May 9, 1933. L. W. EGGLESTON 1,908,477

CONTROL DEVICE

Filed Aug. 27, 1928 3 Sheets-Sheet 1

Fig. 1.

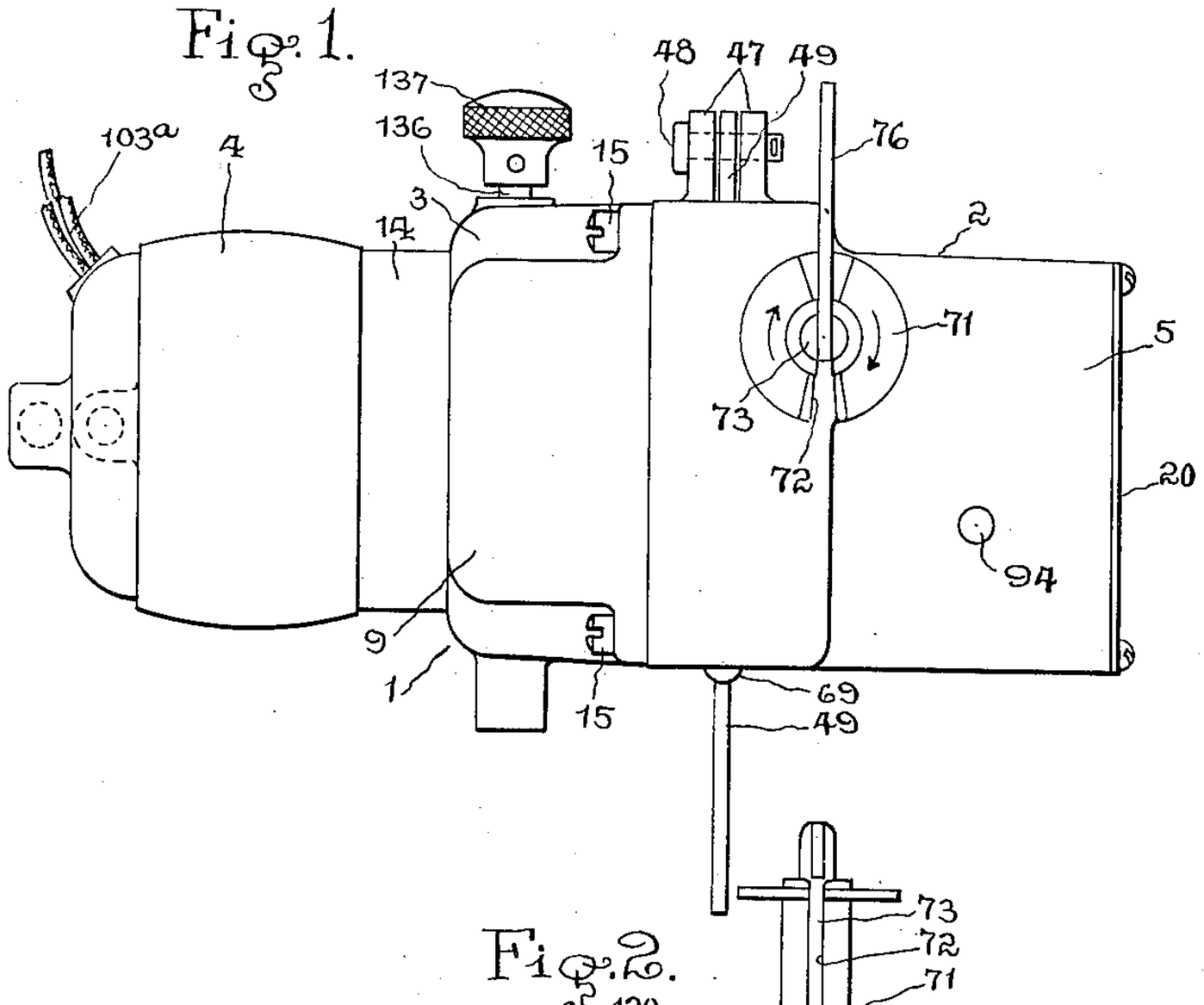
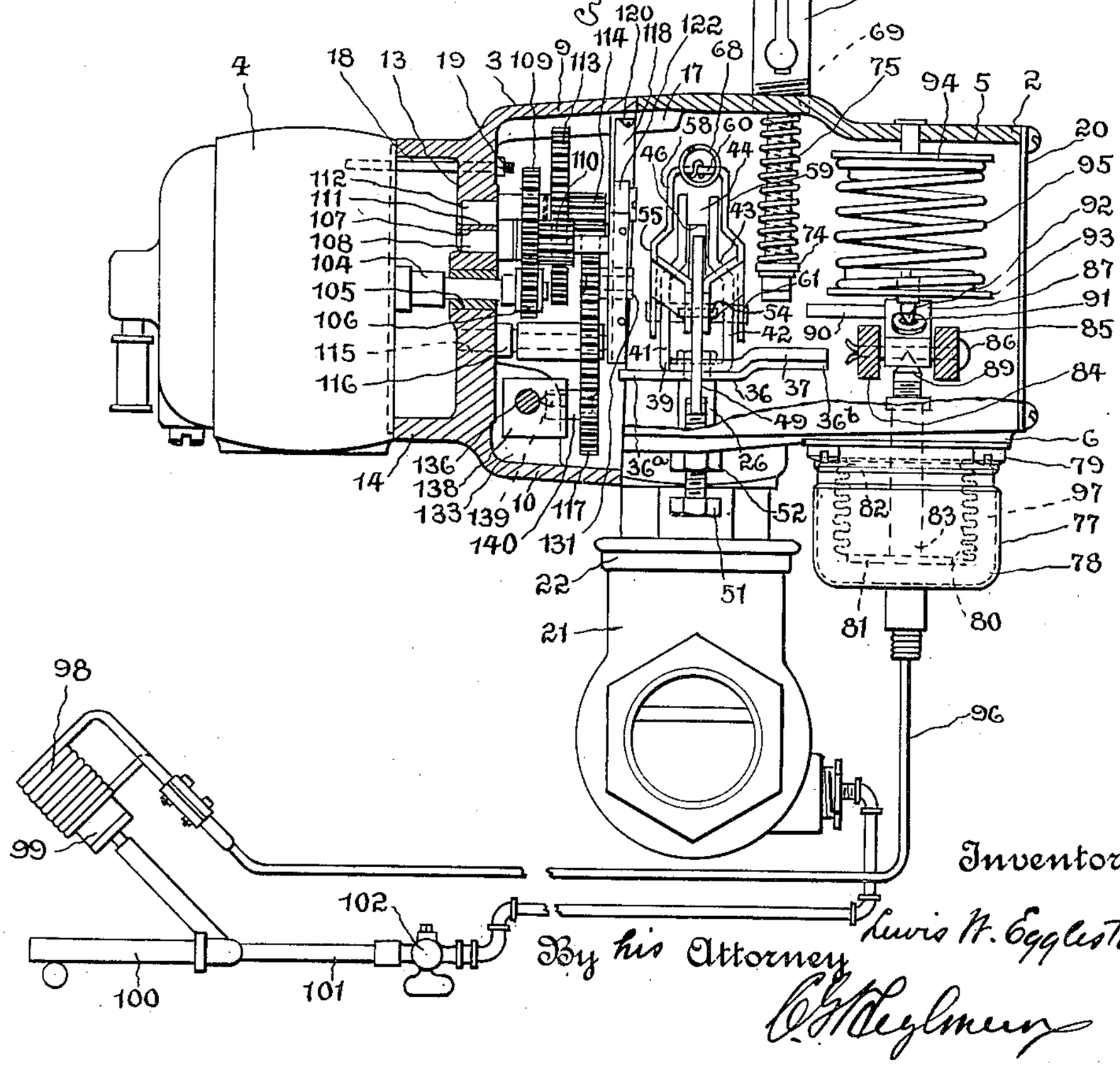


Fig. 2.



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CONTROL DEVICE

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Fig. 3.

