over which the other cam member rides, the passage of said other cam member over the crest of said peak causing said quick movement of said secondary cam member and said quick-throw member; and means for adjusting the position of said secondary cam member relative to said quick-throw member to determine at which position of said primary cam member that said rapid movement takes place.

3. In a quick-throw mechanism, the combination of: a primary cam member adapted to move relatively slowly, a substantial component of said slow movement being in a given direction; a secondary cam member adapted to move quickly, a substantial component of said quick movement being in a direction parallel to said component of said slow movement; means yieldably urging said secondary cam member toward said primary cam member in a direction transverse to the direction of said component of said slow movement; means for limiting said quick movement of said secondary cam member, there being cam surfaces on said cam members which cooperate during said slow movement to move said secondary cam member a given distance in said transverse direction against said yieldable means away from said primary cam member, said cam surfaces disengaging at said distance, to permit said secondary cam member to be moved quickly towards said primary cam member by said yieldable means, said movement resulting in the aforesaid quick movement of said secondary cam member, and rotary adjusting means for varying the cooperative relationship of said cam members and thus vary the time of the quick movement of the secondary cam member relative to the slow movement of the primary cam member.

4. In a quick-throw mechanism, the combination of: a frame; a primary cam member mounted on said frame and capable of relatively slow movement in a given direction; a secondary cam member mounted on said frame for movement in a direction substantially parallel to that of said primary cam member; yieldable means for urging said secondary cam member against said primary cam member, there being cam surfaces on said cam members which cause said slow movement of said primary cam member to force said secondary cam member a given distance in a direction transverse relative to said slow movement, said surfaces then disengaging to permit said secondary cam member to respond to said yieldable means in a quick movement; and means for varying the cooperative relationship of the primary and secondary cam members.

5. In a quick-throw mechanism, the combination of: a primary cam member capable of relatively slow movement; a secondary cam member movable relative to said primary cam member; a cam follower provided on one of said members, there being a peak like cam surface provided on the other member; means for urging said secondary cam member toward said primary cam member so that said follower rests upon a slope of said peak like cam surface so that said secondary cam member is urged laterally; means for limiting lateral movement of said secondary cam member so that with movement of said primary cam member in a given direction, said secondary member is moved away from said primary member until said follower passes over the crest of said cam surface, whereupon said follower is free to run down an opposite slope of said cam surface which results in a quick lateral movement of said secondary cam member in response to said urging means; an actuating member bodily movable with said secondary cam member and having a screw-thread connection therewith; and means for rotating said actuating member to vary the cooperative relationship of said cam members and thus determine at what point in the travel of the primary cam member the quick movement of the secondary cam member and actuating member will take place.

6. A combination as in claim 5 in which said limiting means is adjustable to determine where in said movement of said primary cam member that said follower rides over the crest of said cam surface.

7. In a quick-throw mechanism, the combination of: a frame; a primary cam member mounted on said frame and capable of relatively slow movement in a given direction; a secondary cam member mounted on said

frame for movement in a direction substantially parallel to that of said primary cam member; yieldable means for urging said secondary cam member against said primary cam member, there being cam surfaces on said cam members which cause said slow movement of said primary cam member to force said secondary cam member a given distance in a direction transverse relative to said slow movement, said surfaces then disengaging to permit said secondary cam member to respond to said yieldable means in a quick movement; a rotatable actuating rod having a screw-thread engagement with said secondary cam member; a housing enclosing the above-named mechanism; and means associated with said rod and extending through said housing, said last-named means being operable from the exterior to rotate said rod and vary the cooperative relationship of the two cam members.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 11th day of June, 1927.

PETER S. IVANHOFF.