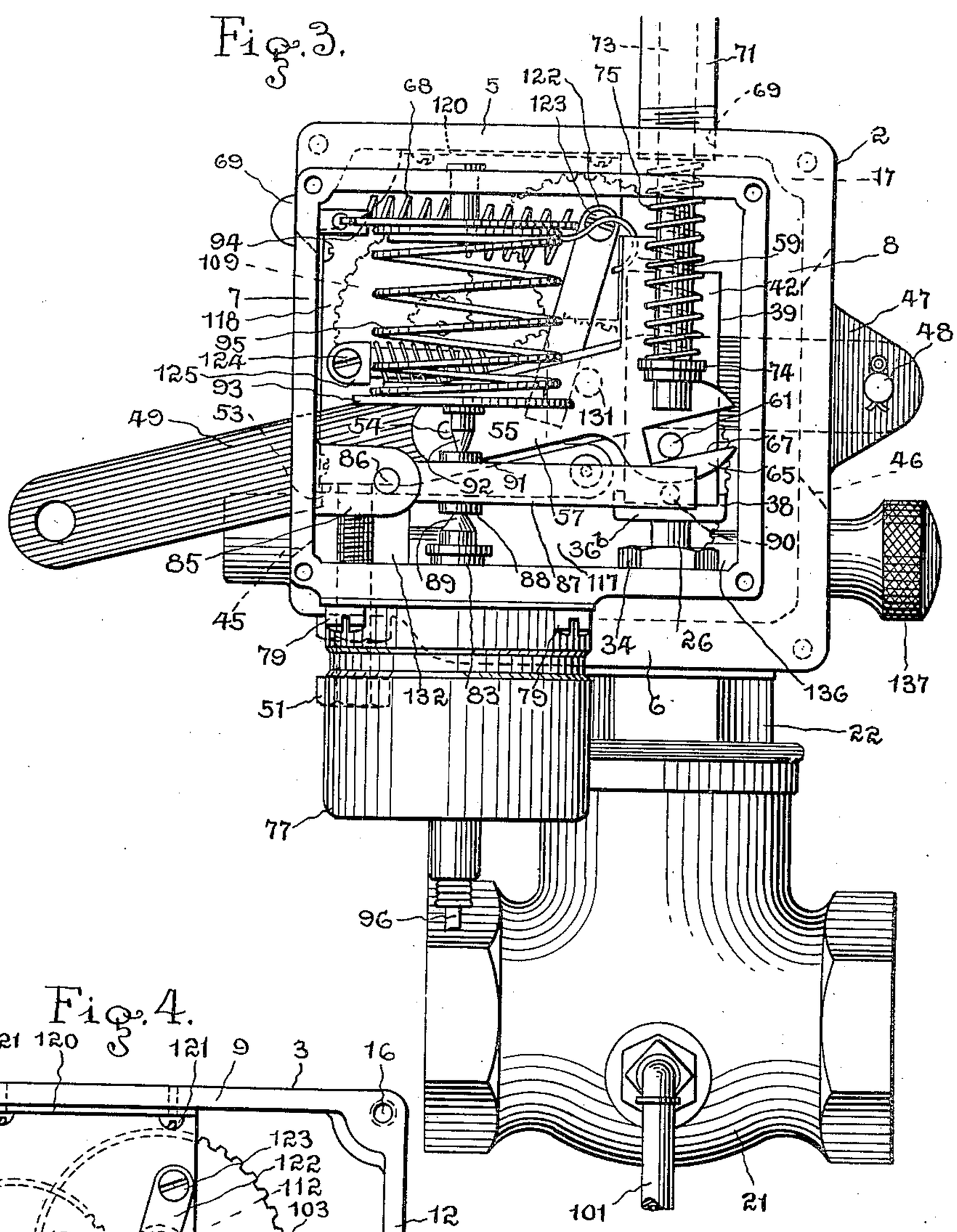
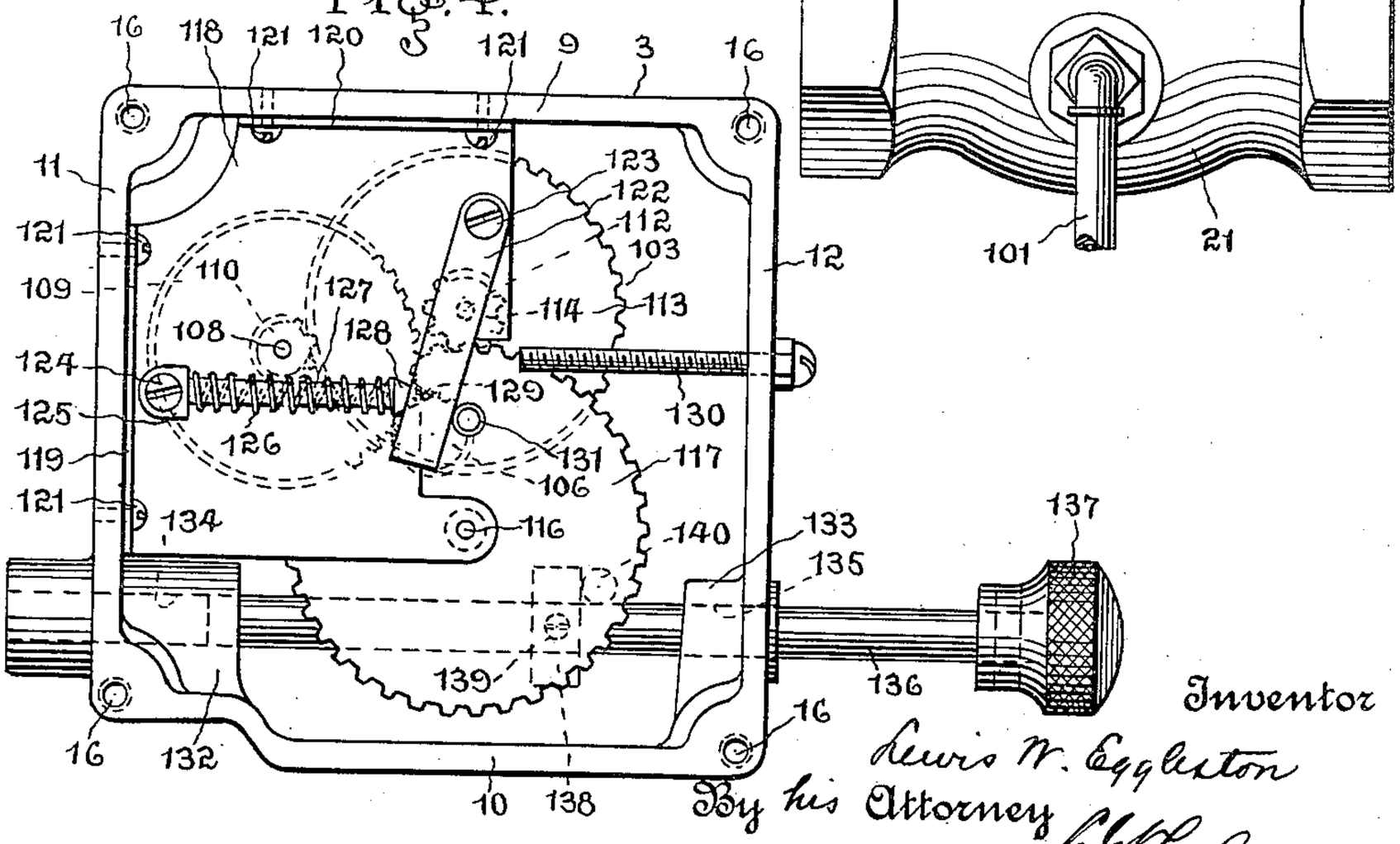


Fig. 4.



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CONTROL DEVICE

Filed Aug. 27, 1928

1,908,477

3 Sheets-Sheet 3

Fig. 5.

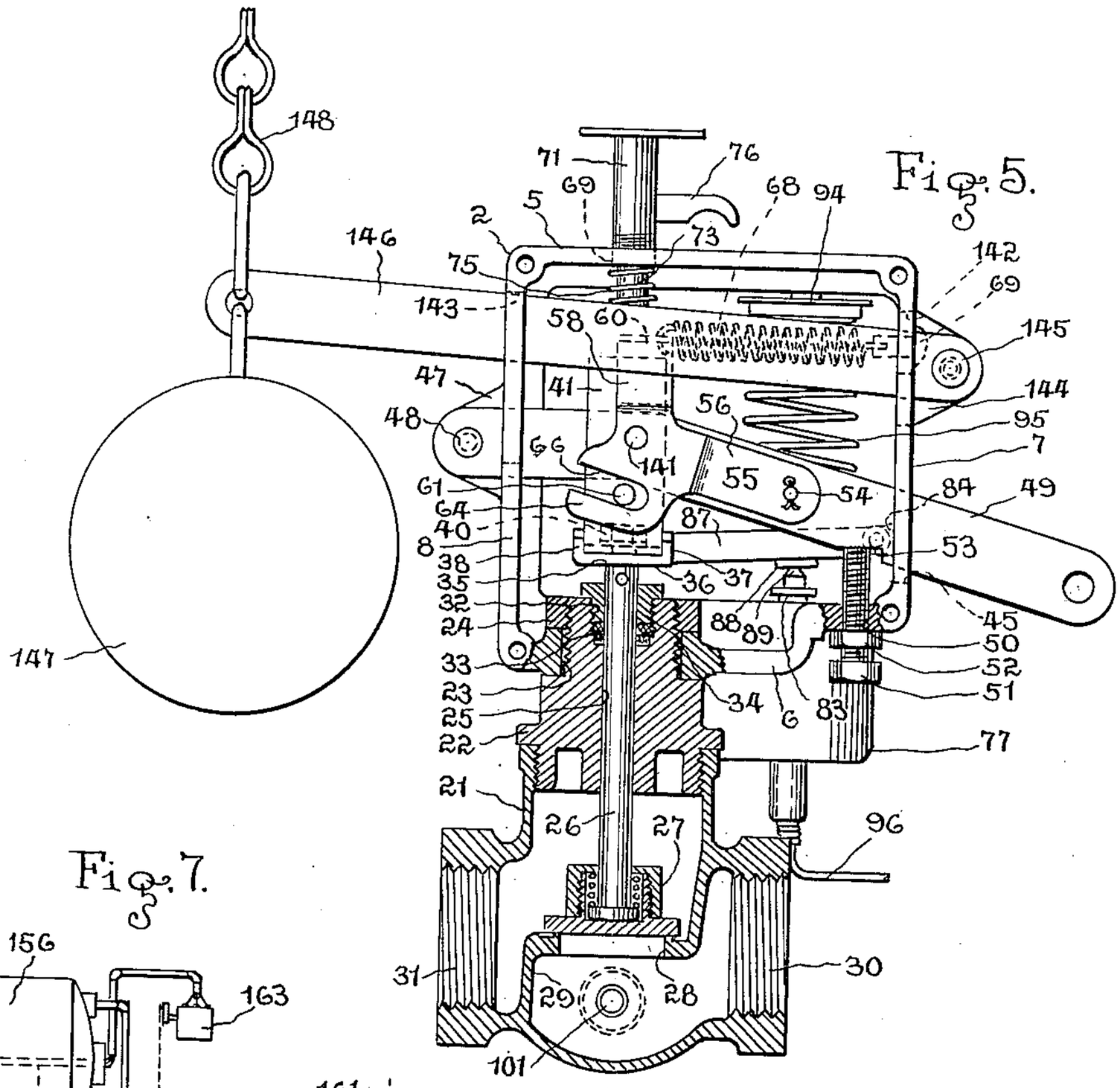


Fig. 7.

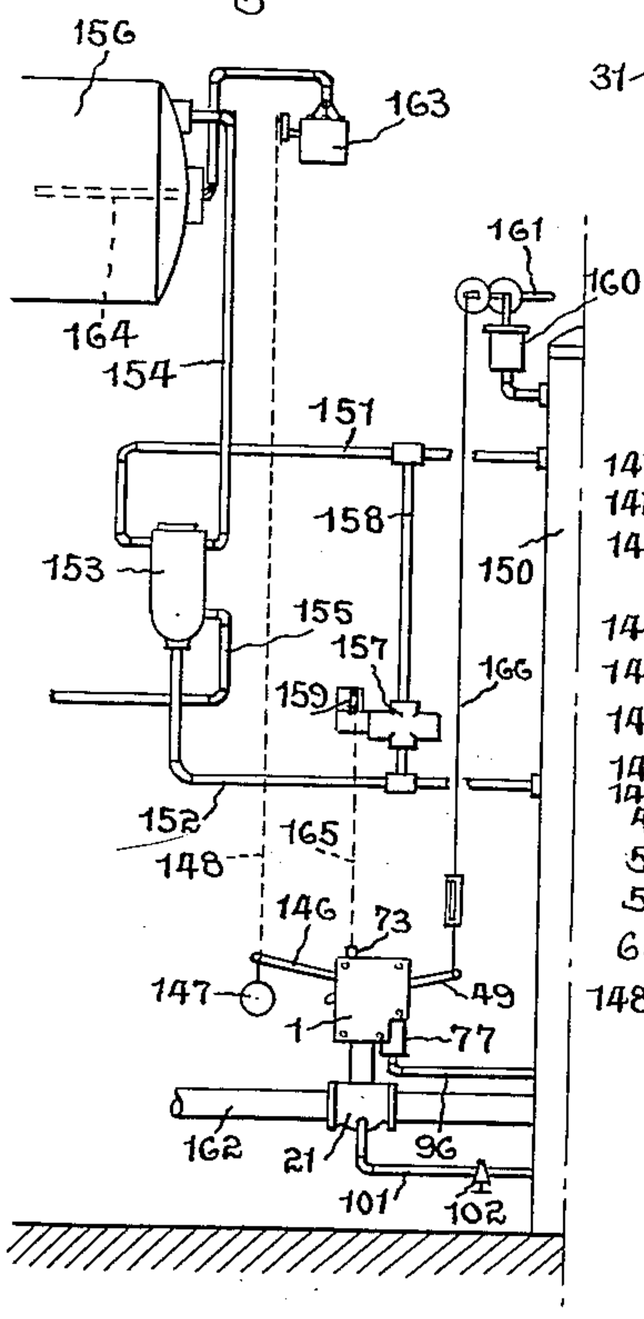
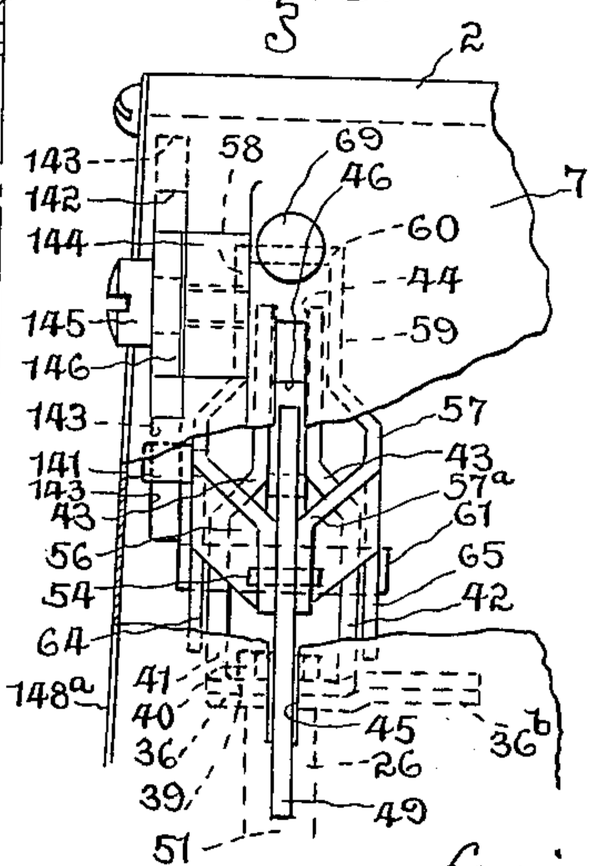


Fig. 6.



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UNITED STATES PATENT OFFICE

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CONTROL DEVICE

Application filed August 27, 1928. Serial No. 302,371.

My invention relates to new and useful improvements in control devices, and more particularly to a device operable to regulate and control opening and closing movement of a valve or the like.

An object of my invention is to provide a device which is operable to reciprocate a plunger of a control means which in the preferred embodiment is a flow control valve.

Another object is to provide a device having regulating means operable between limits to reciprocate the plunger of a valve or the like and having means to move the plunger beyond the limit of movement of the regulating means.

Other objects of the invention will be apparent from the detailed description and operation of the device and from the appended claims.

The invention consists in the improved construction and combination of parts and their aggroupment in operative relation to be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawings, to be taken as a part of this specification, I have fully and clearly illustrated a preferred embodiment of my invention, in which drawings—

Figure 1 is a top plan view of the device embodying my invention,

Fig. 2 is a side view in partial vertical section, and showing certain pilot burner means and having parts of the casing broken away to show the internal construction of my device;

Fig. 3 is an end view with the end cover member removed and looking from the right toward the left of Fig. 2;

Fig. 4 is a detail end view of the motor casing and motor operated gear train shown in Fig. 2,

Fig. 5 is an end view looking from the left toward the right of Fig. 2, with the motor and gear housings removed and with the valve operable by my device in vertical central section and showing a slight modification having provision for remote control means instead of certain direct acting motor and gear control means,

Fig. 6 is a detail view looking from the right toward the left of Fig. 5 with a portion of the casing broken away and showing parts of the mechanism within the casing in dotted lines, and

Fig. 7 is a diagrammatic view showing a system embodying my invention and particularly the form shown in Fig. 5.

Referring to the drawings by characters of reference, 1 designates generally a hollow casing comprising a support preferably composed of three sections including a mechanism housing 2, a gear housing 3, and a motor and motor housing 4, but the casing may be formed as an integral unit. The mechanism housing 2 is preferably substantially rectangular having top and bottom walls 5, 6 respectively and vertical side walls 7, 8. The gear housing 3 is also preferably substantially rectangular having top and bottom walls 9, 10 respectively and side walls 11, 12 which respectively join the walls of the housing 2. Within the housing 3 is a vertical partition or wall 13 beyond which the housing 3 is preferably substantially cylindrical, as at 14 for union with the motor housing 4 which is preferably substantially cylindrical. The gear housing 3 is rigidly connected to the mechanism housing 2 by cap screws 15 or the like passed through apertures 16 in the gear housing 3 and threaded into aligned tapped holes in internal corner lugs 17 of housing 2. The motor housing 4 may be rigidly secured to the other end of housing 3 opposite housing 2 by bolts 18 secured in the housing 4 and passed through apertures in the partition 13 and held by nuts 19. The open end of housing 2 may be closed by a cover member 20 secured thereto by screws or the like.

Depending from the bottom wall 6 of housing 2 is a valve casing 21 having a bonnet 22 and preferably secured to the housing 2 by passing the upper end of the valve bonnet 22 through an aperture 23 in wall 6 and clamping the same tightly to the housing by a nut 24 threaded on the bonnet 22 within the housing 2. Through the bonnet 22 is a central longitudinal bore 25 opening at its opposite ends in the valve casing 21 and housing 2 respectively and serving as a guideway for a

plunger 26 which is reciprocable therein and which has, secured in any suitable manner on its lower end within the valve casing, a valve member 27 such that plunger 26 serves as the stem of the valve. The member 27 cooperates with a valve port 28 in a web or partition 29 which divides the interior of the casing 21 between the inlet and outlet ports 30, 31 thereof, respectively. Concentric with the guideway 25 in the top of the bonnet 22 is a cylindrical recess 32 forming an annular packing receiving space around the plunger 26 containing packing 33 and into which is threaded a packing gland or nut 34 to secure the packing in the recess 32 and seal the guideway 25 around the stem 26.

The upper end of the stem or plunger 26 which projects into housing 2 is of reduced diameter to provide an upwardly facing annular shoulder 35, above which the plunger is threaded. Seated on the shoulder 35 is a substantially rectangular plate member 36 extending substantially parallel with side walls 7, 8 and having upturned side edges 37, 38 and also having an aperture therethrough for passage of the upper end of plunger 26. The ends of the member 36 project longitudinally of the casing 2 from plunger 26, as at 36^a, 36^b. Seated on the member 36 between the vertical edges 37, 38 is the base of an operating member 39 having an aperture therethrough for passage of the threaded end of plunger 26 on which is threaded a nut 40 to tightly hold the plunger 26, plate member 36 and operating member 39 rigidly together. Extending upwardly from the sides of the base of member 39 are substantially parallel arm members 41, 42 which are in planes transverse to the planes of the side edges 37, 38. At substantially half the height of the arm members 41, 42 and of the housing 2, the members 41, 42 are inclined inwardly upward, as at 43, and thereabove are again substantially parallel to reduce the distance between the arm members to form a guideway 44. In the side walls 7, 8 and substantially in the plane of the guideway 44 are vertical slots 45, 46 respectively. Laterally of the slot 46 are vertical bearing lugs or ears 47 which are on the outside of the housing 2 and rigid with wall 8. Through the lugs 47 is a bearing pin 48 which serves as a fulcrum and on which is journaled one end of a lever member 49 which extends across housing 2 through the guideway 44 and slot 45. When in normal down position (see Fig. 3 and 5) the lever member is substantially horizontal for a portion of its length, namely from its fulcrum to the far side of the arm members 41, 42 and then for the remainder of its length is inclined downward at about 18° from the horizontal. Through the bottom wall 6 of housing 2 adjacent the side wall 7 and directly beneath lever member 49 is an internally threaded aperture 50 through which is threaded an adjustment screw 51 which projects into the housing and has a lock nut 52 to secure the screw 51 in adjusted position. The underside of lever member 49 is recessed, as at 53, to form a horizontal seat for engagement with the upwardly extending end of screw 51. The screw 51 serves as a stop means or abutment to limit movement of the lever member 49. Journaled on a pin 54 passed transversely through the lever member 49 at a point substantially midway between the plunger 26 and side wall 7 is one end of a lever means 55 having substantially parallel arms 56, 57 which lie on either side of and normally extend along the lever member 49 toward the plunger 26 such that lever member 49 serves as a guide means for pivotal movement of means 55 on its fulcrum 54. At a point, as 57^a adjacent arm members 41, 42 the arms 56, 57 diverge and again come into parallelism to lie in close lateral proximity to the outside of the arm members 41, 42 respectively. The arms 56, 57 have upwardly projecting portions 58, 59 respectively which are joined by a substantially horizontal portion 60 above the members 41, 42. Through the arm members 41, 42 is a pin 61 which passes beneath the horizontal portion of lever member 49 such that the underside of horizontal portion of the lever member 49 serves as a stop means for engagement by the pin 61 to limit upward movement of lever means 55 relative to member 49. The ends of pin 61 project from or beyond the arm members 41, 42 respectively. The arms 56, 57 are provided with depending portions 64, 65 respectively adjacent their free ends which portions have open-ended slots 66, 67, respectively, which are substantially parallel to the longitudinal center lines of the arms 56, 57. The projecting ends of the pin 61 extend into the slots 66, 67, respectively and provide a connection between the lever member 49 and the plunger 26. Secured to the horizontal portion 60 is one end of a resilient means 68, preferably a coil spring, which is connected at its other free end to housing 2 preferably by means of a headed pin 69 passed through an aperture in the side wall 7 directly above slot 45 and to which the said other end of the spring is secured. The spring 68 is normally under tension and exerts its force to swing the lever means 55 counterclockwise of Fig. 3 and clockwise of Fig. 5 on its fulcrum 54 until the pin 61 brings up against the underside of lever member 49. When pin 61 has been pulled by spring 68 into engagement with lever member 49 then the lever means 55 and the lever member 49 will be rigid with each other and the force of the spring will act through lever means 55 upon the lever member 49 to swing it counterclockwise of Fig. 3 or clockwise of Fig. 5, about its fulcrum 48.

Through the top wall 5 of housing 2 direct-

ly above one end of the plate member 36 is an aperture 69 into which is threaded on the outside of the casing a sleeve 71 having a vertical guide slot 72 in its side wall and open at its upper end. Reciprocable in the sleeve 71 is a plunger rod 73 which projects into housing 2 and has at its lower end a shoulder or annular abutment 74. Between the top wall 5 and shoulder 74 on the rod 73 is a coil spring 75 under compression which normally acts to move the plunger rod 73 downward against the end 36[b] of the member 36. The downward force of the spring 75 upon member 36 and plunger 26 is greater than the force of spring 68 to lift plunger 26. Projecting through the slot 72 and integral with rod 73 is an operating member 76 which may be connected to automatic means or may be a hand grip for manual operation by an operator to lift the plunger rod 73 against spring 75 to raise the grip 76 out of the slot 72 when the rod may be rotated to move grip 76 out of registry with the slot 72 so that the grip 76 will rest on the end of sleeve 71 to hold the rod 73 in raised position and out of contact with the plate member 36 (see Figs. 2 and 3).

Secured to the bottom wall 6 outside the housing and depending therefrom is a device 77 comprising a substantially cup-shaped hollow casing 78 sealed along its top edge or rim to the wall 6 by screws or the like 79. Within the casing 78 is a substantially cylindrical corrugated expansible-collapsible metallic element 80 preferably a metal bellows having a head 81 closing and sealing its inner lower end which is adjacent the base of the casing 78. The bellows 80 is hermetically sealed along its upper free edge to an annular flange projecting inwardly from the side wall of the casing 78, as at 82. Mounted rigidly on the head 81 is a plunger 83 which projects upward within the bellows 80 and through an aperture in the bottom wall 6 into the housing 2. Rigid with the side wall 7 and extending into the housing 2 are vertical parallel spaced bearing lugs or ears 84, 85 which are spaced substantially equidistant from a plane transverse to walls 7, 8 and through the plunger 83. Journaled on a pin 86 passed horizontally through the lugs 84, 85 is a lever 87 having a conical socket 88 in its under face in which the upper free conical end 89 of the plunger 83 seats. At its free end the lever 87 has rigid therewith a laterally extending arm 90, the end of which overlies the end 36[b] of the plate member 36 for operative engagement therewith. In the upper face of the lever 87 and preferably directly above the socket 88, is a conical socket 91 in which seats the conical end 92 of a spring follower member 93. Substantially directly above the socket 91 is a spring abutment member 94 secured rigidly to the top wall 5 of the housing 2. Between the members 93 and 94 is a coil spring 95 under compression and normally acting to force the arm 90 against the end 36[b] of the plate member 36 to move the plunger 26 downward. Depending from the base of the casing 78 in a tube or conduit member 96 which opens into the sealed chamber 97 formed between the casing 78 and bellows 80. The free end of the tube 96 is coiled or wrapped as at 98 around the end of a pilot burner 99 which is supported on a frame 100 and fed with fuel from a conduit 101 preferably tapped into the main supply line or the valve casing 21 on the inlet side 30 thereof (see Fig. 2). The tube 96 and chamber 97 are charged with a suitable expansible fluid so that the fluid upon expansion due to the heat of the pilot flame will compress the bellows 80 to lift plunger 83. The device 77 comprises a thermostatic motor means which is responsive to a characteristic of the fluid within the chamber 97 and tube 96. The conduit 101 may be provided with a flow control cock 102.

Within the motor housing 4 is an electric motor (not shown) which may be of any suitable reversible type to drive the gear train 103 to be described. From the motor 4 extend the usual electric leads 103[a] in which may be electrically connected a control means for the motor 4 such as a thermostat and electric switch means operated thereby responsive to air or liquid temperatures for example. The motor 4 is provided with a drive shaft 104 which is journaled in a suitable bearing opening 105 in the partition or wall 13 in the gear housing 3. The shaft 104 projects through wall 13 and secured tightly on the end of the shaft is a gear pinion 106. Fixed in an aperture 107 in the partition 13, preferably by a drive fit, is a shaft 108 on which is journaled a gear wheel 109 meshing with pinion 106. Also journaled on shaft 108 and integral with gear wheel 109 is a pinion 110. Fixed in an aperture 111 in the partition preferably by a drive fit is a shaft 112 on which is journaled a gear wheel 113 which meshes with the pinion 110. Also journaled on the shaft 112 is a pinion 114 integral with gear wheel 113. Fixed in an aperture 115 in partition 13 preferably by a drive fit, is a shaft 116 on which is journaled a gear wheel 117 which meshes with pinion 114. This gearing comprises the gear train 103 by which the speed of rotation of the motor is reduced. A supporting plate 118 having side and top flanges 119, 120, is fastened rigidly in the housing 3 substantially parallel to wall 13 by screws or the like 121, passed through said flanges and threaded into the housing. The plate 118 is provided with apertures for the reception of the ends of the shafts 108, 112 and 116 which are of reduced diameter. Mounted on the outside face of plate 118 adjacent housing 2 is an abutment

member 122 pivoted on and depending from a pin 123 projecting from plate 118. Pivoted on a pin 124 rigid with and on the outside face of plate 118 adjacent side wall 11 is a spring abutment member 125 on which is a coil spring 126. Telescoped within the free end of the coil spring is a spring follower member 127 having a conical end 128 which seats in a conical recess 129 in the member 122. The spring 126 normally tends to rotate the member 122 counterclockwise of Figs. 3 and 4 into engagement with a stop member 130 projecting horizontally into the housing 3 from side wall 12 into the path of movement of member 122. Projecting from the outside face of the gear wheel 117 is a pin or lug 131 which is adapted to engage the end 36ª of plate member 36 and also to engage the abutment member 122 to limit reverse operation of the reversible motor. At the base or bottom of and within housing 3 are bosses 132, 133 integral with walls 11, 12 respectively. Through the bosses 132, 133 are alined bores 134, 135 respectively in which are reciprocably mounted the ends of a rod 136 which projects from wall 12 and is provided external of the housing with a head 137 for manual reciprocation of the rod by an operator. On the rod 136 between bosses 132, 133 is a block member 138 rigidly secured to the rod by a set screw or the like 139. Secured to and projecting from the inside face of gear wheel 117 is a pin or lug 140 which lies in the path of movement of the block member 138, such that when the rod 136 is pulled outwardly the block will engage the pin 140 to reverse the rotation of the gearing and move pin 131 out of engagement with the end 36ª of plate member 36.

In Figs. 5 and 6, the gear and motor housings 3, 4 have been removed and the device provided with means in lieu thereof to permit a remote control instead of the direct motor control heretofore described. Fixed to and projecting outwardly transverse to the arm 56 of lever means 55 is a pin or lug 141. In the side walls 7, 8 adjacent the top wall of the housing 2 are vertical guide slots 142, 143 respectively, which are in a vertical plane through the pin 141 and transverse to the longitudinal axis thereof. Integral with the wall 7 at one side of slot 142 is a vertical bearing arm or lug 144 which projects from the outside face of wall 7. Projecting from lug 144 is a pivot pin 145, preferably a screw threaded into the lug, which extends across the slot 142 and has journaled thereon at one end a bar or lever member 146 which passes through the slots 142, 143 and from the housing 2. The bar lies above the pin 141 and is adapted to engage the same to depress the lever means 55 and plunger 26. In this arrangement, the pin 141 serves the same function as does the end 36ª of member 36 in Figs. 1 to 4, inclusive and therefore in the construction shown in Figs. 5 and 6 the end 36ª of member 36 is eliminated. The free end of the bar 146 is provided with a weight member 147 which normally acts to move the bar 146 into engagement with the pin 141 to depress the plunger 26. Also secured to the free end of bar 146 is an operating means 148, preferably a chain, by which the bar 146 and weight member 147 may be held out of contact with pin 141 and by which the bar 146 may be manually or automatically operated. The open end of housing 2 left by removal of housings 3 and 4 may be closed by a cover member 148ª secured by screws or the like to housing 2.

The operation of my device is as follows: In Fig. 7, I have shown the form of my device illustrated in Figs. 5 and 6 as embodied in a heating system for the purpose of illustration and description of operation solely as it is evident that my device may be employed in other systems or have other uses. The water containing space of a boiler 150 is connected by suitable upper and lower piping 151, 152 with a water supply heater 153 which may be of the indirect heater type. The heater 153 is provided with outlet and return flow pipes 154, 155 which connect to a hot water supply tank 156. A safety water level means 157 is provided for the boiler which is connected by pipes and fittings 158 to the piping 151, 152 and which may be and preferably is a device such as that shown in my copending application Serial No. 120,068 filed July 2, 1926 having an overcenter float controlled arm 159 which is released when the float drops due to a drop in water level within the boiler below the safe limit. The boiler is also provided with motor means 160 responsive to a characteristic of the fluid in the boiler space and comprising a temperature or pressure responsive device or regulator having a pivoted operating arm 161. The boiler is heated by fluid fuel fed to the main burner by a pipe or conduit 162 in which is inserted the control valve 21 of my device. In the system is a control means 163 preferably a motor and switch which may be the Honeywell Type D, wall motor, manufactured by the Minneapolis-Honeywell Regulator Company, of Minneapolis, Minnesota and which is energized in response to water temperature in the hot water supply tank 156 by means of a thermostat or the like 164, preferably of the expanding fluid type. The operating means or chain 148 of lever arm 146 is connected to the switch 163 for raising and lowering thereby, to control the valve 27. A chain or the like 165 connects the overcenter arm 159 with the operating member 76 and normally holds the plunger 73 in raised position with the member 76 in line with the slot 72 so that release of the chain 165 by the float will permit the spring 75 to move

plunger 73 downward. The lever 161 of regulator 160 is connected by a rod or the like 166 to the lever member 49 to raise and lower the same to regulate or control the opening of the valve port 28. The screw 51 is now adjusted so that valve 27 will not be closed entirely by operation of member 49, the setting preferably being such that the degree of minimum opening of the valve 27 under the closing action of member 49 will be substantially twenty-five per cent of maximum opening. The system having been coupled up as above described, the control cock 102 is opened and the pilot burner 99 is ignited which will heat the fluid in the coil 98, expanding the same, which will collapse bellows 80 and move plunger 83 upward against the force of spring 95. As the plunger 83 is forced upward, it will lift the lever 87 and its arm 90 out of contact with the end 36^b of member 36, see Fig. 2. This will release the plunger 26 and permit the spring 68 acting through lever means 55 to lift the plunger 26 until the pin 61 strikes the underside of the lever member 49. Since the boiler 150 and tank 156 are cold, the lever 161 will have pulled upward on rod 166 and raised lever member 49 to its upper limit of movement, and the thermostat 164 will be calling for heat so that motor and switch 163 will have pulled upward on the chain 148 and lever 146 to hold the lever 146 out of contact with pin 141, therefore spring 68 which acts to rotate lever means 55 clockwise of Fig. 5 upon its fulcrum 54 will pull means 55 and valve stem 26 upward to their maximum before pin 61 engages member 49 and limits or stops further contraction of spring 68 and movement of the valve 27. As fuel flows through valve port 28 to the main burner (not shown) of the boiler 150, it will be ignited by the pilot burner 99 and heat the water in the boiler. As the temperature or pressure in the boiler rises to a predetermined temperature or pressure for which the temperature or pressure regulator 160 is set, it will act through the lever 161 and rod 166 to depress the free end of the member 49 which will act through pin 61 to move the plunger 26 downward and the valve 27 toward closed position until the seat 53 of member 49 engages and comes to rest against the abutment 51. If a chain or flexible member is employed in lieu of the rod 166, then upon release of member 49, the spring 68 will act through means 55 upon lever member 49 and pin 61 to move the valve 27 toward closed position. As the boiler cools the reverse action will take place and the lever 161 will pull upward on chain or rod 166 to lift member 49, permitting spring 68 to pull up on means 55 to lift the valve 27 from its seat. The heated water in the boiler flows through piping 151, 152 to the heater 153 to heat the water circulating therethrough from the tank 156. Should the water in tank 156 reach the desired predetermined temperature which would satisfy the thermostat 164 before the regulator 160 has acted to move the valve toward closed position, then the thermostat 164 will close the circuit through the motor and switch 163 to energize the same which will act to release the chain 148 permitting weight member 147 to swing lever 146 downward into engagement with pin 141, thus rotating lever means 55 on its fulcrum 54 and forcing valve 27 downward to its seat closing port 28 and cutting off fuel flow to the main burner without moving lever member 49 downward to the position of Figs. 3 and 5. Should the thermostat 164 be satisfied after the regulator 160 has moved member 49 downward against stop 51, the above action of released weight member 147 would be the same, but under this condition seating the valve from its quarter open position. When the valve 27 has been closed by the lever 146 and weight member 147, it is held closed irrespective of the operation of the member 49. Should the lever member 49 be in down position when valve 27 is closed by weight member 147 and the boiler then cool so that the regulator 160 pulls up on the rod or chain 166, the rod or chain 166 and the lever member 49 will be permitted upward movement by reason of the stretching of spring 68 as lever means 55 is rotated counter clockwise of Fig. 5 about pin 61. When the temperature of the water in tank 156 drops from any cause so that the thermostat 164 calls for heat, then the motor switch 163 will be energized to pull up on chain 148 to lift lever 146 out of contact with pin 141, as in Fig. 5. Release of pin 141 by lever 146 will permit spring 68 to lift means 55 until pin 61 engages lever member 49 thus opening the valve 27 to the extent demanded by regulator 160 and permitting the regulator 160 to again function to move the valve toward open and closed positions, as above described. If it should happen that the water level in the boiler should drop for any reason below the predetermined safe level for which device 157 is set, then the float in device 157 will throw arm 159 over center releasing chain 165 and permitting spring 75 to move plunger 73 downward onto end 36^b of member 36 to seat valve 27 and close port 28 irrespective of the position in which the valve may be under the action of regulator 160. As the plunger 26 is moved downward, means 55 will be rotated on its fulcrum 54 counter clockwise of Fig. 5 against the force of spring 68. The valve will be held closed by spring 75 against any operative effect of the lever member 49 or spring 68 and until the device 157 is manually reset and water supplied to the boiler 150. The device 157 may be dispensed with or placed out of operative

relation by rotating plunger 73 until the arm 76 overlies the top of sleeve 71 which will hold the spring 75 compressed and plunger 73 out of engagement with member 36 irrespective of drop in water level and the resultant functioning of device 157. If the pilot light at burner 99 should become extinguished, the expansible liquid in the tube 96 and chamber 97 will contract permitting the spring 95 to act to force arm 90 down upon member 36 to seat valve 27 and close port 28 irrespective of the open position in which the valve may be at the time and in the same manner as the closing of the valve by spring 75 and plunger 73. The valve 27 will be held closed by arm 90 until the pilot burner is again ignited and irrespective of operation of member 49.

The employment of the motor 4 and gear train 103 in lieu of the motor switch 163, lever 146 and pin 141 does not alter or change the operation of my device; but permits of a compact device in which operation of the valve in response to water supply tank temperature is direct as distinguished from remote control. When the gear train 103 and motor 4 are employed the member 36 is extended to provide projecting end 36[b], the leads 103[a] are connected to switch means, preferably of the mercury tube type, not shown, as such switches are well known in the art, which is controlled by thermostat 164. When the motor 4 is energized due to the predetermined temperature in the tank 156 being reached which satisfies thermostat 164, the motor shaft 104 will drive gear train 103 and rotate pin 131 clockwise of Figs. 3 and 4 about shaft 116 into engagement with end 36[a] of member 36 thus moving plunger 26 downward to seat valve 27. Pin 131 will engage end 36[a] irrespective of the position in which the valve 27 and member 36 have been placed by the lever member 49 and should the valve be open, will force the same to its seat closing port 28. Upon a drop in temperature in the tank 156, the thermostat 164 will call for heat and close the motor switch means reversing the motor 4 to drive the gear train 103 to rotate pin 131 counterclockwise to the position of Figs. 3 and 4, thus permitting the valve to be opened by spring 68 until pin 61 engages member 49. As the pin 131 comes into contact with abutment member 122 which is normally in contact with stop member 130, spring means 126 will resist the clockwise swing of member 122 on its pivot 123 and cushion the engagement of pin 131 and member 122 thus stopping the motor 4. The pin 131 may be manually moved out of contact with the end 36[a] of member 36 so that the valve 27 may be opened or to permit operation of the valve by regulator 160 by grasping the knob 137 and pulling shaft 136 outward. This will move abutment 138 into engagement with pin 140 and rotate gear wheel 117 counterclockwise of and to the position of Figs. 3 and 4.

From the foregoing description, it will be seen that I have provided a control device for a valve or other control means, it being apparent that my device may operate to control other means than a valve, the device being normally operable between certain minimum and maximum predetermined limits, but which may be moved beyond the minimum limit and when employed with a valve may operate to move said valve from minimum open position to tightly closed position in response to the operation of certain safety means.

Having described my invention what I claim and desire to secure by Letters Patent of the United States is:—

1. In a device of the character described, a support having a plunger mounted thereon for reciprocation, control means operable by said plunger, a pair of levers having fulcrum supports, and means to cause movement of one of said levers upon movement of the other of said levers, said one lever having operative engagement with said plunger whereby movement of said other lever will operate said control means, said other lever being operable to operate said control means independently of said one lever.

2. In a device of the character described, a support having a plunger mounted thereon for reciprocation, control means operable by said plunger, a pair of levers, resilient means to cause movement of one of said levers upon movement of the other of said levers, said one lever acting upon movement of said other lever to operate said control means, each of said levers being operable independently of the other of said levers to move said plunger, and means to limit movement of one of said levers.

3. In a device of the character described, a support having a plunger mounted thereon for reciprocation, control means operable by said plunger, a lever fulcrumed on said support, a second lever fulcrumed on said first-named lever and having operative connection with said plunger, and means to cause said second-named lever to move said plunger to operate said control means in one direction upon movement of said first-named lever, said first-named lever having operative engagement with said plunger to operate said control means in the opposite direction.

4. In a device of the characer described, a support having a plunger mounted thereon for reciprocation, control means operable by said plunger, a lever fulcrumed on said support, a second lever fulcrumed on said first-named lever and having operative connection with said plunger, and resilient means acting on said second-named lever to cause said second-named lever to move said plunger to operate said control means upon movement of

said first-named lever, said first-named lever having operative connection with said plunger to operate said control means.

5. In a device of the character described, a support having a plunger mounted thereon for reciprocation, control means operable by said plunger, a lever fulcrumed on said support, lever means fulcrumed on said lever and having operative engagement with said plunger, and means to cause movement of said lever means upon movement of said lever, said last-named means acting to move said control means in one direction, said lever having operative engagement with said plunger to move said control means in the opposite direction.

6. In a device of the character described, a support having a plunger mounted thereon for reciprocation, a valve operable by said plunger, a pair of cooperable levers having fulcrum supports, each of said levers having operative engagement with said plunger, and means acting through one of said levers and normally urging the other of said levers in one direction whereby said other lever tends to move said valve, said last-named means acting on movement of said other lever in the opposite direction to move said one lever whereby to move said valve.

7. In a device of the character described, a support having a plunger mounted thereon for reciprocation, a valve operable by said plunger, a pair of levers having fulcrum supports, one of said levers having operative engagement with said plunger, means secured to said support and acting on said one lever to cause said one lever to move substantially with the movement of the other of said levers thereby to move said plunger, and means to hold said valve closed, the force exerted by said first-named means being less than the force exerted by said holding means whereby said other lever may move freely when said last-named means holds said valve closed.

8. In a device of the character described, a support having a plunger mounted thereon for reciprocation, a valve operable by said plunger, a pair of levers having fulcrum supports, one of said levers having operative engagement with said plunger, resilient means acting on said one lever to cause said one lever to move substantially with the other of said levers thereby to move said plunger, said resilient means normally urging said valve toward closed position, and means to hold said valve closed, said first-named means permitting free movement of said other lever when said last-named means holds said valve closed.

9. In a device of the character described, a support having a plunger mounted thereon for reciprocation, a pair of levers, each of said levers having independent operative engagement with said plunger to move the same, control means operable by said plunger, means to cause movement of one of said levers upon movement of the other of said levers to move said plunger in one direction, said second-named means normally acting to move said plunger in the opposite direction, and means to limit movement of said other lever by said second-named means.

10. In a device of the character described, a support having a plunger mounted thereon for reciprocation, control means operable by said plunger, a pair of levers having fulcrum supports, one of said levers having operative engagement with said plunger to reciprocate the same, means to cause movement of said one lever upon and substantially with the initial movement of the other of said levers to cause movement of said plunger in one direction, said other lever being operable independently of said one lever to move said plunger in the opposite direction, and means responsive to variation in a characteristic of a fluid and operative to move said other lever whereby said plunger moves said control means in response to variation in a characteristic of said fluid.

11. In a device of the character described, a support having a plunger mounted thereon for reciprocation, control means operable by said plunger, a pair of levers having fulcrum supports, one of said levers having operative engagement with said plunger to reciprocate the same, means acting simultaneously to oppose movement of said one lever by said other lever and to cause movement of said plunger by said one lever upon and substantially with the movement of the other of said levers, motor means operable in response to variation in a characteristic of a fluid and operative to move said other lever whereby said plunger moves said control means in response to variation in a characteristic of the fluid, and means to render said motor means ineffective to move said control means.

12. In a device of the character described, a support having a plunger mounted thereon for reciprocation, control means operable by said plunger, a pair of levers having fulcrum supports, one of said levers having operative engagement with said plunger to reciprocate the same, means resisting operation of the other of said levers throughout its range of movement and acting to cause movement of said one lever upon and substantially with the movement of the other of said levers, motor means operable in response to variation in a characteristic of a fluid and operative to move said other lever whereby said plunger moves said control means in response to variation in a characteristic of the fluid, means operable to engage said one lever to move said plunger, and means operable on said plunger to render said motor means ineffective to move said control means.

13. In a device of the character described, a support having a plunger mounted there-

on for reciprocation, control means operable by said plunger, a pair of levers having fulcrum supports, one of said levers having operative engagement with said plunger to reciprocate the same, means to cause movement of said one lever upon movement of the other of said levers to move said plunger in one direction, means responsive to variation of a characteristic of a fluid and having operative connection with said other lever whereby said plunger is moved in response to variation in a characteristic of said fluid, said other lever being operable for direct engagement with said plunger to move said plunger in the opposite direction, and means to limit movement of said other lever in one direction whereby to limit movement of said plunger.

14. In a device of the character described, a support having a plunger mounted thereon for reciprocation, control means operable by said plunger, a pair of levers having fulcrum supports, one of said levers having operative engagement with said plunger to reciprocate the same, means to cause movement of said one lever upon movement of the other of said levers, means responsive to variation in a characteristic of a fluid and having operative connection with said other lever whereby said plunger is moved in response to variation in a characteristic of said fluid, means to limit movement of said plunger by said other lever in one direction, and means operable on said plunger to move said plunger in said one direction when said other lever has reached its limit of movement.

15. In a device of the character described, a support having a plunger mounted thereon for reciprocation, control means operable by said plunger, a pair of levers having fulcrum supports, one of said levers having operative engagement with said plunger to reciprocate the same, resilient means to cause movement of said one lever upon movement of the other of said levers, means responsive to variation in a characteristic of a fluid and having operative connection with said other lever whereby said plunger is moved in response to variation in a characteristic of said fluid, means to limit movement of said plunger by said other lever in one direction and means operable on said plunger in opposition to said resilient means to move said plunger in said one direction when said other lever has reached its limit of movement.

16. In a device of the character described, a support having a plunger mounted thereon for reciprocation, a pair of levers having fulcrum supports, a valve movable to open and closed positions by said plunger, one of said levers having operative connection with said plunger, means operatively connected to said one lever to cause movement thereof upon movement of the other of said levers, said means normally acting to move said valve to closed position, stop means to limit movement of said other lever to prevent said first-named means from moving said valve towards closed position beyond a predetermined degree, and means operable to move said valve to closed position when said other lever is in engagement with said stop means.

17. In a device of the character described, a support having a plunger mounted thereon mounted thereon for reciprocation, a pair of levers having fulcrum supports, a valve movable to open and closed positions by said plunger, one of said levers having operative connection with said plunger, resilient means operatively connected to said one lever to cause movement thereof upon movement of the other of said levers, said resilient means normally acting to move said valve to closed position, adjustable stop-means to limit movement of said other lever to prevent said resilient means from moving said valve toward closed position beyond a predetermined degree, and thermostatic means operable to move said valve to closed position when said other lever is in engagement with said stop means.

18. In a device of the character described, a support having a plunger mounted thereon for reciprocation, a valve operable by said plunger, means to reciprocate said plunger, means to limit the extent to which said first-named means can move said plunger, and means operable to move said plunger beyond the limit of movement of said plunger by said first-named means.

19. In a device of the character described, a support having a plunger mounted thereon for reciprocation, a valve operable by said plunger, motor means to reciprocate said plunger, means to limit the extent to which said first-named means can move said plunger, thermostatically actuated means operable to move said plunger beyond the limit of movement of said plunger by said first-named means, and thermostatic means to render said motor means operable.

20. In a device of the character described, a support having a plunger mounted thereon for reciprocation, a valve operable by said plunger to open and closed positions, means to reciprocate said plunger, stop means to limit the closing movement of said valve by said reciprocating means, and means to move said valve to closed position when said reciprocating means has been limited by said stop means.

21. In a device of the character described, a support, a valve casing carried by said support, a valve in said casing, a plunger connected to said valve and reciprocably mounted on said support, a pair of levers, one of said levers being connected to said plunger to reciprocate the same to open and close said valve, spring means acting upon said one

lever to cause movement thereof upon movement of the other of said levers, said spring means normally urging said valve toward closed position and means to move said valve toward closed position irrespective of the operation of said other lever.

22. In a device of the character described, a support, a plunger reciprocably mounted on said support, control means operable by said plunger, a lever fulcrumed on said support, a second lever fulcrumed on said first named lever, said second named lever having oppositely extending transverse arms, one of said arms having a pin and slot connection with said plunger for movement of said plunger by said second named lever, and means connected to the other arm of said second named lever to cause movement of said second named lever upon movement of said first named lever thereby to move said plunger.

23. In a device of the character described, a support, a plunger reciprocably mounted on said support, control means operable by said plunger, a lever fulcrumed on said support, a second lever fulcrumed on said first named lever, said second named lever having oppositely extending transverse arms, one of said arms having a pin and slot connection with said plunger for movement of said plunger by said second named lever, and means connected to the other arm of said second named lever to cause movement of said second named lever upon movement of said first named lever thereby to reciprocate said plunger, said means permitting movement of said plunger independently of movement of said first lever.

24. In a device of the character described, a support, a valve casing carried by said support, a valve in said casing operable to control flow of fuel to a burner, a pair of levers, one of said levers having operative connection with said valve to control flow of fuel therethrough, means to cause movement of said one lever upon movement of the other of said levers, means to limit movement of said other lever to limit closing movement of said valve thereby, a pilot burner, and means responsive to the temperature of said pilot burner and operable upon decrease of pilot burner temperature to move said valve beyond the closing limit of movement to which said valve is movable by said other lever.

25. In a device of the character described, a support, a valve casing carried by said support, a valve in said casing operable to control flow of fuel to a burner of a boiler, a plunger reciprocably mounted in said support and operatively connected to said valve, a pair of levers fulcrumed on said support, one of said levers having operative connection with said plunger to move said valve toward open and closed positions, resilient means connected to said one lever to cause movement of said one lever upon movement of the other of said levers, said resilient means normally urging said valve toward closed position, stop means to limit movement of said other lever to limit closing movement of said valve by said resilient means, and means to move said valve beyond the limit of said stop means.

26. In a device of the character described, a support, a plunger mounted on said support for reciprocation, a valve operable by said plunger, a lever fulcrumed on said support, means carried by said plunger and engageable by said lever to move said plunger in one direction, a second lever fulcrumed on said first-named lever and operatively engaging said plunger, stop means to limit movement of said second-named lever in one direction, and spring means normally urging said second-named lever into engagement with said stop means whereby movement of said first-named lever acts through said second-named lever to move said valve in the opposite direction.

27. In a device of the character described, a support, a plunger mounted on said support for reciprocation, a valve operable by said plunger, a lever fulcrumed on said support, a second lever fulcrumed on said first named lever and operatively engaging said plunger, stop means to limit movement of said second named lever in one direction, spring means normally urging said second named lever into engagement with said stop means whereby movement of said first named lever operates said valve, an abutment to limit movement of said first named lever, and means to move said valve beyond the limit of movement thereof by said first named lever and in opposition to said spring means.

28. In a device of the character described, a support, a plunger mounted on said support for reciprocation and operatively connected to a valve to open and close the same, a lever fulcrumed on said support, a second lever fulcrumed on said first-named lever, a pin member carried by said plunger and extending transversely thereto, spring means normally urging said second-named lever into engagement with said pin member, said spring means acting through said second-named lever and said pin member upon said first-named lever to move said valve toward closed position, means to move said first-named lever in opposition to said spring means whereby said spring means acts through said second-named lever to open said valve.

29. In a device of the character described, a support, a plunger mounted on said support for reciprocation and operatively connected to a valve to open and close the same, a lever fulcrumed on said support, a second lever fulcrumed on said first named lever, and having a pin and slot engagement with said plunger, stop means to limit movement of said second

named lever in one direction, spring means normally urging said second named lever into engagement with said stop means, said spring means acting through said second named lever upon said first named lever to move said valve toward closed position, means to limit closing movement of said valve by said first named lever, means to move said first named lever in opposition to said spring means whereby said spring means acts through said second named lever to open said valve, and means to move said valve beyond the limit of closing movement of said valve by said first named lever and in opposition to said spring means.

30. In a device of the character described, a support, a valve carried by said support, a plunger mounted on said support for reciprocation and connected to said valve to move the same to open and closed positions, a pair of levers, one of said levers having operative engagement with said plunger, the other of said levers having operative engagement with said first-named lever to move the same whereby said valve may be moved toward closed position, means to limit movement of said valve toward closed position by said other lever, a pin on said first-named lever, and means operative to engage said pin to move said valve to closed position.

31. In a device of the character described, a support, a valve carried by said support, a plunger mounted on said support for reciprocation and connected to said valve to move the same to open and closed positions, a pair of levers, one of said levers having operative engagement with said plunger, the other of said levers having operative engagement with said first-named lever to move the same whereby said valve may be moved in one direction, said other lever being operable to move said valve in the opposite direction, said plunger having an arm, and means operative to engage said arm to move said valve to closed position.

32. In a device of the character described, a support, a valve carried by said support, a plunger mounted on said support for reciprocation and connected to said valve to move the same to open and closed positions, a pair of levers, one of said levers having operative engagement with said plunger, the other of said levers having operative engagement with said first-named lever to move the same whereby said valve may be moved in one direction, said other lever being operable to move said valve in the opposite direction, motor means energized in response to variations in a characteristic of fluid, and means operable by said motor means to actuate said valve upon energization of said motor means.

33. In a device of the character described, a support, a valve carried by said support, a plunger mounted on said support for reciprocation and connected to said valve to move the same to open and closed positions, a pair of levers, one of said levers having operative engagement with said plunger, the other of said levers having operative engagement with said first-named lever to move the same whereby said valve may be moved in one direction, electric motor means energized in response to variations in a characteristic of a fluid, and means operable by said motor means to move said valve to closed position upon energization of said motor means, said last-named means being manually movable to release said valve for operation by said other lever.

34. An apparatus of the character described, comprising a regulatable means operable to control flow of fuel to a burner, means responsive to a variation in the characteristic of a fluid and having permanent operative connection with said first-named means for regulating said first-named means, means to limit regulation of said first-named means by said responsive means, and means acting through the operative connection to render said responsive means ineffective to control flow of fuel to the burner.

35. An apparatus of the character described, comprising a regulatable valve for controlling flow of fuel to a burner, means responsive to a variation in a characteristic of a fluid and having operative connection with said valve for regulating said valve, means to limit closing movement of said valve by said responsive means, and means acting through the operative connection to move said valve beyond said limiting means and toward closed position.

36. An apparatus of the character described, comprising a regulatable valve for controlling flow of fuel to a burner, a pair of levers having operative engagement with said valve, means acting on said levers and normally urging said valve toward closed position, means to limit closing movement of said valve by said first-named means, means responsive to a characteristic of a fluid and operable through one of said levers to regulate said valve, and means to move said valve beyond said limiting means and toward closed position.

37. In a device of the character described, a control means, a plunger for operating said means, a lever having a fulcrum support and operably connected to said plunger to move the same in one direction, and a second lever having a fulcrum support and having operable engagement with said plunger to move the same in the opposite direction, said second-named lever having operative engagement with said first-named lever to impart the movement of said first-named lever to said plunger to move the said plunger in the said opposite direction.

38. In a device of the character described, a control means, a lever operably en-

gaging said means to move the same, a second lever carried by said first-named lever and operably engaging said means, and means acting on said second-named lever and tending to urge said control means in one direction into engagement with said first-named lever, said second-named means acting through said second-named lever upon said first-named lever to move said control means in the opposite direction.

In testimony whereof I have hereunto signed my name.

LEWIS W. EGGLESTON.